All our energy.
All the time.

MARITIME ELECTRIC
A FORTIS COMPANY

December 18, 2024

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The Island Regulatory and Appeals Commission

Island Regulatory and Appeals Commission
PO Box 577
Charlottetown PE C1A 7L1

Dear Commissioners:

On-Island Capacity for Security of Supply Project

Please find enclosed five copies of a Supplemental Capital Budget Request Application for Maritime Electric's On-Island Capacity for Security of Supply Project ("Project"). The on-Island generating capacity as proposed in this application is required to serve the public interest of all customers.

Maritime Electric has experienced significant increases in customer load, driven by population growth and electrification over the past several years. This growth in customer load is outpacing the available generating capacity resources, resulting in a forecast capacity deficit of 156 megawatts ("MW") by 2033. Without additional generating capacity, it will become increasingly difficult to meet customer needs during peak load periods, exposing customers to health, safety and security of supply risks.

PEI's reliance on on-Island generating capacity is at an all-time low. In 2023, the amount of on-Island generating capacity was only 31 per cent of the peak customer load. This amount is projected to further drop to 17 per cent by 2033 without capacity additions. Additionally, the high reliance on off-Island generating capacity purchases is becoming problematic due to limitations of the subsea cables and mainland transmission system, and concerns about potential generating capacity shortages in Atlantic Canada. Other electric utilities in Atlantic Canada are planning to install fast-acting generation similar to Maritime Electric's proposed Project.

To address the Company's forecast generating capacity deficit, the proposed Project includes the installation of 150 MW of on-Island capacity through a battery energy storage system, combustion turbine and reciprocating internal combustion engine plant. The Project will increase the amount of on-Island dispatchable generating capacity to approximately 50 per cent, supporting a more secure power supply for PEI, and is forecast to provide savings of approximately 20 per cent over purchasing off-Island capacity resources. By adding new on-Island capacity, Maritime Electric can mitigate the risks associated with regional capacity shortfalls and transmission constraints.

Maritime Electric's preliminary cost estimate for the Project of $427 million (in 2024 dollars) requires further engineering to provide greater confidence in costing. As such, the Company expects that a capital expenditure deferral of up to $12 million, or approximately 3 per cent, of the estimated Project cost will be required to complete upfront engineering and undertake a request for proposal ("RFP") process while the application is being reviewed by the Commission. Once proposals are received through the RFP process, the Company will be in a position to submit a report to the Commission with updated cost estimates, prior to awarding a contract for the Project.

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Maritime Electric is working with Commission staff to schedule an in-person technical session with the Commission early in the regulatory process to discuss the urgent need for additional on-Island capacity. This session will assist the Commission in evaluating the necessity of the Project and understanding the immediate need for the Company's proposed deferral of up to $12 million. This is crucial to ensure that the Project can proceed on schedule and address the forecast capacity deficit in a timely manner.

An electronic copy will follow.

Yours truly,

MARITIME ELECTRIC

Jason Roberts
President and Chief Executive Officer

JCR14
Enclosure

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

BEFORE THE ISLAND REGULATORY
AND APPEALS COMMISSION

IN THE MATTER of Section 17(1) of the *Electric Power Act* (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for the approval of a 2024 Supplemental Capital Budget Request for the On-Island Capacity for Security of Supply Project.

APPLICATION AND EVIDENCE
OF
MARITIME ELECTRIC COMPANY, LIMITED

December 18, 2024

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APPENDICES

CONFIDENTIAL INFORMATION FILED SEPARATELY

Legend of Abbreviations	
Abbreviation	**Definition**
A	Amperes
AACE	American Association of Cost Engineering
AC	Alternating Current
AESO	Alberta Electric System Operator
AMI	Advanced Metering Infrastructure
Application	Supplemental Capital Budget Request Application
BESS	Battery Energy Storage System
BGS	Borden-Carleton Generating Station
BTU	British Thermal Units
Bunker C	Heavy Fuel Oil
CAD	Canadian Dollar
CEMS	Continuous Emission Monitoring System
CER	Clean Electricity Regulations
CGS	Charlottetown Generating Station
CNG	Compressed Natural Gas
CO_2e	Carbon Dioxide Equivalent
Commission	Island Regulatory and Approvals Commission
Company	Maritime Electric Company, Limited
CRAA	Capacity Resource Adequacy Assessment
CRS	Sargent & Lundy Capacity Resource Study and Extreme Weather Event Capacity Impact – Addendum to December 2022 Maritime Electric Capacity Resource Study
CT	Combustion Turbine
CT1	Combustion Turbine No. 1
CT2	Combustion Turbine No. 2
CT3	Combustion Turbine No. 3
CT4	Combustion Turbine No. 4
DC	Direct Current
DSM	Demand Side Management
EIA	Environmental Impact Assessment
ELCC	Effective Load Carrying Capability
EPA	Energy Purchase Agreement
EPC	Engineering, Procurement and Construction
EV	Electric Vehicle
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWh	Gigawatt-hour
Interconnection	NB-PEI Interconnection
IRAC	Island Regulatory and Approvals Commission
km	Kilometre
kV	Kilovolts
kW	Kilowatt
kWh	Kilowatt-hour
LNG	Liquid Natural Gas

Legend of Abbreviations	
Abbreviation	**Definition**
LOLE	Loss of Load Expectation
M&NP	Maritimes & Northeast Pipeline
Maritime Electric	Maritime Electric Company, Limited
MMWG	Multiregional Modeling Working Group
Mt	Megatonne
MVA	Megavolt-Amperes
MVAR	Megavolt-Ampere Reactive
MW	Megawatt
MWh	Megawatt-hour
NB	New Brunswick
NB Power OATT	New Brunswick Power Open Access Transmission Tariff
NB Power	New Brunswick Power Corporation
NBTSO	New Brunswick Transmission System Operator
NERC	North American Electricity Reliability Corporation
NLH	Newfoundland and Labrador Hydro
NOx	Nitrogen Oxide
NPCC	Northeast Power Coordinating Council
NPV	Net Present Value
NREL	National Renewable Energy Laboratory
NS	Nova Scotia
NS Power	Nova Scotia Power
O&M	Operations and Maintenance
OHPA	Oil to Heat Pump Affordability
PEI	Prince Edward Island
PEIEC	PEI Energy Corporation
Point Lepreau	Point Lepreau Nuclear Generating Station
PPA	Power Purchase Agreement
Project	On-Island Capacity for Security of Supply Project
Province	Government of Prince Edward Island
RFP	Request for Proposal
RICE	Reciprocating Internal Combustion Engine
S&L	Sargent & Lundy LLC
SCR	Selective Catalytic Reduction
SMR	Small Modular Nuclear Reactor
USD	United States Dollar
VAR	Volt-Ampere Reactive

1.0 APPLICATION

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

BEFORE THE ISLAND REGULATORY
AND APPEALS COMMISSION

IN THE MATTER of Section 17(1) of the *Electric Power Act* (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for the approval of a 2024 Supplemental Capital Budget Request for the On-Island Capacity for Security of Supply Project.

Introduction

Maritime Electric Company, Limited ("Maritime Electric" or the "Company") is a corporation incorporated under the laws of Canada with its head or registered office at Charlottetown and carries on a business as a public utility subject to the *Electric Power Act* engaged in the production, purchase, transmission, distribution, and sale of electricity within Prince Edward Island ("PEI").

Application

Maritime Electric hereby applies for an order of the Island Regulatory and Appeals Commission ("IRAC" or the "Commission") approving the On-Island Capacity for Security of Supply Project (the "Project"). Upon Project completion, the assets will be included in Maritime Electric's rate base.

The proposal contained in this Application represents a just and reasonable balance of the interests of Maritime Electric and those of its customers and will, if approved, allow the Company to continue to perform necessary capital additions at a cost that is, in all circumstances, reasonable.

Procedure

Filed herewith is the Affidavit of Jason C. Roberts, T. Michelle Francis, Angus S. Orford and Enrique A. Riveroll which contains the evidence on which Maritime Electric relies in the Application.

Dated at Charlottetown, Province of PEI, this 18th day of December, 2024.

D. Spencer Campbell, Q.C.

STEWART MCKELVEY
65 Grafton Street, PO Box 2140
Charlottetown PE C1A 8B9
Telephone: 902-892-2485
Facsimile: 902-566-5283
Solicitors for Maritime Electric Company, Limited

2.0 AFFIDAVIT

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

BEFORE THE ISLAND REGULATORY AND APPEALS COMMISSION

IN THE MATTER of Section 17(1) of the *Electric Power Act* (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for the approval of a 2024 Supplemental Capital Budget Request for the On-Island Capacity for Security of Supply Project.

AFFIDAVIT

We, Jason C. Roberts of Suffolk, T. Michelle Francis of Emyvale, Angus S. Orford of Charlottetown and Enrique A. Riveroll of New Dominion, in Queens County, Province of Prince Edward Island, MAKE OATH AND SAY AS FOLLOWS:

We are the President and Chief Executive Officer, Vice President, Finance and Chief Financial Officer, Vice President, Corporate Planning and Energy Supply and Vice President, Sustainability and Customer Operations for Maritime Electric, respectively, and as such have personal knowledge of the matters deposed to herein, except where noted, in which case we rely upon the information of others and in which case we verily believe such information to be true.

Maritime Electric is a public utility subject to the provisions of the *Electric Power Act* engaged in the production, purchase, transmission, distribution and sale of electricity within PEI.

We prepared or supervised the preparation of the evidence and to the best of our knowledge and belief the evidence is true in substance and in fact.

Section 11.0 contains a proposed Order of the Commission based on the Company's Application.

SWORN TO SEVERALLY at
Charlottetown, Prince Edward Island,
the 18th day of December, 2024.

____
Jason C. Roberts

____
T. Michelle Francis

____
Angus S. Orford

____
Enrique A. Riveroll

____
A Commissioner for taking affidavits
in the Supreme Court of Prince Edward Island.

3.0 EXECUTIVE SUMMARY

Growing Capacity Deficits

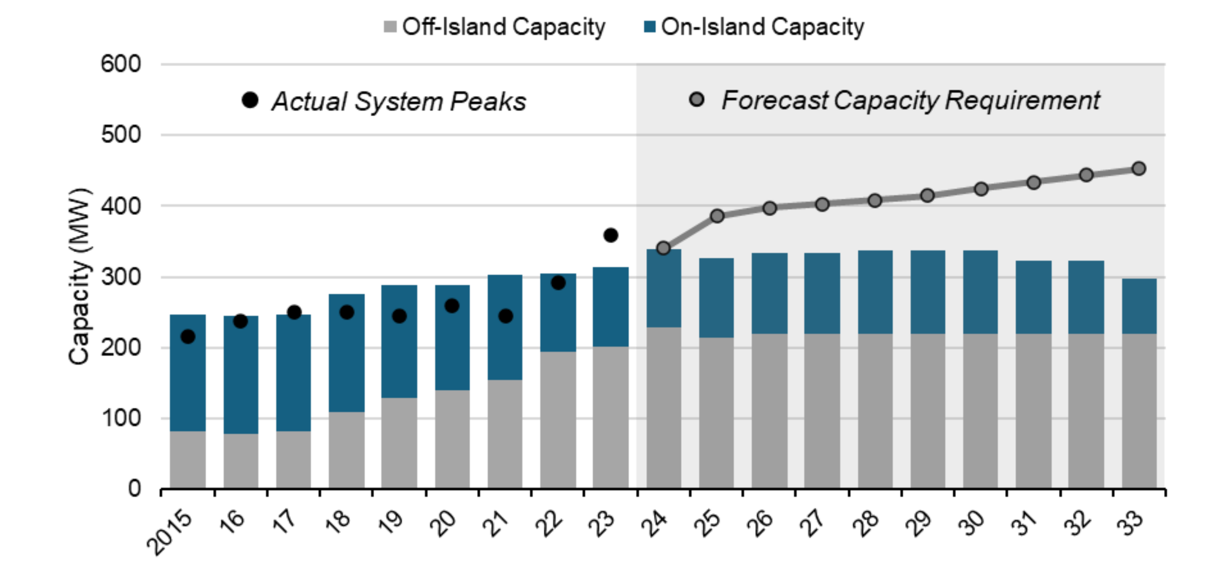
In recent years, Maritime Electric Company, Limited ("Maritime Electric" or the "Company") has experienced rapid customer load growth due to increases in Prince Edward Island's ("PEI") population and electrification. Since 2005, PEI has experienced load growth that is over five times the Canadian average and is the highest of the Atlantic Canadian provinces. Maritime Electric's highest recorded peak customer load (also referred to as system peak) of 359 megawatts ("MW") occurred in February 2023, during a polar vortex weather event, and was almost 60 per cent higher than the Company's 2014 peak customer load of 226 MW, only 10 years ago.[1]

Despite customer load increasing, the Company's power generating resources (also referred to as generating capacity resources or capacity resources) located on PEI are now significantly less than they were a decade ago. With the retirement and decommissioning of the Charlottetown Steam Plant, the Company's on-Island power generating resources decreased from 144 MW in 2015 to 89 MW presently. This reduction has been offset by an increase in off-Island power generating capacity purchases (also referred to as off-Island capacity purchases) from New Brunswick Power Corporation ("NB Power"), but there are limits to the amount of off-Island capacity that can be imported to PEI, and the Company is nearing those limits.

Maritime Electric's growing customer load and limited on-Island power generating resources are forecast to result in power generating capacity deficits during peak customer load periods, as shown in Figure 1. Because of transmission constraints in New Brunswick and concerns about potential power generating shortages in Atlantic Canada, additional power generating resources are required on PEI to address the growing power generating capacity deficit and avoid possible customer load interruptions (i.e., rotating outages) due to insufficient generating capacity.

[1] The system peak of 359 MW was the Maritime Electric load only, it does not include the City of Summerside load. The PEI system peak, including the City of Summerside was 396 MW.

FIGURE 1
Power Generating Capacity Forecast[2]



Maritime Electric engaged Sargent & Lundy LLC ("S&L") to complete a Capacity Resource Study "CRS") in 2022 and a subsequent addendum in 2023, which evaluated options to address the Company's forecast power generating capacity deficit.[3] The CRS evaluated several power generating options, including combustion turbines ("CT"), reciprocating internal combustion engines ("RICE"), onshore wind, solar, battery energy storage systems ("BESS"), small modular nuclear reactors ("SMR") and offshore wind. The CRS recommended the addition of 125 to 150 MW of on-Island power generating resources through a combination of CT, RICE and BESS resources.

Proposed Project

Maritime Electric is seeking Commission approval of this supplemental capital budget request application (the "Application") for its On-Island Capacity for Security of Supply Project (the "Project"), which includes three components:

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[2] NB Power capacity purchases are based on existing levels in the Energy Purchase Agreement with NB Power.

[3] References to content from the CRS within this Application refer to both the original CRS and the subsequent addendum. Any references to recommendations reflect the updated recommendations provided in the Addendum.

1. **Battery Energy Storage System:** Installation of a 10 MW/40 megawatt-hours ("MWh") BESS. This will provide 10 MW of backup capacity for four hours to supply customer load or the transmission system.
2. **Combustion Turbine:** Installation of a 50 MW Combustion Turbine ("CT4") adjacent to the existing Combustion Turbine No. 3 ("CT3") at the Charlottetown Generating Station ("CGS"). Initially, CT4 will be diesel-fired, but can be retrofitted for natural gas, biodiesel or other lower carbon fuel options. It will also be equipped for synchronous condenser operation for critical grid support services.
3. **Reciprocating Internal Combustion Engines:** Installation of a RICE plant on PEI comprised of five RICE units, each rated at 18 MW, totaling 90 MW. The RICE units will also be diesel-fired initially, but can operate on various fuels, including diesel, biodiesel, natural gas, hydrogen and ammonia, in the future.

The three Project components will be operated in a peaking and backup supply role, similar to Maritime Electric's existing CTs.

Based on an AACE Class 4/5 cost estimate provided by S&L, the total cost of the Project is anticipated to be $427 million, with the expected accuracy within 30 per cent. The cost estimate is based on 2024 costs and does not include inflation or cost changes due to market dynamics between 2024 and the time of construction. Maritime Electric will initially expend up to $12 million to complete upfront engineering design work and issue request for proposals ("RFP") for the Project, at which point more accurate cost estimates will be provided to the Commission. The $12 million represents approximately 3 per cent of the estimated project cost of $427 million.[4]

The Project is expected to provide a total of 150 MW of on-Island power generating resources, which will reduce Maritime Electric's dependence on off-Island power generating resources and avoid their associated costs. A 2024 net present value ("NPV") analysis that compares the costs and avoided costs of the Project determined that, over the useful life of the Project components, the Project results in a positive economic benefit to customers. Overall, the Project is estimated

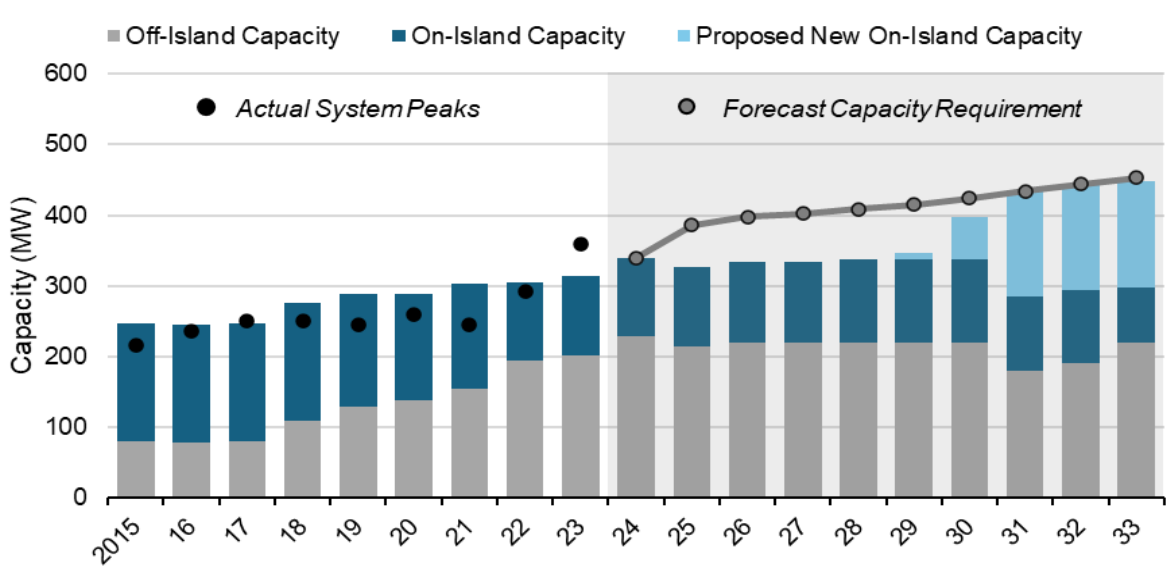
[4] The $12 million allocated for upfront engineering is part of the total estimated project cost of $427 million and is not an additional expense.

to provide savings of approximately 20 per cent compared to purchasing off-Island power generating capacity resources.

Project Benefits

The Project will provide 150 MW of additional on-Island power generating resources that will address Maritime Electric's forecasted growing power generating capacity deficit. Figure 2 shows an updated power generating capacity forecast with the addition of the proposed new on-Island power generating resources, which phases out the deficit by 2031.

FIGURE 2
Proposed Power Generating Capacity Forecast[5]



In recent years, the Company has relied on NB Power for an increasing amount of off-Island power generating capacity purchases to satisfy its requirements. However, the Company's ability to acquire additional off-Island power generating capacity is subject to limitations of the New Brunswick ("NB") transmission system and the NB-PEI Interconnection ("Interconnection"), and the availability of off-Island power generating capacity. The benefits of the proposed on-Island power generating resources include:

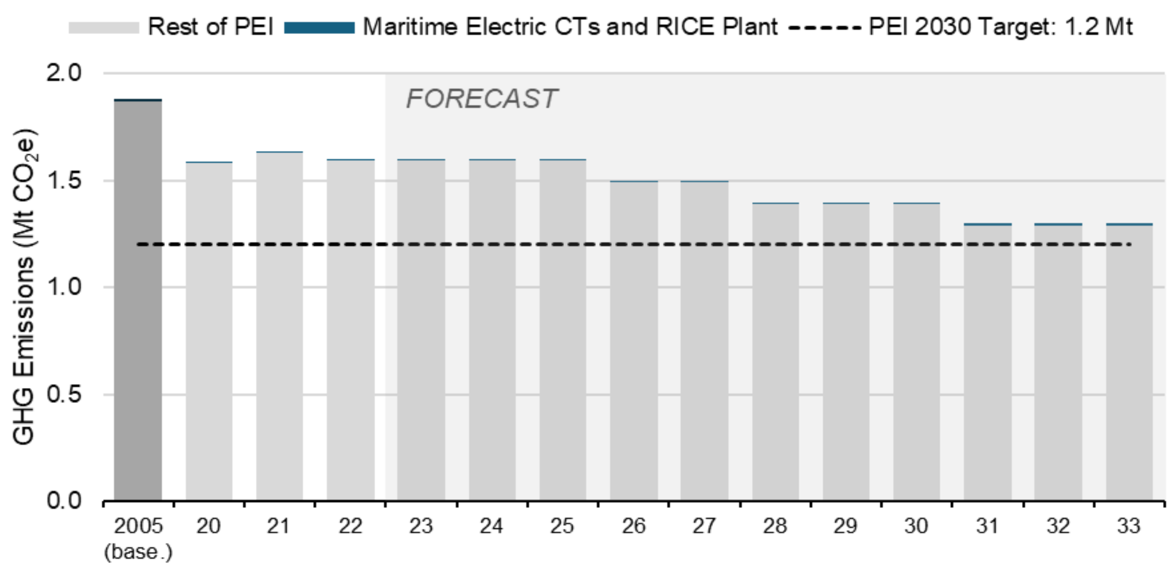
[5] NB Power capacity purchases are based on existing levels in the Energy Purchase Agreement with NB Power.

- An estimated savings of approximately 20 per cent over the useful life of the Project components compared to purchasing off-Island power generating capacity;
- mitigated risk of off-Island power generating capacity shortages and cost increases as demand for capacity increases in the Atlantic Canada region;
- ability to serve more customer load during significant curtailment events or disconnections from the mainland;
- support of additional renewable energy resource development on PEI by providing renewable backup power support;
- reduced risk to personal health, safety and property damage due to power generating capacity shortages during cold weather events; and
- increased system stability, strength and reliability across PEI, especially during periods of high customer load and transmission system outages.

Greenhouse Gas Emissions

Maritime Electric's greenhouse gas ("GHG") emissions due to the operation of its on-Island power generating resources (i.e., CTs) in 2023 was 3,036 tonnes, or an estimated 0.2 per cent of PEI's total 2023 emissions, as shown in Figure 3. Although the use of Maritime Electric's on-Island power generating resources is forecast to increase, the associated GHG emissions are expected to contribute only approximately 1 per cent to the Government of Prince Edward Island's ("Province") 2030 target emission levels.

FIGURE 3
PEI GHG Emissions Forecast



Data sources: Government of PEI 2023 Statistical Review (historical). Government of Canada Greenhouse gas emissions projections 2023 (forecast).

Conclusion

Additional on-Island power generating resources are required to ensure Maritime Electric can meet its power generating capacity requirements and supply customer load during peak periods. The Project is part of a balanced approach to meeting Maritime Electric's power generating capacity requirements in the face of uncertainty regarding the availability and cost of off-Island power generating capacity in the future. The Project mitigates some of this uncertainty by providing an additional 150 MW of on-Island power generating resources that will be used in a standby role and to support further integration of wind and solar energy resources on PEI. Maritime Electric will continue to rely on off-Island power generating capacity for approximately 50 per cent of its total power generating capacity requirements.

Maritime Electric is seeking Commission approval of the need for the Project and a capital expenditure deferral of up to $12 million of the total Project cost to complete upfront engineering work and an RFP process. The Company proposes to submit a report to the Commission with updated cost estimates once proposals are received through the RFP process, prior to awarding contracts for the Project.

4.0 INTRODUCTION

Maritime Electric requires additional dispatchable generating capacity resources located on PEI. This Application describes the Company's plan to address this need.

The Application is structured to provide a clear and thorough understanding of the Project. Section 5.0 includes essential information to provide background and context concerning the current state of electricity on PEI. Section 6.0 provides details of the Project and outlines the technical and logistical elements and the estimated costs of the Project's components. Section 7.0 describes the critical need for additional dispatchable capacity resources and highlights the factors driving this necessity. Section 8.0 outlines the alternatives evaluated and a rationale for the Project. Section 9.0 discusses the GHG emission impacts of the Project and considers environmental regulatory requirements. Section 10.0 presents an analysis of the anticipated impact on the Company's rate base, revenue requirement and customer rates. Finally, Section 11.0 includes a proposed order for the Project.

Through the Project, Maritime Electric will install additional on-Island dispatchable capacity resources ensuring a reliable and secure supply of electricity for customers.

4.1 Corporate Profile

Maritime Electric owns and operates a fully integrated power system providing for the purchase, generation, transmission, distribution, and sale of electricity throughout PEI. The Company's head office is located in Charlottetown with generating facilities in Charlottetown and Borden-Carleton.

Maritime Electric is the primary electric utility on PEI delivering approximately 90 per cent of PEI's supply of electricity. To meet the electricity needs of its customers, the Company has contractual entitlement to capacity and energy from NB Power's Point Lepreau Nuclear Generating Station ("Point Lepreau") and an agreement for the purchase of capacity and system energy from NB Power delivered via four subsea cables owned by the Province. Through various contracts with the PEI Energy Corporation ("PEIEC"), the Company purchases the capacity and energy from 92 MW of wind generation and the energy from 10 MW of solar generation located on PEI. In the event that the wind or solar generation fails to provide the energy expected through these contracts, the shortfall is obtained through additional energy purchases from NB Power or by operating the Company's CTs, which provide 89 MW of on-Island backup generation.

Maritime Electric is a public utility subject to PEI's *Electric Power Act*. As a public utility, the Company is subject to regulatory oversight and approvals of the Island Regulatory and Approvals Commission ("IRAC" or the "Commission"), which has jurisdiction to regulate public utilities under the *Electric Power Act* and the *Island Regulatory and Appeals Commission Act*.

4.2 Purpose

Maritime Electric has experienced significant customer load growth in recent years, driven by increasing population on PEI and the transition from fossil fuel energy sources to electricity (i.e., electrification). Consequently, the Company forecasts a capacity resource deficit as early as 2025, as detailed in Section 5.4.

To address this forecasted deficit, Maritime Electric submits this Application seeking approval for the Project and a capital expenditure deferral of up to $12 million to complete upfront engineering work and issue RFPs for the Project. The Project will ensure the Company meets its legislated responsibility to operate and maintain a reliable power system under changing conditions and manage increased electricity usage effectively.[6]

The Project includes:

1. **Battery Energy Storage System:** Installation of a 10 MW/40 MWh BESS, which will provide backup for customer load, the transmission system, or on-Island renewable generators. The BESS will also be used to help meet the Company's ancillary service and capacity requirements, reducing the amount of these products currently purchased from NB Power.
2. **Combustion Turbine:** Installation of a 50 MW CT (i.e., CT4) adjacent to the existing CT3 at the CGS. This location will limit the incremental capital and operational costs by sharing ancillary equipment between CT3 and CT4. Initially, CT4 will be diesel-fired, but can be

[6] As per Section 3 of the *Electric Power Act*.

retrofitted for natural gas, biodiesel or other lower carbon fuel options. It will also be equipped for synchronous condenser operation for critical grid support services.

3. **Reciprocating Internal Combustion Engines:** Installation of a RICE plant on PEI that will have five RICE units, each rated at 18 MW, for a total of 90 MW. Initially, the RICE units will also be diesel-fired, but can operate on various fuels, including diesel, biodiesel, natural gas, hydrogen and ammonia, in the future.

In total, the Project will add 150 MW of on-Island dispatchable capacity resources, capable of supplying electricity to approximately 42,900 homes during system peak periods.[7] This capacity will primarily serve as peaking and backup capacity for responding to unplanned system events, hold-to-schedule directives from NB Power and facilitating planned maintenance activities.[8] The Project will reduce the need for off-Island capacity purchases, which is expected to provide overall savings of approximately 20 per cent over its useful life. The project is also expected to support additional renewable energy resource development on PEI and enhance the reliability and security of electricity supply to customers.

The reliability and security of supply benefits of installing capacity locally, coupled with the need to upgrade the NB transmission system and the Interconnection to enable more off-Island capacity purchases, makes the Project the best option to meet the Company's growing capacity requirements.

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[7] Estimated number of homes is based on an average of 3.5 kW per home during peak customer load periods.

[8] Hold-to-schedule refers to times when Maritime Electric is required to generate electricity due to a sudden change in energy import requirements that cannot be fulfilled by NB Power. Hold-to-schedule events are typically attributed to rapid changes in renewable production. Further information on hold-to-schedule events can be found in Section 7.3.

5.0 BACKGROUND

Maritime Electric is responsible for supplying three critical functions related to electricity generation: (1) energy; (2) capacity; and (3) ancillary services.

Energy is the amount of electricity that must be delivered by an electrical system to meet a customer's electricity needs over a period of time (e.g., over a month) and is measured in kilowatt-hours ("kWh").[9] Capacity is the maximum amount of electricity that the electrical system can supply to meet a customer's electricity needs at any given time (i.e., instantaneously) and is measured in kilowatts ("kW").[10] Ancillary services refer to the functions that help system operators maintain proper flow and direction of electricity, address imbalances between energy supply and customer load, maintain system voltage and frequency within acceptable limits, and help the system recover after a system event.

5.1 Overview of Electrical System

Maritime Electric operates a fully integrated electrical system on PEI. Figure 4 illustrates the four primary elements of the Company's electrical system:

A. Supply – The Company sources energy and capacity from a variety of generating sources, including NB Power, wind and solar generators and the Company's CTs.

B. Transmission – The sourced electrical energy is transported through the Company's transmission system at high voltage levels (i.e., 69 kilovolts ("kV") or higher) to distribution substations.[11]

C. Distribution – The voltage of the electrical energy is reduced to lower voltage levels (i.e., typically between 12 and 25 kV) through distribution substations and transported to customers through the distribution system.

D. Consumption – The voltage of the electrical energy is reduced to customer voltage levels (i.e., typically between 120 and 600 volts) before being delivered to customers for consumption.

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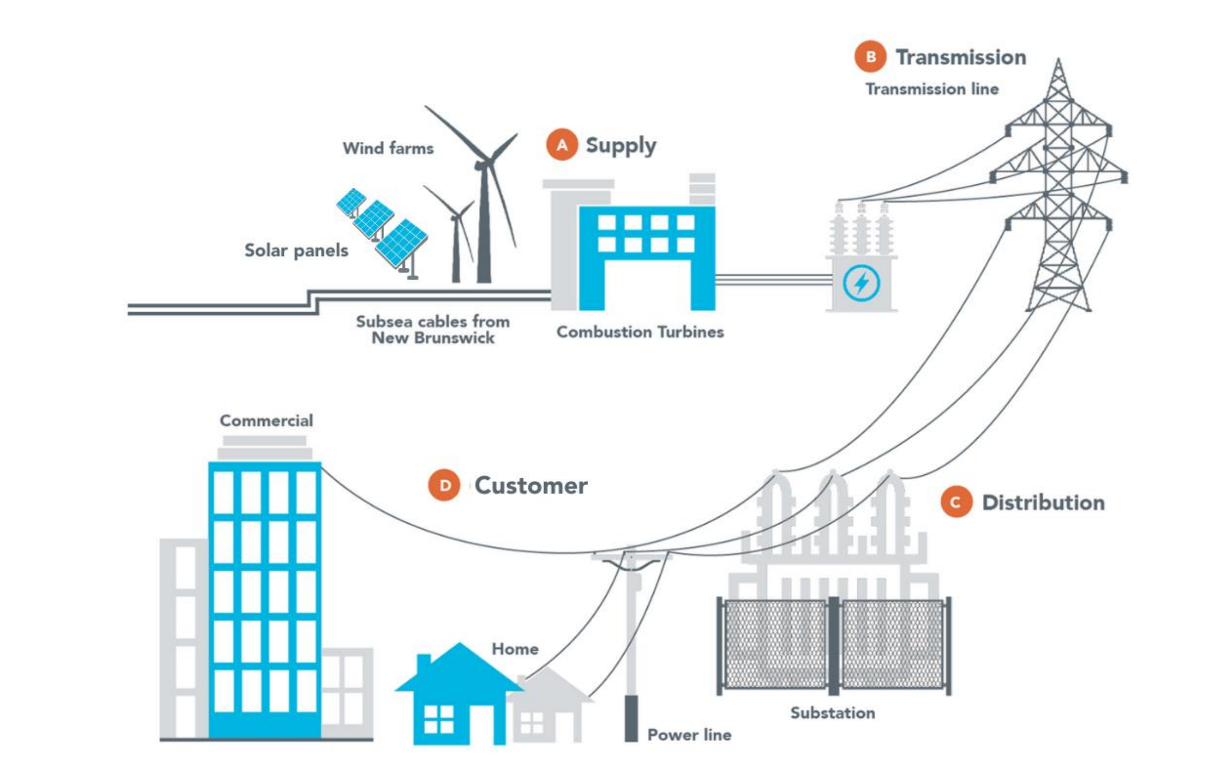
9 1 kWh is equal to 1,000 watt-hours (Wh).
10 1 kW is equal to 1,000 watts (W).
11 1 kV is equal to 1,000 volts (V).

FIGURE 4
Vertically Integrated Electric Utility System



This Application is focused on addressing the needs of Maritime Electric's supply of capacity.

5.1.1 Energy and Capacity Supply

Energy requirements fluctuate throughout the day as customers' needs change, whereas the electrical system's capacity is fixed and based on its physical limitations. One way of thinking about energy and capacity is to consider the example of filling a bathtub with water: energy is comparable to the amount of water collected in the bathtub over a period of time, and capacity is comparable to the size of the bathtub's faucet or the maximum amount of water that can flow into the bathtub at any given time. If the bathtub's faucet cannot deliver the required amount of water, the faucet's size (i.e., capacity) must be increased.

The amount of capacity that an electrical system needs is determined by its system peak (i.e., when the instantaneous collective load of all customers is highest). The Company's system peak typically occurs in January or February between 5 p.m. and 6 p.m., a time when customers are returning home on a cold weekday after sundown. Maritime Electric must ensure that it has access to sufficient capacity resources (i.e., sources of power generation) to supply its customers during the system peak without interruption.[12]

Prior to the installation of two subsea cables to establish the Interconnection between NB and PEI in 1977, PEI relied on imported heavy fuel oil ("Bunker C") and diesel to generate electricity. At the time, Maritime Electric operated steam turbines at its CGS and CTs at its Borden-Carleton Generating Station ("BGS"), which supplied all the customers' energy and capacity requirements. The establishment of the Interconnection provided access to lower-cost energy sources located on the mainland; therefore, Maritime Electric's on-Island generating resources began operating primarily in a peaking and backup supply role.

The Company commissioned its newest on-Island dispatchable generating resource (CT3) in 2005 at the CGS to ensure the Company maintained an adequate level of planning reserves.[13] At the time, the Interconnection had a 100 MW firm transfer capacity limit,[14] and the capacity available through the Interconnection and the existing on-Island generating resources was insufficient to meet the Company's expected system peak.[15]

Around the same time, advances in renewable energy generation technology enabled PEI to begin developing wind energy. This new development allowed Maritime Electric to source a portion of its energy from on-Island resources. The Interconnection continued to supply most of the Company's energy needs, supplemented by on-Island wind energy (when available) and Maritime Electric's on-Island dispatchable generation (when required). As customer load continued to grow, the Interconnection's ability to sustain PEI's energy needs diminished. As a result, either the capacity of the Interconnection needed to be expanded or additional on-Island

[12] As legislated by Section 3(a) of the *Electric Power Act*.

[13] CT3 was approved by the Commission in August 2004 in Order UE04-01. CT3 is not only Maritime Electric's newest dispatchable generating unit, but also the last dispatchable generating unit installed in the Maritime Provinces.

[14] During this period only two cables (Cables 1 and 2) were in service, and the 100 MW firm capacity transfer limit was based on the N-1 criterion of the loss of one cable.

[15] The net present value ("NPV") calculation showed that installing a third cable and procuring capacity from off-Island was more costly than installing CT3.

dispatchable generating capacity resources were needed, despite further development of wind energy resources on PEI.[16]

In 2017, two additional subsea cables (i.e., cables 3 and 4) were installed, which increased the combined physical capacity of the four subsea cables to 560 MW.[17] Around this time, NB Power and Maritime Electric completed upgrades to their transmission systems, which increased the maximum import capacity across the Interconnection to 300 MW.[18] The significant increase in the capacity transfer limit from NB Power, combined with the availability of excess generating capacity in NB at that time, allowed Maritime Electric to replace the generating capacity associated with the Charlottetown Steam Plant, which had reached end of life, with off-Island capacity purchases.[19]

Over the past two decades, renewable energy generation has increased dramatically on PEI, but Maritime Electric's main energy supply continues to be from off-Island resources via the Interconnection. The Company's on-Island dispatchable generation is used primarily in a peaking and backup role and, as such, contributed only 0.2 per cent of the Company's energy supply in 2023.

5.1.2 Existing Capacity Resources

Maritime Electric meets its current energy and capacity requirements with a combination of on- and off-Island generating resources. This combination of resources provides a diverse mix that provides reliability and a degree of price stability for customers. Figure 5 shows a breakdown of Maritime Electric's energy and capacity resources in 2023. The breakdown shows that, while the

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[16] On June 15, 2015, Maritime Electric applied for an additional combustion turbine to be added at the CGS. Maritime Electric did not proceed with the installation of this CT, instead it shifted its focus towards expanding the Interconnection, which had received Federal funding and was being pursued by the Government of PEI.

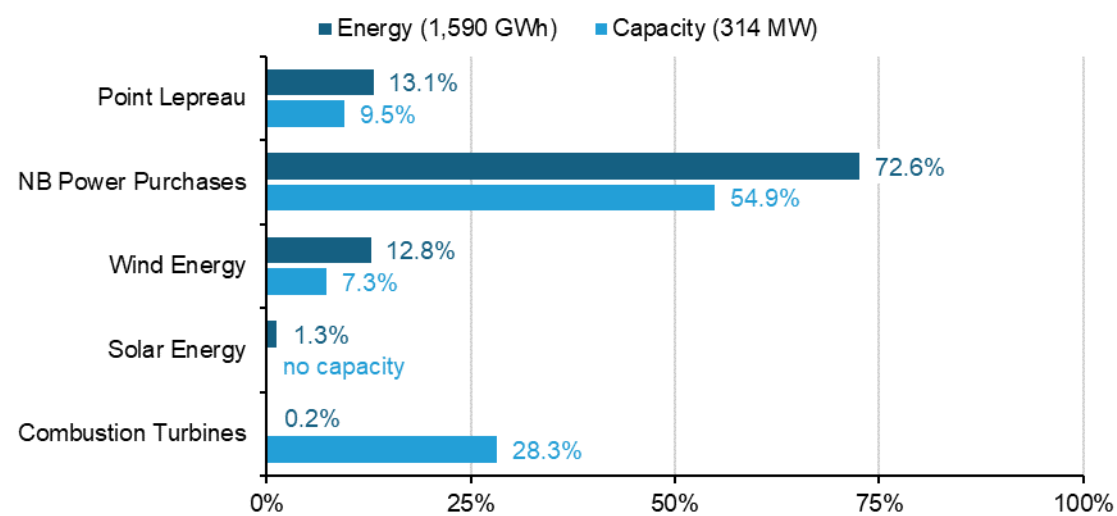
[17] Although the physical capacity of the four subsea cables is 560 MW, the Interconnection capacity is limited to 300 MW. Coincidentally, PEI's import limit is also restricted to 300 MW by the capability of the NB transmission system, which is due to congestion on the transmission system in the South-Eastern region of New Brunswick and a limit to available reactive power sources. This limitation is discussed further in Section 7.2.2.

[18] The import capacity was as low as 80 MW but was increased to 240 MW following modifications on the NB transmission system. This was quickly increased to 300 MW following transmission upgrades that were completed on PEI. This import capacity is shared between Maritime Electric (270 MW) and the City of Summerside (30 MW).

[19] The Charlottetown Steam Plant, which peaked at 60 MW of generating capacity, had reached end of life with units that were 50 to 70 years old. The Steam Plant also did not suit Maritime Electric's current mode of operation as it was slow to come online (i.e., requiring 12 to 24 hours as opposed to 10 minutes for CTs) and was expensive to keep in standby mode due to a requirement to have boiler operators onsite 24/7 while the plant was in standby mode.

same physical resources can be used to meet both energy and capacity requirements, the characteristics of the resource dictates the way each resource is apportioned to energy and capacity. For example, while energy from utility-scale wind turbines provided approximately 12.8 per cent of Maritime Electric's energy needs in 2023, wind turbines supplied only 7.0 per cent of the 2023 capacity requirement. Wind turbines are not dispatchable, meaning they cannot be relied upon to operate on demand when required. In contrast, Maritime Electric owns three CT generators that are dispatchable, meaning they can be started and their output adjusted remotely by system operators at any time. CT availability during system peak is predictable and, as such, they provided 28.3 per cent (89 MW) of the 2023 capacity requirement.[20] However, because the CTs are seldomly operated, they supplied only 0.2 per cent of the energy needs in 2023.[21] This section provides an overview of the energy and capacity resources shown in the Figure.

FIGURE 5
2023 Energy and Capacity Resources



Point Lepreau

Maritime Electric is party to a Unit Participation Agreement with Point Lepreau.[22] The Company's participation share is 4.5 per cent (i.e., 30 MW of the total 660 MW output), resulting in 29 MW of

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[20] In 2023 Maritime Electric's on-Island dispatchable generation provided 89 MW of the Company's total capacity firm resources of 314 MW.

[21] In 2023 Maritime Electric's on-Island dispatchable generation provided 2,509 MWh (gross generation) of energy towards to Company's total energy requirement of 1,590,379 MWh.

[22] The Unit Participation Agreement is essentially a proxy to ownership.

capacity, net of transmission losses, delivered to the Interconnection. This means that Maritime Electric receives 29 MWh of energy for every hour that Point Lepreau is operational, and therefore provides 29 MW of capacity towards the Company's capacity requirement. The Unit Participation Agreement is for the life of the plant, which is expected to be decommissioned in 2039.[23]

NB Power Purchases

NB Power purchases are secured by the Company through an Energy Purchase Agreement ("EPA"). The current EPA was executed in March 2019 and expires on December 31, 2026.[24] The EPA includes the purchase of:

- Firm and non-firm energy;
- Firm capacity;[25]
- Capacity-based ancillary services; and
- Transmission service in NB necessary to deliver these products.

All products included in the EPA, except non-firm energy, are capacity-backed, meaning that NB Power cannot limit or curtail product delivery to the Company, as outlined in the EPA, without curtailing its own customer load proportionally.[26] Non-firm energy is backed by Maritime Electric's CTs and can be curtailed by NB Power with appropriate notification.[27] When curtailment occurs, the Company either supplies the energy from its own CTs or sources additional energy from Nova Scotia Power Incorporated ("NS Power").

Maritime Electric fulfills most of its capacity requirement through the EPA, which specifies an annual allotment of firm capacity. The EPA specified allotment of firm capacity is 180 MW, 185 MW and 190 MW for the calendar years 2024, 2025 and 2026, respectively.[28] NB Power

[23] The year 2039 is 27 years from the completion of the life extension refurbishment in 2012.
[24] The original EPA was set to terminate on February 29, 2024 but was extended until December 31, 2026 through an amending agreement executed on October 22, 2020.
[25] Firm capacity refers to the certainty or order of scheduling with the System Operator. Firm capacity is the last product to be curtailed or shed, it is treated like native NB load. In contrast, non-firm capacity is less certain and would be curtailed or shed completely before firm capacity is impacted.
[26] This is true during normal conditions; however, the NB Power Transmission System Operator follows the North American Electric Reliability Corporation ("NERC") Standard EOP-011-2 which states that, under an Energy Emergency Alert Level 2 or higher, energy supply can be restricted as required to maintain the health of the overall system.
[27] Non-firm energy is also typically less expensive than firm energy because it is interruptible.
[28] These allotments are based on a forecast that was developed in 2020.

supplies this capacity from its own generating resources and through capacity purchases from third parties (e.g., neighbouring electric utilities).

Recently, Maritime Electric's contracted allotments of firm capacity from NB Power were insufficient to meet the Company's capacity requirements due to higher-than-expected system peak growth. To date, NB Power has had excess capacity available and has allowed the Company to purchase additional capacity, on a short-term basis, to meet the Company's capacity requirements.[29] However, NB Power indicated that, without the addition of new capacity resources, it too expects to be capacity deficient within five years. NB Power indicated that it intends to continue providing firm-capacity to Maritime Electric in the future but cannot guarantee what level of capacity will be available. As such, NB Power's ability to continue to increase its firm capacity allowances to Maritime Electric is unclear.[30]

Maritime Electric also purchases ancillary services from NB Power on an ongoing basis to fulfill the Company's generation reliability obligations. Ancillary service requirements can vary slightly but, generally, Maritime Electric must supply or secure the following ancillary services:

- 1.7 MW of frequency regulation;
- 4.7 MW of load following;
- 7.8 MW of spinning reserve;
- 19.7 MW of supplemental reserve (i.e., 10-minutes); and
- 16.2 MW of supplemental reserve (i.e., 30-minutes).

As the Company's CTs are used for peaking and backup supply purposes (i.e., they are typically not running), they cannot be used to fulfill the Company's frequency regulation (1.7 MW), load following (4.7 MW) or spinning reserve (7.8 MW) requirements. To fulfill these requirements, generators must be operating (i.e., running) and not fully loaded, or they must be fast acting such

[29] Short-term capacity is purchased on a monthly basis. The Maritime Electric System Operator estimates what the next month's load will be based on the month-ahead weather and load forecast. If the Maritime Electric System Operator is projecting a load above the Company's contractual capacity, then a request is sent to New Brunswick Energy and Marketing Corporation asking whether additional short-term capacity is available for purchase. To date the Corporation has been able to meet Maritime Electric requests for short-term capacity.

[30] For the purposes of this Application, Maritime Electric has assumed that NB Power can continue to provide the 2026 allotment of 190 MW of firm capacity beyond 2026 but that no additional firm or short-term capacity will be available.

as a BESS. The Company uses its existing CTs to fulfill its supplemental reserve requirements when possible.[31]

Wind Energy

Maritime Electric has power purchase agreements ("PPAs") with the PEIEC to purchase the energy output from a total of 92 MW of utility-scale wind farms. Also, a small number of net metered customers provide wind energy. Per the *Renewable Energy Act*, the Company must accept and credit full retail value for all excess generation from net-metered generators.[32] A list of on-Island wind energy resources and their size is shown in Table 1. In 2023, wind energy accounted for 12.8 per cent of the Company's total energy supply.

TABLE 1
Wind Energy Resources

Name	Location	Size (MW)	In Service Year
Wind Energy Resources under Contract with Maritime Electric			
North Cape Phase 1	North Cape	5	2001
North Cape Phase 2	North Cape	5	2003
Aeolus	Norway	3	2004
Engie Norway	Norway	9	2007
Eastern Kings	Elmira	30	2007
WEICan	Norway	10	2012
Hermanville[a]	Hermanville	30	2014
Total Wind Energy Resources under Contract with Maritime Electric		**92**	
Wind Energy Resources NOT under Contract with Maritime Electric			
West Cape Wind Farm[b]	West Cape	99	2009
City of Summerside[b]	Summerside	12	2011
	TOTAL	**111**	

a. Hermanville was initially developed as a 30 MW wind farm but has had significant operational issues that reduced its capacity for a number of years. Repairs were completed in 2023 and 2024 and 9 of 10 turbines are now at or near full capacity, thereby bringing its total capacity to approximately 27 MW. The 10th turbine was removed from service in 2024.

b. Although Maritime Electric does not purchase energy output from the West Cape or City of Summerside wind farms, they are listed here as they do contribute towards the Company's renewable balancing and operation during curtailments.

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[31] Maritime Electric's existing CTs are also required to provide capacity during winter months, and the same resource cannot count as both capacity and an ancillary service at the same time. The Maritime Electric System Operator assigns the Company's CTs to the best suitable service on a month-to-month basis. When required, Maritime Electric purchases its supplemental reserve requirements from NB Power.

[32] Full retail value includes both the cost of energy, and most delivery charges associated with system infrastructure and energy control centre costs.

The Province intends to increase the amount of wind energy generation under contract with Maritime Electric. PEIEC's Eastern Kings Phase II, a 30 MW Wind Plant expansion which is currently under construction is an example of working towards this goal. The Company has also received several requests from private wind energy developers looking to connect facilities to the Company's transmission system. Table 2 shows the current list of wind energy projects requesting connection to Maritime Electric's system.

TABLE 2
Wind Energy Projects Requesting to Connect to Maritime Electric System

Number[33]	Location	Size (MW)	Requested In-Service Date
1	Eastern Kings	30	January 2026
2	Skinner's Pond	93	2028
3	Bedeque	13	September 2026
	TOTAL	**136**	

The expected development of additional wind energy projects on PEI will increase the Company's supply of renewable energy, which will support the Province's Net Zero emission targets. The new wind energy projects may provide Maritime Electric with fixed energy prices through long-term PPAs, and this will help stabilize energy costs and protect customers from energy market price increases in the region.[34] The Provincial Government's *Renewable Energy Act* will establish the rate for the energy produced.

One of the challenges associated with wind energy resources is their intermittent nature, which means that their output at any given time is unpredictable and dependent on wind speed. Therefore, wind energy cannot supply all the Company's energy needs. Figure 6 shows a comparison of the actual wind generation to Maritime Electric's hourly customer load for a period in October 2023, and indicates that wind generation during the period, in addition to energy

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33 Projects are numbered to provide a total number of renewable projects requesting to connect to Maritime Electric's transmission system.

34 All large-scale wind energy currently purchased by Maritime Electric is secured at the legislated minimum purchase price. This price is primarily fixed with only a portion being escalated each year based on the Canadian Consumer Price Index. The Renewable Energy Act Minimum Purchase Price Regulations can be found here: https://www.princeedwardisland.ca/sites/default/files/legislation/R%2612-1-2-Renewable%20Energy%20Act%20Minimum%20Purchase%20Price%20Regulations.pdf – Renewable Energy Act Minimum Purchase Price Regulations.

supplied from Point Lepreau, remained below the hourly customer load.[35] The Figure also demonstrates the intermittent nature of wind energy, with periods of high wind generation and periods of no wind generation (i.e., periods circled in red). The space between the existing wind generation and the hourly customer load is currently filled by NB Power energy purchases supplied through the Interconnection.

FIGURE 6
October 2023 Energy Supply and Hourly Load

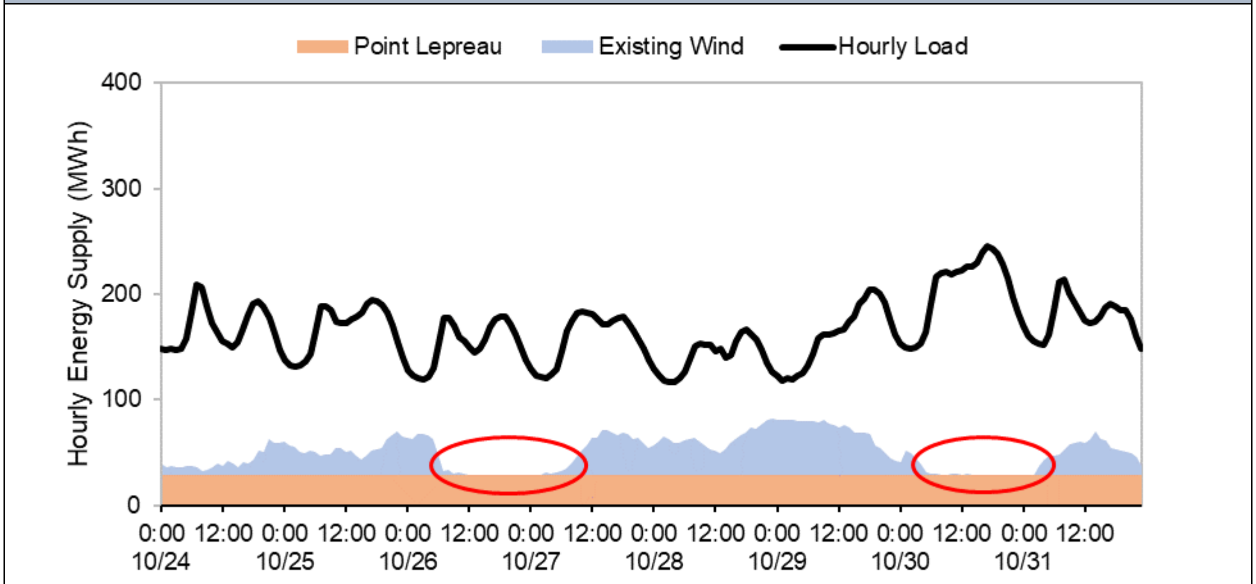
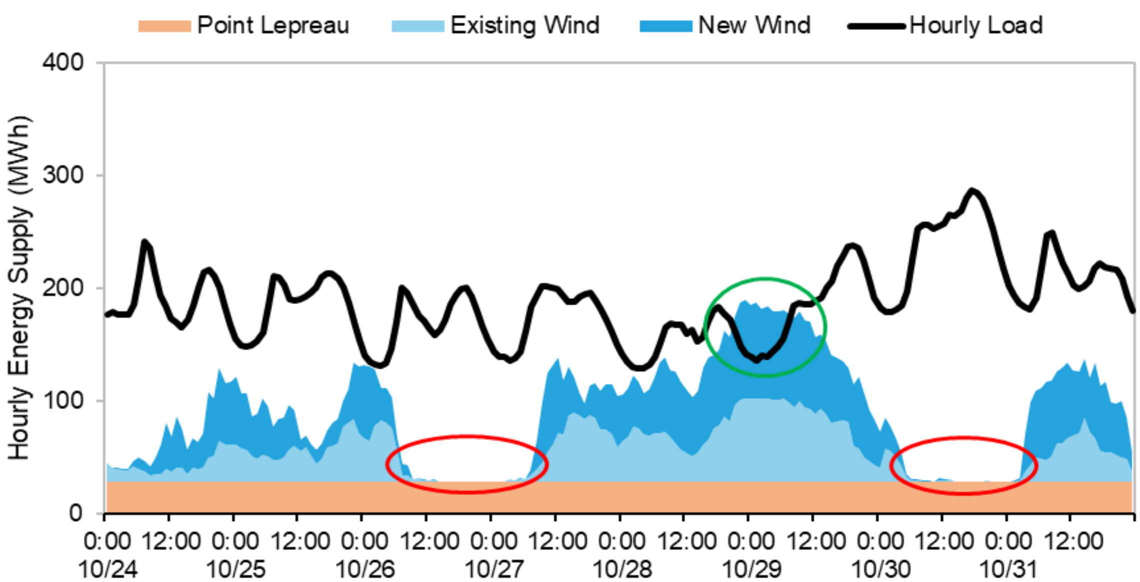


Figure 7 shows the expected wind energy generation and hourly customer load for the same period in 2028 based on the wind speeds and hourly customer load experienced in 2023, assuming that all wind energy projects in Table 2 are operational. In this scenario, the new wind generation helps supply more of Maritime Electric's hourly customer load; however, periods with no expected wind generation remain, and this energy must be supplied by other sources. Today the Company sources energy from NB Power through the Interconnection when on-Island renewable energy generation is incapable of meeting customer load requirements. As electricity

[35] The nature of the Participation Agreement for Point Lepreau means that this energy cannot be scheduled. During operational hours of the plant Maritime Electric's portion of the energy is supplied to the Company. If Maritime Electric cannot accept the energy supplied, there is no credit. Therefore, the energy associated with the 29 MW capacity contracted with Point Lepreau is always included at the bottom of energy supply charts; it is considered baseload generation.

loads increase throughout the region, NB Power and the Interconnection may not be capable of meeting customer load during system peak periods.

FIGURE 7
October 2028 Forecast Based on 2023 Hourly Load and Weather



Note: based on projects requesting to connect to Maritime Electric system.

Additionally, Figure 7 demonstrates an expectation that sometimes wind generation will exceed the hourly customer load (i.e., period circled in green), in which case the excess wind energy must be stored, exported to off-Island markets or curtailed.[36]

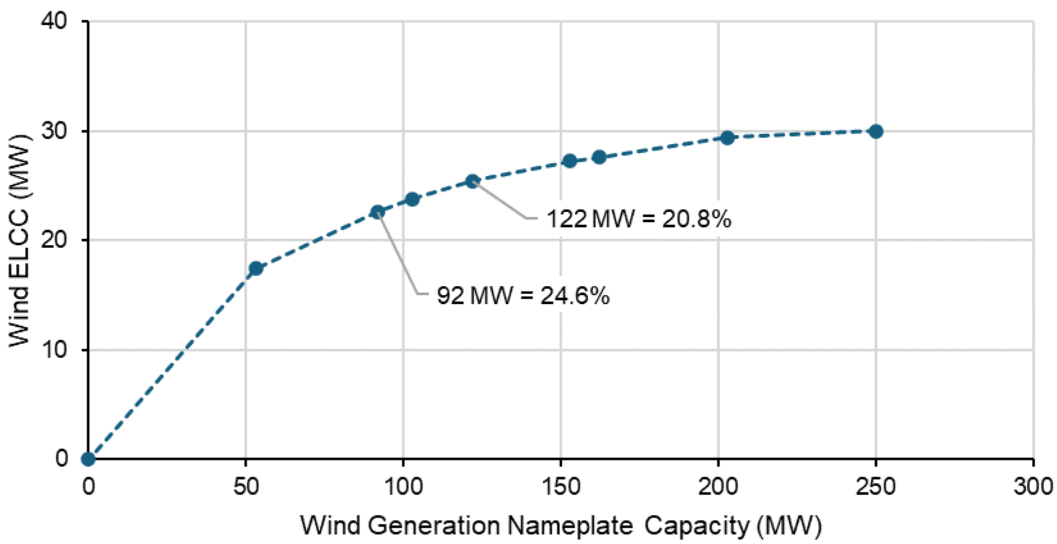
Due to the intermittency of wind energy generation, only a portion of the wind turbine generators' nameplate capacity can be counted towards Maritime Electric's capacity requirements. The portion that can be counted as capacity is called the effective load carrying capability ("ELCC"), which is calculated using a probabilistic loss of load expectation ("LOLE") analysis for local wind energy.[37] Based on historical wind energy generation levels observed on PEI, the ELCC of

[36] With respect to stored energy, Maritime Electric currently has no means to store significant amounts. With respect to exported energy, there are currently no contracts in place to allow the sale of energy from Maritime Electric to NB Power. Curtailed energy refers to energy that the wind plant could have generated but was instructed to reduce production due to restrictions.

[37] LOLE is a common methodology used in the electric utility industry to determine the probability of a specific generator being unavailable during the system peak.

Maritime Electric's current wind energy purchases is 22.6 MW (i.e., 24.6 per cent of the 92 MW of wind energy currently purchased by the Company).[38] Figure 8 shows a plot of the ELCC of wind energy generation at various levels of nameplate capacity. The Figure illustrates that the percentage of installed nameplate capacity that can be counted towards the Company's capacity requirement reduces as more wind energy is added. For example, PEIEC is planning to add 30 MW of wind energy in 2025 that would increase the total wind nameplate capacity under contract with Maritime Electric to 122 MW (i.e., 92 MW existing plus 30 MW planned). The ELCC at 122 MW is 25.4 MW (i.e., 20.8 per cent of 122 MW), compared to 22.6 MW currently. The addition of 30 MW of wind turbines results in only a 2.8 MW (i.e., 25.4 MW minus 22.6 MW) increase in ELCC towards the Company's capacity requirement. As such, additional wind energy generation is not an effective capacity resource for meeting the Company's future capacity requirements.

FIGURE 8
ELCC of Wind Energy Generation Nameplate Capacity



Note: Based on an analysis of existing PEI wind generation sources from November 2017 to March 2022.

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[38] The total amount of wind energy contracted by Maritime Electric is 92 MW; however, actual wind ELCC values in 2024 are slightly less than 22.6 MW due to reductions in capacity at the Hermanville wind farm.

Solar Energy

Maritime Electric purchases all the energy output from PEIEC's 10 MW utility-scale solar farm located in Slemon Park, PEI. The Company also has a growing number of net metered customers with solar panel systems. Per the *Renewable Energy Act*, the Company must accept and credit full retail value for all excess energy from net-metered customers. A list of on-Island solar energy resources and their size is shown in Table 3. In 2023, solar energy accounted for 1.3 per cent of the Company's total energy supply.

TABLE 3
Solar Energy Resources

Name	Location	Size (MW)	In Service Year
Solar Energy Resources under Contract with Maritime Electric			
Slemon Park Microgrid	Slemon Park	10	2024
Net Metering Customers (solar)	Island-wide	44	2007-2024[a]
	Total	54	
Solar Energy Resources Not under Contract with Maritime Electric			
City of Summerside[b]	Summerside	21	2024

a. Net metered generation includes Maritime Electric service territory only. Although the first net metered generator was registered in 2007, most of the net metered generation has been connected since the August 2019 launch of efficiencyPEI's Solar Electric Rebate Program.
b. Although Maritime Electric does not purchase energy output from the City of Summerside solar farm, it is included as it contributes to the Company's renewable balancing requirements.

The PEI Government intends to further increase the amount of solar energy produced on PEI. The recent Slemon Park Microgrid solar farm, owned by the PEIEC, and the approximate 12 MW of net-metered solar customers connecting to the system each year are examples of working towards this goal. The Company has also received several requests from private solar energy developers looking to connect facilities to the Company's transmission system. Table 4 shows the current list of solar energy projects requesting to connect to Maritime Electric's system.

TABLE 4 **Solar Energy Projects Requesting to Connect to Maritime Electric System**			
Number[39]	**Location**	**Output Capability (MW)**	**Requested In-Service Date**
4	Bedeque	100	December 2026
5	Bedeque	40	December 2026
6	Charlottetown	32	To Be Determined
7	Mount Pleasant	32	To Be Determined
	TOTAL	**204**	

The expected development of new solar energy projects on PEI will increase Maritime Electric's supply of renewable energy, which supports the Province's net zero emission targets. The new solar energy projects may provide Maritime Electric with fixed energy prices through long-term PPAs, which would help stabilize energy costs and protect customers from energy market price increases in the region.[40] The Government of PEI's *Renewable Energy Act* will establish the rate for the energy produced.

Solar energy resources are intermittent and, like wind, cannot supply all of the Company's energy needs. Figure 9 is a continuation of Figure 7 with the addition of expected solar energy generation for the same October 2028 period previously discussed. The solar data shown in this Figure is based on the solar irradiance and hourly customer load experienced during this period in 2023 and assumes that all solar projects in Table 4 are operational. The Figure demonstrates that the new solar generation supplies more of the Company's hourly customer load; however, there are periods when there is no expected wind or solar generation (circled in red) that must be supplied by other sources. Maritime Electric expects to continue to source the required energy from off-Island, via the Interconnection, when the supply from on-Island renewable energy generation is insufficient. The addition of solar energy is expected to result in an increased number of periods when the combination of wind and solar generation will exceed the hourly customer load (i.e.,

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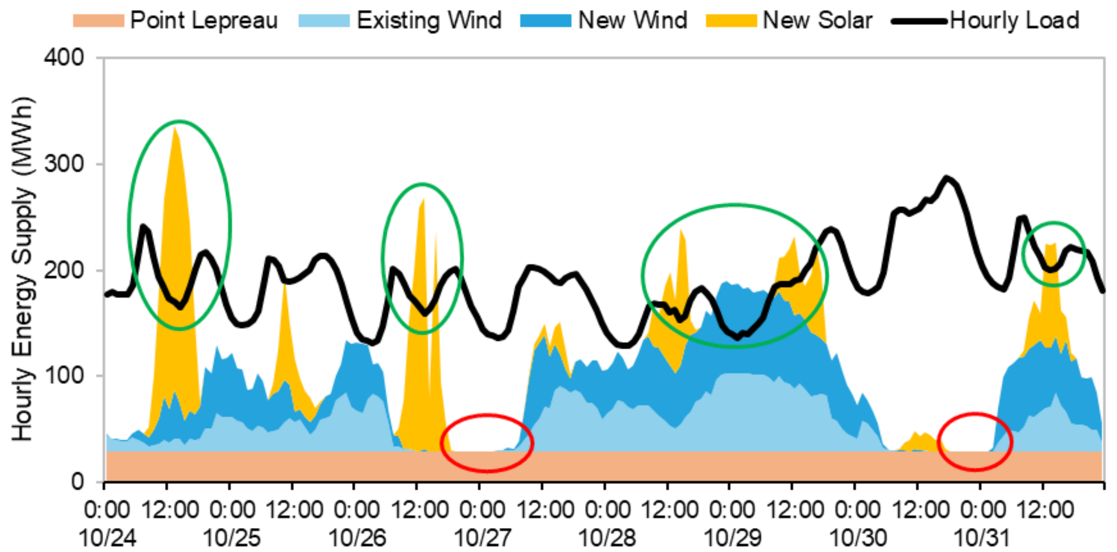
[39] Project numbering has been continued from the list of wind projects to provide a total number of renewable projects requesting to connect to Maritime Electric's transmission system.

[40] All utility-scale renewable energy currently purchased by Maritime Electric is secured at or near the legislated minimum purchase price. This price is primarily fixed with only a portion being escalated each year based on the Canadian Consumer Price Index.

periods circled in green). The amount of excess energy during these periods is also expected to increase, requiring the excess energy to be stored, exported to off-Island markets or curtailed.

FIGURE 9
October 2028 Forecast Based on 2023 Hourly Load and Weather



Note: based on projects requesting to connect to Maritime Electric system and net metering forecast.

Like wind energy generation, the intermittency of solar energy generation impacts its ability to count towards a capacity requirement. However, as Maritime Electric's system peak typically occurs in January or February between 5 p.m. and 6 p.m., which is after sunset (i.e., no solar generation), solar energy generation cannot be counted at all towards the Company's capacity requirement.[41] As such, additional solar energy generation is not a capacity resource option for Maritime Electric.

Combustion Turbines

Maritime Electric owns and operates three CTs, as detailed in Table 5.

[41] An ELCC calculation is not carried out for solar energy because the system peak occurs after sunset. If ELCC and LOLE calculations were completed for solar energy, it would result in an ELCC of 0 MW.

TABLE 5 Maritime Electric Combustion Turbine Information				
Unit Name	**Location**	**Size (MW)**	**In-Service Year**	**Anticipated Retirement Year**
Combustion Turbine No. 1	Borden-Carleton	15	1971	2031
Combustion Turbine No. 2	Borden-Carleton	25	1973	2033
Combustion Turbine No. 3	Charlottetown	49[42]	2005	2055

A decision on the need to replace CT1 and CT2 when they reach end of life will be made at a future date.

As previously indicated, Maritime Electric's CTs provide peaking and backup energy and represent only 0.2 per cent of the Company's total energy supply. Table 6 provides combined operating data for the Company's three CTs.

TABLE 6 Combined CT Operating Data					
	2019	**2020**	**2021**	**2022**	**2023**
Number of starts	46	53	55	74	52
Total gross energy generation (MWh)	836	585	2,112	2,534	2,916
Percentage of Maritime Electric energy supply[a]	0.06%	0.04%	0.10%	0.06%	0.16%
Diesel consumption (cubic meters)	337	264	774	990	1,129
Percentage of PEI diesel consumption[b]	0.38%	0.31%	0.85%	1.08%	1.23%
GHG emissions (tonnes CO_2e)	906	710	2,082	2,662	3,036
Percentage of PEI GHG emissions[b]	0.06%	0.04%	0.13%	0.17%	0.19%[c]

a. Includes only CT generation related to the supply of Maritime Electric customers. Excludes generation for wholesale purposes which typically result from Emergency Energy Supply to Others.
b. Based on the Prince Edward Island 50th Annual Statistical Review 2023.
c. Estimate based on Environment Canada forecast.

42 CT3 has a 50 MW nominal rating, but the maximum output is 49 MW, as 1 MW is used to run the internal systems of the unit.

Maritime Electric's CTs are dispatchable, and as such, they are excellent capacity resources. Electric utilities operate dispatchable generation as baseload or peaking generators. Baseload generators are continuously operated, except during planned and unplanned outages. Peaking generators are only operated as required and the sequence of their dispatch is typically based on economics, as peaking generators typically produce more expensive energy than baseload and renewable generators. While Maritime Electric's CTs are considered peaking generators, they are primarily standby or backup resources, which means they are operated:

- when there are transmission system outages on PEI or elsewhere in the region that disrupts the Company's ability to import sufficient energy through the Interconnection;
- when the Interconnection is at its transfer capacity limit and additional energy is needed, which is known as curtailment by NB Power events;
- to hold the import of energy across the Interconnection to the scheduled amount, which is known as a Hold-to-Schedule directive from NB Power;[43]
- for providing emergency energy to third parties when there are supply shortages in the region, which may be due to planned or unplanned generator outages, or due to higher-than-expected customer load; and
- for monthly test runs to ensure each unit remains in good working order.

To demonstrate the limited operation of Maritime Electric's CTs, their operating hours and gross generation data from 2019 to 2023 are shown in Table 7.

[43] Purchases from NB Power are reserved (i.e., scheduled) on an hourly basis, and at times the hourly forecast can be incorrect. Large discrepancies are often caused by an unexpected shortfall of wind or solar energy and, during these times, dispatchable generation may be required to return the Interconnection to its scheduled amount.

TABLE 7 Annual Combined CT Operating Data						
	2019	**2020**	**2021**	**2022**	**2023**	**Average**
Reason	**Operating Hours**					
Unit Testing	32	20	21	24	22	**24**
NB Power Hold-to-Schedule[a]	28	14	78	29	24	**35**
Emergency Energy Supply to Others[b]	6	-	23	89	12	**26**
On-Island Transmission Related[c]	-	7	7	14	10	**8**
Curtailment by NB Power[d]	-	-	6	19	131	**31**
TOTAL	**66**	**41**	**135**	**175**	**199**	**123**
Reason	**Gross Generation (MWh)**					
Unit testing	236	207	129	161	148	**176**
NB Power Hold-to-Schedule[a]	381	287	1,457	420	312	**571**
Emergency Energy Supply to Others[b]	219	-	351	1,546	236	**470**
On-Island Transmission Related[c]	-	91	84	219	164	**112**
Curtailment by NB Power[d]	-	-	91	188	2,056	**467**
TOTAL	**836**	**585**	**2,112**	**2,534**	**2,916**	**1,797**

a. NB Power Hold-To-Schedule refers to circumstances where Maritime Electric requires additional energy beyond what was reserved during the hourly energy scheduling. NB Power is often able to cover Maritime Electric's increased energy requirements that typically result from reduced renewable production; however, during system constraints, or elevated third-party reservations, there are periods when NB Power is unable to increase deliveries above the scheduled amounts. As renewable generation has no ability to increase generation levels on demand, Maritime Electric is left with two possibilities: shed customer load or start dispatchable generation.

b. Emergency energy supply to others refers to a neighbouring utility being unable to meets its energy needs for any reason and requesting that Maritime Electric generate energy to cover the shortfall or a portion thereof. In this situation, the requesting utility is responsible to cover all associated costs.

c. On-Island transmission related refers to generation in response to Interconnection or on-Island transmission constraints.

d. Curtailment by NB refers to generation in response to transmission constraints in NB.

Maritime Electric's CTs are also used to supply the Company's share of the Maritime Area operating reserve requirement, as set by the Northeast Power Coordinating Council ("NPCC"). The operating reserve requirement states that the Maritimes area must have the ability, within 10 minutes, to replace the energy from an unplanned loss of the largest generator in the area. The largest generator in the Maritimes area is Point Lepreau, with a generating capacity of 660 MW, and Maritime Electric's share of the operating reserve requirement is currently 19.7 MW.[44]

[44] This is non-spinning or supplemental reserve, and the CTs can be used for both 10-minute and 30-minute reserve. To qualify for supplemental reserve, the generator must be available but does not have to be operating (i.e., spinning).

5.2 Energy Sales and System Peak Growth

Customer load determines both the amount of energy and capacity that a utility needs to supply. Customer load over a year determines the utility's annual energy supply requirement, measured in megawatt-hours ("MWh"), and the highest instantaneous customer load throughout the year (i.e., the system peak) is used to determine the capacity requirement, measured in MW.[45]

In recent years, Maritime Electric's system peak has increased significantly. The two primary factors contributing to the Company's recent customer load growth are (1) PEI's rapid increase in population and (2) the transition from fossil fuel energy sources to electricity (i.e., electrification). Increases in population and electrification are discussed in the following sections.

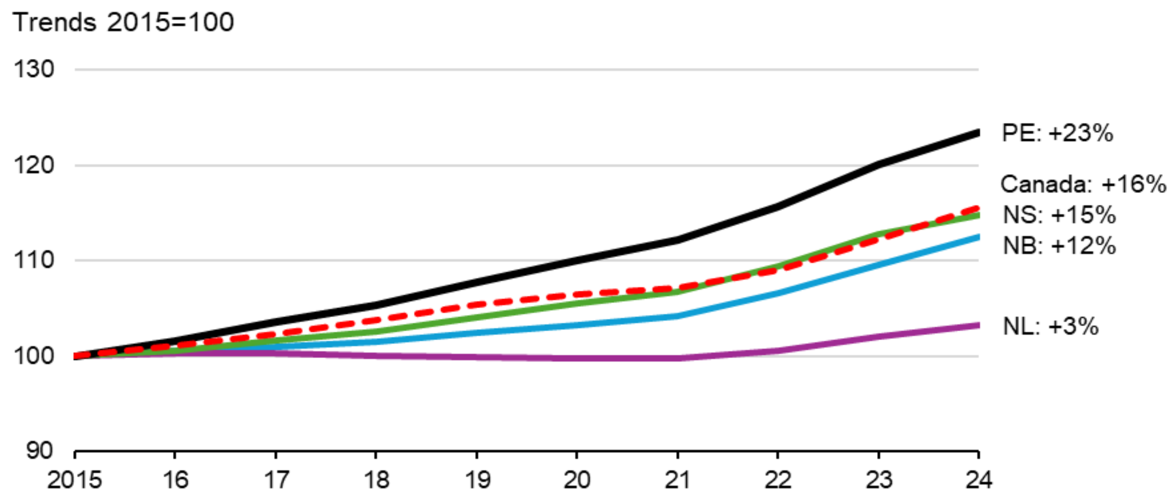
5.2.1 Population Increase

PEI's population has increased rapidly in recent years. Since 2015, PEI has experienced the fastest population growth of any Canadian province.[46] Figure 10 shows that PEI's population increased by 23 per cent since 2015, whereas Canada's population increased by only 16 per cent during the same period.

45 1 MWh is equal to 1 million watt-hours (Wh).

46 PEI's population grew by 23.4 per cent since July of 2015, the highest growth among Canadian provinces. The Territory of Yukon did experience a higher population growth of 23.8 per cent during the same period: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000901 – Statistics Canada Population estimates, quarterly.

FIGURE 10
Population Growth in Atlantic Canada

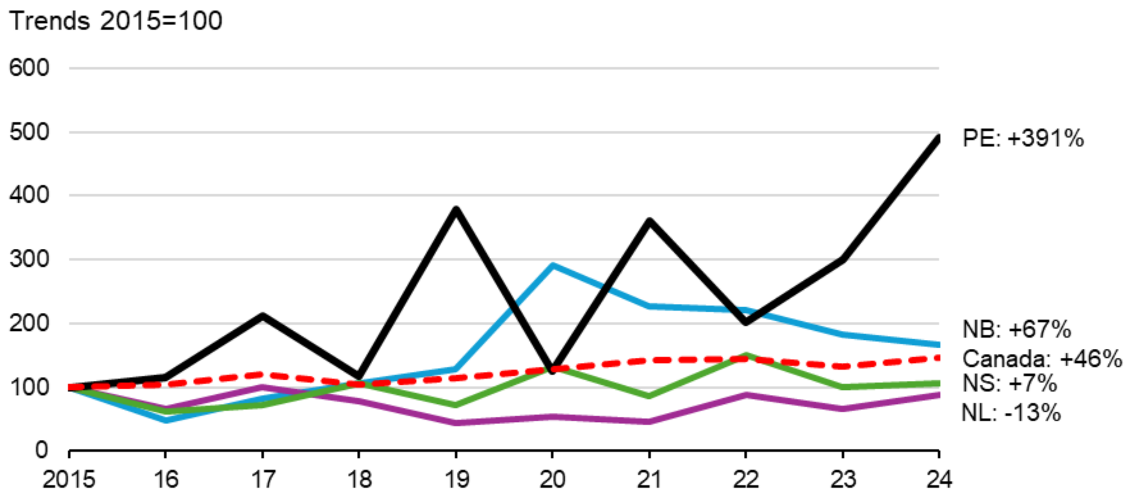


Data source: Statistics Canada. Population estimates quarterly.

The population growth experienced on PEI has resulted in the need for significantly more housing. Figure 11 shows that the annual number of housing starts on PEI has increased by 391 per cent since 2015, whereas the number of housing starts in Canada has increased by only 46 per cent during the same period.[47]

[47] Based on housing starts in July of each year.

FIGURE 11
July Housing Starts in Atlantic Canada



Data source: Statistics Canada. Canada Mortgage and Housing Corporation, housing starts.

PEI's increase in population and housing starts has had a direct impact on Maritime Electric's customer load, as most new construction on PEI has electricity as a primary source of heat. Developments of new single- and multi-family buildings are predominantly installing electric heat pumps supplemented by electric resistive backup heaters. The impacts of the electrification of space heating are discussed further in the following sections.

5.2.2 Electrification

Electrification refers to the transition from fossil fuel energy sources to electricity. The most significant contributor to Maritime Electric's customer load growth has been the electrification of space heating.

Historically, PEI residents used primarily furnace oil or wood for most of their space heating needs and, at that time, electricity accounted for less than 10 per cent of PEI's space heating needs. Electric space heating, primarily through electric boilers and convection air heaters, briefly became popular around 2007, when global oil and natural gas prices increased dramatically. As oil and natural gas prices subsided following a broad economic crisis in 2008, the popularity of electric space heating also decreased. However, since the early 2010s, there has been a gradual trend back to electric space heating that was kickstarted by heat pump technology improvements, and increased further when government incentives began in 2015.[48] This has converted a significant portion of the furnace oil and wood-based space heating on PEI to electric space heating, with corresponding increases in the need for electric energy and capacity.

Since 2015, the Governments of PEI and Canada have introduced many programs to incentivize the installation of heat pumps and other electric-based energy efficiency equipment, and the purchase of electric vehicles (“EV”). Recent programs include the Oil to Heat Pump Affordability (“OHPA”) Program, jointly announced by both Governments (February 2023),[49] and the Province’s expansion of eligibility requirements under its Net Zero Free Heat Pump Program (January 2024).[50] The OHPA Program incents residents with oil heating systems to install electric heating systems, and differs from past incentive programs as it can be applied towards the costs associated with the removal of oil heating systems. Maritime Electric estimates that the OHPA Program alone will result in an additional 30 MW of system peak load. These programs have accelerated the transition to electric space heating and driven higher demand for electric energy and capacity on PEI.

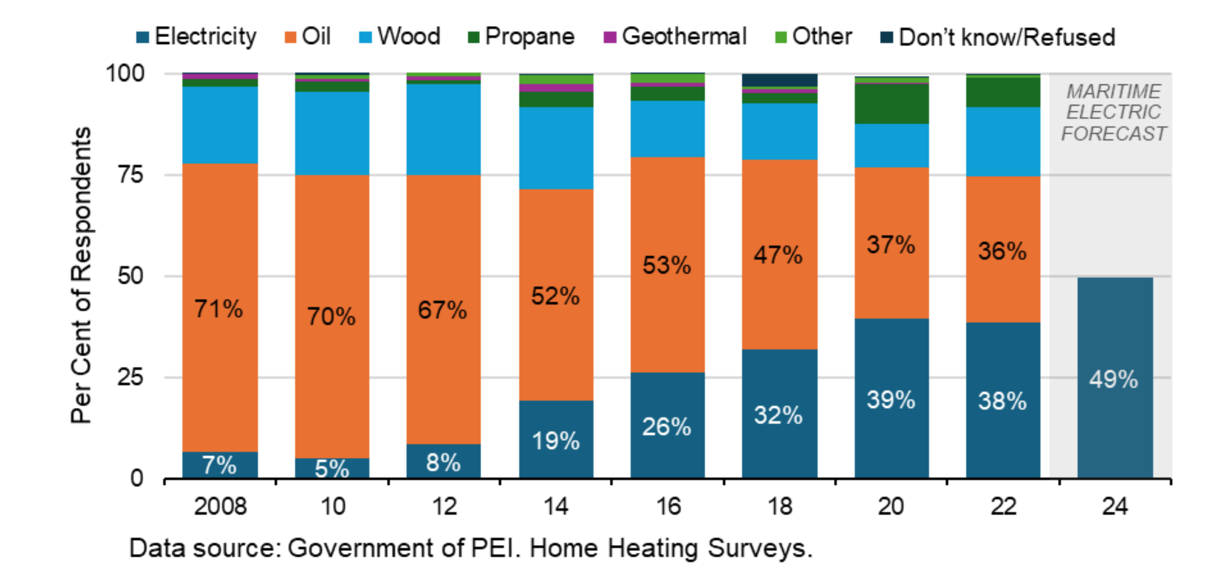
To date, residential space heating electrification has had the greatest impact on Maritime Electric’s system peak, and this trend is expected to continue. Figure 12 shows a breakdown of how primary heating systems on PEI have changed since 2008. The Figure also shows significant growth in the use of electricity as a primary heating source starting in 2014, but that oil, wood and propane heating systems continue to represent a large portion of primary heating systems on PEI. This indicates that the growth in electricity, as a portion of primary heat systems, could continue for some time.

[48] Early heat pump technology could not provide adequate heat during extreme cold weather. Technology improvements continue to increase efficiencies and the output capacity at cold temperatures.

[49] https://www.canada.ca/en/natural-resources-canada/news/2023/02/oil-to-heat-pump-affordability-grant0.html - Natural Resources Canada, Oil to Heat Pump Affordability Grant (Prince Edward Island)

[50] https://www.princeedwardisland.ca/en/news/nearly-3000-free-heat-pumps-installed-across-the-province-even-more-islanders-now-eligible – Government of PEI, Nearly 3,000 free heat pumps installed across the province; even more Islanders now eligible

FIGURE 12
PEI Primary Heating Systems



The demand for electricity on PEI will also increase due to the electrification of transportation. In 2022, 227 million litres of gasoline, 91 million litres of diesel and 113 million litres of furnace oil (i.e., light fuel oil) were sold on PEI.[51] As the PEI Government strives to achieve its net zero targets, converting 50 per cent of these sources of energy to electricity would result in an estimated 33 per cent increase in annual electricity supply requirements.[52]

5.2.3 Energy Sales Growth

The impact that increased population and electrification are having on PEI's electricity load is demonstrated in Figure 13. PEI's electricity load has grown by 66 per cent since 2005, which is over five times the Canadian average and the highest out of all Atlantic Canadian provinces.

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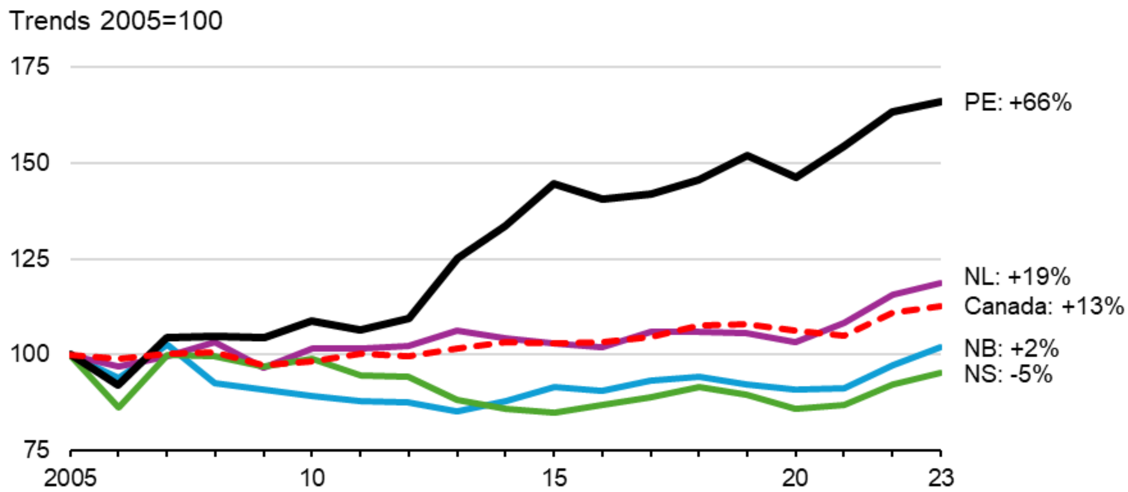
[51] https://www.princeedwardisland.ca/en/publication/annual-statistical-review-2022 - Government of PEI, 2022 Annual Statistical Review (Table 93).

[52] The PEI Government's 2040 Net Zero Framework sets a target of 55 to 65 per cent reduction in emissions from transportation and 85 to 90 per cent reduction in emission from buildings by 2040: https://www.princeedwardisland.ca/en/publication/2040-net-zero-framework - Government of PEI, 2040 Net Zero Framework.

FIGURE 13
Electricity Load Growth in Atlantic Canada



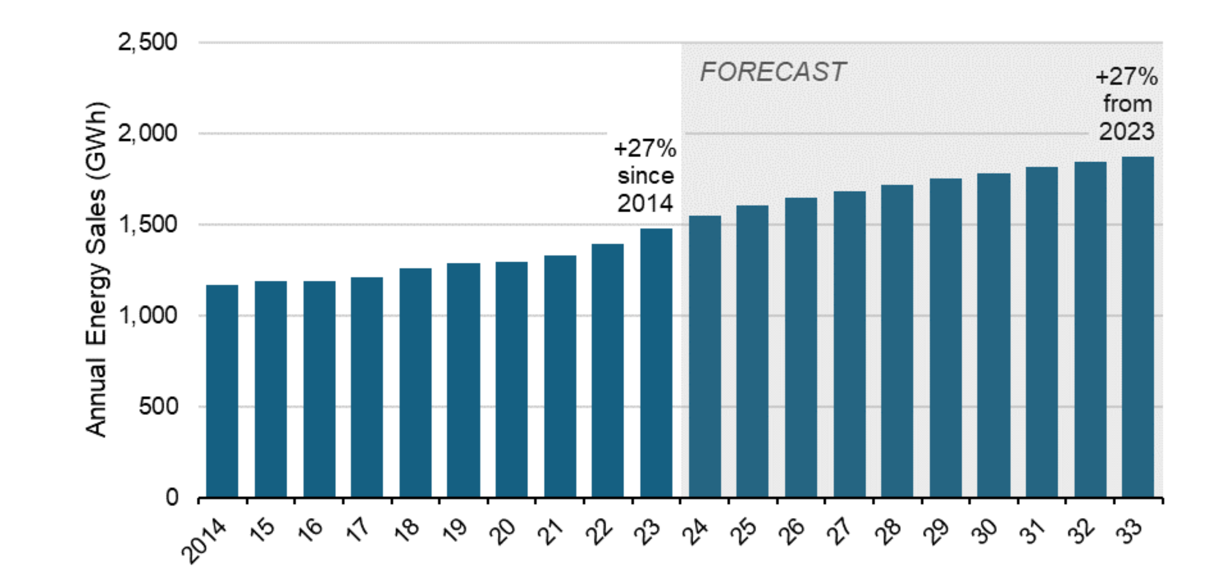
Data source: Canada Energy Regulator. Canada's Energy Future Data Appendices.

Historically, most of PEI’s space heating came from furnace oil-based sources; therefore, electrification is leading to significant electricity load increases. In comparison, provinces like NB historically had higher portions of electric-based heating sources; therefore, customer load increases in that province have been more moderate. As a result, PEI’s electricity load growth since 2005 is much higher than other provinces.

As increases in population and electrification on PEI are expected to continue, Maritime Electric forecasts continued growth in annual energy sales. Figure 14 shows the Company’s forecast annual energy sales for the 10-year period from 2024 to 2033 in gigawatt-hours (“GWh”).[53] The Figure shows that annual energy sales in 2033 are expected to be 27 per cent higher than 2023 levels, which is comparable to the energy sales growth in the previous 10-year period from 2014 to 2023.

[53] 1 GWh is equal to 1 billion watt-hours (Wh).

FIGURE 14
Annual Energy Sales Forecast



Although the Company must ensure it has sufficient energy resources to meet growing energy sales, the purpose of this Application is to address the Company's growing system peak and corresponding capacity requirements, which is discussed in the following section.

5.2.4 System Peak Growth

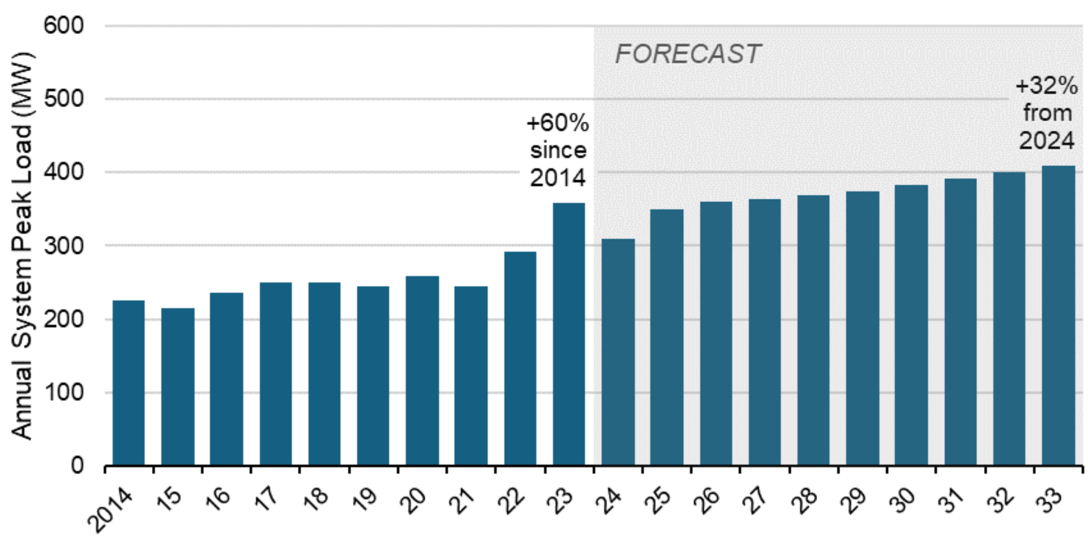
The electrification of space heating has a greater impact on system peak compared to annual energy sales because most electric space heating is being added in the form of heat pumps. Heat pumps are an efficient way to provide space heating, but their efficiency decreases as temperatures drop.[54] Additionally, many heat pump users have electric resistive heating systems as a supplementary (i.e., backup) heat source. The result is the potential for extremely high system peaks during cold weather due to (1) a lack of diversity due to the decreased efficiency of

54 Heat pumps can output between 2.0 and 5.4 kWh of heating energy for every 1 kWh of electric energy consumed under ideal conditions. This ratio can drop to 1:1 (i.e., 1 kWh of heating energy output per 1 kWh of electric energy consumed) during cold weather: https://natural-resources.canada.ca/energy-efficiency/energy-star-canada/about/energy-star-announcements/publications/heating-and-cooling-heat-pump/6817 – Government of Canada, Heating and Cooling with a Heat Pump.

heat pumps and (2) the operation of supplementary resistive electric heat, which compounds the impact on system peak.[55]

In recent years, Maritime Electric's system peak has increased significantly. Figure 15 shows the Company's annual system peak from 2014 to 2023.[56] In the 5-year period from 2014 to 2018, the Company's system peak increased by a compound annual growth rate of 2.7 per cent. In the subsequent 5-year period from 2019 to 2023, the Company's system peak increased by a compound annual growth rate of 10.0 per cent. Overall, the Company's annual system peak increased by 60 per cent between 2014 and 2023, whereas annual energy sales increased by only 27 per cent during the same period. The Company forecasts that the system peak will increase by 32 per cent in the 10-year period from 2024 to 2033. The system peak forecast forms the basis of the Company's capacity requirements, which are discussed in the following section.

FIGURE 15
System Peak Growth



55 An electric power system relies on the diversity of customer loads to manage peak demand. For instance, customers operate electric cooking, laundry and hot water appliances at different times, contributing to a diverse electric load. However, when ambient air temperatures decrease, heat pumps need to run longer to maintain a comfortable indoor temperature. This results in a larger number of heat pumps operating simultaneously, reducing the natural diversity of customer load and leading to higher system peaks.

56 The 2023 system peak occurred during the February 2023 polar vortex weather event. Polar vortexes are uncommon and resulted in an abnormally high system peak due to the extreme cold. Maritime Electric's 2024 system peak forecast is based on normal winter conditions.

5.3 Capacity Requirements

Maritime Electric has a responsibility to ensure that it has sufficient capacity resources to meet customer needs; therefore, the Company develops a capacity requirement forecast to determine the amount of capacity resources it must have in the future. This forecast is based on: (1) the Company's unadjusted system peak forecast;[57] (2) the expected impact of controllable demand side management ("DSM"); (3) the availability of interruptible customer loads; and (4) the Company's planning reserve requirement. Each of these elements are discussed in more detail in the following sections. The Company's capacity requirements forecast is provided in Table 9 in Section 5.3.5.

5.3.1 Unadjusted System Peak Forecast

Maritime Electric forecasts its unadjusted system peak by separating it into three components: (1) residential space heating; (2) non-space heating; and (3) large industrial. Table 8 shows a summary of the unadjusted system peak forecast.

TABLE 8
Unadjusted System Peak Forecast
(MW)

	2024[a]	2025	2026	2027	2028	2029	2030	2031	2032	2033
Residential Space Heating	113	137	145	150	156	163	168	174	179	185
Non-Space Heating	177	194	199	203	207	210	214	217	221	224
Large Industrial	20	19	20	20	20	20	20	20	20	20
TOTAL	**310**	**350**	**363**	**373**	**383**	**393**	**402**	**411**	**420**	**429**

a. 2024 values are based on the actual system peak observed in January 2024.

As the label suggests, the residential space heating category includes peak load related to space heating for the Residential rate class. This part of the forecast is based on a regression analysis that is used to evaluate the impacts of ambient temperature on the residential space heating load for the most recent heating season. The forecast for residential space heating is then calculated based on an ambient temperature of -13.6°C, which is the average temperature at which the peak load occurred in the past 10 years. Added to that calculation is the estimated incremental residential heating peak expected from housing starts, residential electrical panel upgrades and

[57] The Company's unadjusted system peak forecast refers to the Company's system peak forecast before adjusting for demand side management, interruptible customer loads and planning reserve.

heat pump installations, with heat pump installations having the largest impact.[58] The Company's forecast is based on the addition of 5,580 heat pumps per year in 2024 and 2025, and 2,430 heat pumps per year between 2026 to 2033 in existing dwellings.[59]

The non-space heating category includes peak load related to non-space heating for the Residential rate class, and peak loads related to the General Service, Small Industrial, Street Lighting and Unmetered rate classes. This part of the forecast is based on applying a historic load factor to the previous year's forecast of non-space heating energy sales.[60] Increases to energy sales for the category are forecast based on several factors, including:

- forecast number of housing starts;
- forecast number of customer-owned EVs, for which the Company's estimate includes 2,000 customer-owned EVs in 2024 increasing to a 16,000 by 2033; and
- forecast real gross domestic product ("GDP") for PEI.[61]

The large industrial category includes peak load related to the Large Industrial rate class. This part of the forecast assumes that the large industrial peak load will be consistent with past peak loads, and is adjusted based on announcements of production changes from existing or new Large Industrial customers.

5.3.2 Controllable Demand Side Management

DSM is a strategy used by the PEIEC to help reduce Maritime Electric's system peak, which benefits customers through avoided or delayed system capacity costs.[62] Current examples of DSM programs on PEI include the LED light bulb and energy efficient appliance programs

[58] The forecast number of housing starts is based on a forecast from the Conference Board of Canada. Residential electrical panel upgrades refer to customers upgrading their household electrical panel from 100 amperes ("A") to 200 A panels. This typically occurs as customers replace, or supplement, existing fuel-fired heating systems with electric heating systems.

[59] The number of heat pumps associated with new housing is calculated separately.

[60] Load factor is the ratio of an electrical systems average load to its peak load, which is calculated by dividing the total energy sales by the peak load multiplied by 8,760 hours in a year.

[61] The forecast real GDP for the province is based on a forecast from the Conference Board of Canada.

[62] Slowing down peak system growth avoids additional generating capacity that must be procured on an annual basis and delays the need to upgrade or expand both transmission and distribution systems in response to system growth.

administered by efficiencyPEI.[63] Program costs associated with DSM are currently funded by Government, Maritime Electric and the City of Summerside. Projected system peak reductions associated with DSM programs are incorporated into the Company's capacity requirements forecast.

There are two types of DSM programs: (1) non-controllable; and (2) controllable. Non-controllable DSM programs aim to improve energy efficiency and lower Maritime Electric's energy sales, which reduces the Company's energy sales forecast. The two examples above (LED light bulb and energy efficient appliance programs) are both considered non-controllable DSM programs. Controllable DSM programs aim to shift electricity usage from system peak periods to off-peak periods, which impacts the Company's system peak forecast. Examples of controllable DSM programs include incenting the installation of controllable water heaters and heating system thermostats, which can be controlled by the electric utility during system peaks.

The PEIEC provides Maritime Electric with a system peak reduction forecast based on their planned DSM programs, which is incorporated into the Company's capacity requirements forecast. The impact of non-controllable DSM programs is reflected in the Company's energy sales forecast and its unadjusted system peak forecast. Forecasted system peak reductions from controllable DSM programs, however, are directly subtracted from the Company's system peak forecast in the Company's capacity requirements forecast, shown in Table 9.[64]

Significant controllable DSM programs have not yet been implemented because the Company does not yet have a smart meter system (i.e., advanced metering infrastructure or "AMI") in place to enable communication with a customer's meter, a key feature used for controllable DSM programs in other jurisdictions. However, the Commission recently approved a Company application to upgrade to an AMI system.[65] Once implemented, this AMI system will enhance

[63] On PEI, the responsibility for DSM programs resides with the PEIEC, who administers such programming through efficiencyPEI.

[64] In accordance with direction from the Multiregional Modeling Working Group's ("MMWG") procedural manual (V35) for electrical system modeling, the impacts of controllable DSM are allowed to be included in generating capacity planning but are not included in transmission planning. MMWG is a subgroup of NPCC's Eastern Interconnection Reliability Assessment Group.

[65] Utility Application UE20737 was approved by the Commission in October 2024.

efficiencyPEI's ability to incorporate controllable DSM programs in the foreseeable future, which is reflected in the forecast.

5.3.3 Interruptible Customer Loads

Interruptible customer loads are those typically associated with large-usage customers that agree to reduce or eliminate their electricity consumption when there is insufficient generating capacity to meet the system peak. In exchange for allowing the utility to reduce or eliminate their electricity consumption when required, the customer receives a monthly billing credit based on the size of the load that the Company is allowed to interrupt. The use of interruptible customers is a common and cost-effective method for reducing capacity requirements and related costs in the industry. Maritime Electric has a total of 14 MW of interruptible customer load that is subtracted from the Company's unadjusted system peak forecast when calculating the capacity requirements forecast.

5.3.4 Planning Reserve Requirement

Planning reserve is a fixed amount of generating capacity that a utility is required to reserve to account for extreme system peaks or the unplanned failure of a generator. The magnitude of Maritime Electric's planning reserve is dependent on the level of planning reserve required for the Maritimes area by the NPCC and forms part of Maritime Electric's Interconnection Agreement with NB Power.[66] This Agreement stipulates that Maritime Electric must have a generation planning reserve equal to 15 per cent of its forecast annual system peak, adjusted for DSM and interruptible customer loads. For reliability purposes, the Interconnection Agreement also stipulates that a single generator cannot account for more than 30 per cent of Maritime Electric's total generating capacity resources. The 15 per cent planning reserve is added to Maritime Electric's adjusted system peak forecast when calculating the Company's capacity requirements forecast, shown in Table 9.

[66] The Maritimes area consists of PEI, NB, NS, and northern Maine. The NPCC planning reserve amount for the Maritimes area is based on an amount that would require the area to shed firm load due to insufficient generating capacity no more than one day in 10 years, on a probabilistic basis.

5.3.5 Capacity Requirements Forecast

As discussed above, Maritime Electric's capacity requirements forecast provides the total amount of capacity required to meet customers' future needs. Table 9 shows the calculations for Maritime Electric's capacity requirements forecast for the 10-year period from 2024 to 2033. The forecast shows that, despite increases in controllable DSM, the Company's capacity requirement is expected to increase by 114 MW during the forecast period (454 minus 340 MW).

TABLE 9
Capacity Requirements Forecast
(MW)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Unadjusted System Peak Forecast	310	350	363	373	383	393	402	411	420	429
Less: Controllable DSM	-	-	(3)	(9)	(14)	(18)	(19)	(19)	(20)	(20)
Adjusted System Peak Forecast	**310**	**350**	**360**	**364**	**369**	**375**	**383**	**392**	**400**	**409**
Less: Interruptible Customer Loads	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)
Plus: 15% Planning Reserve Requirement	44	50	52	53	53	54	55	57	58	59
Capacity Requirement	**340**	**386**	**398**	**403**	**408**	**415**	**424**	**435**	**444**	**454**

5.4 Capacity Resource Adequacy Assessment

Maritime Electric has a contractual obligation to secure adequate generating capacity, referred to as the Company's capacity requirement, to meet the needs of its customers.[67] The Company evaluates its ability to meet the capacity requirements by completing a capacity resource adequacy assessment ("CRAA"), annually. The CRAA is based on the Company's capacity requirements forecast, which is discussed in Section 5.3.5, and summarized in Table 9. The CRAA is a 10-year outlook that compares the capacity requirements forecast to the expected available generating capacity resources.

[67] The contractual obligation is per the 1977 Interconnection Agreement between Maritime Electric and NB Power, which was established to regulate the amount of capacity that Maritime Electric and PEI contributes to the overall Maritimes area regional capacity requirements.

Table 10 shows the 10-year CRAA forecast, which includes Maritime Electric's existing capacity resources, as discussed in Section 5.1.2. The CRAA forecasts a capacity deficit of 60 MW in 2025, which is equivalent to the supply of electricity to approximately approximately 17,100 homes during system peak periods, increasing to 156 MW by 2033, which is equivalent to the supply of electricity to approximately 44,600 homes during system peak periods.

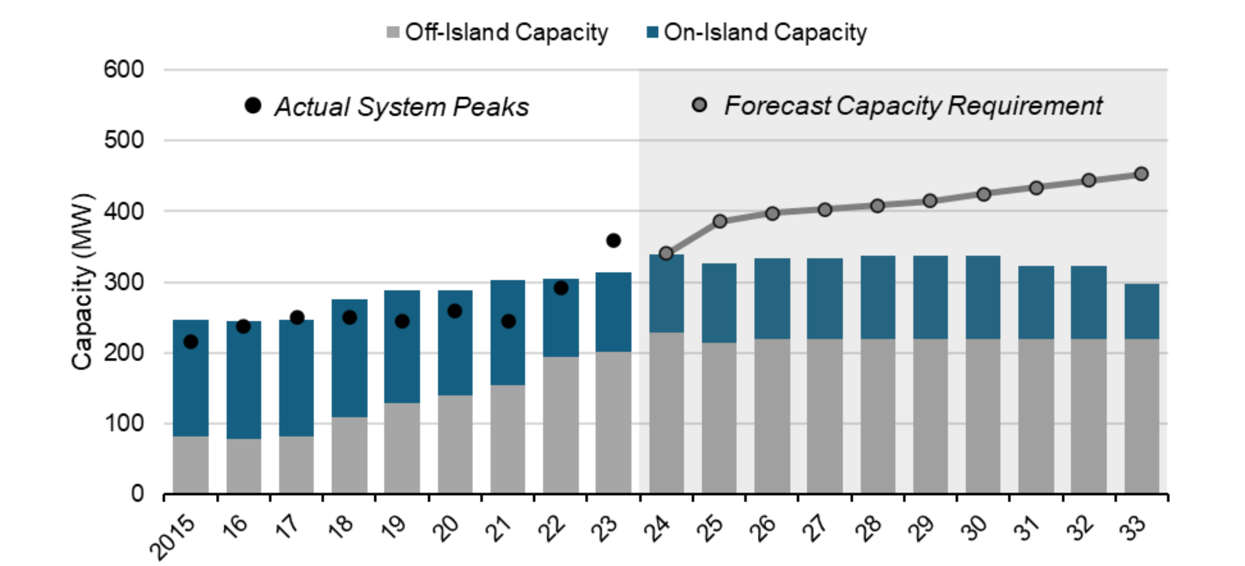
TABLE 10
Capacity Resource Adequacy Assessment
Existing EPA Capacity Projected into Future
(MW)

	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Forecast Capacity Requirement (from Table 9)	340	386	398	403	408	415	424	435	444	454
Capacity Resources										
Point Lepreau	29	29	29	29	29	29	29	29	29	29
NB Power firm capacity purchases[a]	180	185	190	190	190	190	190	190	190	190
NB Power short-term capacity purchases[b]	19	-	-	-	-	-	-	-	-	-
Wind ELCC[c]	23	23	26	26	30	30	30	30	30	30
CT1[d]	15	15	15	15	15	15	15	-	-	-
CT2[d]	25	25	25	25	25	25	25	25	25	-
CT3	49	49	49	49	49	49	49	49	49	49
Total Capacity Resources	**340**	**326**	**334**	**334**	**338**	**338**	**338**	**323**	**323**	**298**
Capacity Surplus (Deficit)[e]	-	(60)	(64)	(69)	(70)	(77)	(86)	(112)	(121)	(156)

a. Firm capacity purchases for 2024 and 2025 are reserved under the current EPA, and 2026 to 2033 are projected levels.
b. NB Power has allowed Maritime Electric to purchase short-term capacity in 2024 and in previous years to cover increased capacity requirements compared to the level reserved in the EPA. Future availability of such short-term capacity is uncertain and, therefore, not included in this assessment. Table 17 in Section 7.2.2 shows a version of the CRAA if the maximum amount of short-term capacity is available in the future.
c. Wind ELCC is a probabilistic calculation that determines the amount of capacity that will be available from the entire wind fleet during system peak.
d. CT1 and CT2 have anticipated retirement dates of 2031 and 2033, respectively.
e. A capacity deficit means that the Company has insufficient resources under contract to meet its capacity requirement and is at risk of not being able supply customer load during system peak periods.

Figure 16 shows a graphical representation of the CRAA for 2015 to 2033. The Figure shows an increasing capacity resource deficit if the Company continues to rely on existing capacity resources, which includes the assumption that 190 MW of capacity will continue to be available from NB Power, but nothing additional.

FIGURE 16
Capacity Resources Forecast
Using Existing EPA Capacity Levels



Until recently, the Company had an amount of on-Island dispatchable generating capacity equal to at least 50 per cent of its system peak. The recent retirement of the Charlottetown Steam Plant and significant customer load growth has significantly reduced this percentage. In 2023, the amount of on-Island capacity resources fell to 31 per cent of the Company's system peak, and the percentage is forecast to fall to 17 per cent by 2033 if on-Island capacity resources are not added. The Project is expected to raise the on-Island dispatchable generation level to above 50 per cent by 2031.

6.0 PROPOSED PROJECT

Population growth and electrification are resulting in significant increases to Maritime Electric's system peak. The Company forecasts a capacity deficit of 156 MW by 2033. Without additional capacity resources, it will become increasingly difficult to meet the needs of customers during system peak periods. Maritime Electric has a responsibility to ensure that it has sufficient capacity resources to meet future customer needs. To address the forecast capacity deficit, the Company submits this Application seeking approval of the On-Island Capacity for Security of Supply Project, which includes the following three components:

- a 10 MW/40 MWh BESS;
- a 50 MW CT4 with synchronous condenser capability; and
- a 90 MW RICE plant.

The capacity values listed in this section (i.e., 10, 50 and 90 MW, respectively) are nominal capacity values, meaning they are approximate and may differ slightly from actual installed capacity values. During the RFP process, Maritime Electric will obtain proposals for a BESS, CT and RICE plant with capacity values that may differ from the Project components defined in this section.[68]

The Project will add 150 MW of additional on-Island capacity resources, which is equivalent to the supply of electricity to approximately 42,900 homes during system peak periods. The Company has selected the CGS site for the CT4 component, but further analysis is required to determine the location of the BESS and RICE plant components.

6.1 Battery Energy Storage System

Maritime Electric is seeking Commission approval to install a 10 MW BESS with 40 MWh (i.e., 4 hours) of storage. The BESS will be used to help meet the Company's annual ancillary service and capacity requirements, reducing the amount of these products currently purchased from NB Power.

[68] For example, the CT is currently based on a 50 MW General Electric LM6000 PC Combustion Turbine; however, alternate manufacturers have different product offerings, and the actual output will not be known until final product selection is completed.

Description

The exact location of the BESS has not yet been finalized. The BESS will be integrated into a substation that has a minimum of two paths to Maritime Electric's transmission system and distribution load. The BESS will include:

- battery storage modules with the capability to store 40 MWh of energy;[69]
- 10 MW of inverters to convert AC electricity into DC for storage and to convert the DC energy back to AC for use on the system when required;
- 10 MW of transformation to step-up the output voltage to the station voltage; and
- additional equipment as required to integrate the BESS into the electrical system.[70]

The BESS is an excellent capacity resource option due to its increased flexibility and positive financial impact.[71] It can serve as a capacity resource or provide fast-acting grid services (i.e., ancillary services), both of which are currently sourced from off-Island resources. Additionally, the BESS has the potential to offer future services, such as energy arbitrage, which could help ensure that renewable energy generated on PEI is consumed locally in the future.

Figure 17 shows a picture of the City of Summerside's 10 MW/20 MWh BESS that was installed as a part of its recent Sunbank Project.

[69] Maritime Electric has not yet selected a battery manufacturer, but 40 MWh of energy storage would equate to approximately 10 shipping container-sized modules.

[70] The list is a high-level list of equipment and is not exhaustive. The upfront engineering will determine the final arrangement and necessary equipment.

[71] The BESS has a positive net present value when the credit for avoided off-Island capacity purchases and ancillary services are considered.

FIGURE 17
City of Summerside Sunbank Project BESS[72]

Operation

During the winter period from December through February (i.e., the high customer load period), the BESS will serve as a 10 MW capacity resource, which will help the Company meet its capacity requirement. During this period, the BESS will remain fully charged and available for use during system peak periods. Specifically, it will be unavailable to (1) respond to Hold-to-Schedule directives from NB Power and (2) backstop renewable energy resources.

For the remainder of the year from March through November (i.e., moderate to low customer load periods), the BESS will help the Company meet its ancillary service requirements, as per the Company's Interconnection Agreement with NB Power. Using the BESS as a capacity resource during the winter period and as ancillary service support for the remainder of the year maximizes its economic benefit. Table 11 shows the types and quantities of ancillary services that Maritime Electric is required to provide, and the current cost of securing those services from the New Brunswick Power Open Access Transmission Tarriff ("NB Power OATT").

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[72] https://www.saltwire.com/atlantic-canada/news/summerside-now-frequently-powered-completely-by-its-own-renewable-energy-sources-100968245/ - Saltwire, Summerside now frequently powered completely by its own renewable energy sources.

TABLE 11
Maritime Electric Ancillary Service Requirements

Ancillary Service	Rate ($/MW-yr)[a] A	Obligation (MW) B	Cost ($/yr) C = AxB	Provided by BESS (MW) D	Annual Savings[b] ($) E=AxD/12x9
Automatic Generation Control (AGC)	126,862	1.7	215,666	-	-
Load Following	126,422	4.7	594,185	2.2	208,597
Spinning reserve	126,276	7.8	984,950	7.8	738,712
Supplemental Reserve - 10 minute	75,218	19.9	1,481,795	Covered by existing CTs	-
Supplemental Reserve - 30 minute	75,218	16.4	1,218,532	Covered by existing CTs	-
				TOTAL SAVINGS	**$947,309**

a. Rates are published in the NB Power OATT Tariff under Schedules 3, 5 and 6: https://tso.nbpower.com/Public/en/docs-EN/tariff/TransmissionTariff_20230101_EN.pdf - NB Power, OATT.
b. Annual savings are associated with not having to purchase these services for nine months of the year.

Due to Maritime Electric's ancillary service requirement levels, the economic benefit of the BESS decreases for a BESS larger than 12.5 MW, at which point it would be considered oversized relative to the Company's ancillary service requirements. The Company selected a 10 MW BESS to maximize its economic benefit and allow it to be installed at a substation without the need for significant substation upgrades.[73]

Location

Further engineering analysis is required to determine a final site for the BESS. Some of the criteria for the selected location include:

- at or close to a distribution substation with significant year-round customer load, such that it can supply up to 10 MW of customer load when required; and
- at a substation connected to a primary transmission line (preferably a transmission hub), such that the substation will have good reliability and thus minimize periods when the capacity and ancillary services are electrically disconnected from the system.

[73] All distribution substations operated by Maritime Electric are designed to accommodate a minimum of 10 MW. Additional rationale for selecting a 10 MW BESS is provided in Section 8.3 – Additional BESS Capacity.

The Company intends to retain a consultant with expertise in BESS development to assist with the final design, including site selection. The selected site will require an Environmental Impact Assessment ("EIA") and a Development Permit, which will include opportunities for public and local jurisdictional input.

6.2 Combustion Turbine

Maritime Electric is seeking approval from the Commission to install a 50 MW CT (to be referred to as CT4) at the CGS. If approved, CT4 will primarily serve as peaking and backup generation to help the Company meet its capacity requirements, which will reduce the annual amount of generating capacity purchased from NB Power.

Description

The 50 MW CT will include:

- a 50 MW aeroderivative CT (similar to CT3);[74]
- a 50 MW generator to convert the mechanical energy into AC electricity at 13.8 kV;
- a 60 MW power transformer to step the voltage up from the generator output voltage of 13.8 kV to the transmission voltage of 69 kV;[75]
- a 13.8 kV switchgear with the ability to supply up to four additional distribution circuits;[76]
- a two-million litre diesel storage tank, a diesel storage day tank and fuel filtration and forwarding equipment;
- a 30-metre high exhaust stack;[77]
- an air-intake filter house;

[74] CT4 is based on a General Electric LM6000 PC model with dual fuel capabilities of diesel and natural gas. GE LM6000 units are also capable of burning bio-diesel or bio-diesel/diesel mixes, as well as natural gas/ammonia and natural gas/hydrogen blends.

[75] The power transformer will be designed to provide backup capacity for the CT3 step-up transformer (X4), which currently does not have a backup. The existing X4 transformer will also be capable of providing backup to the new CT4 transformer.

[76] Including switchgear at the generator output voltage of 13.8 kV allows the Company to serve local distribution load if the transmission substation or transmission system is out of service. The switchgear also serves to off-load the power transformer.

[77] The new exhaust stack for CT4 will match the existing CT3 stack.

- a 700 kW black-start generator;[78]
- a clutch and associated equipment, allowing the generator to operate as a synchronous condenser; and
- additional equipment, such as fuel piping, station service and electrical cabling, compressed air and a water purification system for nitrogen oxide ("NOx") emission controls.[79]

CT4 will increase Maritime Electric's on-Island capacity resources and reduce its reliance on off-Island capacity resources, which is expected to increase the reliability of the capacity supplied to customers. As demand for, and shortfalls of, capacity increases in the region, the cost to purchase off-Island capacity is expected to surpass the cost of CT4 in the future. Additionally, the reliability benefits of installing capacity on-Island, and the Interconnection and mainland transmission system upgrades required to purchase additional off-Island short-term capacity, make CT4 an attractive solution.

One of the reasons a CT was selected for the Project was the ability to include a synchronous condenser, which can supply necessary reactive power without fuel consumption, thereby enhancing system stability and support. CTs are also a mature technology, and Maritime Electric has experience operating and maintaining CTs. Furthermore, the CGS site, which has hosted generation for over 100 years, has adequate space to accommodate an additional CT. CT4 will provide critical backup near the Company's largest customer loads, and it provides the best opportunity to significantly increase the Company's on-Island capacity in a timely manner.

Operation

CT4 will operate primarily in a peaking or backup capacity role, similar to the Company's existing CTs (e.g., to respond to unplanned system events, Hold-to-Schedule directives from NB Power, and to support Maritime Electric's system during on-Island maintenance activities).

[78] Black-start generators are required to allow the CT to start during power outages. CT3 currently has a black-start generator, and it may be possible to use CT3's existing black-start generator to start either CT3 or CT4. Further engineering is required to determine if this alternate arrangement is favourable. The current CT4 cost estimate includes a separate black-start generator.

[79] The list is a high-level list of equipment and is not meant to be exhaustive. The upfront engineering will determine the final arrangement and necessary equipment.

The inclusion of a synchronous condenser will provide dynamic system voltage support to the PEI electrical system with minimal operating cost. As customer load continues to increase, the Company expects that it will be required to operate CT4 as a synchronous condenser more frequently. This operational strategy will enable CT4 to supply necessary reactive power support without fuel consumption.[80] By leveraging CT4 in this manner, Maritime Electric can better manage growing customer load, maintaining reliable and efficient service for customers.

Location

The addition of CT4 at the CGS was considered when CT3 was installed in 2005. The site's physical layout and existing equipment, including a transmission substation, water treatment system, compressed air system, fuel storage and delivery infrastructure and an equipment building, were designed to accommodate a second CT. The benefits of locating CT4 at the CGS site are that:

- it will provide much needed backup during CT3 maintenance operations and vice versa;[81]
- it will allow the step-up transformer for each of CT3 and CT4 to be a backup for the other;[82]
- it will provide the additional generation needed in Charlottetown to offload the West Royalty 138 to 69 kV autotransformers during maintenance outages or periods of high customer load;
- the addition of a synchronous condenser, which is more cost effective when added to a new CT, will provide reactive power for the transmission system in the Charlottetown and eastern PEI areas;[83]
- the CGS site provides reliable access to customer load through the Charlottetown Plant substation, which has three transmission line connections and local distribution circuits;

80 Further information on the benefits of a synchronous condenser and a justification for why Maritime Electric is including a synchronous condenser in the Project can be found in Section 7.5.

81 Because there is no other dispatchable generation in eastern PEI, CT3 maintenance can only occur during low customer load periods. As customer load increases, periods of time when CT3 maintenance can occur is limited. The addition of CT4 will reduce limitations for CT3 and CT4 maintenance periods.

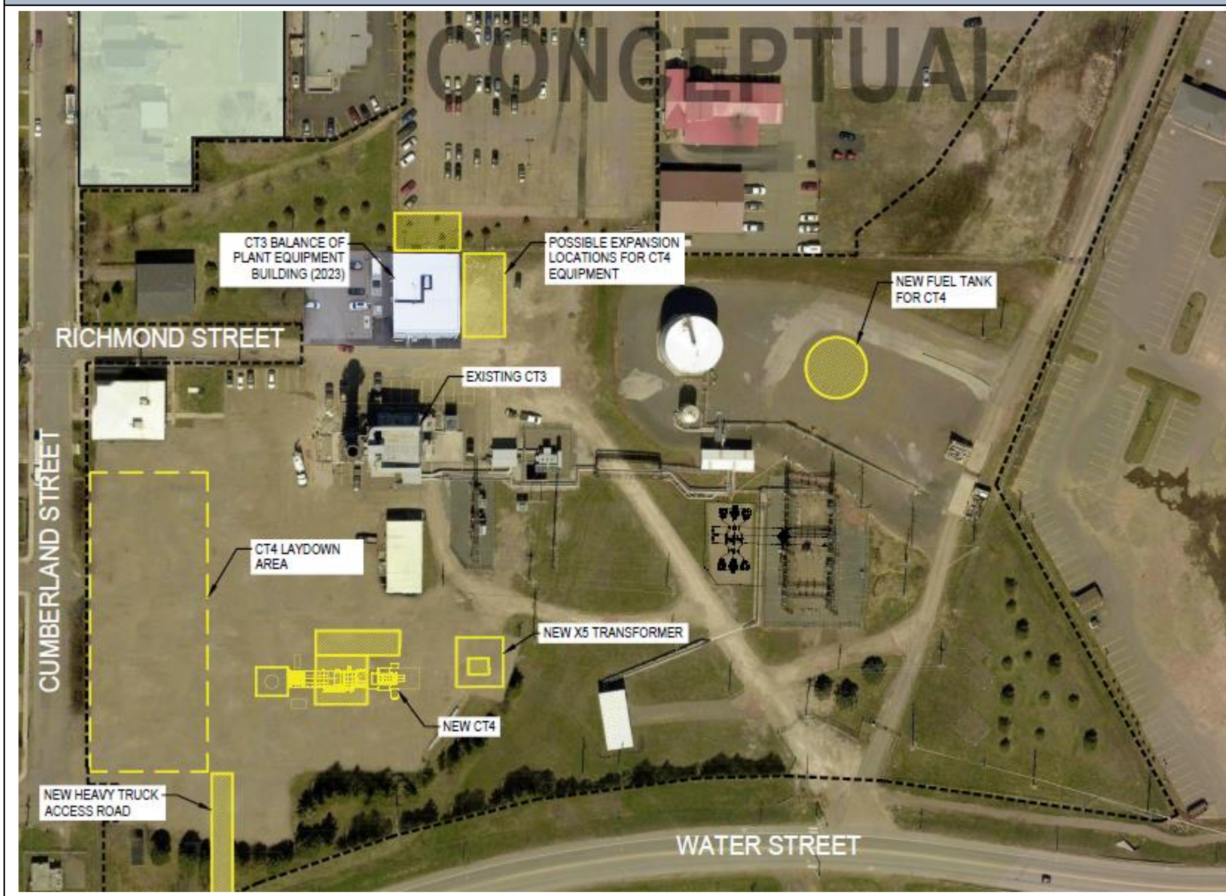
82 The step-up transformer for CT3 (X4) is the only such transformer operated by Maritime Electric, meaning there is currently no backup. If X4 were taken out of service, CT3 would no longer be available to the transmission system. And a replacement transformer may have a 2-year delivery.

83 The synchronous condenser must be in Charlottetown or eastern PEI to maximize its benefits because that is where 65 per cent of Maritime Electric's load is located. Further information on the benefits of a synchronous condenser and a justification for why Maritime Electric is including a synchronous condenser in the project can be found in Section 7.5.

- locating two CTs on the same site will improve operations and maintenance ("O&M") efficiency;
- some existing CT3 infrastructure may also be able to support CT4 (further analysis is required); and
- a portion of the environmental and municipal permitting work was completed in 2014 and 2015 for a previous CT4 application, which will reduce the costs of developing these applications and allow the Company to submit such applications in a timely manner.

Figure 18 shows a proposed layout for the CGS site with the inclusion of CT4.

FIGURE 18
Charlottetown Generating Station Proposed Site Layout with CT4



6.3 Reciprocating Internal Combustion Engine Plant

Maritime Electric is seeking Commission approval to install a 90 MW RICE plant. The RICE plant will include five 18 MW RICEs, fuel handling and storage infrastructure, associated equipment, a substation and a transmission connection. If approved, the RICE plant will operate primarily as peaking and backup generation to help the Company meet its capacity requirements, reducing the amount of annual generating capacity that is currently purchased from NB Power.

Description

The RICE plant will be constructed on a greenfield site, and will include:

- five 18 MW RICEs;[84]
- five 18 MW generators (one for each RICE) to convert the mechanical energy into AC electricity;
- two 60 megavolt-amperes ("MVA") power transformers to step up the voltage from the generator output voltage to the transmission voltage;
- two 1.5-million litre diesel storage tanks, one diesel storage day tank, fuel filtration and forwarding equipment and a fuel containment system;[85]
- five exhaust stacks with silencers;
- one pre-engineered building to house the RICEs and associated equipment;
- one air-intake system, including weather hoods and filtration;
- one engine cooling system;
- one 700 kW black-start generator;[86] and
- additional equipment such as fuel piping, station service and electrical cabling and compressed air.[87]

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[84] The RICE plant is based on a Wartsila model 20V32 engine with dual fuel capabilities. Dual fuel refers to the unit's ability to burn diesel and natural gas. RICEs are capable of burning a wide variety of fuels including bio-diesel or bio-diesel/diesel mixes, and natural gas/ammonia and natural gas/hydrogen blends.

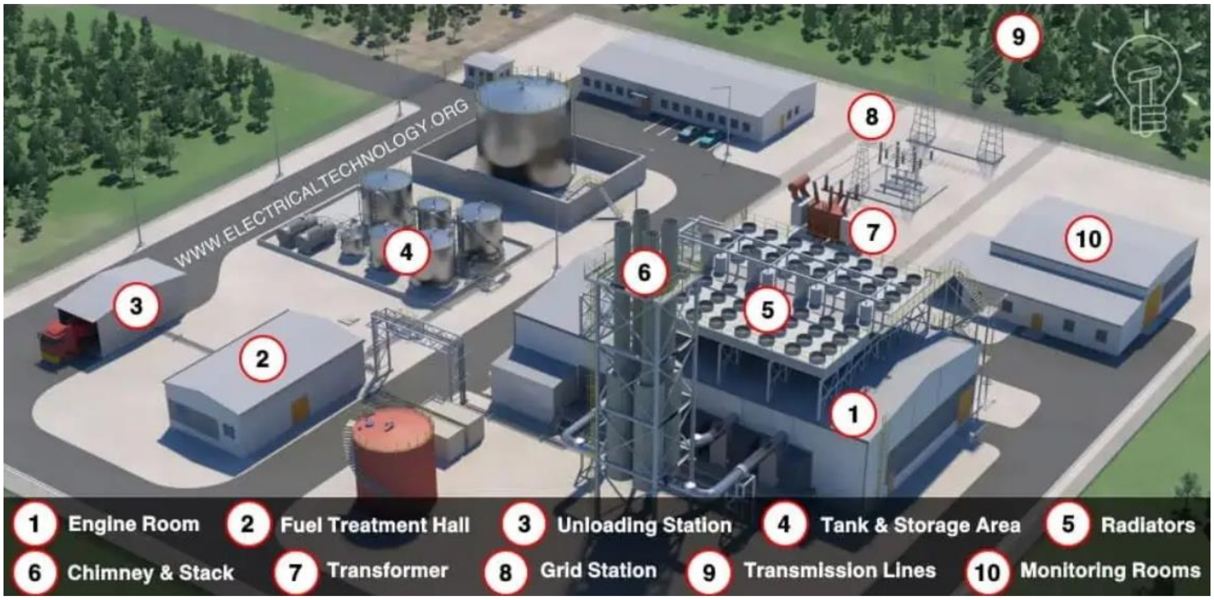
[85] The provision of two 1.5 million litre diesel storage tanks will allow approximately seven days of operation, consistent with the current fuel storage capabilities for CT3 and that proposed for CT4. Two tanks also allow the Company to perform mandated internal tank inspections on either tank without taking the plant offline, which increases reliability for customers.

[86] A black-start generator will be capable of starting one RICE, which would then be used to start subsequent RICEs, as required.

[87] The list is a high-level list of equipment and is not meant to be exhaustive. The upfront engineering will determine the final arrangement and necessary equipment.

The RICE plant will also require transmission line connections and potentially additional 69 kV to 138 kV voltage transformation. Figure 19 illustrates the typical site layout of a RICE plant.

FIGURE 19
RICE Plant Typical Site Layout[88]



A RICE plant was selected for the Project because, similar to CTs, RICE technology is a dispatchable generating resource that is flexible (i.e., they can start, stop and ramp quickly) and is the most cost-effective dispatchable generation technology currently available to the Company. RICEs provide the best future fuel flexibility, and their modular design results in reduced reliability impacts during maintenance activities. RICEs also provide improved operating efficiencies when operating at lower output levels or during warmer weather, which will allow the Company to increase the overall efficiency of its generation fleet.

Operation

The RICE plant will operate primarily in a peaking or backup capacity role, similar to the Company's existing CTs (e.g., to respond to unplanned system events, Hold-to-Schedule directives from NB Power, and to support Maritime Electric's system during on-Island

[88] https://www.electricaltechnology.org/2021/08/diesel-power-plant.html – Electrical Technology, Diesel Power Plant – Components, Operation and Applications.

maintenance activities). RICEs have low minimum operating levels (i.e., in the range of one to two MW) and consistent operating efficiencies at low output levels; therefore, it will become the Company's primary source of on-Island dispatchable generation when only small amounts of generation are required.[89] Also, RICE generation will be prioritized over CT generation during warmer weather, as RICE output and efficiency does not vary with outdoor air temperatures; in comparison, the output and efficiency of CTs decrease as air temperatures increase.

Location

There are several considerations when selecting the optimal location for a RICE plant on PEI:

- A plant that is ideally located at or near a transmission hub. Access to multiple transmission lines increases the probability that the generation will be accessible during system contingencies, especially during adverse weather conditions.
- A location in eastern or western PEI would have significant system benefits as these areas will lack adequate system voltage support as customer load increases.[90]
- The addition of CT4 at the CGS site will result in adequate backup generation in the Charlottetown area. Also, any further generation on the CGS site would require significant transmission upgrades, which is not as cost efficient as installing new transmission at a greenfield site.
- The RICE plant is not as well suited for installations near densely-populated areas as it requires a significant amount of land, which would be challenging to obtain and likely expensive.
- RICEs rotate at slower speeds with higher torque than CTs and generate low frequency noise and vibrations, requiring significant and costly sound attenuation and vibration isolation when located near densely-populated areas.
- The City of Summerside currently maintains 15 MW of dispatchable RICEs in that area of the Province, which can be called upon by the Maritime Electric System Operator.

89 In comparison, CT3 has a minimum load level of 15 MW. This means that when less power is required, another source, typically the Interconnection, must be reduced to allow CT3 to operate; resulting in increased operating costs and GHG emissions for the Company.

90 The need for voltage support is currently higher in eastern PEI.

If the Project is approved, the Company will engage a consultant with expertise in RICE plant development to assist with the site selection. The selected site will require EIA and Development Permit approvals, which will include opportunities for public and local jurisdictional input.

6.4 Project Cost

S&L provided Maritime Electric with a cost estimate for the project. This section outlines the costing methodology employed, the AACE International ("AACE") cost estimate classification and the specific contingencies applied to various project components. It also includes an assessment of the NPV of the project.

6.4.1 Costing Methodology

In September 2023, S&L provided preliminary cost estimates for the dispatchable generation portfolios that they recommended.[91] In September 2024, following the selection of the Project components (i.e., BESS, CT and RICE plant), the preliminary cost estimates were updated by S&L and are provided in Appendix A.

Table 12 shows probable accuracy ranges based on the AACE cost estimate classification system. Based on the maturity level of the project definition and the estimating methods used, S&L categorized the cost estimates as Class 4/5 estimates based on the AACE cost estimate classification system and assigned a probable accuracy range of +/- 30 per cent to the estimates. The probable accuracy range is based on the total cost estimate after the application of appropriate contingency.[92]

[91] The initial cost estimate, completed in September 2023, has not been included in this Application in lieu of the current cost estimate provided in September 2024 and included in Appendix A. S&L also completed an alternate cost estimate for the 90 MW RICE plant in January of 2024 as a five-unit RICE plant was not priced in the original cost estimate.

[92] The +/- value represents typical percentage variation at an 80 per cent confidence interval of actual costs from the cost estimate after application of contingency. Due to market and inflationary pressures and the expected length of time before equipment can be ordered, Maritime Electric does not expect the actual project costs will less than the cost estimate provided.

TABLE 12 AACE Cost Estimate Classification System[a]				
Estimate Class	**Maturity Level of Project Definition Deliverables (per cent of complete definition)**	**End Usage (typical purpose of estimate)**	**Methodology (typical estimating method)**	**Expected Accuracy Range**
Class 5	0% to 2%	Concept screening	Capacity factored, parametric model, judgement, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bod/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit costs with detailed take-off	L: -3% to -10% H: +3% to +15%

a. AACE International Recommended Practice No. 56R-08. Cost estimate classification system – as applied in engineering, procurement, and construction for the building and general construction industries.

S&L estimated that approximately 2 per cent of the Project's engineering is complete. As a result, contingencies are included in the cost estimate as follows:

- Materials: 25 per cent of cost;
- Process equipment: 20 per cent of cost;
- Labour: 25 per cent of cost;
- Construction equipment: 25 per cent of cost;
- Subcontract: 20 per cent of cost; and
- Indirect contingency: 25 per cent of cost.

S&L's cost estimates were based on its recent experience with similar projects. Specific quotes for individual components were not obtained, except for the CT and associated generator. Transformer costs are based on quotes or recent purchases by Maritime Electric. A complete list of cost assumptions is included as Exhibit J in S&L's Cost Estimate, which is included in Appendix A.[93] A summary of the key cost assumptions are as follows:

- Start-up and commissioning support: 2 per cent of total project costs;
- Contractor general and administrative costs: 7 per cent of total project costs;
- Contractor risk fee and profit: 10 per cent of total project costs;
- Owner's costs: 3 per cent of total project costs;
- Warehouse spares: $2,250,000; and
- Fuel costs are included for commissioning purposes, but "first fills" for fuel tanks have not been included.

6.4.2 Class 4/5 Cost Estimate

The final cost of the Project will depend on actual capacity values, inflation and future exchange rates, which make it challenging to provide an accurate cost estimate today. These cost factors are described in detail below.

The capacity values of each component described in this section (i.e., 10, 50 and 90 MW, respectively) are nominal capacity values. During the RFP process, Maritime Electric will obtain proposals for a BESS, CT and RICE plant with capacity values that may differ from the Project components defined in this section. For example, this Application assumes that the RICE plant will consist of five 18-MW RICEs, for a total of 90 MW (i.e., 5 x 18 MW = 90 MW). However, a manufacturer may propose four 20-MW RICEs, which would result in a total capacity of 80 MW (4 x 20 MW = 80 MW). The cost of the Project is dependent on the specific BESS, CT and RICE models and capacity values selected, which will not be known until the RFP process is completed.

Given that the construction of the BESS, CT4 and RICE plant is not anticipated to be complete until 2028, 2029 and 2030 respectively, inflation and future exchange rates will impact the final

[93] The cost estimate includes two separate estimates for each component of the project, an allocated estimate and an unallocated estimate. The unallocated estimates indicate the price of each line item before allowances for general conditions, project indirect costs and contingency. The allocated estimates include the general conditions, project indirect costs and contingency allowances in each line item within the cost estimate. The purpose of the unallocated estimates is to allow the reader to see the actual costs allowed for each item. The purpose of the allocated estimates is to allow the reader to more easily back items out of the cost estimate, such as the emission reduction and monitoring technologies, without having to recalculate the general conditions, project indirect costs and contingency allowances.

cost of the Project. The marketplace for generating capacity resources and electrical components continues to evolve as demand increases across North America and globally, which is resulting in inflation rates that are higher than other sectors. The cost estimates provided do not account for inflation between now and the time of purchase, and do not include interest during construction. Additionally, most of the Project components will be purchased in USD, which will be subject to the United States dollar (“USD”) to Canadian dollar (“CAD”) exchange rate at the time of purchase. S&L’s cost estimate includes a 1.36 USD to CAD exchange rate.

As discussed in Section 6.4.1, S&L’s cost estimate is categorized as an AACE Class 4/5 with an assigned probable accuracy range of within 30 per cent, due to the limited amount of engineering design completed to date. Maritime Electric estimates that up to $12 million of the total Project cost is required to complete additional upfront engineering work and issue RFPs for the Project, at which point more accurate cost estimates will be possible. The $12 million cost is based on an estimate from S&L that 2.5 to 3.0 per cent of the total Project cost consist of upfront engineering.

Table 13 shows the Project cost estimate of $427 million and the percentage allocated to upfront engineering, which is included in the $427 million. The cost estimate is based on the S&L Class 4/5 cost estimate and 2024 estimated costs, which does not include inflation between 2024 and the actual time of construction. Details of the S&L Cost Estimate are included in Appendix A.

TABLE 13 Class 4/5 Total Project Cost Estimate			
Item	**Nominal Capacity (MW)**	**Total Cost in 2024 CAD ($ millions)**	**Upfront Engineering (%; total in $ million)[a]**
BESS[b]	10	27	3.0
CT4[c]	50	156	2.5[d]
RICE[e]	90	244	3.0
TOTAL	**150**	**427**	**12.0%**

a. Upfront engineering costs are included in the total estimated Project cost of $427 million.
b. The BESS cost estimate is included as Exhibit G in the S&L Cost Estimate.
c. The allocated estimate for CT4 is included in Exhibit A and the unallocated estimate is included in Exhibit B of the S&L Cost Estimate. The indicated cost does not include costs associated with the Biodiesel system, Continuous emissions monitoring system or the SCR system. Refer to Section 8.4 for information on why these options have been excluded from Table 13.
d. 2.5 per cent is included for CT4 (as opposed to 3.0 per cent) because site selection and a significant portion of the EIA is already completed for CT4, as discussed in Section 6.2.
e. The total cost of the RICE includes both the Substation Upgrades and 5 x 18 MW Wartsila Engines estimates included in Exhibits E & F and H & I respectively. The allocated estimates are included in Exhibits E and H, and the unallocated estimates are included in Exhibits F and I. The indicated cost does not include costs associated with the Biodiesel system, Continuous emissions monitoring system or the SCR system. Refer to Section 8.4 for information on why these options have been excluded from Table 13. Maritime Electric has also included $2.5 million for a transmission line to connect the RICE plant to the transmission system and $200,000 for land purchase.

Maritime Electric is seeking approval from the Commission for a deferral of the initial $12 million of the total Project cost for upfront engineering work and completion of the RFP process. The $12 million of the total Project cost will be used to hire a consultant to help the Company complete:

- project site selection;
- upfront engineering design;
- EIA and development permit processes;
- project specifications and scope of work development;
- RFP development and bidding process for owner supplied components;

- RFP development and bidding process for Engineering, Procurement and Construction ("EPC") contract;[94]
- proposal review and EPC contractor selection;
- contract negotiations; and
- updated project cost estimating and scheduling.

As proposals are received from contractors for components of the Project, the Company will submit updated estimated Project costs, impact on rate base, revenue requirement and customer rates to the Commission.

6.4.3 Net Present Value Analysis

While the cost of the Project will result in a customer rate increase, the Project is economically beneficial for customers as it fixes the cost of 150 MW of on-Island capacity over the respective useful life of each project component.[95] The Project will reduce Maritime Electric's dependence on off-Island capacity resources and avoid their associated costs, which are expected to increase in the future.

Table 14 shows the results of a 2024 NPV analysis that compares the costs and avoided costs of the Project, based on installation at a cost of $427 million in 2024. The Table shows that, over the useful life of the Project components and on a present value basis, the Project's costs are expected to be more than offset by the avoided costs, resulting in a positive economic benefit to customers. The Project is estimated to result in savings of approximately 20 per cent compared to doing nothing and continuing to purchase capacity resources and ancillary services from NB Power.

[94] EPC is a common type of contract for industrial construction such as generation plants. In an EPC arrangement, the Owner completes a certain level of the overall engineering and then retains an EPC contractor to complete the remaining engineering, procure the required components and complete the installation. This arrangement is how CT3 was constructed in 2005. With CT3, and commonly in industrial construction, the Owner selects and purchases some of the major equipment, especially equipment with long delivery timelines (such as the combustion turbine, generator, and transformer) and turns that equipment over to the EPC Contractor for installation. This pre-selection of equipment allows the Owner to determine the major equipment being installed and helps shorten overall project delivery times.

[95] Actual customer rate impact cannot be finalized until the RFP progress has been completed. An hypothetical rate impact is provided in Section 10.

TABLE 14
2024 Net Present Value Analysis

	BESS	CT4 with Synch. Cond.	RICE	Total
Nominal Capacity (MW)	10	50	90	**150**
Load Following Assignment (MW)	2.2	-	-	**2.2**
Spinning Reserve Assignment (MW)	7.8	-	-	**7.8**
Service Life (Years)	20	50	50	**-**
Total Estimated Installed Cost ($ millions)	27	156	244	**427**
Estimated Annual Fixed O&M in Year 1 ($ millions)	0.2	0.6	1.6	**2.4**
Present Cost of Project (2024 $ millions):				
Total Project Cost Over Useful Life (A)	**32**	**193**	**315**	**5410**
Present Avoided Cost of Project:				
Off-Island Capacity Purchases	16	219	395	**630**
Off-Island Load Following	4	-	-	**4**
Off-Island Spinning Reserve	16	-	-	**16**
Future Standalone Synchronous Condenser[a]	-	35	-	**35**
Total Avoided Cost Over Useful Life (B)	**36**	**254**	**395**	**685**
Net Present Value (2024 $ millions; C = B - A)	**4**	**61**	**80**	**144**
Per Cent Savings (D = C / B)	*11%*	*24%*	*20%*	*21%*

a. Represents the avoided cost of installing a standalone synchronous condenser because the CT4 cost estimate includes a synchronous condenser. Refer to Section 7.5 for more information.

Detailed inputs and calculations of the NPV analysis are provided in Confidential Appendix E.

6.5 Project Delivery

As per the CRAA presented in Section 5.4, a capacity deficit of 60 MW is forecast in 2025 and increasing to 156 MW by 2033.[96] Maritime Electric believes the Project proposed in this Application provides the best way to address this forecast capacity deficit. Furthermore, it is in the best interest of customers that this Project be approved and executed promptly, ensuring the Company has access to the required capacity resources in a timely manner.

To that end, Maritime Electric is seeking Commission approval for a capital expenditure deferral of up to $12 million of the total Project cost to complete the associated upfront engineering design

[96] This capacity deficit assumes no short-term capacity will be available to purchase from NB Power.

and begin the RFP process. Maritime Electric will engage an expert consultant, with experience in executing BESS, CT and RICE projects, to complete the upfront engineering design work, develop an RFP and assist in the evaluation of the received proposals. Once proposals are received, more accurate cost estimates can be provided to the Commission.

The upfront engineering work will also allow the Company and its consultant to begin developing EIA documents, development permits, specifications for long-delivery time items and installation contracts.

6.6 Project Schedule

To date, Maritime Electric has completed the following tasks in relation to the Project:

- Project development began in 2022 when Maritime Electric retained S&L to develop the CRS, which was delivered in December 2022.
- Following the February 2023 polar vortex, S&L provided an update to the December 2022 version of the CRS (the Addendum) in July 2023.
- S&L provided a cost estimate of their recommendations in September 2023.
- An alternative cost estimate was developed and received in January 2024 to provide additional combinations of capacity resource sizes.
- Throughout 2024, the Company has been gathering and documenting the evidence necessary to support this Application, including a further update to the cost estimates as of September 2024.

Maritime Electric developed a Project schedule, which has been separated into three individual component schedules (i.e., one schedule for each component). The schedules indicate that the expected commissioning dates are December 2028, December 2029 and December 2030 for the BESS, CT4 and RICE components, respectively.[97] A discussion of the timelines for each Project component is as follows and detailed schedules for each Project component are provided in Appendix B.

[97] Each component is scheduled to be commissioned in December to allow it to serve as capacity for that winter season (December to February, inclusive). As the Company experiences its peak during the winter season, failure to commission a capacity resource in December results in that resource not contributing towards the Company's capacity obligations for that season.

BESS

To allow for commissioning of the BESS in December 2028, the sitework and installation of equipment must begin in the spring or summer of 2028. It is expected that specific BESS equipment, such as the battery and inverter modules, will have lead times of approximately one year from the time of order. Other electrical components associated with integrating the BESS into a substation are expected to have lead times of approximately 18 months.[98] Therefore, long-lead items must be ordered before January 2027. Before such equipment can be ordered, upfront engineering must be completed and Regulatory, Environmental and Development approvals and permits must be received.[99]

CT4

To allow for commissioning of CT4 in December 2029, the sitework and installation of equipment must begin in the fall of 2028 or spring of 2029. It is expected that items, such as the turbine and generator, will have lead times of up to two years. Other electrical components, such as breakers, switchgear and transformer, are expected to have lead times of up to three years. Therefore, long-lead items must be ordered before July 2026. Before such equipment can be ordered, upfront engineering must be completed and Regulatory, Environmental and Development approvals and permits must be received.

RICE Plant

To allow for commissioning of the RICE plant in December 2030, the sitework and installation of equipment must begin in the fall of 2029 or spring of 2030. It is expected that items, such as the RICE units and generators, will have lead times of up to two years. Other electrical components, such as breakers and transformers, are expected to have lead times of up to three years. Therefore, long-lead items must be ordered before July 2027. Before such equipment can be ordered, upfront engineering must be completed and Regulatory, Environmental and Development approvals and permits must be received.

[98] Depending on the final arrangement, additional equipment, such as a transformer (distribution voltage to transmission voltage), breaker(s) and switchgear may be required. Deliveries of such equipment could require up to three years for delivery and could impact the date of commissioning of the BESS. The final arrangement will be a deliverable of the upfront engineering.

[99] Before equipment can be ordered, quotes must be received, and terms and contracts must also be negotiated.

The proposed timelines are aggressive; however, even with the aggressive timelines, the forecast capacity deficit, as presented in Section 7.1, is not fully addressed until 2031 following the completion of the RICE. The proposed timelines recommend that the Company start ordering long-lead items in the summer of 2026, which requires prior approvals from the Commission.

Maritime Electric believes that the first step in obtaining Commission approval is to establish the urgent need for at least 150 MW of on-Island dispatchable generating capacity. Additionally, Maritime Electric considers it in the best interest of customers to add this 150 MW of capacity as soon as possible. Therefore, the Company proposes to arrange a technical session with the Commission and Maritime Electric's consultant, S&L, at the earliest opportunity. The purpose of this technical session would be to assist the Commission in evaluating the urgent need for additional on-Island dispatchable generating capacity and to review the Company's proposed capital expenditure deferral of up to $12 million. This deferral would be used to complete upfront engineering design work and issue RFPs for the Project. If the upfront engineering design work is not completed by the end of 2025, the Company will be unable to meet the proposed schedules.

7.0 PROJECT JUSTIFICATION

The On-Island Capacity for Security of Supply Project is required to meet Maritime Electric's service obligation to its customers, who are currently exposed to financial and reliability risks due to increased customer load outpacing the available capacity resources. These risks are expected to continue until additional on-Island generating capacity resources are installed. The Project is justifiable because it will:

- result in estimated savings of approximately 20 per cent over the useful life of the Project components compared to purchasing capacity from off-Island resources (as described in Section 6.4.3), which is a financial benefit for customers;
- reduce exposure to regional capacity shortages, which is a reliability benefit for customers;
- limit exposure to Interconnection transfer limitations or curtailments from the NB system, which is a reliability benefit for customers;
- allow the Company to supply a larger portion of its customer load during significant curtailments or a disconnection from the mainland, which is a reliability benefit for customers;
- provide voltage support during periods of high customer load and transmission system outages, which is a reliability benefit for customers;
- decrease exposure to the capacity market prices, which is a financial benefit for customers; and
- increase the Company's ability to backstop renewables, specifically to respond to Hold-to-Schedule directives from the New Brunswick Transmission System Operator ("NBTSO"), which is a reliability benefit for customers. This will also support additional renewable energy resource development on PEI, which is an environment benefit for customers.

Maritime Electric commissioned S&L to complete a CRS that assessed various capacity resource options. The study recommended adding 125 to 150 MW of on-Island capacity resources using a combination of CT, RICE and BESS to address the Company's capacity deficit.

The annual cost of new on-Island dispatchable generation is currently higher than that of existing off-Island capacity purchases. However, due to an anticipated regional capacity shortage in the near future, the future cost to purchase off-Island capacity is expected to surpass the cost of the Project. Additionally, on-Island generation will not be subject to mainland transmission system curtailments, making on-Island generating capacity resources more reliable than off-Island capacity resources.

Detailed justification for the Project is described in more detail in this Section.

7.1 Proposed Capacity Resources Forecast

Table 15 shows the updated CRAA with the addition of the proposed new on-Island capacity resources. The Table shows that the Project reduces the forecast capacity deficit starting in 2029 and eliminates the forecast capacity deficit in 2031 and 2032.

TABLE 15
Capacity Resource Adequacy Assessment
On-Island Capacity for Security of Supply Project and Existing EPA Projected into Future (MW)

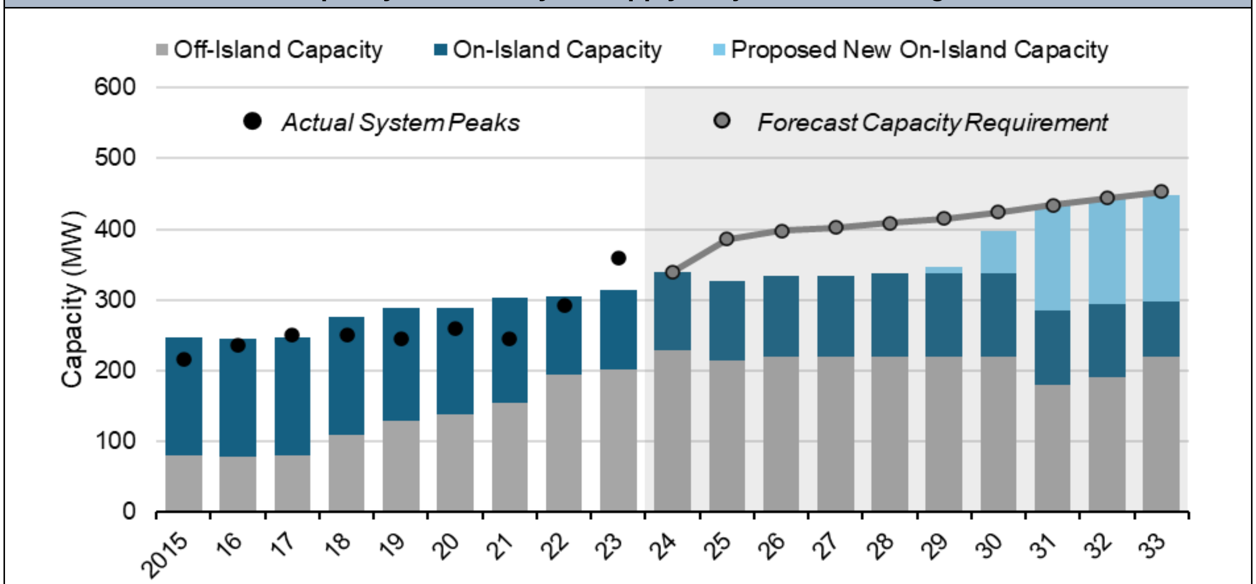
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Forecast Capacity Requirements (from Table 9)	340	386	398	403	408	415	424	435	444	454
Capacity Resources										
Point Lepreau	29	29	29	29	29	29	29	29	29	29
NB Power firm capacity purchases[a]	180	185	190	190	190	190	190	152	161	190
NB Power short-term capacity purchases	19	-	-	-	-	-	-	-	-	-
Wind ELCC	23	23	30	30	30	30	30	30	30	30
CT1	15	15	15	15	15	15	15	-	-	-
CT2	25	25	25	25	25	25	25	25	25	-
CT3	49	49	49	49	49	49	49	49	49	49
BESS	-	-	-	-	-	10	10	10	10	10
CT4	-	-	-	-	-	-	50	50	50	50
RICE	-	-	-	-	-	-	-	90	90	90
Total capacity resources	**340**	**326**	**338**	**338**	**338**	**348**	**398**	**435**	**444**	**448**
Capacity deficit	-	(60)	(60)	(65)	(71)	(67)	(26)	-	-	(6)
Status quo capacity deficit (per Table 10)	-	*(60)*	*(60)*	*(65)*	*(71)*	*(77)*	*(86)*	*(112)*	*(121)*	*(156)*

a. NB Power capacity purchases are forecast to be reduced in 2031 and 2032 to avoid a surplus in capacity resources.

Even with the addition of the Project's proposed capacity resources, a capacity deficit of 6 MW is expected in 2033. The forecast capacity deficit in 2033 and beyond is not addressed as part of this Application as efforts to address the forecast capacity deficit in Eastern Canada may present other options.

Figure 20 shows a graphical representation of the updated CRAA if the Project is approved as proposed. The Figure demonstrates that the Project is expected to increase the amount of on-Island capacity resources to 50 per cent of the Company's capacity requirement, which is closer to the 2015 levels of 77 per cent of the system peak, and aligns with the 50 per cent recommendation from the CRS.

FIGURE 20
Capacity Resources Forecast
On-Island Capacity for Security of Supply Project and Existing EPA Levels



7.2 Risks of Increased Dependence on Off-Island Capacity Purchases

In recent years, Maritime Electric's capacity requirements have exceeded its contracted capacity resources. However, the Company was able to secure incremental capacity by purchasing short-term capacity from NB Power, as demonstrated in 2024 in Table 10 and Table 15. Short-term capacity may continue to be available in the near-term; however, there is considerable reliability risk associated with continuing to rely on off-Island capacity purchases as the Company's capacity requirement increases. The reliability risk is associated with: (1) expected regional capacity shortages; (2) firm transfer capacity limits; and (3) potential disconnections from the mainland. These three reliability risks are discussed in the following sections.

7.2.1 Regional Capacity Shortages

The demand for capacity is increasing throughout Eastern Canada, while the availability of capacity is projected to decline due to Government of Canada mandates to retire or repurpose all coal-fired generating units by 2030. This is expected to result in regional capacity shortages. If the Company is unable to acquire the necessary incremental capacity from off-Island resources, it will have insufficient capacity resources to meet its obligations, resulting in significant risks of load shedding.[100]

The Government of Canada's mandate to eliminate coal-fired generating units by 2030 is expected to eliminate approximately 482 MW (20 per cent) of the existing generating capacity in Nova Scotia ("NS").[101] Two coal-fired units in NS and one in NB are expected to be repurposed and converted to operate as peaking generators with alternate fuels.[102] Table 16 summarizes the forecast capacity shortages expected in Eastern North America.

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[100] Load shedding (i.e., controlled power outages or rotating blackouts) refers to intentionally disconnecting electricity customers to protect the power system during periods when demand exceeds the available supply. This can occur if insufficient generation is available, or if issues on the transmission system prevent the delivery of electricity (ISO-NE, 2024).

[101] NS Power has announced plans to retire Point Aconi (171 MW) and Trenton (311 MW) and repurpose Point Tupper (154 MW) and Lingan (600 MW): https://www.cbc.ca/news/canada/nova-scotia/nova-scotia-power-plans-to-burn-heavy-fuel-oil-1.6895930 – CBC News, Nova Scotia Power plans to burn heavy fuel oil at phased-out coal plants.

[102] NB Power has announced that it will likely convert Belledune to burn a yet-to-be-determined form of wood pellets: https://www.cbc.ca/news/canada/new-brunswick/belledune-likely-survive-coal-2030-1.7249081 – CBC News, Belledune likely to survive the end of coal in 2030, N.B. Power hearing told.

TABLE 16 Forecast Capacity Shortages in Eastern North America		
Province	**Projected Shortage Year**	**References**
Quebec	2027	"Quebec doesn't have enough electricity to satisfy all the companies wanting to carry out industrial projects in the province, Energy Minister Pierre Fitzgibbon says — and the situation could drag on for a decade."[a] Hydro Quebec requires 8,000 – 9,000 MW of additional generating capacity by 2035 to meet its needs.[b] "When we talk about electricity, we're really talking about two things – energy – what we can produce over the course of a year – and power – the maximum we can produce at any given time," says Gabriel Giguère, public policy analyst at the MEI and author of the study. "Hydro-Québec is heading towards a shortage of both as early as 2027, which complicates the problem."[c]
New Brunswick	2027 - 2030	NB Power has forecast a capacity shortage by 2027 under a high electrification forecast, and 2030 using a low electrification forecast.[d]
Nova Scotia	2030	"All scenarios add new fast acting generation resources in the range of generally 300 MW to 900 MW by 2030."[e]
Newfoundland and Labrador	2034	Newfoundland and Labrador Hydro has forecast that it needs at least 385 MW of additional capacity by 2034.[f]
New England	-	ISO-New England conducts annual Forward Capacity Auctions to ensure it has sufficient capacity to meets its forecast. It annually imports capacity from other areas through its various interchanges.[g]

a. https://montrealgazette.com/news/local-news/quebec-companies-could-face-energy-shortages-for-next-10-years-fitzgibbon – Montreal Gazette, Quebec companies could face energy shortages for next 10 years: Fitzgibbon.
b. https://www.hydroquebec.com/data/a-propos/pdf/action-plan-2035.pdf – Hydro Quebec, Towards a Decarbonized and Prosperous Québec Action Plan 2035 (Action Plan #3 Increasing our power generation capacity).
c. https://www.newswire.ca/news-releases/quebec-government-unprepared-for-end-of-electricity-surplus-says-mei-839394678.html – Newswire, Quebec government unprepared for end of electricity surplus, says MEI.
d. https://www.nbpower.com/media/1492536/2023_irp.pdf – NB Power, 2023 Integrated System Plan, Pathways to a Net-Zero Electricity System (Section 9.4).
e. https://www.nspower.ca/docs/default-source/irp/2023-action-plan-and-road-map.pdf?sfvrsn=bcd3c747_1 – NS Power, Powering a Green Nova Scotia, Together, 2023 Evergreen Integrated Resource Plan.
f. https://nlhydro.com/wp-content/uploads/2024/07/Power-the-Province.pdf.pdf – Newfoundland and Labrador Hydro, Powering the Province, 2024 Adequacy Resource Plan.
g. https://www.iso-ne.com/about/key-stats/markets#fcaresults – ISO New England, Markets (Results of the Annual Forward Capacity Auctions).

The North American Electric Reliability Corporation's ("NERC") 2022-2023 Winter Reliability Assessment report further highlights the risk of load increases and capacity shortages in the Maritimes region. The report notes that "some areas [of the bulk power system] are highly vulnerable to extreme and prolonged cold weather and may require customer load-shedding procedures to maintain reliability."[103] The report noted that during extreme cold events, the Maritimes region is likely to have the second-worst capacity reserve margin levels (after Texas) out of all regions overseen by NERC.[104] The next report issued by NERC, its 2023-2024 Winter Reliability Assessment, was slightly more optimistic of the Maritimes region, noting that "peak demand [(i.e., system peak)] growth has been offset by additional resource capacity and import agreements for the upcoming winter, causing reserve margins to rise by over 2 percentage points compared to 2022," but cautioned that "demand [(i.e., customer load)] levels at the forecasted [system] peak can still strain the area's firm supplies and lead to operating mitigations or energy emergencies."[105]

Electrical systems in Atlantic Canada experience system peaks during the winter months. Due to their close geographical proximity, neighboring utility systems typically peak at similar times, as they experience similar weather and temperatures. Additionally, the utilities often share capacity resources throughout the year, leading to competition for capacity resources during shortages. The anticipated capacity shortages and competing needs among electric utilities in Atlantic Canada during extreme cold events are expected to impact Maritime Electric's ability to secure additional capacity from off-Island resources during these periods. Consequently, the Company's customers face the risk of load shedding or rotating blackouts for short or extended durations. The Company's reliance on off-Island capacity resources exposes its customers to increasing reliability risks associated with capacity shortages in Atlantic Canada and surrounding regions.

In 2023, 64 per cent of Maritime Electric's capacity resources were imported from off-Island, which will increase as system peak increases until there is no more capacity available or the Company's Interconnection capacity transfer limit is reached. With projected capacity shortages throughout the region, the Company's best option to ensure it meets its capacity requirements is to install additional on-Island capacity resources.

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[103] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2022.pdf – NERC, 2022-2023 Winter Reliability Assessment.

[104] Appendix D: Extreme Weather Event Capacity Impact – Addendum to December 2022 Maritime Electric Capacity Resource Study (page 20).

[105] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2023.pdf – NERC, 2023-2024 Winter Reliability Assessment.

7.2.2 Interconnection and Mainland Transmission System Limitations

The CRAA in Section 5.4 shows an increasing, and eventually significant, capacity deficit if off-Island capacity purchases remain at the current EPA level of 190 MW. However, even if there were endless capacity resources available on the mainland, there would still be limitations on its delivery to PEI.

Maritime Electric obtains energy and capacity from off-Island via the mainland transmission systems and the Interconnection. The capabilities of both the mainland transmission system and the Interconnection determine the amount of capacity that the Company can import to PEI. The term "transfer capacity limit" refers to the maximum firm capacity that the Company can import from off-Island, which is constrained by the most restrictive limit of either the Interconnection or the mainland transmission system.

There are three operating conditions typically considered as part of Maritime Electric's evaluation of the Interconnection's transfer capacity limit: (1) normal operating conditions; (2) abnormal operating conditions; and (3) subsea cable outage conditions. The implications of the three conditions are discussed in this Section.

Normal Operating Conditions

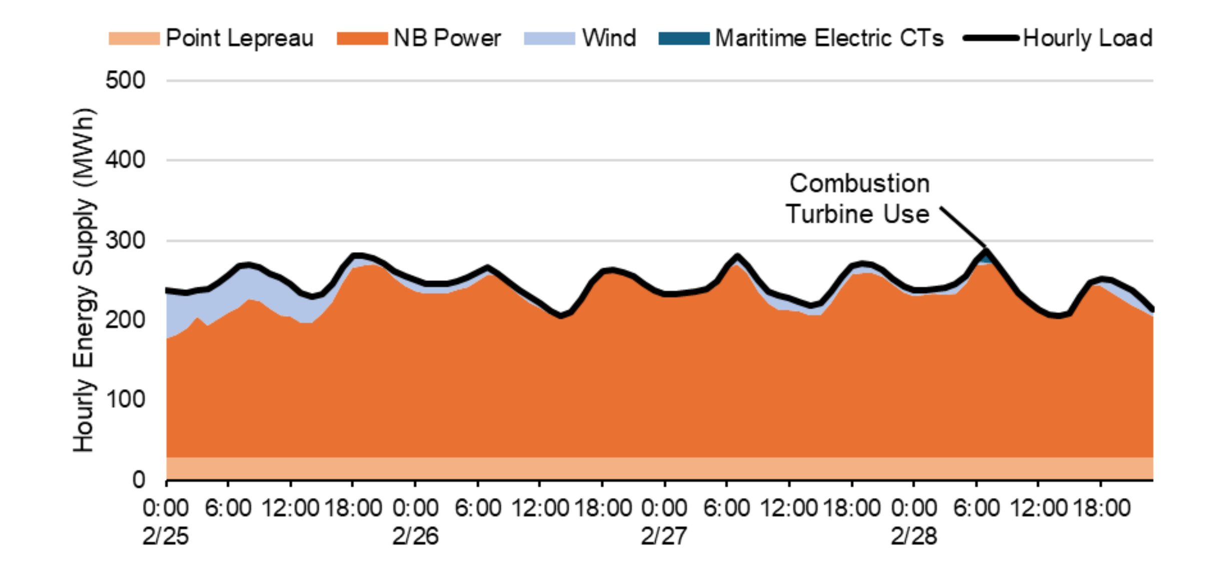
Under normal operating conditions, the mainland transmission system is currently capable of providing 300 MW of firm transfer capacity to the NB-NS/PEI Interface, all of which is currently dedicated to PEI. Coincidentally, the Interconnection also has an approximate 300 MW transfer capacity limit, based on N-1 contingency analysis of the four subsea cables.[106] This results in a 300 MW firm transfer capacity limit for PEI, of which 10 per cent (30 MW) is reserved for the City of Summerside and the remaining 90 per cent (270 MW) is reserved for Maritime Electric.[107] Maritime Electric's Point Lepreau capacity resource of 29 MW is delivered through the Interconnection, which leaves 241 MW (270 MW minus 29 MW) available for the purchase of additional off-Island capacity resources by Maritime Electric.

[106] The N-1 contingency analysis considers the loss of either Cable 1 or Cable 2, which would overload the remaining Cable 1 or 2 at import levels above 300 MW.

[107] The allocation is based on the ratio of each utility's contribution towards the average 12-month coincident peak demand for electricity. The current ratio is 90.5 per cent for Maritime Electric and 9.5 per cent for the City of Summerside. For the purpose of this Application, an approximate 90:10 split was used, which allocates 270 MW to Maritime Electric and 30 MW to Summerside.

Figure 21 demonstrates the implications of this transfer capacity limit with an example of Maritime Electric utilizing the full 270 MW of available transfer capacity during a period in February 2023. The Figure shows a period of high hourly customer load (shown as the black line) with a peak load of 287 MW. Through the Interconnection, NB Power was able to provide a total of 241 MW after the inclusion of short-term capacity purchases (in addition to 29 MW from Point Lepreau, for a total of 270 MW), requiring the remaining 17 MW to be provided on Island.[108] At the time, the hourly customer load reached 287 MW and renewable generation sources of generation supplied only 2 MW; the Company's CTs were required to generate the remaining 15 MW to supply the customer load.

FIGURE 21
February 2023 Energy Supply and Hourly Load

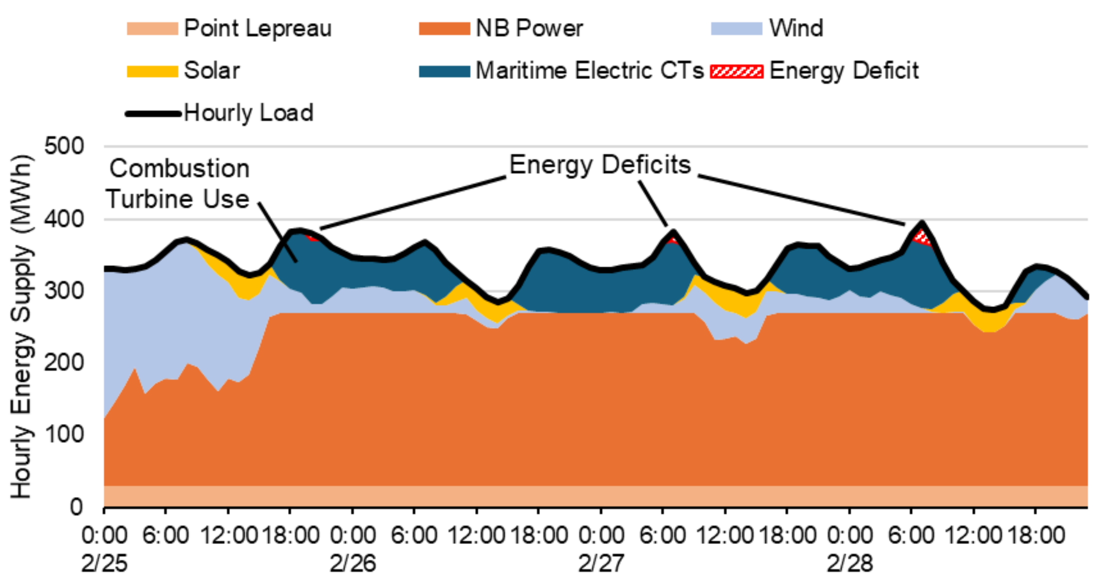


Maritime Electric had sufficient CT capacity in February 2023 to meet its customer load while using the maximum Interconnection transfer capacity available (270 MW); however, as customer load continues to increase, there may not be sufficient CT capacity on PEI. Figure 22 shows a projection of expected wind and solar energy generation and hourly customer load for the same period in 2031, based on the wind speeds, solar irradiance and hourly customer load experienced

108 Per the EPA, NB Power was contractually obligated to supply Maritime Electric with 173 MW of capacity in 2023. Anything is excess of this contractual amount (i.e., short-term capacity) is entirely dependent on NB Power's ability to sell such capacity to Maritime Electric.

in 2023. This scenario assumes that NB Power will have capacity resources available to supply 241 MW to the Company (in addition to 29 MW from Point Lepreau). Hourly customer load for the 2031 period is forecast to peak at 395 MW, which is 108 MW higher than in 2023. This results in 125 MW (395 MW minus 270 MW) of capacity needing to be supplied on Island. Since renewable sources are projected to generate 9 MW during the peak hour and Maritime Electric's existing CTs have a capacity of 89 MW, a deficit of 27 MW is observed, which is equivalent to the supply of electricity to approximately 7,700 homes during system peak periods.

FIGURE 22
February 2031 Energy Supply and Hourly Load Forecast



Note: Based on projects requesting to connect to Maritime Electric system and net metering forecast.

Table 17 is an updated version of the CRAA in Section 5.4, and assumes 270 MW of off-Island capacity is available (i.e., 29 MW from Point Lepreau, 190 MW contracted through NB Power EPA, and 51 MW of additional mainland short-term capacity). It demonstrates that the Company will still be capacity deficient, even if there is an endless supply of capacity resources available in the region, due to the mainland and Interconnection capacity transfer limits of 300 MW. In this scenario, the capacity deficit is forecast to begin in 2025 at 4 MW, which is equivalent to the supply of electricity to approximately 1,100 homes during system peak periods, and increase to

105 MW by 2033, which is equivalent to the supply of electricity to approximately 30,000 homes during system peak periods.

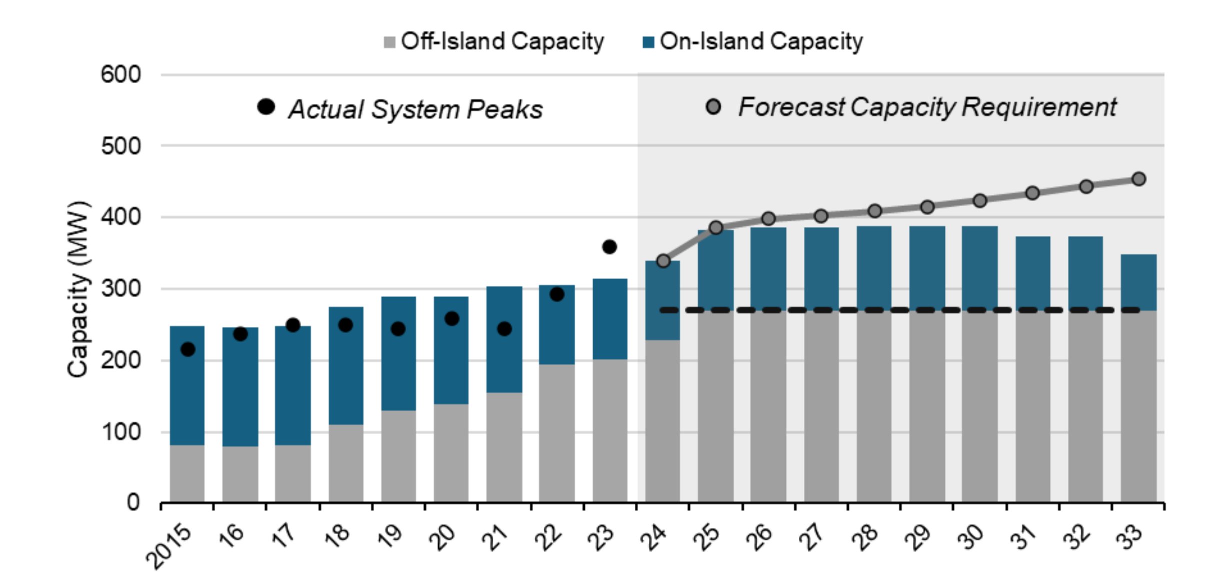
TABLE 17
Capacity Resource Adequacy Assessment
Maximizing Interconnection Transfer Capacity of 270 MW
(MW)

	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Forecast Capacity Requirements (from Table 9)	340	386	398	403	408	415	424	435	444	454
Capacity Resources										
Point Lepreau	29	29	29[a]	29	29	29	29	29	29	29
NB Power firm capacity purchases	180	185	190[a]	190	190	190	190	190	190	190
NB Power short-term capacity purchases	19	56	51[a]	51	51	51	51	51	51	51
Wind ELCC	23	23	26	26	30	30	30	30	30	30
CT1	15	15	15	15	15	15	15	-	-	-
CT2	25	25	25	25	25	25	25	25	25	-
CT3	49	49	49	49	49	49	49	49	49	49
Total capacity resources	**340**	**382**	**385**	**385**	**389**	**389**	**389**	**374**	**374**	**349**
Capacity deficit	-	(4)	(13)	(18)	(19)	(27)	(35)	(61)	(60)	(105)

a. Point Lepreau (29MW) plus NB Purchases through EPA (190 MW) plus Short-Term Purchases (51MW) equals 270 MW, which is Maritime Electric's 90 per cent share of the import firm transfer capacity.

Figure 23 shows a graphical representation of the CRAA with the Company's transfer capacity limit of 270 MW maximized. The Figure shows an increasing reliance on off-Island capacity resources, but that an increasing capacity resource deficit still exists, even if the Company maximizes the transfer capacity limit.

FIGURE 23
Capacity Resources Forecast
Maximizing Interconnection Transfer Capacity of 270 MW



Abnormal Operating Conditions

Maritime Electric's Interconnection transfer capacity limit of 270 MW (under normal operating conditions) is periodically reduced for maintenance due to transmission constraints on the Interconnection, transmission constraints on the mainland or generation outages on the mainland.[109] As a result, Maritime Electric's off-Island capacity resource purchases can be curtailed (i.e., limited or reduced). Advance notice of curtailment is provided for planned outages or limitations, but no notice is provided for unplanned outages or limitations. Customer load growth in NB, NS and PEI is resulting in more frequent curtailments due to insufficient transmission capacity.

When Maritime Electric is curtailed, it must assess if and how this curtailment will impact its ability to provide continuous service to customers. The Company reviews its forecasted customer load and available capacity resources, including expected wind and solar generation, while considering the limits imposed to the Interconnection transfer capacity by the curtailment. If the reduced Interconnection transfer capacity plus available on-Island renewable energy generation is not

[109] Generation outages impact transmission system energy flows, and can impact transmission system capabilities, depending on the location of the generation outage.

sufficient to fulfill the projected customer load, the Company operates its CTs to generate the difference.

In recent history, curtailments have not limited Maritime Electric's ability to provide continuous service to customers, but, periodically, the margins have been very small. As the frequency of curtailments increase and the Company increasingly relies on off-Island capacity resources for a larger portion of its capacity requirement, the risk of capacity deficits during curtailment events increases.

Subsea Cable Outage Conditions

The Interconnection's transfer capacity limit of 300 MW to Maritime Electric and the City of Summerside can also be reduced if there is an outage to any of the Interconnection's four subsea cables. The two original subsea cables (i.e., Cables 1 and 2) were installed in 1977 and are now 47 years old. If one of the subsea cables is out of service, Maritime Electric's Interconnection transfer capacity limit is reduced from 270 MW to 162 MW.[110]

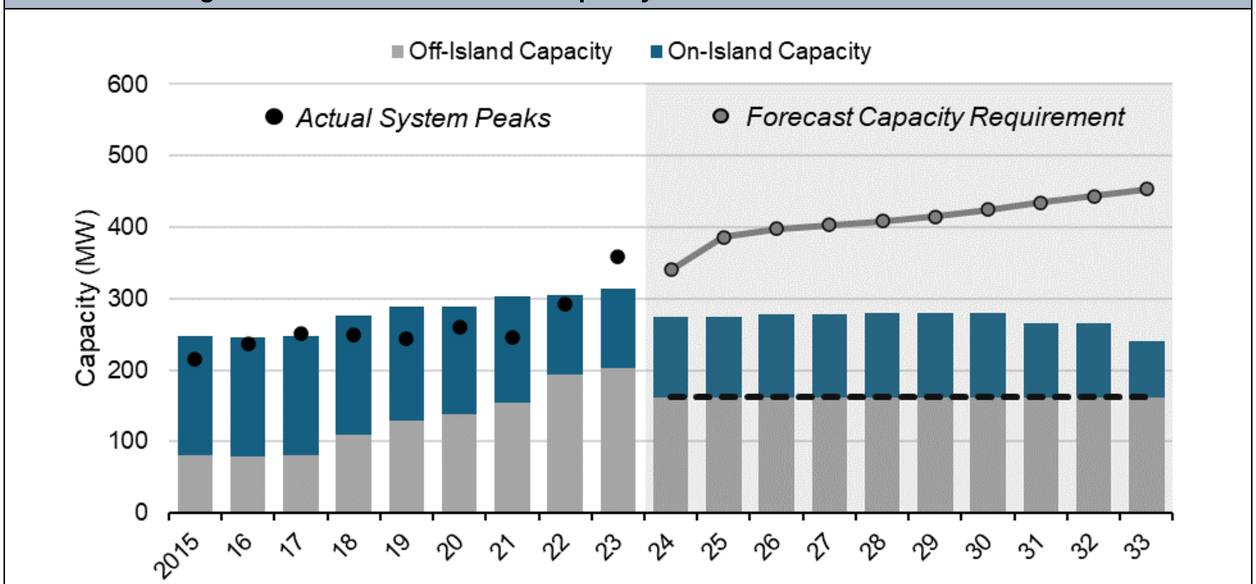
Table 18 is an updated version of Table 10 in Section 5.4 with 162 MW of off-Island capacity available (29 MW from Point Lepreau and 133 MW from NB Power capacity purchases) due to one subsea cable out of service. The Table shows that the loss of one subsea cable results in significant capacity resource deficits. In this scenario, the capacity deficit in 2024 is 66 MW, which is equivalent to the supply of electricity to approximately 18,900 homes during system peak periods, and increases to 213 MW by 2033, which is equivalent to the supply of electricity to approximately 60,900 homes during system peak periods.

[110] Based on the N-1 contingency analysis.

TABLE 18 **Capacity Resource Adequacy Assessment** **Maximizing Interconnection Transfer Capacity of 162 MW with One Cable Out of Service** **(MW)**										
	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Forecast Capacity Requirements (from Table 9)	340	386	398	403	408	415	424	435	444	454
Capacity Resources										
Point Lepreau	29	29	29	29	29	29	29	29	29	29
NB Power firm capacity purchases	133	133	133	133	133	133	133	133	133	133
Wind ELCC	23	23	26	26	30	30	30	30	30	30
CT1	15	15	15	15	15	15	15	-	-	-
CT2	25	25	25	25	25	25	25	25	25	-
CT3	49	49	49	49	49	49	49	49	49	49
Total capacity resources	**274**	**274**	**277**	**277**	**281**	**281**	**281**	**266**	**266**	**241**
Capacity deficit	(66)	(112)	(121)	(126)	(127)	(134)	(143)	(169)	(178)	(213)

Figure 24 shows a graphical representation of the CRAA with one subsea cable out of service, which limits the Company's Interconnection transfer capacity limit to 162 MW. The Figure shows that, under this scenario, a significant capacity resource deficit exists.

FIGURE 24
Capacity Resources Forecast
Maximizing Interconnection Transfer Capacity of 162 MW with One Cable Out of Service



7.2.3 Disconnections from the Mainland

Maritime Electric purchases a significant amount of energy and capacity from NB Power. In 2023, the Company purchased 85.7 per cent of its energy supply and 64.4 per cent of its capacity from off-Island resources (i.e., Point Lepreau and NB Power). This reliance on off-Island resources means that the Company has insufficient on-Island capacity resources to meet customer needs if PEI's electrical system were disconnected from the mainland. Disconnection would result in an immediate collapse of electrical support and a total loss of renewable energy generation, regardless of its output at the time, and would lead to load shedding and rotating blackouts until the mainland connection is reestablished.[111]

While the impact of a mainland disconnection on customers is high, the probability is low, and the Company believes it is uneconomical and unreasonable to fully mitigate the risk of a mainland disconnection.[112] Instead, the Company believes that increasing the on-Island generating capacity by 150 MW, as proposed in this Application, helps mitigate the impacts of a mainland disconnection.[113]

Load Shedding Protocol

The lack of sufficient dispatchable generation resources on PEI means that the Company can only supply approximately 80 MW of customer load during a disconnection from the mainland.[114] As such, the Company would have to shed load (i.e., undertake rotating blackouts) because 80 MW is insufficient to meet even the Company's lowest customer load levels.[115]

The Project's 150 MW of additional on-Island capacity would increase on-Island dispatchable capacity from 89 MW to 239 MW, and would limit the likelihood and severity of rotating blackouts

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[111] Impacts of disconnection on renewable energy generation operation is discussed in detail later in this section.

[112] There have been four disconnection events of varying duration since 2004, The most recent event took place on November 29, 2018 and lasted approximately 8 hours.

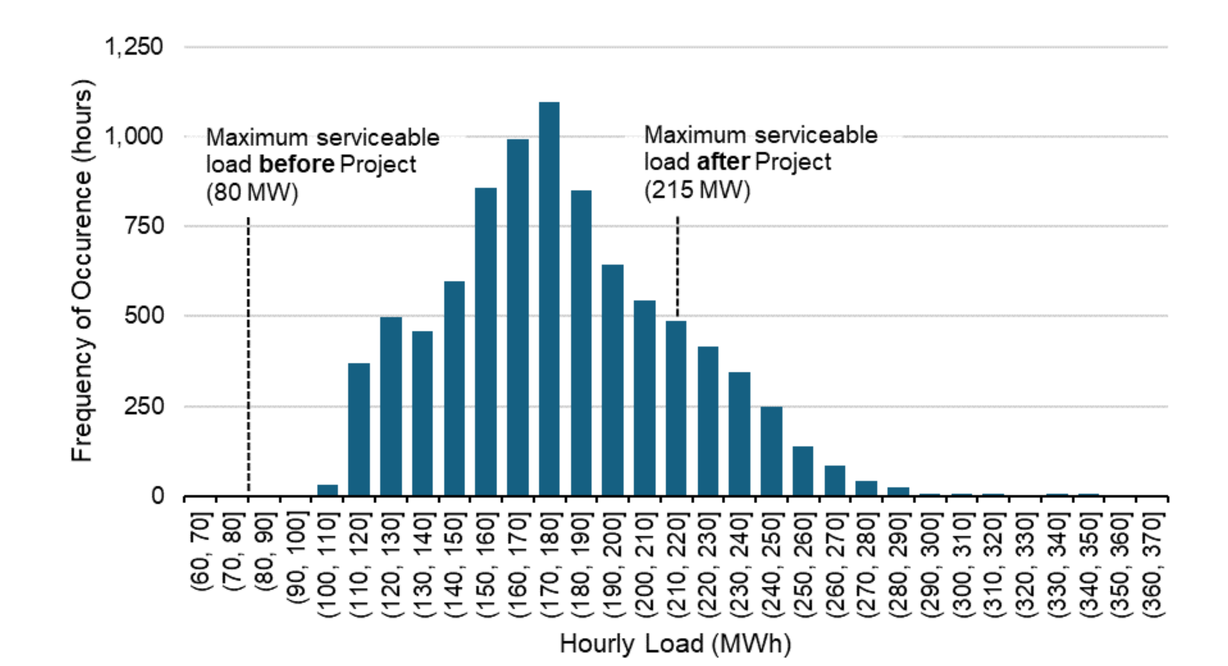
[113] Installing 150 MW of on-Island capacity will bring the ratio of total on-Island capacity to capacity requirements back above 50 per cent, which aligns with historic levels and is one of the primary recommendations of the CRS provided by S&L.

[114] Although the maximum output from the Company's combustion turbines is 89 MW, the turbines cannot be operated at full output during a disconnection event. The output must be reduced by approximately 10 per cent to allow for variations in load. The Company estimates that the average load that could be served is approximately 80 MW.

[115] Maritime Electric's lowest hourly customer load in 2023 was 106 MWh, which occurred on September 17th between 4 a.m. and 5 a.m.

during a mainland disconnection.[116] Figure 25 shows a histogram of Maritime Electric's 2023 hourly customer load (i.e., the frequency of each hourly customer load range during the year), which shows the maximum serviceable customer load with its on-Island capacity resources during a disconnection before (80 MW) and after (215 MW) the Project. The Figure demonstrates that, with the addition of 150 MW of on-Island capacity resources, a disconnection would result in rotating blackouts for only 18 per cent of the hours of the year (for 2023 customer load levels).

FIGURE 25
2023 Hourly Load Histogram



Loss of Electrical Support

The Interconnection provides more benefits to the PEI electrical system than access to energy and capacity; being connected to the North American grid via NB Power's electrical system provides electrical support and stability to the PEI electrical system. For example, the size of NB Power's electrical system provides stability to PEI's electrical system by absorbing changes in customer load and renewable energy generation throughout the day. The NB Power electrical system also provides sufficient fault current that allows the PEI electrical system's protection and

[116] The total generation of 239 MW would be operated at approximately 90 per cent, providing 215 MW, during a disconnection.

control devices to function properly, a key safety measure that increases public safety of the electrical system. A disconnection from the mainland last occurred during an ice storm in November 2018 and lasted approximately 8 hours.[117]

During a disconnection from the mainland, Maritime Electric is forced to rely on on-Island capacity resources to absorb changes in customer load and renewable generation levels, stabilize the electrical system's frequency and voltage and provide fault current to allow the system's protection and control devices to function properly. However, generation resources are programmed never to exceed safe operating limits to protect the equipment from damage; therefore, generation resources will trip (i.e., shut down) prior to exceeding safe operating limits. Unfortunately, if CT3 were to trip during a disconnection from the mainland today, a subsequent loss of supply, voltage support and stability support would occur, which would result in a system collapse.[118]

Additional on-Island dispatchable generating capacity would increase the level of voltage support and stability, increasing the overall reliability of the system. Additional generation would also increase the diversity of generation resources available, meaning that the loss of a single generator may not result in a system collapse. The additional available fault current and increased ability to follow load or renewable generation output is also likely to allow the operation of at least a portion of renewable generation.

Loss of Renewable Energy Generation

The Company has determined that, with PEI's current electrical system, on-Island utility-scale renewable generation cannot be used to supply load during a disconnection from the mainland. The existing level of on-Island dispatchable generation cannot provide adequate short circuit current at the wind farms to safely operate protection and control devices, or supply sufficient

[117] Details on the historical frequency of mainland disconnections can be found in Section 2.2.3 of the S&L CRS (provided in Appendix C).

[118] Voltage and current limits are placed on generators to ensure they do not produce too much internal heat or torque, which would lead to asset degradation or damage.

system stability to support large renewable energy generation installations, especially during adverse weather.[119]

During a disconnection, the Company's existing CTs could adequately respond to normal renewable energy generation increases and decreases resulting from small changes in wind speed or cloud cover; however, the decreased system stability (i.e., system strength) when disconnected from the mainland means that system disturbances, such as faults or generator trips, would result in critical system instabilities, such as voltage drops or frequency deviations. Large voltage drops or frequency deviations could cause cascading generator trips, eventually resulting in system collapse. Considering that historical disconnections occur during adverse weather, the likelihood of faults and generator trips are elevated during mainland disconnection events.

Additional on-Island dispatchable generation would support the electrical system by responding to customer load and system disturbances, while increasing the strength and stability of the system. Generator trips or system faults would have less ability to negatively impact system parameters, such as voltage or frequency, meaning that a portion of the on-Island renewable generation could operate, further increasing load-serving capabilities during a system event. This operation mode (dispatchable generation with renewable generation) would require further study and would likely require a dedicated grid control system.

7.2.4 Financial Risks

Section 7.2.1 discusses the circumstances resulting in a regional capacity storage and the uncertainty regarding plans to install additional capacity in the region. In the absence of additional on-Island generating capacity, the Company will have to compete financially with neighbouring provinces to purchase available capacity.

[119] Net-metered solar generation is different as it has enough geographic diversity that large variations in output are generally not experienced in a short timeframe, although high concentrations of rooftop solar in one particular area may cause some localized system strain.

Maritime Electric currently sources off-Island generating capacity from NB Power, which has indicated it can supply the Company with current levels of generating capacity into the future.[120] However, NB Power has not committed to increasing generating capacity levels in the future and indicated that it will be capacity deficient by 2027 or 2030 under high or low electrification scenarios, respectively.[121] In addition, the planned closures and repurposing of coal facilities by 2030, and limited opportunity to access capacity beyond NB, are likely to create capacity deficits in the entire Maritimes area, jeopardizing the area's ability to meet NPCC generating resource adequacy criteria.

It is unlikely that the region will operate under a capacity deficient scenario for an extended period. NS has indicated its intention to install 300 MW of "fast-acting generation,"[122] and a recent study completed for Newfoundland and Labrador Hydro ("NLH") recommended the addition of a 150 MW CT.[123] NB Power recently announced its intention to have a 400 MW natural gas plant operational in the Moncton area by 2028.[124] Some projects could include spare capacity that may become available, but the Company would need to compete financially with neighboring provinces to purchase any spare capacity.

In the past, Maritime Electric benefited from off-Island capacity purchases being less expensive than the cost to build new capacity resources on Island. Off-Island capacity was less expensive because it was predominantly sourced from legacy baseload generation assets. Electric utilities in the region are now planning the addition of renewable energy generation combined with energy storage as their main energy sources, and the primary purpose of dispatchable generation will

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120 As per Section 5.1.2, NB Power has indicated that it plans to continue to provide firm Capacity to Maritime Electric in the future.

121 Electrification scenarios refer to scenarios modelled with various levels of electrification.

122 NS has indicated that it will require new fast-acting, dispatchable generation by 2027. NS's 2030 Clean Power Plan suggests its next step is to finalize technology choice, location and timing for 300 MW of fast acting generation: https://beta.novascotia.ca/sites/default/files/documents/1-3582/nova-scotia-clean-power-plan-presentation-en.pdf – Nova Scotia Department of Natural Resources and Renewables, Nova Scotia's 2030 Clean Power Plan (page 19).

123 NLH has indicated that studies are ongoing and final technology, size and location are not finalized: https://www.cbc.ca/news/canada/newfoundland-labrador/new-combustion-turbine-study-hydro-1.6987750 – CBC News, New combustion turbine could cost $500M, but NLH stresses many options are being studied.

124 NB Power has selected an unnamed firm to build a 400 MW natural gas generating plant in Scoudouc, about 20 km northeast of Moncton, and have it running by 2028: https://tj.news/new-brunswick/exclusive-nb-power-plans-big-new-natural-gas-plant-to-avoid-blackouts - Telegraph Journal, NB Power plans big, new natural gas plant to avoid blackouts.

change from baseload generation to back-up generation, similar to the operation of Maritime Electric's dispatchable generation sources.

The most common type of new dispatchable generation will be CTs and RICE plants. As the cost to source and install these units will be relatively similar across Atlantic Canada, the cost of purchasing additional capacity from off-Island resources is expected to be comparable to the cost of building additional on-Island generating capacity resources.[125] Relying on the purchase of additional off-Island capacity resources exposes customers to the risk of increasing capacity costs in the future, especially as the demand for capacity in Atlantic Canada increases. Alternatively, investing in additional on-Island capacity will fix (i.e., secure) the cost of the associated capacity over the useful life of the asset.

7.3 Renewable Backstopping Requirements

The NBTSO acts as the balancing authority for the entire Maritime region.[126] Within the NBTSO balancing region, there are smaller system operators, such as the Maritime Electric System Operator, that are responsible for scheduling energy imports and exports from their service territory. The Maritime Electric System Operator receives hourly generation forecasts from all on-Island generation sources (including renewable energy generators), estimates hourly customer load for PEI and subsequently schedules (i.e., forecasts) the necessary energy imports from or exports to the NBTSO.

Maritime Electric's hourly customer load is relatively predictable (i.e., easy to forecast); however, combining it with the variability of renewable energy generation to forecast energy imports and exports through the Interconnection is increasingly difficult.[127] As weather systems move across PEI, wind speed and cloud cover can change quickly, which impacts wind and solar energy generation. When renewable energy generation production decreases quickly, PEI must import

[125] The cost of capacity is primarily based on fixed costs of generation, as non-fixed costs for generation are typically associated with energy, not capacity.

[126] The NBTSO is responsible for ensuring the amount of energy produced and imported to/exported from the region is equal to the load within the region. It requires submission of day-ahead schedules to ensure that there is appropriate generation capability available and hour-ahead schedules to fine-tune the system and adapt to current system conditions.

[127] Predicting hourly energy imports or exports is becoming more difficult with more than 40 MW of net-metered solar now installed on the system, along with a 10 MW of utility-scale solar farm and 92 MW of wind generation under contract with Maritime Electric. As this generation source ramps up and down the resulting requirement for energy import or exports does the opposite.

additional energy from NB Power, which results in the amount of energy imported being significantly more than what was initially scheduled by the Maritime Electric System Operator. If this causes contractual or system operational issues on the mainland, the NBTSO may issue a Hold-to-Schedule directive to the Maritime Electric System Operator.

During Hold-to-Schedule events, PEI must operate its dispatchable generation resources or decrease its customer load to maintain the previously scheduled import level.[128] Currently, Hold-to-Schedule directives are managed by on-Island dispatchable generation resources. This means that, when energy imports are limited to the previously scheduled level, the resulting energy shortfall can be supplied by the Company's CTs and customer load is not impacted. The Company refers to this type of operation as renewable backstopping. A typical renewable backstopping operation lasts until the end of the scheduling hour, as import schedules for the following hour are updated to reflect current system conditions.

The number of Hold-to-Schedule directives are increasing, driven by more frequent periods when there is insufficient excess energy available from NB Power to accommodate periods of lower-than-expected renewable energy generation on PEI. During the five-year period from 2019 to 2023 there were 173 Hold-to-Schedule directives requiring the operation of on-Island CTs to maintain previously scheduled import levels.

There are currently 276 MW of renewable energy generation sources located on PEI: 203 MW of wind energy generation and approximately 73 MW of solar energy generation.[129] In addition, there are 340 MW of renewable generation projects presently requesting to connect to Maritime Electric's system, as detailed in Table 2 and Table 4 in Section 5.1.2. If all requested projects proceed, there will be a total of 616 MW of renewable energy generation on PEI, comprised of 339 MW of wind energy generation and 277 MW of solar energy generation.[130] A 340 MW increase in renewable energy generation (i.e., 616 MW minus 276 MW), without any increase in

[128] Neighbouring utilities also schedule energy from the NBTSO, which can limit Maritime Electric's ability to increase its import levels.

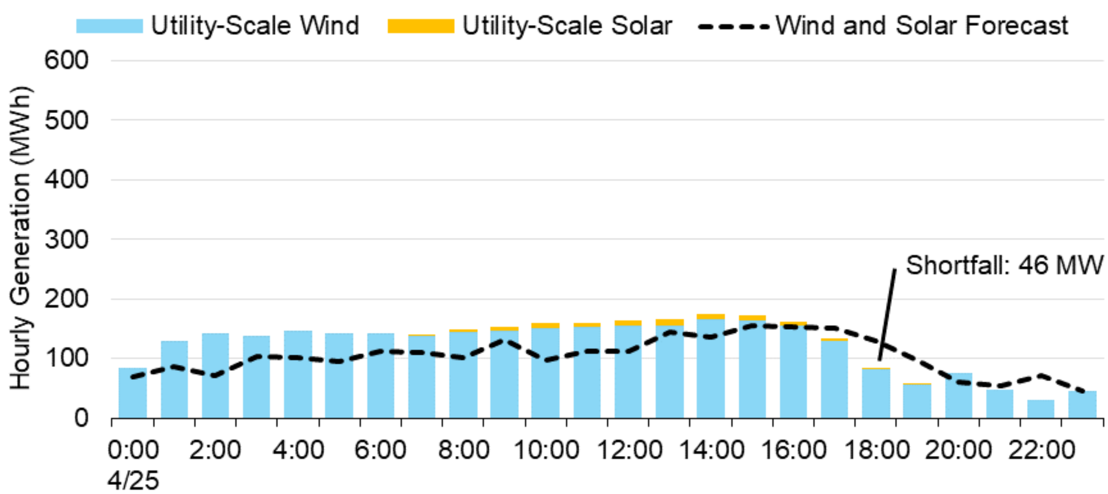
[129] 21 MW at Summerside Sunbank, 10 MW at PEIEC Selmon Park and approximately 42 MW of net-metered solar generation. The net-metered solar generation total is approximate because net-metered solar is continuously being added to the system. Currently, there is approximately 1 MW of net-metered solar added to the system per month.

[130] The total additional net metered solar generation added to the system between now and then would be in addition to the total renewable energy generation of 616 MW.

on-Island dispatchable generating capacity, will result in shortfalls beyond the Company's ability to supply during Hold-to-Schedule events, resulting in the need for customer load shedding.

Figure 26 shows actual hourly renewable energy generation compared to what was scheduled (i.e., forecast) on April 25, 2024. The Figure shows that actual renewable energy generation was significantly lower than forecast, which resulted in a 46 MW shortfall.[131,132]

FIGURE 26
April 2024 PEI Renewable Energy Generation (Actual)



Note: Excludes City of Summerside generation.

Figure 27 shows a forecast for renewable energy generation for the same period in April 2028, based on 2024 weather and assuming that the renewable energy generation projects requesting to connect to Maritime Electric's system proceed.[133] With 341 MW of additional wind and solar generation, a 107 MW shortfall is forecast, compared to the 46 MW shortfall experienced in 2023. Maritime Electric's current 89 MW of on-Island dispatchable generating capacity is not large enough to accommodate a 107 MW shortfall; additional on-Island dispatchable generating

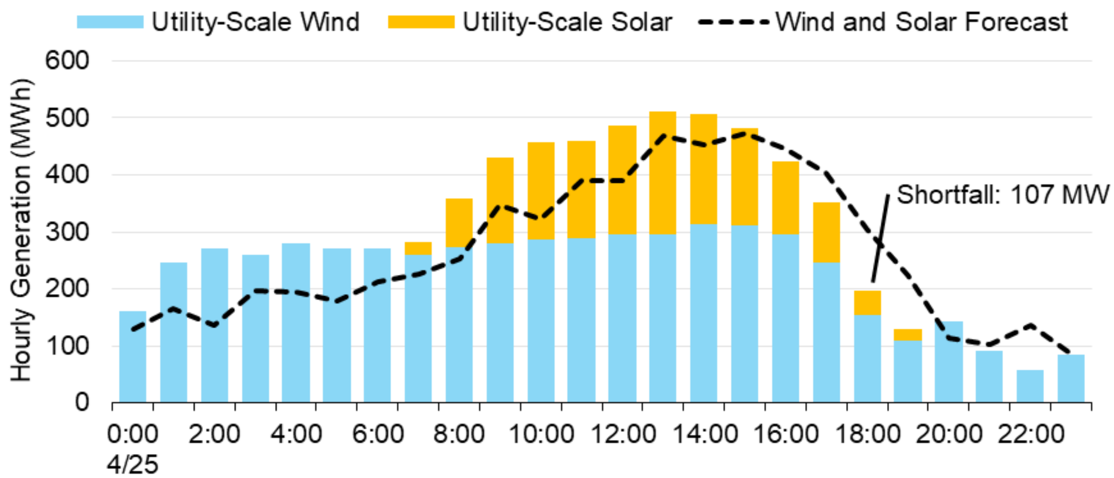
[131] The shortfall experienced in April 2024 did not result in the operation of Maritime Electric's CTs due to the availability of capacity from NB Power, but serves as an example. Additional NB Power capacity is not always available.

[132] Renewable generation varies continuously; a shortfall of 46 MW means a shortfall of 46 MWh within a 1-hour period.

[133] Figure 27 assumes that the 32 MW solar projects proposed for Charlottetown and Mount Pleasant, which did not provide an in-service-date in Table 3 found in Section 5.1.2, are in service by 2028.

capacity resources are required to accommodate the expected wind and solar energy shortfalls by 2028.

FIGURE 27
April 2028 PEI Renewable Energy Generation Forecast Based on 2024 Weather



Note: Excludes City of Summerside generation. Based on projects requesting to connect to Maritime Electric system.

7.4 Impacts of Customer Load Shedding

Customer load shedding is required when there is insufficient generating capacity to serve customer load, in which case some customers need to be "turned off." As an increasing number of PEI residents transition to using electricity as their primary (or worse, their only) heat source, customer load shedding due to a capacity shortage during extreme cold temperatures poses significant risks for personal health and safety and property damage. There have been several recent events across North America where customer load shedding was or was almost required, as summarized in this section.

January 2014: Newfoundland and Labrador

In January 2014, customers in Newfoundland experienced sporadic and rotating blackouts over seven days, resulting in up to 200,000 customers without power at a time. The resulting review by the Public Utility Board of Newfoundland and Labrador found that "there had been insufficient generating capacity on the island interconnected system, and suggested NLH was to blame for improper upkeep at the Hardwoods CT, the Stephenville turbine, and the Holyrood Unit 3 generator."[134]

February 2021: Texas

In February 2021, extreme cold in Texas resulted in high customer load, causing disruptions to generators and supply of natural gas, widespread power outages and water shortages. The crisis resulted in billions of dollars in damage and the deaths of 246 people, two-thirds of whom died from hypothermia.[135]

February 2023: Eastern Canada Polar Vortex

In February 2023, a polar vortex weather event resulted in record high customer load on PEI and throughout Eastern Canada. High customer load resulted in significant stress on the electrical system, with PEI reaching a record high system peak of 395.7 MW.[136] During the event, wind generation on PEI dropped significantly, as both the cold temperatures and high wind speeds caused wind turbines to shutdown. NB Power was able to provide imports with minimal curtailment; however, NB declared an Energy Emergency Alert Level 2, which indicates that it was at serious risk of being unable to meet its firm load commitments.[137] Quebec also declared an Energy Emergency Alert Level 2 and curtailed electricity exports to NB. Fortunately, NB was able to import energy from New England and Newfoundland and Labrador via NS, which helped avoid customer load shedding. Had these imports been unavailable to NB, it is likely that it would have curtailed electricity exports to PEI, which would have resulted in customer load shedding in the province.[138]

January 2024: Alberta

In January 2024, the Alberta Electric System Operator ("AESO") issued an urgent appeal to Albertans to conserve electricity, resulting in a 200 MW reduction in customer load and allowing

[134] Appendix D: Extreme Weather Event Capacity Impact – Addendum to December 2022 Maritime Electric Capacity Resource Study (page 5).

[135] Appendix D: Extreme Weather Event Capacity Impact – Addendum to December 2022 Maritime Electric Capacity Resource Study (page VI).

[136] This system peak was 22 per cent higher than the previous record peak, which was set in 2022.

[137] Energy Emergency Alert Level 2 is based on NERC standards and indicates that the Balancing Authority (in this case, NB Power) is no longer able to provide its expected energy requirements. In Energy Emergency Alert Level 2 firm capacity purchases are no longer guaranteed.

[138] Appendix D: Extreme Weather Event Capacity Impact – Addendum to December 2022 Maritime Electric Capacity Resource Study (page IV).

the region to avoid rotating blackouts.[139] In April 2024, tens of thousands of Alberta households lost power as a shortage of generation prompted the AESO to cut usage.[140] The January event was triggered by low renewable production coinciding with high customer load, and the April event was triggered by two natural gas plants tripping off. The AESO has stated that new generating facilities with a combined capacity of 1,800 MW are forecast to come online in 2024 and should remove the risk of rotating blackouts in the future.[141]

7.5 Synchronous Condenser

This section discusses a secondary benefit of additional on-Island dispatchable generating capacity, reactive power support, through the use of a CT as a synchronous condenser. A synchronous condenser is an electric generator acting as a motor that is synchronized to the electrical system to provide reactive power support. Its purpose is to improve system stability and maintain voltages within desired limits under changing customer load conditions and contingency situations.

Typically, synchronous condensers are initially powered by a spinning turbine before they are synchronized to the electrical system, at which time a clutch disengages the turbine from the generator. Once the turbine is disengaged, it is no longer required for the operation of the synchronous condenser, so it shuts down and stops consuming fuel. The generator, however, continues to rotate at its rated (i.e., synchronous) speed. The Maritime Electric System Operator can then control the generator's electrical field by adjusting a voltage regulator to either generate or absorb reactive power, which impacts the electrical system's voltage. It is possible to use the generator included with a CT as a synchronous condenser provided the CT is designed to operate as such.

139 https://www.aeso.ca/aeso/media/aeso-thanks-albertans-for-quick-response-to-call-for-power-conservation/ - AESO, AESO Thanks Albertans for Quick Response to Call for Power Conservation.

140 https://www.cbc.ca/news/canada/edmonton/rotating-brownouts-leave-thousands-of-albertans-without-power-friday-1.7165290 - CBC News, Rotating brownouts leave thousands of Albertans without power.

141 https://www.cbc.ca/news/canada/edmonton/province-did-everything-it-could-to-prepare-for-winter-surge-in-power-demand-minister-says-1.7083882 – CBC News, Province did everything it could to prepare for winter surge in power demand, minister says.

Synchronous condensers provide additional benefits over other voltage control equipment (e.g., capacitors and reactors) as they provide stepless control and inertia to the system, increasing stability and reliability.

Maritime Electric currently relies heavily on the Interconnection to provide much of its reactive power support.[142] However, as the Company's system peak continues to increase, a source of dynamic reactive power support will be required in central or eastern PEI to support high customer loads in those areas, especially during transmission system outages.

Synchronous condensers and conventional generators contain heavy spinning rotors that provide significant system inertia, which enables them to maintain operation during system disturbances, such as system faults or customer load and generation fluctuations. In contrast, inverter-based generators, such as solar energy generators and modern wind energy generators, use electronic devices to convert direct current ("DC") electricity to alternating current ("AC") electricity.[143] These electronic devices do not provide system inertia; rather, they have control algorithms which are set to follow the grid voltage and trip the generator if the system parameters are outside of tolerance. This means that small system disturbances can cause inverter-based resources to operate abnormally or possibly trip, which consequently increases the impact of such an event. Operating a synchronous condenser provides the system with inertia, limiting the ability of that disturbance to impact system parameters, such as voltage. Inverter-based generators supported by a synchronous condenser can ride through small disturbances that it otherwise could not, preventing a cascading event that could result in significant loss of load. As the amount of inverter-based renewable energy generators increases on PEI, the need for additional system inertia will also increase. Installing a generator with a synchronous condenser will benefit the electrical system and help provide this future need.

[142] The subsea cables between NB and PEI produce 146 megavolt-ampere reactive ("MVAR") of capacitance (a form of reactive power). The four 30 MVAR reactors installed in Bedeque and Borden can absorb most of this reactive power when it is not required by PEI. The Maritime Electric System Operator controls the supply of reactive power from the Interconnection by switching those reactors on and off as required. Approximately 65 per cent of Maritime Electric's load is located in or east of Charlottetown and localized dynamic reactive power support is required in this area at elevated load levels.

[143] Although older wind generators were not inverter-based, today, almost all renewable generation being added to the grid is considered inverter-based. There is approximately 70 MW of inverter-based generation currently connected to the PEI electrical system. As per Section 5.1.2, there are approximately 340 MW of utility scale inverter-based projects requesting access to the Maritime Electric transmission system.

There are two viable options to add synchronous condensing capability to PEI's electrical system:[144]

1. include synchronous condensing capabilities with a new CT at an estimated cost of approximately $7.0 million;[145] or
2. install a stand-alone synchronous condenser, which is estimated to costs in excess of $30 million, partially because it would require dedicated electrical equipment and a motor to spin the synchronous condenser up to speed.[146]

Both options would have similar equipment and electrical capabilities. The Company has included Option 1 in the CT4 component of the Project as it is considerably less expensive. Without the addition of a Synchronous Condenser, the Company will have to explore less resilient and reliable forms of reactive power support, which could ultimately be more expensive.

7.6 Capacity Resource Study

In 2022, Maritime Electric engaged S&L to complete a CRS, which is included in Appendix C. The CRS was a generation planning exercise that analyzed the Company's generating capacity requirements and options to meet those requirements. The CRS evaluated a variety of capacity resource technologies, developed cost estimates and provided recommendations for cost-effective technologies that could achieve Maritime Electric's capacity requirements.

In February 2023, two months after the completion of the CRS, large areas of eastern Canada, including the Maritime provinces, experienced a polar vortex weather event. This event brought

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144 A third option to retrofit CT3 with a synchronous condenser, which is estimated by S&L to cost approximately $13.4 million, and would require CT3 to be out of service for approximately nine months was also considered. However, due to the forecast capacity resource deficit and the reliability risks associated with removing CT3 for nine months, the Company does not recommend this option today. The addition of a clutch and synchronous condenser to CT3 may be a consideration once sufficient additional on-Island capacity has been added, in order to reduce customer reliability exposure to an extended CT3 outage.

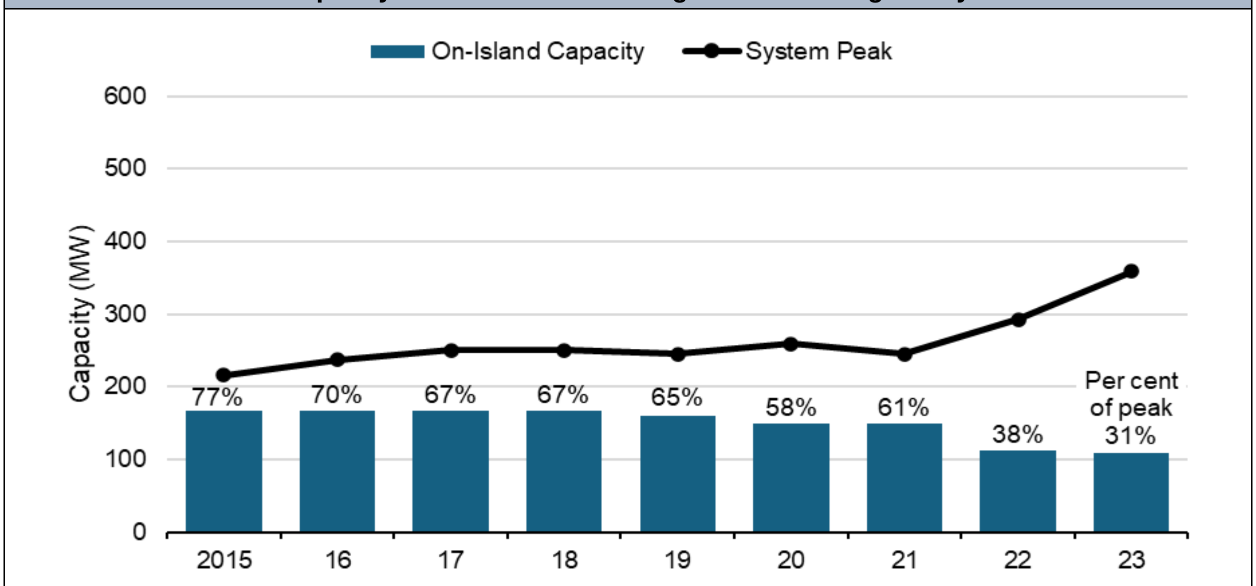
145 This is a class 4/5 estimate based on the AACE cost estimate classification system and assigned a probable accuracy range within 30 per cent. This cost is in 2024 dollars and is based on a USD to CAD exchange rate of 1.36.

146 A February 2021 document from ISO New England indicated several synchronous condenser projects with varying costs but all projects are above $30 million for a 50 MVAR synchronous condenser after USD to CAD conversion and inflation are accounted for: https://www.iso-ne.com/static-assets/documents/2021/02/a6_dynamic_reactive_device_technologies.pdf – ISO New England, Looking Forward: Dynamic Reactive Device Technologies.

temperatures as low as -27°C (-43°C with the windchill) on PEI. The extreme cold led to record customer load on PEI and throughout Eastern Canada, significantly stressing electrical systems. As a result, Maritime Electric requested S&L to reevaluate the findings of the CRS and prepare an Addendum, which was completed in July 2023. The Addendum, which is included in Appendix D, provided revised recommendations, superseding those from the original CRS, based on the record customer load experienced in February 2023. References to the CRS in this Application reflect the updated recommendations provided in the Addendum.

Prior to the decommissioning of the Charlottetown Steam Plant in 2022, approximately 60 per cent of Maritime Electric's capacity requirement was supplied by on-Island capacity resources.[147] Currently, only 31 per cent of the Company's capacity requirement is supplied by on-Island capacity resources, as illustrated in Figure 28.[148] During a period of increasing system peak, a decrease in on-Island capacity results in an increasing risk that the Company will be unable to provide continuous service to customers.

FIGURE 28
On-Island Capacity Resources Decreasing as a Percentage of System Peak



[147] The average ratio of dispatchable on-Island capacity to peak load was 60 per cent during the five-year period between 2015 and 2019.

[148] The system peak experienced in 2023 was 359 MW and the Company's CTs provided 89 MW of capacity with the ELCC of wind providing another 22 MW, resulting in on-Island coverage of 31 per cent (i.e., (89 + 22) / 359 = 31 per cent).

The CRS discussed Maritime Electric’s increased reliance on off-Island capacity resources and reviewed reliability risks, such as disconnection from the mainland events, that would result in rotating blackouts, as discussed in Sections 7.2.3 and 7.4.[149] The CRS highlighted that relying on off-Island capacity resources for more than 50 per cent of Company’s capacity requirement “leaves Maritime Electric customers exposed to significant financial and health/safety risks.”[150]

S&L also completed an analysis of 16 potential capacity resources as part of the CRS, which are summarized in Table 19. The CRS shortlisted eight of the technologies for further study as part of a first level screening, which are identified as “Selected” in the Table. The initial screening primarily considered whether the technology (1) had sufficient industry deployment to be considered an established technology and (2) whether the technology had an adequate supply of the required resource (e.g., fuel) for it to be a viable option on PEI.

TABLE 19
S&L Initial Capacity Resource Technology First Level Screening Results[151]

Technology Type	Significant Energy Industry Deployment?	Sufficient Renewable Resource?	Notes / Other Considerations	Initial Screening Results
Onshore Wind Power	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Offshore Wind Power	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Solar PV (Utility Scale)	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Rooftop Solar PV	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Concentrating Solar Power (CSP)	Yes	No	Renewable technology, but PEI's direct normal irradiance levels are not high enough and PEI’s climate is not ideal to support a CSP plant	Not Selected
Energy Storage (BESS, Li-Ion)	Yes	Not Applicable	Widely used technology in energy industry	Selected

149 S&L referred to rotating blackouts as “rolling blackouts.” The two terms are interchangeable.

150 Refer to page III of the S&L CRS provided in Appendix C. It should be noted that the CRS indicates that only a portion of the on-Island wind generation could operate during a disconnection from the mainland. Since the publication of this report, Maritime Electric conducted a thorough review of its system and has determined that during a disconnection the system is not strong enough to support any wind generation. Refer to Section 5.2.3 for more detail.

151 Table 19 is reproduced from Table 5-1 on page 60 of the CRS.

TABLE 19
S&L Initial Capacity Resource Technology First Level Screening Results[151]

Technology Type	Significant Energy Industry Deployment?	Sufficient Renewable Resource?	Notes / Other Considerations	Initial Screening Results
Energy Storage (BESS, Flow)	No	Not Applicable	Technology has not gained widespread energy industry deployment to date	Not Selected
Energy Storage (Compressed Air)	No	Not Applicable	Only a handful of CAES [compressed air energy storage] facilities are in operation around the globe, relatively few are for output greater than 10 MW.	Not Selected
RICE	Yes	Not Applicable	Widely used technology in energy industry, can operate on various fuel types, including renewable-derived fuels	Selected
CT – Aeroderivative	Yes	Not Applicable	Widely used technology in energy industry, can operate on various fuel types, including renewable-derived fuels	Selected
Biomass Power Plant	Yes	Yes	Widely used technology in energy industry, flexibility to operate on various renewable-derived fuels, renewable technology	Selected
Nuclear – Small Modular Reactor (SMR)	No	Not Applicable	Technology has not yet gained widespread energy industry deployment to date	Not Selected
Tidal Power	No	No	Renewable technology, but only a handful of tidal power stations are in operation around the globe, PEI also lacks a significant tide	Not Selected
Wave Power	No	No	Renewable technology, but technology is in infancy with only a handful of very small-scale projects installed around the globe	Not Selected
Geothermal Power Plant	Yes	No	While widely used in energy industry, the best locations with sufficient heating resource are generally located in western Canada, renewable technology	Not Selected
Fuel Cell	No	Not Applicable	Currently, fuel cells are not yet a technology that has gained significant industry adoption for large power generation applications and existing systems tend to be small in size	Not Selected

7.6.1 Comparison of Capacity Resource Technologies

A summary of the detailed analyses and cost comparisons of each capacity resource technology that the CRS selected for secondary screening is provided in this section. The secondary screening considered the technology's ability to (1) contribute towards Maritime Electric's energy and capacity obligations, (2) provide support when PEI is disconnected from the mainland and (3) impacts on the Company's sustainability targets.

Onshore Wind Power

From a power generation perspective, consistent and strong wind speeds are one of PEI's best resources; however, onshore wind power is not an effective capacity resource since ELCC decreases as a percentage of nameplate capacity as more wind generation is added, as discussed in Section 5.1.2. Rather, onshore wind power is more effective as a supply of energy.[152]

S&L developed a cost estimate for a 50 MW onshore wind power plant, which is provided in the CSR.[153] The capital cost of onshore wind is estimated to be $2,126/kW, which is reasonable; however, when the ELCC of additional wind resources at less than 10 per cent of nameplate capacity is considered, the cost of capacity is 14 times more than a RICE plant.[154]

Although onshore wind has excellent potential as a source of energy for PEI, it is not a useful or cost-effective source of capacity. For that reason, S&L did not include it in their recommendations.

Offshore Wind Power

Offshore wind power uses larger wind turbines that are erected offshore and can generate more electricity with less intermittency due to more consistent winds offshore. While offshore wind power typically has a higher capacity factor than onshore wind power, PEI's onshore wind power

[152] For example the PEIEC's proposed 30 MW wind farm expected to be online in 2026 will only provide an additional 2.8 MW of generating capacity for the Company. As more wind is added to Maritime Electric's system, the relative percentage of that capacity which contributes to the ELCC will reduce further.

[153] The cost estimate located in Appendix A of the CSR, which is provided in Appendix C of this Application.

[154] The cost estimate of $2,126 for onshore wind power was provide by S&L in 2022 and was based on industry average installation costs, not specific to PEI.

is very favourable in terms of wind speed and intermittency.[155] As a result, the expected capacity factor (i.e., levels of generation throughout the year) improvements of offshore wind power near PEI are only modest.

Offshore wind power is significantly more expensive than onshore wind power due to the challenges associated with installing wind turbines and associated infrastructure in water. S&L estimates that offshore wind power would cost between $6,000/kW and $8,000/kW, which is three-to-four times more than onshore wind power on a per-kW basis.[156]

For the same reason as onshore wind power, offshore wind power was not recommended as a capacity source.

Utility-Scale Solar Photovoltaic

Utility-scale solar photovoltaic is a reasonable source of energy for PEI; however, Maritime Electric's system peak typically occurs on a cold day in January or February between the hours of 5 p.m. and 6 p.m.[157] At that time, the sun has already set (i.e., solar generation is not producing energy) and solar generation cannot be relied upon; therefore, it cannot be counted as a capacity resource towards the Company's capacity requirements.

Rooftop Solar Photovoltaic

Rooftop solar generation uses the same technology as utility-scale solar and does not produce energy during system peak periods in January and February after 5 p.m. Therefore, it too cannot be counted as a capacity resource towards the Company's capacity requirements.

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[155] Capacity factor refers to the ratio of actual electricity generated over the course of a period of time compared to if the generator operated at maximum capacity for the same period. PEI's wind farms consistently achieve capacity factors above 40 per cent. National Renewable Energy Laboratory ("NREL") indicates that historical off-shore wind capacity factors have varied between 37 and 43 per cent over the past 10 years and projects future capacity factors between 45 and 50 per cent: https://atb.nrel.gov/electricity/2024/offshore_wind – NREL, Offshore Wind.

[156] A cost estimate of $6,000/kW to $8,000/kW for offshore wind power was provided in section 5.2.1.2 (page 64) of the original CRS and was based on industry average installation costs, not specific to PEI.

[157] PEI's wind farms consistently achieve capacity factors above 40 per cent making them a good source of energy for PEI. Solar farms are expected to achieve capacity factors between 12 and 17 per cent, making them a reasonable source of energy for PEI.

Lithium-Ion Battery Energy Storage System

A lithium-ion BESS differs from other alternatives discussed thus far in this section as it is not a generation resource, but instead stores energy generated by other sources. Also, the unique technical characteristics of a BESS allows it to act in ways that differ from generation technologies. For example, a BESS' ability to respond instantaneously to events on the power system makes it well suited to provide ancillary services, such as spinning reserve, load following and voltage support. The CRS estimated the capital cost for a 10 MW/40 MWh BESS to be $2,714/kW (installed). Industry standards dictate that a BESS must have at least 4 hours of storage to be counted as a capacity resource.

A BESS has several capabilities or modes of operation, including:

- Energy mode: a BESS absorbs energy when surplus energy is available and it is not fully charged, and it can inject energy into the electrical system when energy is needed. The BESS freely charges and discharges according to the energy market or needs of the system. The concept of storing renewable energy for later discharge would fall under this mode of operation.
- Capacity mode: the BESS maintains its state of charge as high as possible in case it is required as a capacity resource. When the electrical system requires additional capacity the BESS discharges until the need for capacity is satisfied or the BESS is depleted. Then, the BESS is recharged as soon as the electrical system has sufficient excess capacity.
- Ancillary service mode: the BESS can provide system ancillary services, such as load following, frequency regulation and spinning reserve, as required.[158] When operating in ancillary service mode, the Maritime Electric System Operator would need to relinquish control of the BESS to the NBTSO, acting as the balancing authority for the Maritime region.

The capabilities of a BESS cannot be double counted, meaning that the same portion of storage cannot be used as an energy resource, capacity resource or ancillary service resource

[158] The Company presently purchases load following, frequency regulation and spinning reserve from the NB Power System. Should these services be provided by a BESS, the Company would discontinue purchasing these products from NB Power.

concurrently. However, nameplate capacity of a BESS can be divided into separate capabilities, allowing portions of a BESS to operate in different modes. For example, a 10 MW/40 MWh BESS could be treated as two 5 MW/20 MWh BESS units. The first 5 MW portion could be operated as an energy resource while the second 5 MW portion is operated as a capacity resource.

It is important to note that a battery's state of charge during a contingency event is not known. System contingencies often occur with no warning, and the state of charge when a contingency occurs significantly impacts its ability to provide support. Also, contingency events commonly last longer than 4 hours, meaning that a 4-hour BESS will not be able to provide full output for the duration of the event.[159] The Maritime Electric System Operator would have to determine when and at what level to engage the BESS during a contingency event, which may prove to be a difficult task.

In addition, the type of service provided by a BESS can change throughout the year. As Maritime Electric's need for capacity is highest when customer load is highest during the winter months, the Company can use a BESS as a capacity resource during the winter months and repurpose it as an energy resource or an ancillary services resource for the remainder of the year.

While a BESS can be considered a useful capacity resource, it is more expensive as a capacity resource compared to a CT or RICE plant due to its lifespan. The estimated capital cost of a 4-hour BESS is $2,714/kW, which is comparable to the estimated capital cost of a CT at $3,120/kW or a RICE at $2,710/kW. However, the expected lifespan of a CT and a RICE is approximately 50 years, which is more than twice the expected lifespan of a BESS at approximately 20 years. In addition, a BESS is subject to capacity degradation over its lifespan and requires periodic augmentation to maintain its nameplate capacity value. Augmentation costs can be up to 15 per cent of the initial capital costs but depend significantly on the BESS' operating conditions.[160]

A BESS that is operated as a capacity resource could provide some benefit to Maritime Electric's grid during a short-duration event where additional capacity is required (e.g., a disconnection from

[159] The most recent disconnection from the mainland occurred in November 2018. It lasted approximately 8 hours, meaning the battery would only last half as long as the outage duration.

[160] S&L estimated the augmentation costs of a 50 MW, four-hr battery to be $19.8 million over its 20-year lifetime.

the mainland or a curtailment that lasts for less than 4 hours). If the event lasts longer than 4 hours, a BESS would no longer provide a benefit after it has been depleted.[161] However, a BESS providing fast-acting grid services (i.e., ancillary services) could provide system benefits, such as load following, for a longer duration during such an event.[162]

As a result of the multiple modes of operation of a BESS and the various benefits associated with each mode, along with its estimated capital cost, S&L recommended this technology on a small scale initially with a possibility of expansion in the future.

Reciprocating Internal Combustion Engines

RICEs are a type of dispatchable generator that resembles a large car engine. They are common in the industry due to their modularity, operating flexibility and fuel flexibility. Natural gas and diesel are their most common fuel sources, but RICEs can also operate on renewable fuels, such as biodiesel, ammonia and hydrogen.[163] According to S&L, some modification to the engine components are required to operate it with a drastically different fuel. For example, modifications would be required to convert a RICE that primarily consumes diesel and biodiesel to be capable of operating on hydrogen. In general, the variety of fuels compatible with a RICE helps reduce the risk associated with operating a RICE if diesel generation (by itself) is no longer permitted under future regulations.[164]

The estimated capital cost of a RICE plant is $2,710/kW. RICE technology has several advantages compared to other capacity resources and Maritime Electric's existing CTs, through its:

- capability to operate on a wide variety of fuels and fuel blends;

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[161] This is a considerable drawback to a BESS when compared to a CT or Rice plant with seven days of fuel storage and the ability to supplement the fuel supply to extend the unit's operation even further.

[162] A BESS providing load following during a disconnection would remove the variability from the load, allowing the dispatchable generating units to operate at higher output levels throughout a prolonged disconnection.

[163] Currently, RICE plants can operate on a blended mix of diesel/biodiesel or hydrogen/natural gas, but it is expected that RICE plants will be capable of operating on 100 per cent biodiesel, ammonia or hydrogen in the future.

[164] S&L state that traditional diesel and biodiesel are similar enough in composition that many of the most common RICEs available today can use both without needing significant modifications (some minor modifications would be required to allow for biodiesel firing).

- consistent output that is independent of ambient environmental conditions;[165]
- ability to operate at lower output levels than CTs, and superior efficiencies when operating at lower output levels;[166]
- availability in a variety of sizes up to 20 MW;
- modularity, as RICE plants are typically made up of more than one unit, meaning that maintenance can be performed on smaller individual units while the remaining units remain available; and
- ability to operate continuously at full output for extended periods.[167]

Maritime Electric has some experience operating small RICE "black-start" units.[168] While RICE plants can provide energy with a capacity factor above 90 per cent, the energy produced by such a plant would be expensive and potentially carbon-intensive, depending on the fuel used. For these reasons, S&L recommended that a RICE plant be operated similar to the operation of the Company's existing CTs as a peaking and backup capacity resource.

Combustion Turbines

CT technology is based on aeroderivative engines. The technology has many advantages as a capacity resource, including that:

- it is a mature technology that has been used in the industry for over 50 years;
- CTs are designed for quick start-up, and can go from start to maximum power in less than 10 minutes;
- CTs have a small footprint and are relatively quiet, which makes them more favourable for urban locations compared to other generating technologies;

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[165] RICE output is independent of ambient air conditions (i.e., temperature, humidity and pressure (primarily related to elevation)), while the output from CTs varies based on those same ambient air conditions. For example, CT3 has an output of 49 MW during winter conditions, but the output during warm summer conditions is reduced to 35 MW. However, an 18 MW RICE would be capable of outputting 18 MW under all conditions.

[166] Operationally, this means that if system conditions require 2 MW of dispatchable generation, a RICE can provide 2 MW. By comparison, CTs, such as CT3, have a minimum load level of 15 MW. If only 2 MW is required, the system operator must dispatch the CT at 15 MW and reduce another source by 13 MW. As CT energy is typically more expensive than other sources, running CTs above the needed level is financially disadvantageous.

[167] The Company intends to provide adequate fuel storage to operate the RICE plant at full output for seven days. During an extended run, fuel delivery can be scheduled to allow the plant to continue to run beyond seven days.

[168] The City of Summerside also maintains seven individual RICEs varying in size from 1.0 to 4.2 MW, and its oldest unit was first commissioned in 1950.

- if equipped with a synchronous condenser, the CT's generator can disengage from the turbine and synchronize to the grid to provide reactive power support without requiring fuel consumption;
- CTs can operate continuously at full output for extended periods;[169] and
- CTs have flexible fuel capabilities, which means they can operate on renewable fuels with appropriate upfront design or modifications.

CTs have similar capacity factors as RICEs and can operate on fuels such as diesel and natural gas. They have less fuel flexibility than RICEs, as the fuel standards for CTs are more stringent. They also have a higher minimum output level than RICEs, meaning they produce more than required if only small amounts of capacity are needed.

As diesel is currently the best fuel source for on-Island CTs, the cost of energy produced by this technology will be high. However, CTs are well-suited as a capacity resource operating only in peaking and backup situations, similar to the operation of the Company's existing CTs.

The estimated capital cost of a 50 MW CT is $3,120/kW.

CTs are a dispatchable generating resource that are flexible (i.e., they can start, stop and ramp quickly), cost effective and very common in the industry. Maritime Electric has experience operating CTs, as its current generating fleet is entirely made up of CTs. Similar to RICE plants, CTs can provide reliable capacity and energy; however, the energy produced by such CTs would be expensive and potentially carbon-intensive, depending on the fuel used. For these reasons, S&L recommended including a CT in the project to be operated as a peaking and backup capacity resource, similar to the operation of the Company's existing CTs.

Biomass Power Plant

Biomass power plants burn biomass (e.g., wood) to produce electricity. The estimated capital cost of a biomass power plant is $5,856/kW.[170] In addition, biomass power plants have high operating

[169] The Company intends to provide adequate fuel storage to operate the CT at full output for seven days. During an extended run fuel deliveries can be scheduled to allow the plant to continue to run beyond seven days.

[170] The cost estimate of a biomass power plant was provided by S&L in 2022 and was based on industry average installation costs and is not specific to PEI.

costs due to the amount of fuel and the number of personnel required to operate it. There is also a lack of long-term biomass fuel supply on PEI, as biomass power plants require significant wood resources and land mass for consistent long-term fuel supply. At this time, a biomass power plant is not considered a viable capacity resource based on its upfront costs and long-term fuel supply availability.

As a result of the high capital cost and the lack of long-term fuel source on PEI, S&L did not recommend a biomass power plant as a capacity resource.

Summary of Technologies

A summary of the shortlisted technologies is included in Table 20.

TABLE 20
Summary of Shortlisted Capacity Resource Technologies

Technology	Cost of Installed Capacity ($/kW)	Comment	Viable Capacity Resource
On-Shore Wind	37,964[a]	Expensive capacity source and diminishing capacity impact as more installed. Good carbon-free energy source.	No
Off-Shore Wind	88,000 – 118,000[b]	Expensive capacity source and diminishing capacity impact as more installed. Good carbon-free energy source.	No
Utility-Scale Solar PV	N/A[c]	No capacity value as system peak occurs after sundown. Reasonable carbon-free energy source.	No
Rooftop Solar PV	N/A[c]	No capacity value as system peak occurs after sundown. Reasonable carbon-free energy source.	No
BESS	2,714[d]	Expensive per unit of installed capability but provides system benefits. This should be developed at a small scale initially and may be expanded after experience gained and upfront installation costs drop.	Yes
RICE	2,710	Fuel flexibility, quick startup, extended operation, and good efficiency at lower output levels are benefits.	Yes
CT	3,120	Some fuel flexibility, quick startup, extended operation, and good reactive power support	Yes
Biomass	5,856	Expensive capacity source, and there is an insufficient long-term Island-based fuel supply.	No

a. S&L estimated the capital cost on a per kilowatt basis for a 50 MW onshore wind plant to be $2,126. Due to the reduced ELCC for additional wind resources on PEI a 50 MW wind plant will only result in additional 2.8 MW of Capacity. $2,126/kW x 50 MW/2.8 MW = $37,964 per kW of additional capacity.
b. The reduced ELCC for a 50 MW offshore wind plant would only result in an additional 3-4 MW of Capacity resulting in a very high cost on a per kW of additional capacity.
c. As solar provides no additional capacity value, a cost per kW of additional capacity is irrelevant.
d. A BESS has an expected operational life of 20 years while CTs, RICEs and biomass plants would be expected to operate reliably for up to 50 years.

7.6.2 Capacity Resource Study Findings and Recommendations

S&L's final recommendations, as detailed in the CRS, indicate that additional capacity resources are needed today. Providing additional on-Island dispatchable generation represents the most practical means for the Company to meet its capacity obligations and it:

- protects customers from future regional capacity shortfalls and the associated capacity market price exposure resulting from increased customer load and the impending closure of coal-fired generating units in the region;
- reduces risk to personal health, safety and property damage due to shortage of supply during cold weather events;
- increases the Company's ability to serve customer load during a disconnection from the mainland or severe curtailment events;
- supports additional renewable energy resource development on PEI by providing ancillary services and renewable backstopping support;
- provides voltage support to the PEI electrical system during periods of high load and during transmission system outages; and
- improves the Company's proportion of on-Island capacity resources as a percentage of its capacity requirement, which was 60 per cent from 2015 to 2019 (on average) and is expected to decrease to 17 per cent by 2033.

S&L also indicated that BESS, CT and RICE are the most appropriate and practical technologies for additional capacity given Maritime Electric's current operating conditions. The combination was selected for the specific advantages of each of the three selected technologies and to help diversify Maritime Electric's capacity resources. The advantages of each of the selected technologies that are most relevant to the PEI electrical system are:

- BESSs have increased flexibility; they can be utilized as a capacity resource or as fast-acting grid services (i.e., ancillary services), both of which are currently being sourced from off-Island resources. The ability to provide both capacity and ancillary services results in increased financial benefits for a moderately sized BESS. The BESS also has good potential to provide additional services in the future, such as energy arbitrage or helping the Company ensure renewable energy generated on PEI can be consumed on PEI.

BESS is also a technology that is actively being developed and increasingly installed throughout the world; therefore, installing a moderately sized BESS will provide insights for the Company for potential future projects.

- CTs offer the best opportunity to significantly and promptly increase the Company's on-Island capacity. Additionally, they enable the cost-effective inclusion of a synchronous condenser, which is necessary for providing dynamic system stability and support.
- RICEs provide the most cost-effective opportunity to increase the Company's on-Island capacity to the required level while achieving multiple added benefits. It will provide improved operating efficiencies when operating at lower output levels or during warmer weather, which allows the Company to increase the overall efficiency of its generation resources. RICEs also provide the best future fuel flexibility and its installation and maintenance can be completed in stages to reduce impact on operations.

S&L recommended installing a total of 125 to 150 MW of on-Island dispatchable generation and a 10 MW/40 MWh BESS. The range was recommended before the Company was aware of the OHPA program. Based on the expected impact that the OHPA program will have on system peak, the Company is proposing to install a total of 150 MW.

Following the completion of the CRS addendum, S&L was retained to complete cost estimates for potential capacity portfolios, including the suggested technologies at varying levels, to provide the recommended level of on-Island dispatchable generating capacity. A preliminary cost estimate was provided in September 2023 and was used to allow Maritime Electric to choose the components and their relative sizes to be included in the Project. The current combination of a 10 MW/40 MWh BESS, 50 MW CT4 and 90 MW RICE plant was selected to provide a balance of operational requirements, including reactive power support, cost effectiveness and operational flexibility.

The preliminary cost estimates were updated in September 2024 to reflect changes in design parameters and equipment pricing and is included in Appendix A.[171] The Component costs included in Section 6.4 were taken from the updated cost estimate.

[171] The updated cost estimate was an AACE Class 4/5 cost estimate which is assigned a probable accuracy range of 30 per cent after application of a 20 per cent contingency. Refer to Section 6.4 for further details on this estimate.

7.7 Long-Term Fuel Options

Given the Federal and Provincial Governments' goals to reduce GHG emissions, along with Maritime Electric's goals to reduce GHG emissions, the Company is mindful of the type of fuel that will be consumed by the proposed capacity resources. In order of importance, the selected fuel type must be: (1) readily available to ensure the capacity resources can be operated when needed and for as long as they are needed; (2) cost effective; and (3) environmentally responsible.

In the short term, CT4 and the RICE plant will both be diesel-fired. The use of diesel is warranted because it is the only current fuel source that satisfies criteria 1 and 2. With respect to criteria 3, the Company believes that the short-term use of diesel does not disregard its pledge to be environmentally responsible. The fact that the Company's capacity resources will only be used as peaking and backup resources means that the consumption of diesel will be limited. As alternate fuel sources become more mainstream, thereby satisfying criteria 1 and 2, the Company will be properly positioned to convert to a more environmentally responsible fuel because the proposed CT4 and RICE plant will be capable of operating on alternate fuels.

There are several alternate fuel sources with less carbon impact than diesel that can be used with CTs and RICEs. Biodiesel, natural gas, and hydrogen have all been touted as potential fuel sources that have less environmental impact than diesel and could be used in the proposed generation.

Biodiesel

Biodiesel is a renewable fuel that is produced from wood mass, vegetable oils, animal fat or recycled restaurant grease. There is presently no large-scale biodiesel producer in the region, and PEI likely has insufficient biomass available to justify the construction and operation of a biodiesel production facility. The biodiesel industry is in its infancy and needs to be developed where resource materials are available for the fuel to be used in both electricity production and industry.

Biodiesel has composition issues that make it more limiting as a fuel than traditional diesel. Impurities and its chemical properties, depending on its source material, mean its storage and use must be more carefully monitored. As such, it will likely be used in small quantities, often blended into traditional diesel to lower the overall carbon footprint of the fuel consumed.[172]

While Biodiesel is a future fuel option for RICEs, CTs have much more stringent standards for fuel chemical composition and physical properties, so biodiesel would have to be thoroughly evaluated before it is considered for use in CTs. However, turbine manufacturers indicate that CTs can burn biodiesel blends today.

Natural Gas

Natural gas is regionally available through the Maritimes & Northeast Pipeline ("M&NP"), which is a 1,100-kilometre ("km") natural gas pipeline from NS to Massachusetts. There is no pipeline connecting the M&NP to PEI, so any natural gas use on PEI must be transported by truck or shipped from the mainland. Several PEI businesses use gas sourced from the M&NP pipeline in a compressed natural gas ("CNG") state. This CNG is typically drawn from the pipeline and compressed at a location near Port Elgin, NB.

The use of natural gas on PEI generation facilities would require the development of transportation pathways, natural gas supply contracts and on-Island offloading and storage facilities. The logistics are more complicated than for traditional diesel, since a 50 MW CT at full output would use approximately 39 CNG trucks over a 24-hour period.[173] The combustion of natural gas for electricity production emits roughly half the GHG emissions compared to diesel. The Company believes that strong consideration should be given for CNG use in existing and future CTs, if supply and transportation logistics are developed or if Federal regulations limit the allowed amount of diesel-fired electricity generation. The proposed CT4 and RICE plant will both be capable of using natural gas, should handling and storage infrastructure be developed on PEI in the future.

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[172] Storing biodiesel in small quantities ensures that it will be used before it expires. Diesel may be needed to accommodate longer, unexpected operations.

[173] Based on a daily requirement of 11,400,000 cubic feet of natural gas for 50 MW of output over a 24-hour period, and a quantity of 300,000 cubic feet of natural gas per truck. If an offloading compressor is not incorporated into the design an additional 10 trucks per day could be required to compensate for the high gas pressure required in combustion turbines.

Liquefied natural gas ("LNG") is not practical from a supply, storage or usage perspective for Maritime Electric. First, there is no regional supplier of LNG, which would require its shipment over a much greater distance than CNG. Second, it would require offloading and storage facilities similar to CNG. Third, the shelf life of LNG is limited as it boils back to its gaseous state over time, requiring additional refrigeration to return it to its liquid state or resulting in lost product. The nature of the Company's generation operation, as a peaking and backup resource, means that there are extended periods when the units would not operate, which could result in the LNG boiling and becoming unusable. All these factors result in LNG not currently being a viable option.

Hydrogen

Hydrogen is a renewable fuel that is growing in popularity. Its carbon impact and level of renewability depend on how it is sourced. Hydrogen is typically produced from methane, which leads to carbon emissions. It can also be produced through electrolysis of water and can be up to 100 per cent renewable, depending on the energy source used for the process. Electrolysis is energy intensive, and the energy required to separate the water molecules into hydrogen and oxygen is far more than the energy derived from the hydrogen fuel itself.

Hydrogen on its own burns very hot, causing thermal issues with materials currently used in CTs and RICEs. Hydrogen can alternatively be blended with a gaseous fuel source, such as CNG, at concentrations of up to 30 per cent.[174] This makes hydrogen a potential blending fuel source if combined with CNG.

There is presently no large-scale hydrogen producer or source in the region. The hydrogen industry is in its infancy and needs to be developed further before it can be considered for electricity production or other industrial uses.

Maritime Electric will continue to monitor the technological development of hydrogen as a potential fuel source; however, it is not currently a viable option.

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[174] Some tests have proven that higher concentrations can be used in CTs and RICEs, as documented in the following link: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf - U.S. Environmental Protection Agency, Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document.

Fuel Recommendation

As indicated above, the proposed CT4 and RICE plant will initially be diesel-fired as diesel is readily available, the Company has existing storage capabilities for diesel and it is much more cost effective than other available fuel sources. CT4 and the RICEs will have dual fuel capabilities, meaning they can be converted to burn gaseous fuels in the future. In the long term, the Company expects the most likely alternative fuels for the proposed CT4 and RICE plant to be as follows:

- **CT4:** CNG, possibly combined with hydrogen if it is available and economic.
- **RICE Plant:** biodiesel combined with traditional diesel or a new, not yet developed, renewable diesel.[175]

Standalone use of a specialty fuel such as biodiesel or hydrogen is expensive and can lead to fuel supply challenges. The Company believes that the long-term alternate fuel choice for the proposed generation cannot be made in isolation and should be made in conjunction with the long-term alternate fuel plan and strategy for the province and region. This will help avoid stranded costs if future expenditures are made to accommodate alternate fuels.

[175] Such as SustainAGRO proposed to begin manufacturing in Kensington back in 2023: https://www.cbc.ca/news/canada/prince-edward-island/pei-biomass-energy-facility-kensington-1.6847833#:~:text=6-,The%20town%20of%20Kensington%2C%20P.E.I.%2C%20may%20soon%20be%20home%20to,new%20jobs%20for%20the%20community - Green energy business eyes opportunity in P.E.I.'s net-zero plans

8.0 ALTERNATIVES

The Company examined several alternatives to the Project as proposed, including increasing the transfer capabilities from the mainland to PEI and locating additional generation on the mainland. In addition, the Company examined costs associated with BESS sizing and inclusion of emissions reduction technology in the Project.

8.1 Increase Transfer Capabilities

Maritime Electric can access off-Island capacity resources if there is appropriate transmission infrastructure both on the mainland and connecting the mainland to PEI. Currently, the NB transmission system transfer limit for PEI is 300 MW, while the Interconnection's transfer capacity limit is also (separately, but coincidentally) 300 MW. Both mainland transmission and Interconnection facilities have to be expanded in order for PEI to be capable of importing more than 300 MW of firm capacity.

8.1.1 Increase Mainland Transfer Capabilities

Large-scale NB transmission expansion projects that would increase the transfer limit to the interconnection and PEI have been under consideration for some time. A much-publicized proposal to develop an "Atlantic Loop" would have increased the NB transmission system capacity limit to both PEI and NS and supplied large-scale hydro electric energy from Quebec to the Maritime region. However, the Governments of Canada, NS and NB recently shifted their focus to a "Modified Atlantic Loop," which could eventually lead to increases in the NB transmission capacity transfer limits to PEI.[176]

The first phase of the proposed Modified Atlantic Loop would include a new 65 km 345 kV transmission line from Salisbury, NB to Memramcook, NB (the substation where the Interconnection originates) and continuing into the NS transmission system. This would not increase the transfer limits from NB to PEI but would increase the reliability of the transmission interties between NB and NS/PEI. Additional phases are being considered that could potentially

[176] https://www.canada.ca/en/natural-resources-canada/news/2023/10/governments-of-canada-nova-scotia-and-new-brunswick-show-progress-toward-phasing-out-coal-by-2030-and-expanding-their-clean-reliable-and-affordable.html - Natural Resources Canada, Governments of Canada, Nova Scotia and New Brunswick Show Progress Toward Phasing Out Coal by 2030 and Expanding Their Clean, Reliable and Affordable Electricity Grids.

increase transfer limits between NB and NS/PEI, but no project announcements have been made to date.[177]

The cost of this multi-phase transmission expansion is significant and could not be justified based on the benefits to PEI alone. A cost-sharing mechanism between the benefiting parties (i.e., Governments of Canada, NB, NS and PEI, as well NS Power, NB Power, Maritime Electric and smaller municipal utilities) is outstanding. Regardless, the Modified Atlantic Loop does not add capacity resources in the region and does not address on-Island reliability issues for limitations on the Interconnection.

8.1.2 Interconnection Expansion

The transfer capacity of the Interconnection is limited by Cables 1 and 2, each of which has a capacity of 100 MW. The Interconnection transfer limit cannot be increased without replacing these cables. When Cables 1 and 2 reach end of life, they will likely be replaced with cables having a capacity of 180 MW, similar to Cables 3 and 4, along with a fourth transmission line connecting the mainland system to the cables.[178] This will increase the transfer capacity of the Interconnection itself, but it must be completed in conjunction with NB transmission system upgrades in order to increase the import capacity transfer limits to PEI. With both the cable replacement and an upgrade to the NB transmission system, the import capacity transfer limit to PEI could potentially be increased beyond 300 MW. Given the capital investment needed for both of these upgrades, the Company does not believe this is a realistic solution to address the immediate forecast capacity deficit.

Even if the import capacity transfer limit was increased above 300 MW, PEI would lose the reliability benefits associated with locating additional dispatchable capacity resources on-Island if it elects to source incremental capacity from off-Island resources.

[177] Along with transmission expansion, additional reactive power support is also required in the southeast region of NB before transfer limits to PEI could be increased. Subsequent references to transmission upgrades within this section refer to both transmission expansion and additional reactive power support.

[178] The Company is currently studying expansion of the Interconnection. Preliminary results suggest that replacing Cables 1 and 2 with cables similar to Cables 3 and 4, each with a dedicated transmission line, is the preferred option. The study will be completed early in 2025 and will be filed with the Commission upon completion.

8.2 Generation Expansion in New Brunswick

NB Power recently announced plans to add a 400 MW natural gas plant in Scoudouc, 20 km northeast of Moncton. Maritime Electric expects that such a generation project would use CT or RICE technology, and that the cost of securing generating capacity from such a project would be comparable to building additional generation resources on PEI. Such a project will provide system benefits to that area, such as increased reliability, voltage support and increased system strength. Some of these benefits will also benefit PEI, but due to the distance between the project and PEI and the physical properties of the subsea cables, the voltage support and system strength benefits will not be as impactful to PEI. In addition, the Interconnection's 300 MW firm transfer capacity limit will still limit the amount of capacity that can be imported from the mainland.

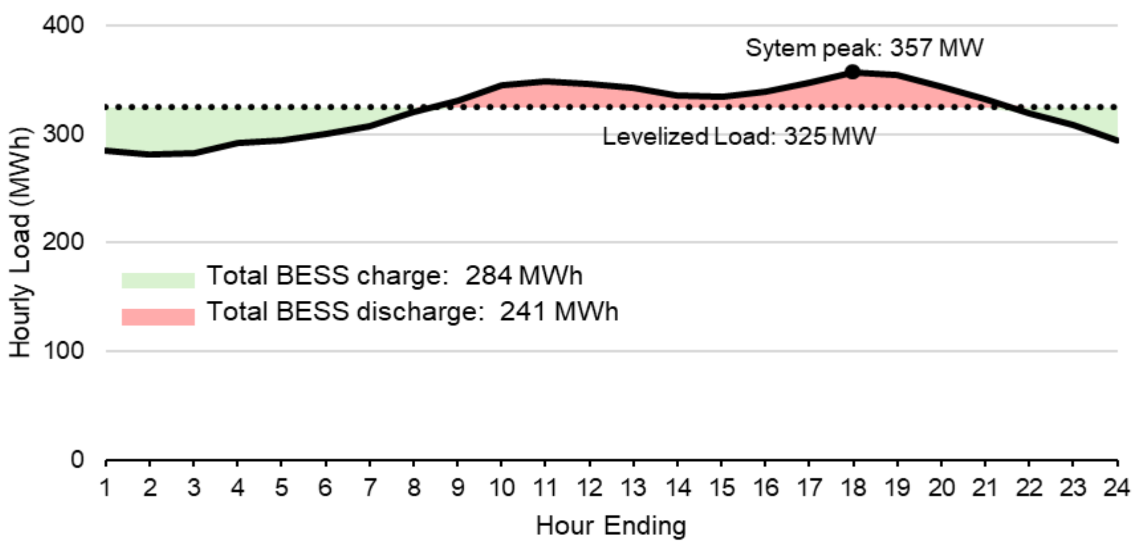
The Company expects that the cost of capacity from new mainland-based generation will be similar to the cost of on-Island generation, but without many of the reliability benefits. As such, the Company is not pursuing new mainland-located generation as a source of incremental capacity at this time.

8.3 Additional BESS Capacity

As discussed in Section 6.1, a 10 MW/40MWh BESS is a prudent investment at this time. A larger-scale BESS to address the forecast capacity deficit during a system peak is not recommended as the system peak reduction capabilities of a BESS are limited.

In order for a BESS to be counted as a capacity resource, it must be charged during low-load periods and discharged during high-load periods. Figure 29 shows the hourly customer load during the February 4, 2023, system peak, and demonstrates the amount of energy storage that would have resulted in a perfectly levelized load, which represents the theoretical maximum system peak reduction possible by a BESS. The Figure shows the BESS charging (in green) when the load is less than the levelized load and discharging (in red) when the load is higher than the theoretical load curve. The maximum system peak reduction that could be achieved in this example is 32 MW (357 MW minus 325 MW, or a 9 per cent reduction), requiring a BESS with at least 262 MWh of energy storage.[179] This example is an academic exercise, meaning that, in reality, the Maritime Electric System Operator would be unable to predict what the levelized load level will be for the day, and thus would not know in advance when to switch from charge to discharge.

FIGURE 29
System Peak Load Curve
February 4, 2023



A more practical and economic approach is to use a smaller BESS to achieve some level of system peak reduction (e.g., 10 or 20 MW), as recommended in this Application. Table 21 shows the BESS capacity requirements to reduce system peaks by 10, 20 and 30 MW in 2019 to 2023, and the maximum system peak reduction possible with a levelized load. It shows that increasing system peak reduction from 20 to 30 MW using a BESS requires a significantly larger BESS (167 MWh compared to 66 MWh), and the BESS cost would more than double. The first 10 MW of system peak reduction with a BESS is the most practical and economic, and the size requirements and cost of the BESS increase rapidly to achieve higher reductions in system peak.

[179] The round-trip efficiency of a BESS is assumed to be 85 per cent, resulting in 262 MWh of energy storage required to discharge 241 MWh from the BESS. 284 MWh (241 MWh divided by 85 per cent) of energy is required to charge the BESS up to 262 MWh, and the 262 MWh of storage capacity is required to discharge 241 MWh from the BESS.

TABLE 21 BESS Peak Reduction Capabilities							
	Units	**2019**	**2020**	**2021**	**2022**	**2023**	**Avg.**
Date		Dec 16	Jan 17	Dec 27	Jan 11	Feb 4	
System peak	MW	250	260	268	292	357	
Required energy storage capacity (in MWh) from BESS to:							
Reduce Peak by 10 MW	MWh	23	12	11	11	23	**16**
Reduce Peak by 20 MW	MWh	68	62	59	40	102	**66**
Reduce Peak by 30 MW	MWh	135	190	162	122	227	**167**
Achieve a levelized load	MWh	295	330	189	251	262	**265**
Peak reduction with levelized load	MW	43	39	32	40	32	**37**

Additionally, as per Section 6.1, the Company plans to operate the BESS as a capacity resource during the winter peaking season and then as ancillary service support for the remaining 9 months of the year. This annual operating methodology maximizes the economic benefit of the BESS. As the Company only requires 12.5 MW of ancillary services, a BESS larger than 12.5 MW would have diminished economic benefit.[180]

Therefore, the Company is proposing a 10 MW/40MWh BESS as part of the Project.

8.4 Emission Reduction and Monitoring Technology

Equipment can be added to a CT or RICE unit to help monitor or reduce certain types of emissions. The cost estimate provided by S&L included optional pricing for several equipment technologies related to emissions monitoring and reduction including emissions controls, biodiesel capability and a Continuous Emission Monitoring System ("CEMS"). Table 22 provides a brief description and the associated costs for each of these options.

[180] As per Table 11, the Company presently purchases 4.7 MW of load following and 7.8 MW of spinning reserve. The Company also purchases 1.7 MW of AGC (or frequency regulation) but the BESS cannot satisfy this service.

TABLE 22
Emission Reduction and Monitoring Technology Estimated Costs

Option	Description	Estimated Cost ($ millions)	
		CT4	RICE Plant
Emission Controls (SCR)	As fuel is consumed in a CT or RICE, flue gases, including NOx, are formed. A Selective Catalytic Reduction (“SCR”) system is a post-combustion NOx control technology, which injects an ammonia based reagent into the flue stream to reduce NOx emissions	$ 8.0	$ 9.4
Biodiesel Capability	Biodiesel is a renewable fuel that is produced from wood mass, vegetable oils, animal fat, or recycled restaurant grease. Using biodiesel reduces life cycle emissions because carbon dioxide released from biodiesel combustion is offset by the carbon dioxide absorbed from growing the feedstocks used to produce the fuel.	$ 5.7	$ 1.7
Continuous Emission Monitoring System (“CEMS”)	CEMS provides continuous monitoring of the exhaust from the generation unit making the exact emission quantities known. CEMS makes the measurement of emissions more accurate but does not change the quantity of emissions.	$ 0.8	$ 3.3

These technologies have not been included in this Application. The SCR system has a high cost for the amount of energy that is expected to be produced. With respect to the CEMS, it would provide better accuracy for emissions but does not change actual emissions.[181] Combined with the knowledge that this generation will operate minimally and only as required, the Company does not believe that extra cost of CEMS and SCR are warranted.[182] However, biodiesel could be a viable option when such fuel supply becomes readily available and economical compared to alternate fuels.

[181] In the absence of CEMS the generating source’s emissions are measured, recorded and plotted during commissioning. These measured emissions are then used to estimate future emissions. This method is how current emissions from CT1, CT2 and CT3 are recorded and reported annually.

[182] The Company has forecasted that the total energy supply from its entire on-Island dispatchable generation fleet will be make up less than 1 per cent of the total energy supply to customers. The increased cost of sourcing energy from CT4 or the RICE plant as compared to sourcing it from NB Power or on-Island renewable sources will serve as a significant deterrent to operating this generation more than required.

There are currently no regulations that require the Company to install such emission control or monitoring technology. While the Company is keen to reduce emissions as low as reasonably possible, the Company believes it is appropriate to list these options for discussion but to exclude them from the base price for the Project.

8.5 Analysis of Alternatives

Off-Island transmission and generation initiatives have the ability to increase the delivery and supply of off-Island capacity resources to PEI. However, neither of these initiatives addresses issues of:

- financial risk due to competition between utilities;
- exposure to disconnection from the mainland; and
- increased Hold-to-Schedule events as more renewable energy supplies are built on-Island.

For these reasons, the Company recommends that the Project proceeds as proposed.

9.0 GREENHOUSE GAS EMISSIONS

Maritime Electric supports the Province's net zero emissions by 2040 target by delivering cleaner energy to customers. As customers transition from fossil fuel-based energy sources to electricity, the electricity delivered to customers should support the clean energy objective. The Company's on-Island dispatchable generation resources, which are primarily used for backup purposes, will play an important role in supporting the transition to renewable energy and supplying customer load during system peak periods.

9.1 Generation Requirements

As discussed in Section 5.1.2, there are five primary reasons why Maritime Electric operates its CTs: (1) unit testing; (2) NB Power hold-to-schedule directives; (3) emergency energy supply to others; (4) on-Island transmission related-events; and (5) curtailment by NB Power. Table 23 shows Maritime Electric's annual generation requirements by reason from 2021 to 2023, and a generation requirement forecast up to 2033. The Table shows that generation requirements, especially those related to "Curtailment by NB Power" events are forecast to increase. "Curtailment by NB Power" events are expected to increase because the amount of time when Maritime Electric's customer load is above the Interconnection transfer capacity limit is expected to increase. Despite a forecast increase in total generation requirements, it is forecast to be a small percentage of the total energy supplied remaining below 1 per cent by 2033.

TABLE 23 Generation Requirements Forecast (GWh)							
Year	**Unit Testing**	**NB Power Hold-to-Schedule**	**Emergency Energy Supply to Others**	**On-Island Transmission Related**	**Curtailment by NB Power**	**Total**	***Per Cent of Customer Energy Supply***
2021A	0.1	1.5	0.4	0.1	0.1	**2.1**	*0.1%*
2022A	0.2	0.4	1.5	0.2	0.2	**2.5**	*0.1%*
2023A	0.1	0.3	0.2	0.2	2.1	**2.9**	*0.2%*
2024F	0.2	0.7	0.5	0.1	1.4	**2.9**	*0.1%*
2025F	0.2	0.7	0.5	0.1	3.3	**4.7**	*0.2%*
2026F	0.2	1.2	0.5	0.1	3.7	**5.3**	*0.3%*
2027F	0.2	1.2	0.5	0.1	4.2	**6.1**	*0.3%*
2028F	0.2	1.5	0.5	0.1	4.8	**7.1**	*0.4%*
2029F	0.2	1.6	0.5	0.1	6.4	**8.7**	*0.4%*
2030F	0.3	1.6	0.5	0.1	8.0	**10.4**	*0.5%*
2031F	0.3	1.6	0.5	0.1	9.9	**12.4**	*0.6%*
2032F	0.3	1.6	0.5	0.1	12.0	**14.5**	*0.7%*
2033F	0.3	1.6	0.5	0.1	14.2	**16.7**	*0.8%*

9.2 Generation Fuel Efficiency

Maritime Electric's existing CTs consume diesel and produce GHG emissions during operation. The fuel efficiency of the Company's existing CTs and proposed generating units vary depending on their age and type. Table 24 shows the fuel efficiencies (i.e., heat rate) of the Company's existing CTs based on data from 2019 to 2023 and the expected fuel efficiencies of the proposed CT4 and RICE plant.[183]

[183] Heat rate is a measurement of the efficiency of electrical generators/power plants that convert a fuel into heat and into electricity. The heat rate is the amount of energy used by an electrical generator/power plant, which in this case is measured in British Thermal Units ("BTU"), to generate 1 kWh of electricity.

TABLE 24
Generation Unit Statistics and Fuel Efficiency
(2019 – 2023 totals)

Generating Unit	Diesel Consumption (cubic meters)	Gross Generation (GWh)	Average Heat Rate (BTU/kWh)	Total Operating Time (hours)
CT1	452	0.8	20,746	26
CT2	947	1.6	21,930	35
CT3	2,096	6.6	11,638	62
CT4 (forecast)[a]	-	-	11,638	-
RICE Plant (forecast)[b]	-	-	8,400	-

a. The heat rate for CT4 is assumed to be the same as CT3.
b. The heat rate for the RICE plant is based on Page A-1 of the S&L Extreme Weather Event Capacity Impact, Addendum to December 2022 CRS. It assumes maximum efficiency is achieved because a RICE unit has consistent heat rate at part load and through differing environmental conditions.

CT1 and CT2 were installed in 1971 and 1973, respectively, and are significantly less fuel efficient (i.e., have higher heat rates) than CT3, which was installed in 2005; therefore, the Company prioritizes the use of CT3 when generation is required, which reduces total fuel consumption, emissions, and operating costs.[184] CT4 is expected to have a similar heat rate to CT3, but the RICE plant's heat rate is expected to be lower because its efficiency is unaffected by generator loading levels and ambient environmental conditions.[185] If the proposed CT4 and RICE plant are added, the Company will prioritize the use of the RICE plant, CT4 and CT3 over CT1 and CT2, which are less efficient.

9.3 Greenhouse Gas Emissions Forecast

Table 25 shows the forecast generation-related diesel consumption and associated GHG emissions. Although the total GHG emissions is forecast to increase, the average GHG emission intensity (i.e., kg CO_2e/kWh) is expected to improve with the addition of the BESS (2028), CT4

[184] If the required generation is below 15 MW, which is the minimum load for CT3, then CT1 or CT2 is used instead of CT3.

[185] The efficiency of RICE technology does not decrease at lower output levels like CTs do. Also, a RICE plant will contain a number of small individual generating units which are operated such that units are loaded up to full output before the next unit is started. If 18 MW of generation is needed, only one unit runs, for 27 MW one unit would run at 100 per cent and a second unit would run at 50 per cent, at 36 MW two units run at 100 per cent, etc. This further increases the efficiency of a RICE plant at reduced output levels.

(2029) and the RICE plant (2030), as well as the eventual retirement of CT1 (2031) and CT2 (2033).[186] This is due to CT4 and the RICE plant being more fuel efficient than CT1 and CT2.

TABLE 25
Generation GHG Emissions Forecast

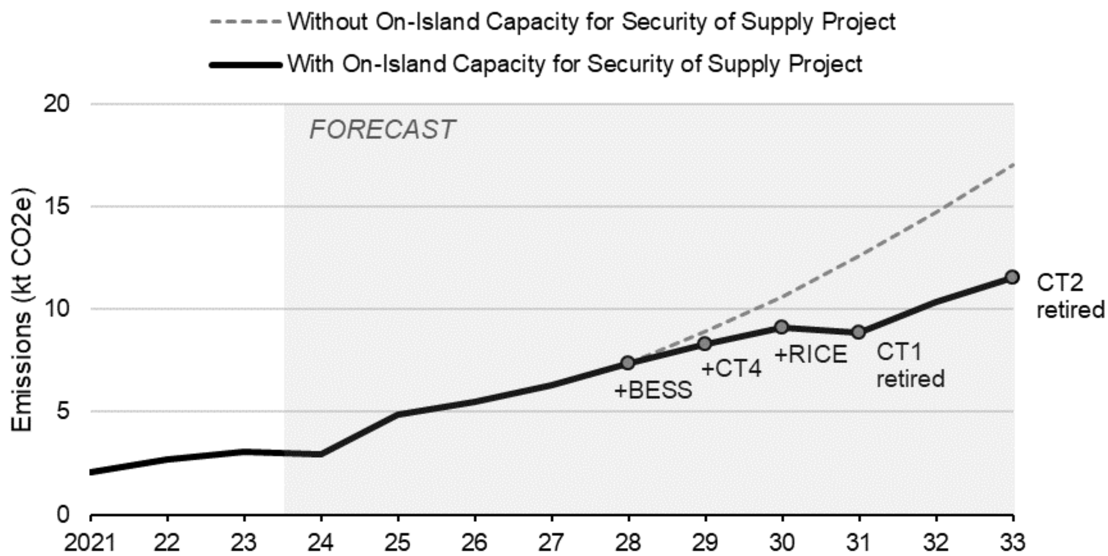
Year	Total Generation Required (from Table 23) (GWh)	Diesel Consumption (cubic meters)[a]	GHG Emissions (kilotonnes CO_2e)[b]	Average GHG Emission Intensity (kilograms CO_2e/kWh)
2021A	2.1	774	2.1	0.99
2022A	2.5	990	2.7	1.05
2023A	2.9	1,129	3.0	1.04
2024F	2.9	1,104	3.0	1.04
2025F	4.7	1,816	4.9	1.03
2026F	5.3	2,051	5.5	1.03
2027F	6.1	2,349	6.3	1.03
2028F	7.1	2,731	7.3	1.03
2029F	8.7	3,098	8.3	0.96
2030F	10.4	3,387	9.1	0.87
2031F	12.4	3,301	8.9	0.71
2032F	14.5	3,855	10.4	0.71
2033F	16.7	4,296	11.6	0.69

a. Diesel consumption forecast is based on average heat rates for each unit shown in Table 24.
b. Based on GHG emission factors for diesel in the 2019 Canada Greenhouse Gas Quantification Requirements Report - Table 2-6 and global warming potentials from the IPCC Fifth assessment report.

The addition of the BESS, CT4 and the RICE plant, as well as the retirement of CT1 and CT2, are expected to result in lower GHG emission increases compared to the Company continuing to rely solely on CT1, CT2 and CT3 to fulfill its future generation requirements. Figure 30 compares the estimated annual generation-related GHG emissions with and without the Project. The Figure demonstrates the GHG emission impacts of utilizing more fuel-efficient generation resources.

[186] The installation a BESS, CT4 and a RICE plant are assumed to lower the average emission intensity in the year following their installation.

FIGURE 30
Generation GHG Emissions Forecast Comparison



Note: "Without On-Island Capacity for Security of Supply Project" has CT1 and CT2 not retiring.

9.4 Impact on PEI Greenhouse Gas Emissions Goals

In 2018, the Province announced a target to reduce GHG emissions on PEI to 1.2 megatonnes of carbon dioxide equivalent (“CO_2e”) by 2030, which is a 40 per cent reduction from 2005 baseline levels.[187] In 2022, the Province released a 2040 Net Zero Framework report that outlines how PEI will reach the 2030 target and a net zero by 2040 target.[188] The six pillars and associated targets outlined in the report are:

1. Transportation emissions: 25 to 30 per cent reduction by 2030 and 55 to 65 per cent reduction by 2040;
2. Buildings: 65 to 70 per cent reduction by 2030 and 85 to 95 per cent reduction by 2040;
3. Agriculture: 10 to 15 per cent reduction by 2030 and 35 to 40 per cent reduction by 2040;
4. Carbon removal: 10 to 15 per cent increase by 2030 and 25 to 30 per cent increase by 2040 per cent;

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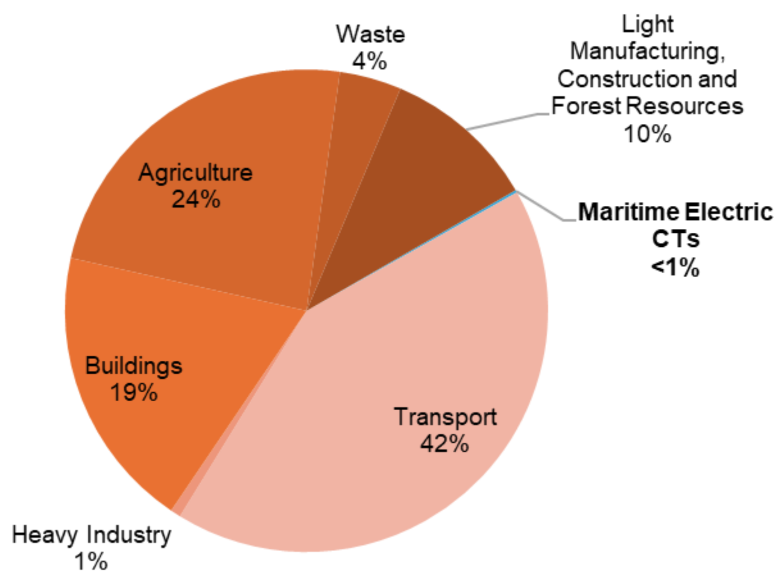
[187] https://www.princeedwardisland.ca/en/information/environment-energy-and-climate-action/greenhouse-gas-emissions – Government of PEI, Greenhouse Gas Emissions.

[188] https://www.princeedwardisland.ca/en/publication/2040-net-zero-framework - Government of PEI, 2040 Net Zero Framework.

5. Industry and waste: 65 to 70 per cent reduction by 2030 and 85 to 95 per cent reduction by 2040; and
6. Net zero energy by 2030 and net zero GHG emissions by 2040.

Figure 31 shows PEI's total 2022 GHG emissions by sector, including a category for Maritime Electric's generation-related GHG emissions. The Figure demonstrates that the Company's generation-related GHG emissions are the smallest of all the categories with less than one percent (i.e., 0.17 per cent) of PEI's total GHG emissions.

FIGURE 31
PEI 2022 GHG Emissions

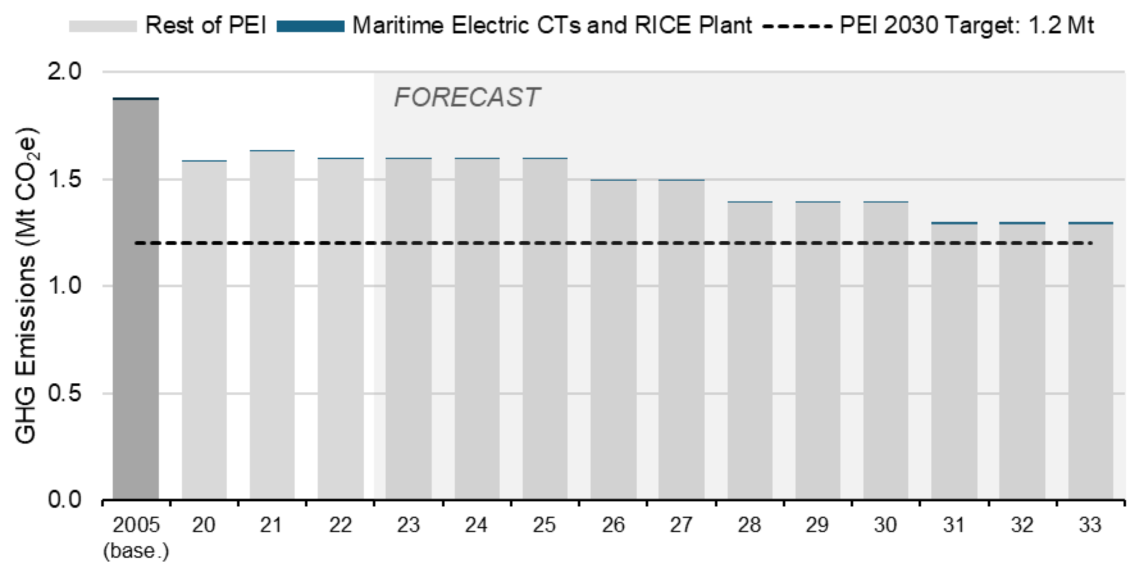


2022 PEI GHG Emissions: 1,603 kilotonnes CO_2e

Data source: Environment and Climate Change Canada, National inventory report 1990 – 2020: Greenhouse Gas Sources and Sinks in Canada, Table A12-3.

Despite the Company's forecast that generation-related GHG emissions will increase, they will remain a small percentage of PEI's total GHG emissions. Figure 32 shows the Company's forecast of its generation-related GHG emissions alongside the Government of Canada's forecast for PEI's total GHG emissions. The Company's generation-related GHG emissions are forecast to be less than 1 per cent of the total PEI GHG emission target of 1.2 megatonne ("Mt") of CO_2e by 2030.[189]

FIGURE 32
PEI GHG Emissions Forecast



Data sources: Government of PEI 2023 Statistical Review (historical). Government of Canada Greenhouse gas emissions projections 2023 (forecast).

9.5 Canada Clean Electricity Regulations

In August 2023 the Federal Government released draft Clean Electricity Regulations ("CER") that align with a target of net-zero electricity grid by 2035. Following a public consultation period, an updated draft CER was released in February 2024. The updates include details about GHG emission standards for existing and future power generation units. A final version of the CER is expected by the end of 2024, and the CER is expected to be effective on January 1, 2025.[190]

The August 2023 draft of the CER included provisions for peaking electricity generation units with a 450-hour operation limit per year.[191] The February 2024 draft of the CER proposes an emissions

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[189] The forecast PEI GHG emissions from the Government of Canada showed the target being reached in 2031.

[190] https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/clean-fuel/electricity/clean-electricity-regulations-public-update-16022024.pdf – Environment and Climate Change Canada, Clean Electricity Regulations, Public Update.

[191] Peaker units are generators that generally only run during periods of high customer load (i.e., during a system peak).

limit approach, where each generating unit would have an annual emission limit based on the formula shown in Figure 33 and a performance standard of 30 t/GWh.[192]

FIGURE 33
Draft Clean Electricity Regulations Unit-Specific Annual Emissions Limit[193]

$$\underset{(t/year)}{\textit{Unit Emission limit}} = \underset{(t/GWh)}{\textit{Performance standard}} \times \underset{\textit{(capacity of unit)}}{MW} \times \underset{\textit{(total hours in a year)}}{\textit{8760 hours}} \times \underset{\textit{(unit conversion)}}{\left(\frac{1\ GW}{1000\ MW}\right)}$$

A performance standard of 30 t/GWh results in an emission limit that is well above the current emission levels of Maritime Electric's existing CTs. For example, CT1, CT2 and CT3 have a combined capacity of 89 MW, which results in an emission limit of 23,389 t/year (30 t/year x 89 MW x 8760 hours / 1000); whereas, in 2023, the CTs emitted 3,036 t of CO_2e, which is only 13 per cent of the draft CER limit.

Figure 34 shows the Company's forecast of generation emissions and the corresponding emission limits per the draft CER with a performance standard of 30 t/GWh. The Figure demonstrates that Maritime Electric forecasts its generation emissions to remain well below the draft CER emission limits. The installation of CT4 and the RICE plant, which are significantly more fuel efficient than CT1 and CT2, will help to lessen increases in generation emissions while increasing the combined emission limit. The fuel flexibility options for CT4 and the RICE plant described in Section 7.7 also provide options to further reduce generation emissions in the future to ensure the Company complies with the CER.

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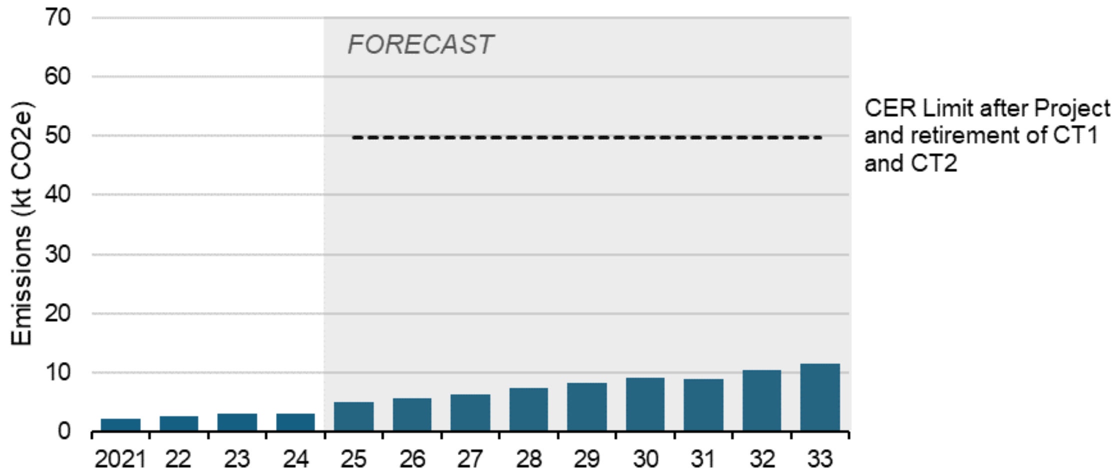
192 The August 2023 draft of the CER included a performance standard of 30 tonnes of CO_2e per GWh (i.e., 30 t/GWh); however, the February 2024 update indicated that the 30 t/GWh performance standard is under consideration as meeting the limit would likely not be feasible for load-following units equipped with carbon capture and storage. Load-following units are generators that operate while continuously adjusting their output to balance customer load and renewable energy generation.

193 https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/clean-fuel/electricity/clean-electricity-regulations-public-update-16022024.pdf – Environment and Climate Change Canada, Clean Electricity Regulations, Public Update (page 7).

FIGURE 34
Maritime Electric CTs and RICE Plant Forecast GHG Emissions and CER Limit



Note: CER limit based on draft CER with 30 t/GWh performance standard

Based on the February 2023 draft CER, the generation proposed in this Project, and the Company's existing CTs, will be exempt from the CER. In addition, the draft CER states that the Federal Government is considering adding provisions to exclude emissions related to the operation of generating units during emergency situations. Details of the emergency provisions, such as what events constitute an emergency and the amount of time that generating units can operate and remain exempt, have not been released by the Federal Government.[194] The Company is closely monitoring the progress of the CER and will provide the Commission with an update when the final CER is issued.

9.6 Maritime Electric Greenhouse Gas Emissions Target

Maritime Electric has a target to reduce its GHG emissions by 55 per cent by 2030, from 2019 levels. The target includes all GHG emissions associated with electricity delivered to customers. Although this Project will result in an increase of generation emissions, the Company's goal of integrating additional wind and solar energy resources to the grid will significantly reduce the Company's Scope 2 and 3 GHG emissions. The GHG emission reductions achieved by integrating wind and solar energy are significantly greater in magnitude than the forecast

[194] An emergency provision would be of interest for the Company when considering the possibility of significant generation requirements during a prolonged subsea cable outage or similar event.

increases in emissions due to dispatchable generation. Therefore, the Company remains on track to achieve its 2030 target.

10.0 ESTIMATED IMPACT ON RATE BASE, REVENUE REQUIREMENT AND CUSTOMER RATES

As discussed in Section 6.4.2, there are several factors that make it challenging to provide an accurate cost estimate for the Project. Similarly, these factors make it difficult to provide an accurate impact on rate base, revenue requirement and customer rates for the Project. The factors that will influence the estimated impact on rate base, revenue requirement and customer rates include:

- the capacity values of each Project component (i.e., 10, 50 and 90 MW) are nominal capacity values that may change during the RFP process;
- inflation between 2024 (i.e., the base year for the Project cost estimate) and the time of construction;
- the impact of CT and RICE equipment market pricing dynamics in a period of high demand;
- the USD to CAD exchange rate at the time of material purchases;
- the level of accuracy of the Class 4/5 cost estimate provided by S&L, which is assigned an accuracy range of 30 per cent;
- the timing of completion for each Project component;
- Maritime Electric's rate base and customer rates at the time of Project completion; and
- the cost of avoided capacity and ancillary service purchases from NB Power at the time of Project completion.

Given the large number of factors that influence estimated impact on rate base, revenue requirement and customer rates of the Project, it is not feasible to provide accurate estimates at this time; however, Maritime Electric calculated a hypothetical impact on rate base, revenue requirement and customer rates of the Project to provide a level of magnitude to the Commission and stakeholders. The hypothetical impacts are based on the following:

- 2024 Class 4/5 Project cost estimate provided by S&L;
- 2024 estimated annual O&M costs provided by S&L;

- Avoided capacity and ancillary service costs based on 2024 rates in Maritime Electric's EPA with NB Power; and
- Maritime Electric's 2024 rate base and rates.

The hypothetical impact to customer rates of the Project is approximately 10 per cent for benchmark Rural Residential, Urban Residential and General Service customers.[195] The impact on customer rates is hypothetical because it is based on an assumption that the Project is installed in 2024, based on 2024 estimated Project costs, 2024 avoided costs and 2025 rate base. Detailed calculations for the hypothetical impact on rate base, revenue requirement and customer rates are provided in Confidential Appendix F.

While the completion of this Project will result in an increase in customer rates, over the useful life of the Project components and on a present value basis, the Project's costs are expected to be more than offset by the avoided costs, resulting in a positive economic benefit to customers, as discussed in Section 6.4.3. The Project is estimated to result in savings of approximately 20 per cent compared to doing nothing and continuing to purchase capacity resources and ancillary services from NB Power.

Maritime Electric will provide an accurate impact on rate base, revenue requirement and customer rates once the RFP process is complete. Therefore, the Company is seeking approval from the Commission for a deferral of up to $12 million for upfront engineering work and completion of the RFP process.

[195] Benchmark Residential Rural and Residential Urban customers include 650 kWh of consumption per month. Benchmark General Service customers include 10,000 kWh of consumption per month. Taxes are excluded from the impact to customer rates.

11.0 PROPOSED ORDER

C A N A D A

PROVINCE OF PRINCE EDWARD ISLAND

**BEFORE THE ISLAND REGULATORY
AND APPEALS COMMISSION**

IN THE MATTER of Section 17(1) of the *Electric Power Act* (R.S.P.E.I. 1988, Cap. E-4) and **IN THE MATTER** of the Application of Maritime Electric Company, Limited for the approval of a 2024 Supplemental Capital Budget Request for the On-Island Capacity for Security of Supply Project.

UPON receiving an Application by Maritime Electric Company, Limited (the "Company") for approval of the Company's On-Island Capacity for Security of Supply Project;

AND UPON considering the Application and Evidence filed in support thereof;

NOW THEREFORE, for the reasons given in the annexed Reasons for Order and pursuant to the Electric Power Act

IT IS ORDERED THAT

1. The need for the Supplemental Capital Budget Request Application of the Company for the On-Island Capacity for Security of Supply Project, filed herein on December 18, 2024 is approved.

2. The AACE Class 4/5 Project cost estimate of $427 million, based on 2024 costs, is approved.

3. The capital expenditure deferral of up to $12 million of the total Project cost for upfront engineering work and the completion of the RFP process is approved.

4. In the event that the upfront Engineering costs exceeds $12 million, Maritime Electric shall submit an update in writing.

5. Maritime Electric will submit a report to the Commission when proposals are received for each Project component prior to awarding a contract for the Project. The report will include updated estimated Project costs, impact on rate base, revenue requirement and customer rates.

6. Maritime Electric shall supply to the Commission quarterly update reports detailing Project work completed, progress, schedule and budget details.

DATED at Charlottetown, Prince Edward Island, this ___ day of _____, 2024.

BY THE COMMISSION:

____

Chair

____

Commissioner

____

Commissioner

APPENDIX A

Sargent & Lundy Project
Cost Estimates

Terrence Coyne, P.E.
Principal Energy Consultant (Licensed in IL)
+1-312-269-3642
terrence.p.coyne@sargentlundy.com

Sent via email

September 26, 2024 | Final
Project No. 14782.003

Re: Cost Estimating Services for Maritime Electric

Mr. Kent Nicholson, MBA, P.Eng.
Manager, Production and Energy Control Operations
Maritime Electric Company, Ltd.
50 Cumberland Street
Charlottetown, PE C1A 5B9

Dear Kent,

Sargent & Lundy is pleased to submit to Maritime Electric Company, Ltd. the engineering cost estimates for new generation, battery energy storage, and electrical support equipment to be added to Prince Edward Island, consistent with the general recommendations of Sargent & Lundy's report titled *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company*.

Further details are provided within this summary report with the cost estimates contained in the subsequent exhibits.

Best Regards,

Terrence Coyne, P.E.
Principal Energy Consultant

Attachments – All recipients
Electronic Distribution Only
Sam McKnight (Sargent & Lundy)

1. INTRODUCTION AND BACKGROUND

On December 9, 2022, Sargent & Lundy (S&L) issued a report titled *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company*, which included an evaluation of different electricity capacity resource technologies, high level cost estimates, and recommend technologies well suited to helping Maritime Electric Company, Limited (MECL) meet its goals and needs. MECL's most important goals include meeting capacity and energy obligations, improving its ability to serve load during interruptions in electricity, and achieving environmental sustainability targets. The report ultimately concluded that a portfolio of reciprocating internal combustion engines (RICE) / combustion turbines (CTs), onshore wind, and solar photovoltaic (PV) was best suited to help MECL meet these goals.

During the period between February 3 and 5, 2023, large areas of Eastern Canada and the Maritimes provinces experienced extreme cold, driven by the disrupted southward movement of the northern polar vortex. S&L, in an addendum to the original *Capacity Resource Study* report, analyzed the event and its impact on Price Edward Island's (PEI) electrical systems as issued in a report titled *Extreme Weather Event Capacity Impact*. Due to the shortage in dependable resources seen during the event, S&L ultimately recommended to MECL to install 125 to 150 MW of new RICE/CTs with biofuel compatibility.

Consistent with the two previously submitted reports, the cost estimates developed for this scope of work provide MECL a more refined budgetary estimate for new on-island generation and other grid support equipment. A summary of the cost estimates is provided in the following sections of this submittal. Exhibit A through I contain the cost estimates developed, while Exhibit J contains the technical basis of the estimates.

2. ESTIMATE SUMMARY

S&L and MECL ultimately decided to proceed with developing Association for the Advancement of Cost Engineering (AACE) Class 4/5 cost estimates (accuracy level of approximately +/- 30%) for the following:

- 1 x LM6000 PC Sprint Simple Cycle
- Addition of Synchronous Condensing Capability to Existing LM6000
- Substation Upgrades
- 10 MW / 40 MWh BESS
- 5 x 18 MW Wärtsilä Engines

The capital cost summary associated with each estimate performed is outlined below in Table 2-1, in Canadian Dollars (CAD), at a conversion rate of 1.36 CAD to 1.00 USD. Further assumptions / inputs related to the estimates are contained in Exhibit J.

Table 2-1 – Summary of Cost Estimates (CAD)

Estimate Description	Project Capital Cost (CAD)	Exhibit Reference
1 x LM6000 PC Sprint Simple Cycle	170,586,329	Exhibits A, B
Addition of Synchronous Condensing Capability to Existing LM6000	13,435,661	Exhibits C, D
Substation Upgrades	10,550,742	Exhibit E, F
10 MW / 40 MWh BESS	26,636,960	Exhibit G
5 x 18 MW Wärtsilä Reciprocating Engines (RICE)	245,016,625	Exhibit H, I

The critical major components in the above cost estimates are specified in each respective exhibit. The details within the existing substation upgrade cost estimate, are based on anticipated upgrades that will be required to allow full utilization of the reciprocating engines (RICE) power plant. These upgrades include adding an outer ring to an existing 69 kV bus and the addition of a 138 kV transmission line.

Note that all the detailed estimates (excluding for the BESS) documented in the attached Exhibits are provided in both “allocated” as well as “unallocated” versions. The unallocated versions show all individual estimate cost details with the General Conditions, Project Indirects, and Contingency costs broken out separately (on page 3 of the estimates). The allocated versions are provided as summary-level estimates that incorporate all indirect costs into each line item to provide an estimated total cost for each of the cost groupings as if priced separately by an EPC contractor (note that the BESS estimate is based on subcontract costs only, and therefore, the allocated and unallocated versions are the same).

2.1. ADDITIONAL LAND PURCHASE

While the RICE and BESS cost estimates were developed assuming no purchase of additional land would be required, there is the potential that land purchases may be require depending on the selected locations of the projects.

Based on RICE design, S&L estimates the following land requirements:

- 5 x 18 MW RICE: approximately 4 acres

Based on the BESS size, S&L’s design criteria specify approximately 200 MWh/acre for battery enclosures and balance of plant. Therefore, for a 40 MWh BESS, approximately 0.2 acres would be required.

Based on feedback from MECL, land in the targeted areas ranges from CAD $20,000 to CAD $60,000 per acre.

LEGAL NOTICE

This deliverable was prepared by Sargent & Lundy, L.L.C. (S&L) expressly for the sole use of Maritime Electric Company, Ltd. (Client) in accordance with the contract agreement between S&L and Client. This deliverable was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances. Client acknowledges: (1) S&L prepared this deliverable subject to the particular scope limitations, budgetary and time constraints, and business objectives of Client; (2) information and data provided by others, including Client, may not have been independently verified by S&L; and (3) the information and data contained in this deliverable are time-sensitive and changes in the data, applicable codes, standards, and acceptable engineering practices may invalidate the findings of this deliverable. Any use or reliance upon this deliverable by third parties shall be at their sole risk.

ISSUE SUMMARY AND APPROVAL PAGE

This is to certify that this document has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

Contributors

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Reviewed by:

Name	Title	Section(s) Reviewed
Jeffrey Mallory	Manager/Consultant II	Cost Estimates (Overall)
Terry Coyne	Principal Energy Consultant	Letter Report

Approved by:

September 26, 2024

Terry Coyne
Principal Energy Consultant and Project Manager

Date

LIST OF EXHIBITS

EXHIBIT A. 1 X PC SPRINT SIMPLE CYCLE TURBINE – ALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/20024
Reviewed By	GA
Approved By	BA
Estimate No.	36484C
Factor table	_4 Productivity 1.15

Estimate No.: 36484C
Project No.: A14782.003
Estimate Date: 09/24/20024
Prep./Rev/App.: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		BASE							
	21.00.00	CIVIL WORK	1,345,846		565,701	7,338	1,033,296	627,161	3,572,004
	22.00.00	CONCRETE			1,039,973	9,760	1,531,794	186,518	2,758,285
	23.00.00	STEEL			270,564	714	143,843	26,239	440,646
	24.00.00	ARCHITECTURAL	659,306						659,306
	27.00.00	PAINTING & COATING	188,144		8,112	190	33,840	7,375	237,472
	31.00.00	MECHANICAL EQUIPMENT		81,900,342	16,067	13,023	2,459,852	365,135	84,741,395
	35.00.00	PIPING			1,219,519	15,448	3,111,706	860,242	5,191,466
	36.00.00	INSULATION			199,385	2,681	440,361	41,313	681,059
	41.00.00	ELECTRICAL EQUIPMENT	498,469	21,295,642	989,322	18,301	3,628,586	560,519	26,972,538
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			739,295	9,084	1,911,048	23,466	2,673,810
	43.00.00	CABLE			706,974	9,347	1,971,539	302,170	2,980,683
	44.00.00	CONTROL & INSTRUMENTATION	1,150,655		555,405	2,301	489,011	27,213	2,222,284
	61.00.00	CONSTRUCTION INDIRECT				1,138	203,365	0	203,365
	71.00.00	PROJECT INDIRECT	363,231						363,231
		1 BASE	4,205,652	103,195,983	6,310,317	89,326	16,958,242	3,027,351	133,697,545
BIO		BIODIESEL SYSTEM							
	21.00.00	CIVIL WORK			29,095	159	20,598	4,610	54,303
	22.00.00	CONCRETE			19,460	353	56,467	6,333	82,260
	31.00.00	MECHANICAL EQUIPMENT	1,350,938	3,986,042		138	27,799	4,820	5,369,600
	36.00.00	INSULATION	172,712						172,712
	41.00.00	ELECTRICAL EQUIPMENT			38,968	64	12,128	1,929	53,025
		BIO BIODIESEL SYSTEM	1,523,650	3,986,042	87,523	714	116,993	17,692	5,731,899
CEMS		CONTINUOUS EMISSIONS MONITORING SYSTEM							
	21.00.00	CIVIL WORK			89	2	205	50	344
	22.00.00	CONCRETE			2,440	24	3,750	438	6,627
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			2,888	58	12,201	150	15,239
	43.00.00	CABLE			1,351	12	2,471	355	4,178
	44.00.00	CONTROL & INSTRUMENTATION		716,776		345	72,547	891	790,213
		CEMS CONTINUOUS EMISSIONS MONITORING SYSTEM		716,776	6,767	440	91,173	1,884	816,601
FUEL OIL		FUEL OIL SYSTEM							
	21.00.00	CIVIL WORK	341,054		410,788	3,884	537,778	215,318	1,504,939
	22.00.00	CONCRETE			181,109	2,345	373,335	52,005	606,449
	23.00.00	STEEL			92,798	576	112,842	30,434	236,073
	24.00.00	ARCHITECTURAL	359,825						359,825
	27.00.00	PAINTING & COATING	47,036		4,963	121	21,551	4,697	78,246
	31.00.00	MECHANICAL EQUIPMENT	2,006,976	3,003,008		202	36,154	4,535	5,050,673
	35.00.00	PIPING			1,590,576	10,393	2,094,658	416,429	4,101,663
	36.00.00	INSULATION			40,683	585	96,133	9,019	145,835
	41.00.00	ELECTRICAL EQUIPMENT	319,845	1,283,830	1,183,180	3,971	799,776	112,730	3,699,361
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			753,819	8,908	1,874,202	23,014	2,651,034
	43.00.00	CABLE			1,176,804	4,707	992,801	142,738	2,312,344
	44.00.00	CONTROL & INSTRUMENTATION		985,881	72,070	797	172,428	7,045	1,237,424
	61.00.00	CONSTRUCTION INDIRECT				1,724	308,129	0	308,129
		FUEL OIL FUEL OIL SYSTEM	3,074,735	5,272,719	5,506,791	38,215	7,419,786	1,017,963	22,291,995
SCR		SCR SYSTEM							
	21.00.00	CIVIL WORK			7,341	97	13,017	3,199	23,557
	22.00.00	CONCRETE			190,503	1,456	226,848	28,513	445,863
	31.00.00	MECHANICAL EQUIPMENT		6,137,174		5,770	1,158,478	199,196	7,494,848
	35.00.00	PIPING			73,909	43	8,618	1,494	84,021
		SCR SCR SYSTEM		6,137,174	271,752	7,366	1,406,961	232,401	8,048,288
		TOTAL	8,804,037	119,308,694	12,183,150	136,060	25,993,157	4,297,291	170,586,328

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	25,993,157		136,060
Material Costs	12,183,150		
Subcontract Costs	8,804,037		
Construction Equipment Costs	4,297,291		
Process Equipment Costs	119,308,694		
Total Direct Cost	**170,586,329**	**170,586,329**	
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General Conditions			
Additional Labor Costs			
Site Overheads			
Other Construction Indirects			
		170,586,329	
Project Indirect Costs			
		170,586,329	
Contingency			
		170,586,329	
Escalation			
Total		**170,586,329**	

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		**BASE**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	COMBUSTION TURBINE	519.49 CY	-	-		90	12,014	2,952	14,966
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	GENERATOR STEP-UP TRANSFORMER (1 CTG)	53.09 CY	-	-		9	1,228	302	1,529
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	UNIT AUXILIARY TRANSFORMER	26.22 CY	-	-		5	606	149	755
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FIN FAN COOLERS	67.17 CY	-	-		12	1,553	382	1,935
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	MV PDC	148.49 CY	-	-		26	3,434	844	4,278
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	CT DRAINS TANK	138.09 CY	-	-		24	3,193	785	3,978
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	CONTROL PACKAGE	59.59 CY	-	-		10	1,378	339	1,717
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	DEMIN WATER PUMPS	16.01 CY	-	-		3	370	91	461
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	GENERATOR CIRCUIT BREAKER	32.02 CY	-	-		6	741	182	923
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ISOLATED PHASE BUS DUCT	43.16 CY	-	-		7	998	245	1,243
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ADDITIONAL CT SKIDS/EQUIPMENT	75.80 CY	-	-		13	1,753	431	2,184
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	55.25 CY	-	-		7	977	240	1,218
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	NEW ELECTRICAL ROOM/BUILDING	55.25 CY	-	-		7	977	240	1,218
	21-17-00-11	TRENCH EXCAVATION 6 FT TO 10 FT DEEP	CONCRETE DUCT BANKS	3,597.03 CY	-	-		269	36,048	8,858	44,906
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP	MISCELLANEOUS MECHANICAL BURIED PIPING	3,334.63 CY	-	-		249	33,418	8,211	41,630
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP	UNDERGROUND DRAINAGE PIPING	2,804.10 CY	-	-		209	28,102	6,905	35,007
	21-17-00-29	REMOVE 6 IN GRAVEL AND GEOTEXTILE	RESTORE CONSTRUCTION LAYDOWN AREA 1	8,982.89 CY	-	-		413	61,359	74,951	136,310
	21-17-00-29	REMOVE TEMPORARY DRAINGE DITCHES AND SEDIMENT TRAPS	RESTORE CONSTRUCTION LAYDOWN AREA 1	867.68 LF	-	-		15	2,224	2,717	4,941
		EXCAVATION						**1,372**	**190,375**	**108,822**	**299,197**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL, 8 MILE CYCLE	RESTORE CONSTRUCTION LAYDOWN AREAS	19,812.28 CY	-	-		1,365	202,982	247,947	450,929
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	34.90 CY	-	-		2	247	61	308
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	NEW ELECTRICAL ROOM/BUILDING	34.90 CY	-	-		2	247	61	308
		DISPOSAL						**1,369**	**203,476**	**248,068**	**451,545**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	20.35 CY	-	-		3	360	88	448
	21-20-00-01	FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	NEW ELECTRICAL ROOM/BUILDING	20.35 CY	-	-		3	360	88	448
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	COMBUSTION TURBINE	125.41 CY	-	-	8,165	22	2,900	713	11,778
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	GENERATOR STEP-UP TRANSFORMER (1 CTG)	14.56 CY	-	-	948	3	337	83	1,367
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	UNIT AUXILIARY TRANSFORMER	7.07 CY	-	-	460	1	163	40	664
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	FIN FAN COOLERS	18.34 CY	-	-	1,194	3	424	104	1,722
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	MV PDC	41.64 CY	-	-	2,711	7	963	237	3,910
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	CT DRAINS TANK	7.56 CY	-	-	492	1	175	43	710
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	CONTROL PACKAGE	16.38 CY	-	-	1,066	3	379	93	1,538
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	DEMIN WATER PUMPS	2.36 CY	-	-	153	0	54	13	221
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	GENERATOR CIRCUIT BREAKER	6.94 CY	-	-	452	1	160	39	652
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ISOLATED PHASE BUS DUCT	7.41 CY	-	-	482	1	171	42	695
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ADDITIONAL CT SKIDS/EQUIPMENT	13.77 CY	-	-	896	2	318	78	1,293
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	MISC PIPE SUPPORTS, RACKS	70.47 CY	-	-	4,587	12	1,630	400	6,618
	21-20-00-02	FOUNDATION BACKFILL, FROST FREE FILL	MV PDC	57.46 CY	-			10	1,329	327	1,655
	21-20-00-11	TRENCH BACKFILL AND BEDDING, PREVIOUSLY EXCAVATED MATERIAL	CONCRETE DUCT BANKS	3,046.47 CY	-	-		350	46,969	11,541	58,510
	21-20-00-11	TRENCH BACKFILL AND BEDDING, PREVIOUSLY EXCAVATED MATERIAL	MISCELLANEOUS MECHANICAL BURIED PIPING	9,616.22 CY	-	-		1,105	148,258	36,429	184,688
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DRAINAGE DITCH AND CULVERTS	1,533.47 CY	-	-		176	23,642	5,809	29,452
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING FROM BORROW PIT ONSITE	MISCELLANEOUS PIPING ALLOWANCE	176.11 CY	-	-		32	4,236	1,041	5,276
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	EFFLUENT PIPING	266.15 CY	-			40	5,334	1,311	6,645
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	UNDERGROUND DRAINAGE PIPING	1,609.42 CY	-	-		240	32,256	7,926	40,182
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	DRAINAGE DITCH AND CULVERTS	1,740.18 CY	-			260	34,877	8,570	43,447
		BACKFILL					**21,606**	**2,275**	**305,296**	**75,016**	**401,918**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-11	CRUSHED ROCK SURFACING, 6" DEEP	DRAINAGE DITCH AND CULVERTS	16,917.25 SY	-	-	182,412	292	41,986	19,940	244,339
	21-41-00-31	STRAW BALE	INSTALL AND REMOVE	132.00 EA	-	-	4,028	76	10,338	607	14,972
	21-41-00-60	SILT FENCE	SITE PREPARATION	8,247.89 LF	-	-	21,476	237	32,305	1,895	55,676
	21-41-00-99	STONE CHECK DAMS		122.00 EA	-	-	24,820	140	20,077	2,097	46,994
		EROSION AND SEDIMENTATION CONTROL					**232,736**	**745**	**104,706**	**24,539**	**361,981**
		FENCEWORK									
	21-43-00-10	FABRIC, WIRE & POSTS, CHAIN LINK FENCE, GALVANIZED, 6 FT TALL, 6 GAGE 3 STRANDS OF BARB WIRE, 2 IN POST AT 10 FT O.C.	TEMPORARY FENCING	2,728.40 LF	-	-	130,999	314	42,746	2,508	176,252
	21-43-00-29	DOUBLE SWING GATE 40 FT WIDE	TEMPORARY FENCING	2.00 EA	-	-	18,310	74	12,534	257	31,101

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		FENCEWORK									
	21-43-00-30	MAN GATE, 4 FT WIDE BY 7 FT TALL	TEMPORARY FENCING	2.00 EA	-	-	2,238	28	4,700	96	7,035
	21-43-00-99	REMOVE TEMPORARY CHAIN LINK FENCE INCLUDING GATES	RESTORE CONSTRUCTION LAYDOWN AREA 1	2,728.40 LF	-	-		94	12,824	752	13,577
		FENCEWORK					**151,546**	**509**	**72,804**	**3,614**	**227,964**
		LANDSCAPING									
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING TOPSOIL FROM PILE & FERTILIZER		24,043.99 SY	-	-	44,007	332	49,292	60,211	153,510
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING 4 IN TOPSOIL FROM PILE & FERTILIZER	RESTORE CONSTRUCTION LAYDOWN AREA 1	41,712.33 SY	-	-	76,345	575	85,513	104,456	266,314
	21-47-00-10	MISC SITE IMPROVEMENTS		1.00 LS	56,443	-					56,443
		LANDSCAPING			**56,443**		**120,352**	**907**	**134,805**	**164,667**	**476,267**
		ROAD, PARKING AREA, & SURFACED AREA									
	21-57-00-01	ASPHALT ROADS	1,500 FEET	4,000.03 SY	475,990	-					475,990
	21-57-00-02	AGGREGATE ROADS		1,000.01 SY	86,545	-					86,545
	21-57-00-80	GEOTEXTILE FABRIC	CRUSHED STONE SURFACING	10,000.08 SY	-	-	33,357	115	15,663	919	49,939
	21-57-00-99	TEMPORARY LAY DOWN AND PARKING AREAS		1.00 AC	162,436	-					162,436
		ROAD, PARKING AREA, & SURFACED AREA			**724,971**		**33,357**	**115**	**15,663**	**919**	**774,910**
		CIVIL WORK,TESTING									
	21-98-00-69	INDEPENDENT EARTHWORK TESTING CONTRACTOR	ALLOWANCE ESTIMATED BASED ON RECENT EXPERIENCE	1.00 LS	376,288	-					376,288
		CIVIL WORK,TESTING			**376,288**						**376,288**
		CIVIL WORK, MISCELLANEOUS									
	21-99-00-19	DEWATERING	ALLOWANCE	1.00 LS	188,144	-					188,144
	21-99-00-99	STABILIZED CONSTRUCTION ENTRANCE/EXIT		2.00 EA	-	-	6,103	46	6,171	1,516	13,790
		CIVIL WORK, MISCELLANEOUS			**188,144**		**6,103**	**46**	**6,171**	**1,516**	**201,934**
		CIVIL WORK			**1,345,846**		**565,701**	**7,338**	**1,033,296**	**627,161**	**3,572,004**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	50.07 CY	-	-	16,809	55	7,834	1,335	25,978
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	NEW ELECTRICAL ROOM/BUILDING	50.07 CY	-	-	16,809	55	7,834	1,335	25,978
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	COMBUSTION TURBINE	402.75 CY	-	-	135,196	578	82,368	14,032	231,597
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	35.11 CY	-	-	11,785	50	7,180	1,223	20,189
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	UNIT AUXILIARY TRANSFORMER	15.84 CY	-	-	5,316	23	3,238	552	9,106
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FIN FAN COOLERS	43.29 CY	-	-	14,532	62	8,853	1,508	24,893
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	MV PDC	110.77 CY	-	-	37,183	159	22,654	3,859	63,696
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	CT DRAINS TANK	12.79 CY	-	-	4,295	18	2,617	446	7,357
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	DEMIN WATER PUMPS	6.33 CY	-	-	2,125	9	1,294	221	3,639
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	GENERATOR CIRCUIT BREAKER	17.26 CY	-	-	5,794	25	3,530	601	9,925
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ISOLATED PHASE BUS DUCT	19.89 CY	-	-	6,676	29	4,068	693	11,437
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	40.72 CY	-	-	13,668	58	8,327	1,419	23,414
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	MISC PIPE SUPPORTS, RACKS	177.18 CY	-	-	59,478	254	36,237	6,173	101,888
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	DUCT BANKS	759.72 CY	-	-	255,026	1,091	155,375	26,469	436,870
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	10.17 CY	-	-	3,413	20	2,911	496	6,819
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	UNIT AUXILIARY TRANSFORMER	4.69 CY	-	-	1,574	9	1,343	229	3,145
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	MV PDC	12.85 CY	-	-	4,312	26	3,678	627	8,616
	22-13-00-20	MUD MAT, 1500 PSI	COMBUSTION TURBINE	62.71 CY	-	-	12,119	36	5,130	874	18,123
	22-13-00-20	MUD MAT, 1500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	7.28 CY	-	-	1,407	4	596	101	2,104
	22-13-00-20	MUD MAT, 1500 PSI	UNIT AUXILIARY TRANSFORMER	3.53 CY	-	-	683	2	289	49	1,021
	22-13-00-20	MUD MAT, 1500 PSI	FIN FAN COOLERS	9.17 CY	-	-	1,772	5	750	128	2,650
	22-13-00-20	MUD MAT, 1500 PSI	MV PDC	20.80 CY	-	-	4,020	12	1,702	290	6,012
	22-13-00-20	MUD MAT, 1500 PSI	CT DRAINS TANK	3.79 CY	-	-	732	2	310	53	1,094
	22-13-00-20	MUD MAT, 1500 PSI	CONTROL PACKAGE	8.19 CY	-	-	1,583	5	670	114	2,367
	22-13-00-20	MUD MAT, 1500 PSI	DEMIN WATER PUMPS	1.19 CY	-	-	230	1	97	17	344
	22-13-00-20	MUD MAT, 1500 PSI	GENERATOR CIRCUIT BREAKER	3.47 CY	-	-	670	2	284	48	1,003
	22-13-00-20	MUD MAT, 1500 PSI	ISOLATED PHASE BUS DUCT	3.70 CY	-	-	716	2	303	52	1,070
	22-13-00-20	MUD MAT, 1500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	6.88 CY	-	-	1,329	4	562	96	1,987
	22-13-00-20	MUD MAT, 1500 PSI	MISC PIPE SUPPORTS, RACKS	35.20 CY	-	-	6,803	20	2,880	491	10,173
	22-13-00-80	CONCRETE WALL, 4500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	38.05 CY	-	-	12,773	87	12,451	2,121	27,345
	22-13-00-80	CONCRETE WALL, 4500 PSI	UNIT AUXILIARY TRANSFORMER	19.45 CY	-	-	6,529	45	6,364	1,084	13,977
	22-13-00-80	CONCRETE WALL, 4500 PSI	CT DRAINS TANK	2.79 CY	-	-	935	6	912	155	2,002

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE					**646,292**	**2,757**	**392,639**	**66,889**	**1,105,820**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	COMBUSTION TURBINE	2,800.53 LB	-	-	17,093	161	27,418	563	45,074
	22-15-00-10	EMBEDMENTS, CARBON STEEL	GENERATOR STEP-UP TRANSFORMER (1 CTG)	274.61 LB	-	-	1,676	16	2,688	55	4,420
	22-15-00-10	EMBEDMENTS, CARBON STEEL	UNIT AUXILIARY TRANSFORMER	132.02 LB	-	-	806	8	1,293	27	2,125
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FIN FAN COOLERS	301.02 LB	-	-	1,837	17	2,947	60	4,845
	22-15-00-10	EMBEDMENTS, CARBON STEEL	MV PDC	792.15 LB	-	-	4,835	46	7,755	159	12,749
	22-15-00-10	EMBEDMENTS, CARBON STEEL	CT DRAINS TANK	100.02 LB	-	-	610	6	979	20	1,610
	22-15-00-10	EMBEDMENTS, CARBON STEEL	CONTROL PACKAGE	266.72 LB	-	-	1,628	15	2,611	54	4,293
	22-15-00-10	EMBEDMENTS, CARBON STEEL	DEMIN WATER PUMPS	44.01 LB	-	-	269	3	431	9	708
	22-15-00-10	EMBEDMENTS, CARBON STEEL	GENERATOR CIRCUIT BREAKER	133.36 LB	-	-	814	8	1,306	27	2,146
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ISOLATED PHASE BUS DUCT	133.36 LB	-	-	814	8	1,306	27	2,146
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ADDITIONAL CT SKIDS/EQUIPMENT	273.05 LB	-	-	1,667	16	2,673	55	4,395
	22-15-00-10	EMBEDMENTS, CARBON STEEL	MISC PIPE SUPPORTS, RACKS	1,188.22 LB	-	-	7,252	68	11,633	239	19,124
	22-15-00-10	EMBEDMENTS, CARBON STEEL	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	500.74 LB	-	-	3,056	13	2,224	46	5,325
	22-15-00-10	EMBEDMENTS, CARBON STEEL	NEW ELECTRICAL ROOM/BUILDING	500.74 LB	-	-	3,056	13	2,224	46	5,326
		EMBEDMENT					**45,413**	**396**	**67,487**	**1,385**	**114,286**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	COMBUSTION TURBINE	1,157.16 SF	-	-	4,355	266	43,891	4,085	52,332
	22-17-00-10	BUILT UP INSTALL & STRIP	GENERATOR STEP-UP TRANSFORMER (1 CTG)	2,431.17 SF	-	-	9,150	559	92,215	8,582	109,947
	22-17-00-10	BUILT UP INSTALL & STRIP	UNIT AUXILIARY TRANSFORMER	1,138.48 SF	-	-	4,285	262	43,183	4,019	51,487
	22-17-00-10	BUILT UP INSTALL & STRIP	FIN FAN COOLERS	290.73 SF	-	-	1,094	67	11,027	1,026	13,148
	22-17-00-10	BUILT UP INSTALL & STRIP	MV PDC	922.16 SF	-	-	3,471	212	34,978	3,255	41,704
	22-17-00-10	BUILT UP INSTALL & STRIP	CT DRAINS TANK	459.99 SF	-	-	1,731	106	17,448	1,624	20,803
	22-17-00-10	BUILT UP INSTALL & STRIP	CONTROL PACKAGE	224.25 SF	-	-	844	52	8,506	792	10,141
	22-17-00-10	BUILT UP INSTALL & STRIP	DEMIN WATER PUMPS	53.13 SF	-	-	200	12	2,015	188	2,403
	22-17-00-10	BUILT UP INSTALL & STRIP	GENERATOR CIRCUIT BREAKER	193.19 SF	-	-	727	44	7,328	682	8,737
	22-17-00-10	BUILT UP INSTALL & STRIP	ISOLATED PHASE BUS DUCT	275.99 SF	-	-	1,039	63	10,468	974	12,481
	22-17-00-10	BUILT UP INSTALL & STRIP	ADDITIONAL CT SKIDS/EQUIPMENT	418.59 SF	-	-	1,575	96	15,877	1,478	18,930
	22-17-00-10	BUILT UP INSTALL & STRIP	MISC PIPE SUPPORTS, RACKS	2,914.49 SF	-	-	10,969	670	110,547	10,289	131,805
	22-17-00-10	BUILT UP INSTALL & STRIP	DUCT BANKS	8,095.80 SF	-	-	30,470	1,861	307,075	28,579	366,125
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	208.00 SF	-	-	783	6	1,026	96	1,904
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	NEW ELECTRICAL ROOM/BUILDING	208.00 SF	-	-	783	6	1,026	95	1,904
		FORMWORK					**71,477**	**4,283**	**706,611**	**65,763**	**843,851**
		PRECAST									
	22-23-00-50	MANHOLE - 4 FT ID BY 5 FT DEEP	SANITARY SEWER	2.00 EA	-	-	8,382	41	5,554	1,365	15,300
	22-23-00-50	CATCH BASIN - 4 FT X 4 FT BY 4 FT DEEP	STORM WATER SYSTEM	5.00 EA	-	-	17,550	92	12,342	3,033	32,924
	22-23-00-50	MANHOLE - 5 FT ID BY 5 FT DEEP	STORM WATER SYSTEM	3.00 EA	-	-	18,859	69	9,256	2,274	30,390
	22-23-00-50	MANHOLE - 6 FT ID BY 6 FT DEEP	STORM WATER SYSTEM	3.00 EA	-	-	29,861	83	11,107	2,729	43,697
		PRECAST					**74,651**	**285**	**38,259**	**9,401**	**122,311**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	COMBUSTION TURBINE	29.65 TN	-	-	67,551	687	110,076	14,511	192,137
	22-25-00-10	UNCOATED A615 GR60	GENERATOR STEP-UP TRANSFORMER (1 CTG)	6.87 TN	-	-	15,649	159	25,501	3,362	44,512
	22-25-00-10	UNCOATED A615 GR60	UNIT AUXILIARY TRANSFORMER	3.32 TN	-	-	7,563	77	12,323	1,625	21,511
	22-25-00-10	UNCOATED A615 GR60	FIN FAN COOLERS	2.99 TN	-	-	6,802	69	11,083	1,461	19,346
	22-25-00-10	UNCOATED A615 GR60	MV PDC	8.94 TN	-	-	20,375	207	33,202	4,377	57,954
	22-25-00-10	UNCOATED A615 GR60	CT DRAINS TANK	1.22 TN	-	-	2,768	28	4,511	595	7,874
	22-25-00-10	UNCOATED A615 GR60	CONTROL PACKAGE	2.76 TN	-	-	6,277	64	10,229	1,349	17,855
	22-25-00-10	UNCOATED A615 GR60	DEMIN WATER PUMPS	0.43 TN	-	-	978	10	1,593	210	2,780
	22-25-00-10	UNCOATED A615 GR60	GENERATOR CIRCUIT BREAKER	1.20 TN	-	-	2,730	28	4,448	586	7,764
	22-25-00-10	UNCOATED A615 GR60	ISOLATED PHASE BUS DUCT	1.47 TN	-	-	3,354	34	5,466	720	9,540
	22-25-00-10	UNCOATED A615 GR60	ADDITIONAL CT SKIDS/EQUIPMENT	2.82 TN	-	-	6,421	65	10,463	1,379	18,264
	22-25-00-10	UNCOATED A615 GR60	MISC PIPE SUPPORTS, RACKS	12.67 TN	-	-	28,863	294	47,033	6,200	82,095
	22-25-00-10	UNCOATED A615 GR60	DUCT BANKS	6.89 TN	-	-	15,693	160	25,571	3,371	44,635
	22-25-00-10	UNCOATED A615 GR60	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	3.76 TN	-	-	8,558	79	12,649	1,667	22,875
	22-25-00-10	UNCOATED A615 GR60	NEW ELECTRICAL ROOM/BUILDING	3.76 TN	-	-	8,558	79	12,649	1,667	22,875
		REINFORCING					**202,139**	**2,040**	**326,798**	**43,080**	**572,017**
		CONCRETE					**1,039,973**	**9,760**	**1,531,794**	**186,518**	**2,758,285**
		STEEL									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		GALLERY									
	23-17-00-10	PLAIN, GALVANIZED GRATING, 1 1/4" DEEP WITH 3/8" CHECKERED PLATE	CT DRAINS TANK	100.00 SF	-	-	5,563	23	4,804	344	10,712
	23-17-00-11	SERRATED, GALVANIZED GRATING, 1 1/2" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	MV PDC	65.99 SF	-	-	4,052	15	3,171	227	7,450
	23-17-00-11	SERRATED, GALVANIZED GRATING, 1 1/2" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	MISC PLATFORMS	175.99 SF	-	-	10,805	40	8,455	606	19,866
	23-17-00-12	2 1/2" PLAIN, GALVANIZED GRATING	GENERATOR STEP-UP TRANSFORMERS - STD	377.52 SF	-	-	42,718	95	19,951	1,429	64,098
	23-17-00-12	2 1/2" PLAIN, GALVANIZED GRATING	UATS	181.49 SF	-	-	20,537	46	9,592	687	30,815
	23-17-00-20	DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	MV PDC	57.74 LF	-	-	7,501	12	2,497	179	10,177
	23-17-00-20	DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	MISC PLATFORMS	87.98 LF	-	-	11,430	18	3,805	273	15,507
	23-17-00-30	LADDER W/O CAGE	MISC PLATFORMS	6.60 LF	-	-	830	3	634	45	1,509
	23-17-00-31	LADDER WITH CAGE	MISC PLATFORMS	6.60 LF	-	-	1,245	5	1,110	79	2,434
	23-17-00-35	METAL GRATING STAIR TREADS 4 FT WIDE, INCLUDING STRINGER, HANDRAIL NOT INCLUDED	MV PDC	17.00 EA	-	-	14,962	29	6,125	439	21,526
	23-17-00-35	METAL GRATING STAIR TREADS 4 FT WIDE, INCLUDING STRINGER, HANDRAIL NOT INCLUDED	MISC PLATFORMS	9.00 EA	-	-	7,921	16	3,243	232	11,396
		GALLERY					**127,563**	**303**	**63,387**	**4,540**	**195,491**
		ROLLED SHAPE									
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	GENERATOR STEP-UP TRANSFORMERS (STD)	0.18 TN	-	-	1,660	5	1,021	275	2,956
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	UNIT AUX TRANSFORMER	0.09 TN	-	-	803	3	494	133	1,430
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	MV PDC	0.06 TN	-	-	532	2	327	88	948
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	CT DRAINS TANK	0.39 TN	-	-	3,500	11	2,153	581	6,234
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	GENERATOR CIRCUIT BREAKER	0.18 TN	-	-	1,606	5	988	266	2,860
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	ISOLATED PHASE BUS DUCT	0.09 TN	-	-	812	3	499	135	1,446
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	MISC PIPE SUPPORTS, RACKS, CABLE TRAY STEEL	0.71 TN	-	-	6,378	20	3,923	1,058	11,359
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	MISC PLATFORMS	0.20 TN	-	-	1,777	6	1,093	295	3,165
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	GENERATOR STEP-UP TRANSFORMERS (STD)	0.92 TN	-	-	6,901	20	3,941	1,063	11,904
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	UNIT AUX TRANSFORMER	0.44 TN	-	-	3,319	10	1,895	511	5,725
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MV PDC	0.62 TN	-	-	4,648	14	2,654	716	8,018
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	CT DRAINS TANK	0.39 TN	-	-	2,914	8	1,664	449	5,026
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	GENERATOR CIRCUIT BREAKER	0.36 TN	-	-	2,681	8	1,531	413	4,624
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	ISOLATED PHASE BUS DUCT	0.46 TN	-	-	3,462	10	1,977	533	5,972
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MISC PIPE SUPPORTS, RACKS, CABLE TRAY STEEL	6.36 TN	-	-	47,773	139	27,280	7,357	82,410
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MISC PLATFORMS	1.77 TN	-	-	13,269	39	7,577	2,043	22,889
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	GENERATOR STEP-UP TRANSFORMERS (STD)	2.57 TN	-	-	17,363	46	9,086	2,450	28,900
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	UNIT AUX TRANSFORMER	1.24 TN	-	-	8,348	22	4,368	1,178	13,894
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	CT DRAINS TANK	0.77 TN	-	-	5,216	14	2,730	736	8,682
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	GENERATOR CIRCUIT BREAKER	0.18 TN	-	-	1,201	3	629	170	1,999
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	ISOLATED PHASE BUS DUCT	1.31 TN	-	-	8,840	24	4,626	1,248	14,714
		ROLLED SHAPE					**143,001**	**411**	**80,456**	**21,699**	**245,156**
		STEEL					**270,564**	**714**	**143,843**	**26,239**	**440,646**
		ARCHITECTURAL									
		PRE-ENGINEERED BUILDING									
	24-35-00-01	SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA 200 FT 100 FT 20 FT	NEW ELECTRICAL ROOM/BUILDING	676.00 SF	331,991	-					331,991
	24-35-00-01	SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA 200 FT 100 FT 20 FT	EXISTING BUILDING EXTENSION FOR WATER PUMPS AND AIR COMPRESSORS	676.00 SF	327,315	-					327,315
		PRE-ENGINEERED BUILDING			**659,306**						**659,306**
		ARCHITECTURAL			**659,306**						**659,306**
		PAINTING & COATING									
		PAINTING									
	27-17-00-14	PIPE PAINTING, 1.5 IN DIA		65.19 LF	-	-	180	5	972	211	1,364
	27-17-00-17	PIPE PAINTING, 3 IN DIA		394.58 LF	-	-	2,007	47	8,303	1,814	12,124
	27-17-00-17	PIPE PAINTING, 3 IN DIA		17.15 LF	-	-	87	2	361	79	527
	27-17-00-17	PIPE PAINTING, 3 IN DIA		27.45 LF	-	-	140	3	578	126	843

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PAINTING									
	27-17-00-18	PIPE PAINTING, 4 IN DIA		363.70 LF	-	-	2,383	56	9,883	2,149	14,414
	27-17-00-19	PIPE PAINTING, 6 IN DIA		10.29 LF	-	-	99	2	410	90	599
	27-17-00-21	PIPE PAINTING, 10 IN DIA		205.87 LF	-	-	3,217	75	13,333	2,906	19,456
	27-17-00-61	EQUIPMENT, TOUCH UP PAINTING	ALLOWANCE	1.00 LS	188,144	-					188,144
		PAINTING			**188,144**		**8,112**	**190**	**33,840**	**7,375**	**237,472**
		PAINTING & COATING			**188,144**		**8,112**	**190**	**33,840**	**7,375**	**237,472**
		MECHANICAL EQUIPMENT									
		COMPRESSOR & ACCESSORIES									
	31-17-00-99	1X100% AIR COMPRESSORS, 250 SCFM, 125 PSIG INCLUDING AFTERCOOLERS AND MOISTURE SEPARATORS		1.00 EA	-	227,883	-	172	30,813	3,865	262,561
	31-17-00-99	WET AIR RECEIVER, 500 GALLONS	EQUIPMENT COST INCLUDED WITH COMPRESSORS	1.00 EA	-		-	28	4,930	618	5,548
	31-17-00-99	DRY AIR RECEIVER, 500 GALLONS	EQUIPMENT COST INCLUDED WITH COMPRESSORS	1.00 EA	-		-	28	4,930	618	5,549
	31-17-00-99	1X100% AIR DRYERS W/FILTERS, 200 SCFM, 150 PSIG	EQUIPMENT COST INCLUDED WITH COMPRESSORS	1.00 EA	-		-	28	4,930	618	5,548
		COMPRESSOR & ACCESSORIES				**227,883**		**255**	**45,603**	**5,721**	**279,207**
		NOX CONTROL EQUIPMENT									
	31-53-00-35	AMMONIA TRUCK UNLOADING SKID W/ CONTROLS & ACCESSORIES		1.00 EA		80,531	-	69	12,325	1,546	94,402
		NOX CONTROL EQUIPMENT				**80,531**		**69**	**12,325**	**1,546**	**94,402**
		BLACK START GENERATOR									
	31-65-00-99	CAT 700 KW DIESEL GENERATOR	PRICING PROVIDED BY TOROMONT CAT	1.00 LS	-	498,896	-	126	22,596	2,835	524,327
		BLACK START GENERATOR				**498,896**		**126**	**22,596**	**2,835**	**524,327**
		PUMP									
	31-75-00-99	2X100% SS PUMPS, 120 GPM, 100' TDH	DEMIN. TRANSFER PUMPS	1.00 EA	-	40,507	-	37	6,573	825	47,905
	31-75-00-99	SUMP PUMPS, 150 GALLONS, 35 FT HEAD, 15 HP	CTG UNIT 1 TRANSFORMERS SUMP PUMPS	1.00 EA	-	31,084	-	37	6,573	825	38,482
		PUMP				**71,591**		**74**	**13,147**	**1,649**	**86,387**
		TANK									
	31-83-00-05	WATER WASH DRAINS TANK, 5000 GALLONS	DOUBLE WALLED, UNDERGROUND TANK WITH LEAK DETECTION	1.00 EA	-	33,874		69	13,265	2,536	49,675
		TANK				**33,874**		**69**	**13,265**	**2,536**	**49,675**
		COMBUSTION TURBINE									
	31-85-00-99	COMBUSTION GAS TURBINE GENERATORS (CTGS), LM6000PC SPRINT	INCLUDING DUAL FUEL CAPABILITY, AIR INLET FILTER, ANTI-ICING SYSTEM, FINAL FUEL FILTER SKID, PCM, LUBE OIL SYSTEM, FIN FAN COOLERS	1.00 EA		67,886,874	-	6,667	1,191,432	149,457	69,227,763
	31-85-00-99	FIELD TECHNICAL ASSISTANCE INCLUDING ADDITIONAL ALLOWANCE FOR TIME AND TRAVEL	INCLUDED ABOVE	1.00 EA			-				
	31-85-00-99	LOGISTICS BY CTG VENDOR		1.00 LT		2,847,173					2,847,173
	31-85-00-99	CT STACK	ALLOWANCE FOR CREDIT TO REMOVE CT SIMPLE CYCLE STACK FROM GE SCOPE - STACK IS PROVIDED WITH HTSCR/CO CATALYST SYSTEM SEPARATELY, WHICH WAS NOT QUOTED BY GE	(1.00) LT		(210,902)					(210,902)
	31-85-00-99	ALLOWANCE FOR INTERCONNECTING PIPING FOR ALL CTG AUXILIARY SYSTEMS		1.00 LT			16,067	4,384	883,490	153,189	1,052,746
	31-85-00-99	SYNCHRONOUS CONDENSER CAPABILITY	PRICING PROVIDED BY GE	1.00 LT		10,464,422		1,379	277,993	48,202	10,790,617
		COMBUSTION TURBINE				**80,987,567**	**16,067**	**12,430**	**2,352,915**	**350,848**	**83,707,397**
		WATER TREATING									
	31-93-00-30	DEMINERALIZER	COST NOT INCLUDED - ASSUME USING EXISTING	0.00 LS	-	-	-				
		MECHANICAL EQUIPMENT, MISCELLANEOUS									
	31-99-00-09	DI FINAL FILTER SKID (20 MICRON FINAL FILTERS) DOWNSTREAM OF DEMINERALIZED WATER STORAGE TANK	COST NOT INCLUDED - ASSUME USING EXISTING	0.00 LS	-		-				
		MECHANICAL EQUIPMENT				**81,900,342**	**16,067**	**13,023**	**2,459,852**	**365,135**	**84,741,395**
		PIPING									
		SS 304, ABOVE GROUND, PROCESS AREA									
	35-13-01-06	0.75 IN DIA, SCH 40S		1,399.64 LF	-	-	52,394	1,625	327,569	189,985	569,948
	35-13-01-18	2 IN DIA, SCH 40S		314.92 LF	-	-	45,168	511	102,892	59,762	207,823
	35-13-01-22	3 IN DIA, SCH 40S		799.80 LF	-	-	88,028	1,499	302,086	52,379	442,493
	35-13-01-30	6 IN DIA, SCH 40S		39.99 LF	-	-	10,137	93	18,718	3,246	32,101
		SS 304, ABOVE GROUND, PROCESS AREA					**195,727**	**3,728**	**751,266**	**305,372**	**1,252,366**
		SS 316, ABOVE GROUND, PROCESS AREA									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		SS 316, ABOVE GROUND, PROCESS AREA									
	35-13-02-14	1.5 IN DIA, SCH 40S		199.95 LF	-	-	25,058	297	59,769	34,782	119,609
	35-13-02-22	3 IN DIA, SCH 40S		469.88 LF	-	-	67,203	881	177,476	30,773	275,451
		SS 316, ABOVE GROUND, PROCESS AREA					**92,261**	**1,177**	**237,244**	**65,555**	**395,060**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-14	1.5 IN DIA, SCH 80		399.90 LF	-	-	13,505	524	105,638	61,133	180,275
	35-13-10-18	2 IN DIA, SCH 80		519.87 LF	-	-	24,960	741	149,375	86,323	260,659
	35-13-10-25	3 IN DIA, SCH 40		639.84 LF	-	-	37,619	986	198,673	34,448	270,740
	35-13-10-29	4 IN DIA, SCH 40		399.90 LF	-	-	30,916	680	137,143	23,780	191,839
	35-13-10-33	6 IN DIA, SCH 40, GALVANIZED, MECHANICAL JOINT		169.96 LF	-	-	20,020	215	43,320	7,511	70,852
	35-13-10-33	6 IN DIA, SCH 40		89.98 LF	-	-	10,599	167	33,568	5,820	49,987
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**137,619**	**3,313**	**667,717**	**219,015**	**1,024,352**
		SS 304, BURIED									
	35-15-01-17	2 IN DIA, SCH 10S, WRAPPED	2" UG SS304	299.92 LF	-	-	23,919	290	58,379	28,853	111,151
	35-15-01-26	4 IN DIA, SCH 40S, WRAPPED	4" UG SS304	224.94 LF	-	-	29,334	238	47,954	8,315	85,603
		SS 304, BURIED					**53,253**	**528**	**106,332**	**37,168**	**196,754**
		SS 316, BURIED									
	35-15-02-22	3 IN DIA, SCH 40S, WRAPPED	3" UG SS316	149.96 LF	-	-	16,658	143	28,842	5,001	50,501
		SS 316, BURIED					**16,658**	**143**	**28,842**	**5,001**	**50,501**
		CARBON STEEL, BURIED									
	35-15-10-26	3 IN DIA, SCH 80, WRAPPED	3" UG CARBON STEEL	549.86 LF	-	-	35,014	474	95,560	16,569	147,144
		CARBON STEEL, BURIED					**35,014**	**474**	**95,560**	**16,569**	**147,144**
		HDPE, BURIED									
	35-15-30-09	3/4 IN DIA, DR 9	3/4" UG HDPE	89.98 LF	-	-	714	54	10,842	1,880	13,436
	35-15-30-09	2 IN DIA, DR 9	2" UG HDPE	449.89 LF	-	-	3,570	269	54,209	9,399	67,178
	35-15-30-09	1.5 IN DIA, DR 9	1.5" UG HDPE	799.80 LF	-	-	6,346	478	96,371	16,710	119,427
	35-15-30-13	3 IN DIA, DR 9	3" UG HDPE	399.90 LF	-	-	3,986	349	70,425	12,211	86,623
	35-15-30-17	4 IN DIA, DR 9	4" UG HDPE	49.99 LF	-	-	692	26	5,328	924	6,944
	35-15-30-21	6 IN DIA, DR 9	6" UG HDPE	724.81 LF	-	-	20,497	575	115,888	20,094	156,479
	35-15-30-29	10 IN DIA, DR 9		199.95 LF	-	-	16,515	225	45,406	7,873	69,794
		HDPE, BURIED					**52,320**	**1,977**	**398,469**	**69,091**	**519,880**
		CHDPE, BURIED									
	35-15-31-99	12 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	49.99 LF	-	-	1,031	5	899	135	2,065
	35-15-31-99	18 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	99.97 LF	-	-	3,729	13	2,583	389	6,700
	35-15-31-99	24 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	149.96 LF	-	-	8,458	22	4,254	640	13,352
	35-15-31-99	30 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	199.95 LF	-	-	15,157	37	7,094	1,067	23,318
	35-15-31-99	24 IN DIA, CHDPE	STORMWATER DRAINAGE CULVERTS	199.95 LF	-	-	11,277	30	5,672	853	17,802
	35-15-31-99	18 IN DIA, CHDPE	STORMWATER DRAINAGE CULVERTS	149.96 LF	-	-	5,593	20	3,874	583	10,050
	35-15-31-99	48 IN DIA, CHDPE	STORMWATER DRAINAGE CULVERTS	249.94 LF	-	-	45,091	55	10,451	1,572	57,114
		CHDPE, BURIED					**90,335**	**182**	**34,827**	**5,239**	**130,401**
		PIPE SUPPORTS, HANGERS									
	35-35-00-01	SINGLE ROD SUPPORT W/O BEAM FOR 1 IN AND BELOW DIA PIPE		100.00 EA	-	-	35,603	230	46,332	8,034	89,969
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 1-1/2 IN AND 2 IN DIA PIPE		115.00 EA	-	-	40,943	264	53,282	9,239	103,464
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 2 IN DIA PIPE		60.00 EA	-	-	21,362	138	27,799	4,820	53,981
	35-35-00-04	SINGLE ROD SUPPORT W/O BEAM FOR 3 IN PIPE		106.00 EA	-	-	43,561	366	73,668	12,773	130,003
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE		20.00 EA	-	-	9,480	92	18,533	3,213	31,227
	35-35-00-06	SINGLE ROD SUPPORT W/O BEAM FOR 6 IN PIPE		13.00 EA	-	-	7,009	90	18,070	3,133	28,211
	35-35-00-07	SINGLE ROD SUPPORT W/O BEAM FOR 8 IN PIPE		8.00 EA	-	-	4,508	64	12,973	2,249	19,731
	35-35-00-25	SINGLE ROD SUPPORT W/ BEAM FOR 1 IN AND BELOW DIA PIPE		100.00 EA	-	-	39,061	402	81,081	14,059	134,202
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN		115.00 EA	-	-	45,622	463	93,244	16,168	155,034
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 2 IN PIPE		60.00 EA	-	-	23,803	241	48,649	8,435	80,887
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE		106.00 EA	-	-	58,657	804	162,070	28,102	248,829
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE		20.00 EA	-	-	12,329	175	35,212	6,106	53,647
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE		13.00 EA	-	-	8,860	143	28,911	5,013	42,784
	35-35-00-31	SINGLE ROD SUPPORT W/ BEAM FOR 8 IN PIPE		8.00 EA	-	-	5,827	114	22,981	3,985	32,792
		PIPE SUPPORTS, HANGERS					**356,625**	**3,586**	**722,806**	**125,328**	**1,204,760**
		VALVES									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		VALVES									
	35-45-00-07	1.5 IN VALVE, CLASS 600, MANUAL, WELD END	SW	3.00 EA	-	-	3,137	9	1,876	325	5,338
	35-45-00-15	3 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	CA	2.00 EA	-	-	3,666	10	1,992	345	6,004
	35-45-00-15	3 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	ANTI-ICING	2.00 EA	-	-	3,666	10	1,992	345	6,004
	35-45-00-23	6 IN ISOLATION VALVE, CLASS 150, MANUAL, MECHANICAL JOINT	FIRE PROTECTION	6.00 EA	-	-	32,589	45	9,035	1,567	43,190
	35-45-00-25	6 IN HYDRANT, CLASS 150, MANUAL, FLANGE END	FIRE PROTECTION	6.00 EA	-	-	32,589	90	18,070	3,133	53,791
		VALVES					**75,647**	**164**	**32,965**	**5,716**	**114,328**
		STAINLESS STEEL VALVES									
	35-46-00-07	1.5 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	PW	4.00 EA	-	-	3,802	18	3,614	627	8,043
	35-46-00-09	2 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	CA	3.00 EA	-	-	3,259	17	3,336	578	7,173
	35-46-00-15	3 IN CHECK VALVE, CLASS 150, MANUAL, WELD END	DEMIN WATER	2.00 EA	-	-	7,604	14	2,919	506	11,029
	35-46-00-15	3 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	DEMIN WATER	8.00 EA	-	-	19,553	58	11,676	2,024	33,253
		STAINLESS STEEL VALVES					**34,218**	**107**	**21,545**	**3,736**	**59,498**
		MISCELLANEOUS VALVES									
	35-49-00-99	1.5 IN DIA HOSE STATIONS	SW	3.00 EA		-	48,883	34	6,950	1,205	57,038
	35-49-00-99	3 IN Y-STRAINER, CLASS 150, 304 SS, MANUAL, FLANGE END	PW	2.00 EA		-	10,320	18	3,707	643	14,669
	35-49-00-99	8 IN Y-STRAINER, CLASS 150, 304 SS, MANUAL, FLANGE END	DEMIN WATER	1.00 EA		-	20,640	17	3,475	603	24,717
		MISCELLANEOUS VALVES					**79,843**	**70**	**14,131**	**2,450**	**96,424**
		PIPING					**1,219,519**	**15,448**	**3,111,706**	**860,242**	**5,191,466**
		INSULATION									
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-99	LARGE BORE PIPING		1,999.49 LF	-	-	156,854	2,031	333,556	31,293	521,703
	36-17-03-99	SMALL BORE PIPING		1,099.72 LF	-	-	42,530	650	106,805	10,020	159,355
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**199,385**	**2,681**	**440,361**	**41,313**	**681,059**
		INSULATION					**199,385**	**2,681**	**440,361**	**41,313**	**681,059**
		ELECTRICAL EQUIPMENT									
		CABLE BUS									
	41-10-00-01	3000 A, 5KV CABLE BUS		76.98 LF	-	172,609		310	58,368	9,285	240,262
	41-10-00-01	3200 A, 480V CABLE BUS		43.99 LF	-	44,669		162	30,493	4,851	80,013
		CABLE BUS				**217,279**		**472**	**88,861**	**14,136**	**320,275**
		BUS DUCT									
	41-13-00-19	1,200 AMPS, 13.8 KV RATED	INCLUDED IN THE MAIN BUS BELOW	0.00 LF	-						
	41-13-00-19	3,500 AMPS, 13.8 KV RATED	SINGLE PHASE	162.76 LF	131,589						131,589
		BUS DUCT			**131,589**						**131,589**
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION SYSTEM (RECTIFIERS, CONDUCTOR, LINEAR ANODE SYSTEM)	2500 FT OF COATED, WRAPPED, CARBON STEEL PIPE WITH LINEAR ANODE SYSTEM OF 25 ANODES, 1-208V 3 PH 15 KVA RECTIFIER, & 10 TEST STATIONS, FURNISH AND ERECT SUBCONTRACTOR COST	1.00 LS	141,108	-					141,108
		CATHODIC PROTECTION			**141,108**						**141,108**
		COMMUNICATION SYSTEM									
	41-17-00-99	COMMUNICATIONS - PHONE LINE (CABLES INCLUDED UNDER 43.00.00)	4 PHONES FOR CTG PDCS; MV & LV PDC, GAS COMP BLDG, ADMIN/CONTROL BLDG	1.00 LS	-		4,604	152	28,591	4,548	37,743
	41-17-00-99	COMMUNICATIONS - PHONE CONNECTION ALLOWANCE	FROM MAIN DISTRIBUTION PANEL INSIDE THE ADMIN BLDG TO THE INTERFACE WITH TELECOM COMPANY	1.00 LS	103,479						103,479
	41-17-00-99	PAGE PARTY, GAI-TRONICS	ALLOWANCE ESTIMATED BASED ON RECENT EXPERIENCE	1.00 LS	-	83,517		1,770	333,556	53,062	470,134
		COMMUNICATION SYSTEM			**103,479**	**83,517**	**4,604**	**1,922**	**362,146**	**57,610**	**611,356**
		CONTROL & BACKUP POWER									
	41-21-00-09	125V DC BATTERIES, 1800 AH	INCL THE FOLLOWING: (2) 125V BATTERY CHARGER, 100A,480V PANELS & 50KVA INVERTER & UPS, AC & DC PANELS	0.66 LS	-	266,524		137	25,729	4,093	296,346
	41-21-00-19	40KVA UPS WITH BYPASS	40KVA, 3PH, 120-208V OUTPUT	0.66 LS		120,232		36	6,861	1,091	128,184
		CONTROL & BACKUP POWER				**386,756**		**173**	**32,590**	**5,184**	**424,530**
		GENERATOR NEUTRAL GROUNDING & PROTECTION									
	41-27-00-19	13.8KV, 3,500A, CT GENERATOR CIRCUIT BREAKER		1.00 EA	-	1,070,838		172	32,486	5,168	1,108,492
		GENERATOR NEUTRAL GROUNDING & PROTECTION				**1,070,838**		**172**	**32,486**	**5,168**	**1,108,492**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-30-00-16	#500 KCMIL CU INSULATED STRANDED GROUND WIRE	G	98.97 LF	-	-	2,316	6	1,200	173	3,688
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	G	3,958.99 LF	-	-	57,266	127	26,881	3,865	88,011
	41-31-00-08	#500 KCMIL CU BARE STRANDED GROUND WIRE	G	4,948.73 LF	-	-	100,678	267	56,404	8,109	165,191
	41-31-00-14	#4/0 CU INSULATED STRANDED GROUND WIRE	G	3,299.16 LF	-	-	33,224	140	29,601	4,256	67,081
	41-31-00-16	EXOTHERMIC WELD	#4/0 AWG WIRE	396.00 EA	-	-	12,085	910	192,011	27,606	231,702
	41-31-00-16	EXOTHERMIC WELD	250-500 KCMIL WIRE	495.00 EA	-	-	15,106	1,138	240,014	34,508	289,627
	41-31-00-18	COPPER CLAD GROUND ROD, 20' LONG, 3/4 " DIA.		330.00 EA	-	-	67,137	759	160,009	23,005	250,151
	41-31-00-19	CADWELD		132.00 EA	-	-	4,028	303	64,004	9,202	77,234
	41-31-00-29	CABLE TRAY GROUND CONNECTIONS		297.00 EA	-	-	10,876	256	54,003	7,764	72,643
	41-31-00-99	GROUNDING ALLOWANCE	INCLUDES GROUND GRID, CADWELDS, GROUND RODS, GROUND CABLE/STRAPS	0.66 LS	-	-	89,515	506	106,673	15,337	211,525
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING TEST	TEST & DOCUMENTATIONS	0.66 LT	-	-		137	28,802	4,141	32,943
		ELECTRICAL EQUIPMENT, GROUNDING					**392,230**	**4,550**	**959,602**	**137,965**	**1,489,797**
		HEAT TRACING									
	41-33-00-04	SMALL BORE PIPING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	1,099.72 LF	-	-	46,424	1,075	226,680	32,590	305,694
	41-33-00-08	LARGE BORE PIPING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	1,999.49 LF	-	-	102,144	2,253	475,179	68,318	645,641
	41-33-00-59	HEAT TRACE TRANSFORMER 480-208/120V 15 KVA		2.00 EA	-	-	3,255	28	5,198	827	9,280
	41-33-00-99	HEAT TRACING - ENGINEERING & FIELD SUPPORT		1.00 LS	56,443	-					56,443
		HEAT TRACING			**56,443**		**151,823**	**3,355**	**707,057**	**101,735**	**1,017,057**
		LIGHTNING PROTECTION									
	41-35-00-99	LIGHTNING PROTECTION	ALLOWANCE	1.00 LS	65,850	-					65,850
		LIGHTNING PROTECTION			**65,850**						**65,850**
		EXTERIOR LIGHTING									
	41-38-00-99	30 FT ALUMINUM ROADWAY POLE WITH ONE ARM & 200 WATT LED FIXTURE		30.00 EA		-	229,607	552	103,955	16,537	350,099
	41-38-00-99	STANCHION MOUNT FIXTURES, OUTDOOR RATED, 80W LED (AND SUPPORTS)		27.00 EA		-	52,733	93	17,542	2,791	73,066
	41-38-00-99	WALL MOUNT FIXTURES, OUTDOOR RATED, 80 W LED (AND SUPPORTS)		15.00 EA		-	34,789	52	9,746	1,550	46,085
	41-38-00-99	LIGHT FIXTURE ON POLES ALLOWANCE		1.00 LS		-	50,352	431	81,215	12,920	144,487
		EXTERIOR LIGHTING					**367,481**	**1,128**	**212,458**	**33,798**	**613,737**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	BOP PROTECTIVE RELAY PANELS - ALLOWANCE	PROTECTIVE RELAYS, METERS, ETHERNET SWITCHES	1.00 LS	-	104,857		143	27,028	4,300	136,185
	41-47-00-09	MAIN DC DISTRIBUTION BOARD AND DC SUB PANELS	125V DC, 1200A, 3 MAIN, 12 FEEDER	1.00 LS	-	154,664		36	6,757	1,075	162,496
	41-47-00-99	MAIN UPS DISTRIBUTION BOARD	3PH, 120-208V, 1-MIAN, 16-FEEDER	1.00 LS	-	69,507		19	3,604	573	73,684
	41-47-00-99	MISCELLANEOUS DISCONNECT SWITCHES		1.00 LS	-		13,711	574	108,113	17,199	139,022
		PANEL: CONTROL, DISTRIBUTION, & RELAY				**329,028**	**13,711**	**772**	**145,502**	**23,146**	**511,387**
		POWER TRANSFORMER									
	41-51-00-99	UAT TRANSFORMERS (9/12/15, 13.8-4.16KV) ONAN AT 65 DEG-C		1.00 EA	-	879,776		575	108,286	17,226	1,005,289
	41-51-00-99	4.16KV-480V STATION SERVICE TRANSFORMER, 1.5/2.2 MVA		1.00 EA	-	391,012		736	138,607	22,049	551,668
	41-51-00-99	69/15 KV, 60 MVA, GSU	INCLUDING ALLOWANCES FOR FREIGHT AND LOAD TAP CHANGER	2.00 EA		15,073,267		2,989	563,090	89,576	15,725,932
		POWER TRANSFORMER				**16,344,055**		**4,299**	**809,983**	**128,851**	**17,282,889**
		POWER DISTRIBUTION CENTER (PDC)									
	41-52-00-10	PDC FOR MV SWGR COMPLETE WITH HVAC, PANEL BOARDS, UTILITIES, LIGHTS, FIRE DECT		1.00 EA	-	1,020,144		402	78,806	21,254	1,120,205
		POWER DISTRIBUTION CENTER (PDC)				**1,020,144**		**402**	**78,806**	**21,254**	**1,120,205**
		SWITCHGEAR									
	41-55-00-09	4160V MV SWGR	3000A BUS, 50 KA, 3-3000A BKRS, 6-1200A BKRS, & 4-400A MV MCC STARTERS	1.00 EA	-	631,082		195	36,817	5,857	673,757
	41-55-00-09	480V LV SWGR	3200A BUS, 65 kV, 3-3200A BKRS, 2-1200A BKRS, 1-1600A, 6-800A BKRS	1.00 EA	-	91,461		37	6,930	1,102	99,494
	41-55-00-79	480V MCCs	6-800A MCCs & 2-1200A MCCs	6.00 EA	-	831,466		305	57,435	9,137	898,037
		SWITCHGEAR				**1,554,009**		**537**	**101,183**	**16,096**	**1,671,288**
		WIRING DEVICE									
	41-57-00-99	120V AC WEATHERPROOF RECEPTACLES, GFCI TYPE	OUTDOOR LIGHTING	24.00 EA	-	-	2,441	34	6,497	1,034	9,972
	41-57-00-99	120 VAC GFCI RECEPTACLES		52.00 EA	-	-	5,290	75	14,077	2,239	21,606

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		WIRING DEVICE									
	41-57-00-99	480VAC POWER OUTLETS (60 AMPS), OUTDOOR RATED		9.00 EA	-	-	4,761	62	11,695	1,860	18,316
		WIRING DEVICE					**12,491**	**171**	**32,269**	**5,133**	**49,894**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	600 V ELECTRICAL EQUIPMENT UPGRADE FROM 480 V	ALLOWANCE BASED ON 10% OF PROCESS EQUIPMENT, MATERIAL, AND INSTALLATION HOURS OF 480 V EQUIPMENT IN ESTIMATE	1.00 LS	-	290,016	46,982	348	65,643	10,442	413,084
		ELECTRICAL EQUIPMENT, MISCELLANEOUS				**290,016**	**46,982**	**348**	**65,643**	**10,442**	**413,084**
		ELECTRICAL EQUIPMENT			**498,469**	**21,295,642**	**989,322**	**18,301**	**3,628,586**	**560,519**	**26,972,538**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY COVER, ALUMINUM									
	42-13-02-01	12 IN WIDE INCLUDING FITTINGS		104.26 LF	-	-	1,977	1	252	3	2,232
	42-13-02-02	18 IN WIDE INCLUDING FITTINGS		44.87 LF	-	-	1,084	2	336	4	1,425
	42-13-02-05	36 IN WIDE INCLUDING FITTINGS		213.78 LF	-	-	8,281	43	9,049	111	17,442
	42-13-02-05	36 IN WIDE INCLUDING FITTINGS	VENTED TYPE	92.38 LF	-	-	3,578	19	3,910	48	7,537
		CABLE TRAY COVER, ALUMINUM					**14,921**	**64**	**13,548**	**166**	**28,635**
		CABLE TRAY, ALUMINUM									
	42-13-37-01	12 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		315.66 LF	-	-	16,691	401	84,372	1,036	102,098
	42-13-37-01	12 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		274.49 LF	-	-	14,514	379	79,674	978	95,166
	42-13-37-03	24 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		135.66 LF	-	-	9,367	273	57,392	705	67,464
	42-13-37-05	36 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		646.90 LF	-	-	53,090	1,564	329,066	4,041	386,198
	42-13-37-99	CABLE TRAY DIVIDER STRIP		68.62 LF	-	-	247	1	183	2	432
		CABLE TRAY, ALUMINUM					**93,909**	**2,618**	**550,687**	**6,762**	**651,358**
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-12	3/4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		765.00 EA	-	-	30,878	659	138,746	1,704	171,327
	42-15-23-17	1-1/2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		26.00 EA	-	-	2,825	37	7,859	97	10,781
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		13.00 EA	-	-	2,153	25	5,187	64	7,404
	42-15-23-20	3 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		7.00 EA	-	-	3,851	16	3,386	42	7,278
	42-15-23-23	5 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		3.00 EA	-	-	6,864	9	1,995	24	8,883
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**46,571**	**747**	**157,173**	**1,930**	**205,674**
		CONDUIT, PVC									
	42-15-33-19	4 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		17,182.00 LF	-	-	323,341	1,995	419,756	5,154	748,251
	42-15-33-21	5 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,323.88 LF	-	-	34,879	213	44,832	551	80,262
	42-15-33-23	6 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		135.13 LF	-	-	4,907	32	6,832	84	11,823
		CONDUIT, PVC					**363,127**	**2,241**	**471,420**	**5,789**	**840,336**
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		7,752.99 LF	-	-	86,121	1,729	363,812	4,467	454,400
	42-15-37-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		395.90 LF	-	-	6,347	109	22,887	281	29,515
	42-15-37-05	1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		237.54 LF	-	-	6,041	78	16,318	200	22,559
	42-15-37-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,111.46 LF	-	-	71,179	855	179,778	2,208	253,164
	42-15-37-08	3 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		316.72 LF	-	-	22,294	235	49,413	607	72,314
	42-15-37-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		158.36 LF	-	-	15,029	147	30,912	380	46,320
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		79.18 LF	-	-	13,757	103	21,585	265	35,606
		CONDUIT, RGS					**220,767**	**3,255**	**684,704**	**8,408**	**913,879**
		CONDUIT, MISCELLANEOUS									
	42-15-99-98	CONDUIT TRENCHING	USING ELECTRICAL TRENCHING MACHINE, INCLUDES BACKFILL	923.76 LF	-	-		159	33,517	412	33,928
		CONDUIT, MISCELLANEOUS						**159**	**33,517**	**412**	**33,928**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		RACEWAY, CABLE TRAY & CONDUIT					**739,295**	**9,084**	**1,911,048**	**23,466**	**2,673,810**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-01	600V #16 1 TRIAD CU SHIELDED XLPE LSZH		2,535.86 LF	-	-	3,044	52	11,070	1,592	15,705
	43-10-00-01	600V #16 2 TRIAD CU SHIELDED XLPE LSZH		127.74 LF	-	-	153	3	558	80	791
	43-10-00-02	600V #16 4 TRIAD CU SHIELDED XLPE LSZH		1,268.99 LF	-	-	7,539	74	15,694	2,256	25,489
	43-10-00-03	600V #16 8 TRIAD CU SHIELDED XLPE LSZH		1,268.99 LF	-	-	5,964	74	15,694	2,256	23,914
	43-10-00-09	600V #16 1 TW PR CU KX SHIELDED XLPE LSZH		8,869.45 LF	-	-	3,068	153	32,261	4,638	39,967
	43-10-00-09	600V #16 1 TW PR CU SHIELDED XLPE CPE		12,669.81 LF	-	-	4,382	218	46,084	6,626	57,092
	43-10-00-10	600V #16 2 TW PR CU KX SHIELDED XLPE LSZH		760.92 LF	-	-	1,393	20	4,244	610	6,247
	43-10-00-10	600V #16 2 TW PR CU SHIELDED XLPE CPE		2,027.79 LF	-	-	3,713	54	11,310	1,626	16,649
	43-10-00-11	600V #16 4 TW PR CU SHIELDED XLPE LSZH		1,268.99 LF	-	-	3,124	42	8,924	1,283	13,331
	43-10-00-11	600V #16 4 TW PR CU KX SHIELDED XLPE CPE		888.40 LF	-	-	2,187	30	6,247	898	9,333
	43-10-00-12	600V #16 8 TW PR CU SHIELDED XLPE LSZH		1,141.51 LF	-	-	3,600	68	14,394	2,069	20,063
	43-10-00-12	600V #16 8 TW PR CU KX SHIELDED XLPE CPE		508.07 LF	-	-	1,602	30	6,407	921	8,930
	43-10-00-13	600V #16 12 TW PR CU SHIELDED XLPE CPE		888.40 LF	-	-	2,838	56	11,849	1,704	16,391
	43-10-00-15	600V #14 2/C CU XLPE LSZH		190.03 LF	-	-	217	4	876	126	1,218
	43-10-00-16	600V #14 3/C CU XLPE LSZH		10,136.33 LF	-	-	12,785	221	46,706	6,715	66,207
	43-10-00-17	600V #14 4/C CU XLPE LSZH		5,069.09 LF	-	-	9,385	134	28,273	4,065	41,723
	43-10-00-17	600V #14 5/C CU XLPE LSZH		5,702.52 LF	-	-	10,557	151	31,806	4,573	46,936
	43-10-00-18	600V #14 7/C CU XLPE LSZH		5,069.09 LF	-	-	12,582	152	31,960	4,595	49,137
	43-10-00-18	600V #14 7/C CU XLPE LSZH		395.90 LF	-	-	983	12	2,496	359	3,838
	43-10-00-20	600V #14 12/C CU XLPE LSZH		7,602.84 LF	-	-	29,079	306	64,529	9,278	102,886
	43-10-00-23	#24 4 TW PR CU CATEGORY 5e PLENUM RATED JACKET		1,506.00 LF	-	-	1,563	26	5,478	788	7,828
	43-10-00-24	RG-62/U TYPE SHIELDED COAXIAL CABLE		127.74 LF	-	-	70	2	465	67	602
	43-10-00-31	6 FIBER 62.5 µM MULTI MODE OPTICAL FIBER ARMORED RISER RATED		888.40 LF	-	-	6,778	46	9,716	5,181	21,675
	43-10-00-31	12 FIBER 62.5 µM MULTI MODE OPTICAL FIBER ARMORED RISER RATED		1,902.43 LF	-	-	14,514	99	20,807	11,095	46,416
	43-10-00-32	24 FIBER 62.5 µM MULTI MODE OPTICAL FIBER ARMORED RISER RATED		1,647.47 LF	-	-	17,596	98	20,774	9,816	48,186
	43-10-00-80	TERMINATION - FIBER OPTIC		635.00 EA	-	-	9,689	438	92,369	13,280	115,338
	43-10-00-81	TERMINATION - RG6 COAXIAL CABLE		8.00 EA	-	-	14	2	485	70	568
	43-10-00-83	TERMINATION - ETHERNET		8.00 EA	-	-	33	3	679	98	809
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		4,244.00 EA	-	-	10,361	244	51,445	7,396	69,203
	43-10-00-84	TERMINATION - COMPRESSION LUG, #18 AND SMALLER, 1 HOLE, COPPER		964.00 EA	-	-	2,353	55	11,686	1,680	15,719
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		2,438.00 EA	-	-	8,432	280	59,107	8,498	76,036
	43-10-00-99	TEST CONTROL/INSTRUMENTATION WIRE		8,078.00 EA	-	-		464	97,921	14,078	111,999
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**189,595**	**3,614**	**762,314**	**128,317**	**1,080,225**
		600V CABLE & TERMINATION									
	43-20-00-08	600V #10 3/C CU XLPE LSZH		6,336.23 LF	-	-	26,168	197	41,485	5,964	73,618
	43-20-00-08	600V #10 3/C CU W/G XLPE LSZH		422.82 LF	-	-	1,746	13	2,768	398	4,913
	43-20-00-10	600V #10 4/C CU XLPE LSZH		2,534.02 LF	-	-	11,239	82	17,205	2,474	30,918
	43-20-00-10	600V #10 5/C CU XLPE CPE		141.73 LF	-	-	629	5	962	138	1,729
	43-20-00-10	600V #10 7/C CU XLPE CPE		211.41 LF	-	-	938	7	1,435	206	2,579
	43-20-00-10	600V #10 10/C CU XLPE CPE		283.46 LF	-	-	1,257	9	1,925	277	3,459
	43-20-00-13	600V #8 3/C CU W/G EPR TS-CPE		857.11 LF	-	-	4,534	32	6,651	956	12,141
	43-20-00-13	600V #8 4/C CU W/G EPR TS-CPE		422.82 LF	-	-	2,237	16	3,281	472	5,989
	43-20-00-13	600V #8 3/C CU W/G EPR TS-CPE		987.11 LF	-	-	5,221	36	7,660	1,101	13,983
	43-20-00-17	600V #6 3/C CU EPR TS-CPE		987.11 LF	-	-	6,627	52	11,011	1,583	19,221
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		422.82 LF	-	-	4,430	35	7,485	1,076	12,991
	43-20-00-26	600V #2 3/C W/G CU EPR TS-CPE		1,691.01 LF	-	-	22,087	122	25,834	3,714	51,635
	43-20-00-30	600V #1/0 3/C W/G CU EPR TS-CPE		3,521.12 LF	-	-	54,944	316	66,603	9,576	131,123
	43-20-00-35	600V #2/0 3/C W/G CU EPR TS-CPE		706.28 LF	-	-	16,797	80	16,785	2,413	35,995
	43-20-00-39	600V #4/0 3/C W/GND CU		3,521.12 LF	-	-	158,887	445	93,925	13,504	266,316
	43-20-00-43	600V #350 KCMIL 1/C CU EPR TS-CPE		845.64 LF	-	-	10,408	60	12,714	1,828	24,950
	43-20-00-45	600V #500 KCMIL 1/C CU		2,111.46 LF	-	-	35,052	153	32,257	4,638	71,948
	43-20-00-81	TERMINATION - COMPRESSION LUG, #10, 1 HOLE, COPPER		1,520.00 EA	-	-	6,803	437	92,127	13,245	112,175
	43-20-00-82	TERMINATION - COMPRESSION LUG, #8, 2 HOLE, COPPER		570.00 EA	-	-	7,538	197	41,457	5,960	54,955
	43-20-00-83	TERMINATION - COMPRESSION LUG, #6, 2 HOLE, COPPER		380.00 EA	-	-	6,958	175	36,851	5,298	49,107
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		664.00 EA	-	-	12,496	382	80,490	11,572	104,557
	43-20-00-85	TERMINATION - COMPRESSION LUG, #2, 2 HOLE, COPPER		476.00 EA	-	-	10,652	328	69,240	9,955	89,848
	43-20-00-86	TERMINATION - COMPRESSION LUG, #1/0, 2 HOLE, COPPER		380.00 EA	-	-	10,630	314	66,331	9,537	86,498

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		600V CABLE & TERMINATION									
	43-20-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		380.00 EA	-	-	13,916	480	101,339	14,570	129,825
	43-20-00-90	TERMINATION - COMPRESSION LUG, #250, 2 HOLE, COPPER		96.00 EA	-	-	4,101	152	32,118	4,618	40,837
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		58.00 EA	-	-	4,484	147	30,935	4,448	39,867
	43-20-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		38.00 EA	-	-	4,793	132	27,914	4,013	36,721
	43-20-00-99	TEST AND DOCUMENTATION		4,752.00 EA	-	-		819	172,810	24,845	197,656
		600V CABLE & TERMINATION					**445,571**	**5,223**	**1,101,602**	**158,380**	**1,705,554**
		5/8KV CABLE & TERMINATION									
	43-40-00-04	5/8KV #4/0 3/C CU TRIPLEXED EPR TS-CPE		844.58 LF	-	-	27,887	129	27,240	3,916	59,044
	43-40-00-10	5/8KV #500 KCMIL 1/C CU EPR TS-CPE		2,375.39 LF	-	-	41,512	232	48,963	7,040	97,514
	43-40-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		32.00 EA	-	-	1,172	61	12,801	1,840	15,813
	43-40-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		16.00 EA	-	-	1,237	61	12,801	1,840	15,878
	43-40-00-99	TEST AND DOCUMENTATION		48.00 EA	-	-		28	5,819	837	6,655
		5/8KV CABLE & TERMINATION					**71,808**	**510**	**107,623**	**15,473**	**194,904**
		CABLE					**706,974**	**9,347**	**1,971,539**	**302,170**	**2,980,683**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS)	TOTAL SYSTEM COST, BOTH HARDWARE AND PROGRAMMING	1.00 LS	1,150,655						1,150,655
	44-13-00-09	CABINET	INCLUDED ABOVE	13.00 EA				359	75,641	10,875	86,516
	44-13-00-11	TESTING, CALIBRATION AND DOCUMENTATION BASED ON I/O COUNT		824.00 EA	-	-		947	199,769	2,872	202,641
		CONTROL SYSTEM			**1,150,655**			**1,306**	**275,410**	**13,747**	**1,439,813**
		INSTRUMENT PANEL AND RACK									
	44-17-00-01	INSTRUMENT TUBING - 0.25 & 0.5 IN DIA, 0.065 IN WALL, 316SS, INCLUDES FITTINGS, VALVES, AND SUPPORTS		1,161.30 LF	-	-	102,064	200	43,429	1,897	147,390
	44-17-00-30	INSTRUMENT PEDESTAL	FOR 2 OR 3 INSTRUMENTS ON RACK VARIOUS SIZES + FLOOR MTG HDWR (ALLOWANCE)	20.00 EA	-	-	32,606	138	29,019	356	61,981
		INSTRUMENT PANEL AND RACK					**134,671**	**338**	**72,448**	**2,253**	**209,372**
		INSTRUMENT									
	44-21-00-20	DIFFERENTIAL PRESSURE TRANSMITTER	PDIT - WITH 5 VALVE MANIFOLD PER DEVICE	7.00 EA	-	-	73,364	97	20,937	914	95,216
	44-21-00-32	FLOW ELEMENT	FE - ORIFICE	5.00 EA	-	-	23,290	23	4,985	218	28,493
	44-21-00-37	FLOW INDICATING TRANSMITTER	FT/FIT - WITH INTEGRAL 5-VALVE MANIFOLD	5.00 EA	-	-	52,403	69	14,955	653	68,011
	44-21-00-47	LEVEL INDICATING TRANSMITTER	LIT (DP)	2.00 EA	-	-	20,961	9	1,994	87	23,042
	44-21-00-62	PRESSURE INDICATOR	PI - WITH MANIFOLD	4.00 EA	-	-	9,316	37	7,976	348	17,640
	44-21-00-64	PRESSURE TRANSMITTER	PT/PIT - WITH 2 VALVE MANIFOLD PER DEVICE	20.00 EA	-	-	163,032	184	39,880	1,742	204,653
	44-21-00-96	THERMOCOUPLE	TE	12.00 EA	-	-	12,577	41	8,728	1,255	22,559
	44-21-00-96	TEMPERATURE INDICATING TRANSMITTER	TIT	12.00 EA	-	-	57,406	83	17,456	2,510	77,371
	44-21-99-95	THERMOWELLS	TEW INCLUDING TESTING	12.00 EA	-	-	8,385	28	5,819	837	15,040
		INSTRUMENT					**420,734**	**570**	**122,728**	**8,563**	**552,026**
		CONTROL & INSTRUMENTATION, TESTING									
	44-98-00-09	INSTRUMENT TESTING AND CALIBRATION	FIELD MOUNTED DEVICES	76.00 EA	-	-		87	18,425	2,649	21,074
		CONTROL & INSTRUMENTATION, TESTING						**87**	**18,425**	**2,649**	**21,074**
		CONTROL & INSTRUMENTATION			**1,150,655**		**555,405**	**2,301**	**489,011**	**27,213**	**2,222,284**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	CRAFT STARTUP SUPPORT		1.00 EA	-	-		1,138	203,365	0	203,365
		CRAFT PERSONNEL						**1,138**	**203,365**	**0**	**203,365**
		CONSTRUCTION INDIRECT						**1,138**	**203,365**	**0**	**203,365**
		PROJECT INDIRECT									
		FREIGHT									
	71-27-00-25	HEAVY HAUL	SUBCONTRACT FOR MAJOR EQUIPMENT OFFLOADING & STAGING - ALLOWANCE	1.00 LS	188,144	-				-	188,144
		FREIGHT			**188,144**						**188,144**
		PROJECT INDIRECT, USER DEFINED									
	71-99-00-99	SITE GEOTECHNICAL		1.00 LS	49,670	-				-	49,670

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PROJECT INDIRECT, USER DEFINED									
	71-99-00-99	SITE TOPOGRAPHIC SURVEY		1.00 LS	80,714	-				-	80,714
	71-99-00-99	INDEPENDANT CQA EARTHWORK TESTING CONTRACTOR	GAS TURBINE/GENERATOR & ACCESSORY MODULE	1.00 LS	44,703	-				-	44,703
		PROJECT INDIRECT, USER DEFINED			**175,087**						**175,087**
		PROJECT INDIRECT			**363,231**						**363,231**
		1 BASE			**4,205,652**	**103,195,983**	**6,310,317**	**89,326**	**16,958,242**	**3,027,351**	**133,697,545**
BIO		**BIODIESEL SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	322.76 CY	-	-		72	9,703	2,399	12,102
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	9.88 CY	-	-		3	343	84	427
		EXCAVATION						**75**	**10,046**	**2,483**	**12,529**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.75 CY	-	-		1	164	40	205
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-		0	54	13	68
		DISPOSAL						**2**	**219**	**54**	**272**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	24.21 CY	-	-	1,576	5	728	180	2,484
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	5.96 CY	-	-	388	1	179	44	611
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	280.80 CY	-	-	18,281	48	6,494	1,596	26,370
	21-20-00-12	SAND BEDDING	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	16.68 CY	-	-	577	3	435	107	1,118
		BACKFILL					**20,821**	**58**	**7,835**	**1,926**	**30,583**
		POND, CONTAINMENT LINER									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	5,841	18	2,498	147	8,485
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	2,433	6			2,433
		POND, CONTAINMENT LINER					**8,274**	**24**	**2,498**	**147**	**10,919**
		CIVIL WORK					**29,095**	**159**	**20,598**	**4,610**	**54,303**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.21 CY	-	-	5,778	49	7,041	1,199	14,018
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-	1,317	11	1,605	273	3,195
		CONCRETE					**7,095**	**61**	**8,645**	**1,473**	**17,213**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	172.07 LB	-	-	1,050	10	1,685	35	2,769
		EMBEDMENT					**1,050**	**10**	**1,685**	**35**	**2,769**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	557.48 SF	-	-	2,098	128	21,145	1,968	25,211
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	212.35 SF	-	-	799	68	11,276	1,049	13,125
		FORMWORK					**2,897**	**197**	**32,422**	**3,017**	**38,336**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	3.69 TN	-	-	8,417	86	13,716	1,808	23,941
		REINFORCING					**8,417**	**86**	**13,716**	**1,808**	**23,941**
		CONCRETE					**19,460**	**353**	**56,467**	**6,333**	**82,260**
		MECHANICAL EQUIPMENT									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, 304L STAINLESS STEEL, AWWA D100	22 FT DIA. X 18 FT TALL, 50,000 GAL - BIO-DIESEL DAY TANK	1.00 EA	1,350,938		-				1,350,938
		TANK			**1,350,938**						**1,350,938**
		COMBUSTION TURBINE									
	31-85-00-99	BIODIESEL COMPATIBILITY PACKAGE	ALLOWANCE FOR OEM SUPPLY COST ADDER TO STANDARD DUAL FUEL CAPABILITY	1.00 LT		3,986,042		138	27,799	4,820	4,018,661
		COMBUSTION TURBINE				**3,986,042**		**138**	**27,799**	**4,820**	**4,018,661**
		MECHANICAL EQUIPMENT			**1,350,938**	**3,986,042**		**138**	**27,799**	**4,820**	**5,369,600**
		INSULATION									
		EQUIPMENT									
	36-15-00-99	INSULATION OF NEW BIO-DIESEL DAY TANK	ALLOWANCE FOR RE-PURPOSED EXISTING SS TANK TO BE USED AS BIO-DIESEL TANK	1,999.95 SF	172,712	-					172,712
		EQUIPMENT			**172,712**						**172,712**
		INSULATION			**172,712**						**172,712**
		ELECTRICAL EQUIPMENT									
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	TANK IMMERSION HEATER	BIO-DIESEL DAY TANK	2.00 EA	-	-	30,517	46	8,663	1,378	40,558
	41-99-00-09	TANK RTD	BIO-DIESEL DAY TANK	2.00 EA	-	-	8,451	18	3,465	551	12,467
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**38,968**	**64**	**12,128**	**1,929**	**53,025**
		ELECTRICAL EQUIPMENT					**38,968**	**64**	**12,128**	**1,929**	**53,025**
		BIO BIODIESEL SYSTEM			**1,523,650**	**3,986,042**	**87,523**	**714**	**116,993**	**17,692**	**5,731,899**
CEMS		**CONTINUOUS EMISSIONS MONITORING SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ADDITIONAL CT SKIDS/EQUIPMENT	7.50 CY	-	-		1	173	43	216
		EXCAVATION						**1**	**173**	**43**	**216**
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ADDITIONAL CT SKIDS/EQUIPMENT	1.36 CY	-	-	89	0	31	8	128
		BACKFILL					**89**	**0**	**31**	**8**	**128**
		CIVIL WORK					**89**	**2**	**205**	**50**	**344**
		CONCRETE									
		CONCRETE									
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	4.03 CY	-	-	1,352	6	824	140	2,316
	22-13-00-20	MUD MAT, 1500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	0.68 CY	-	-	131	0	56	9	197
		CONCRETE					**1,483**	**6**	**879**	**150**	**2,512**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ADDITIONAL CT SKIDS/EQUIPMENT	27.01 LB	-	-	165	2	264	5	435
		EMBEDMENT					**165**	**2**	**264**	**5**	**435**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	ADDITIONAL CT SKIDS/EQUIPMENT	41.40 SF	-	-	156	10	1,570	146	1,872
		FORMWORK					**156**	**10**	**1,570**	**146**	**1,872**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	ADDITIONAL CT SKIDS/EQUIPMENT	0.28 TN	-	-	636	6	1,036	137	1,808
		REINFORCING					**636**	**6**	**1,036**	**137**	**1,808**
		CONCRETE					**2,440**	**24**	**3,750**	**438**	**6,627**
		RACEWAY, CABLE TRAY & CONDUIT									
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		260.00 LF	-	-	2,888	58	12,201	150	15,239

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONDUIT, RGS					**2,888**	**58**	**12,201**	**150**	**15,239**
		RACEWAY, CABLE TRAY & CONDUIT					**2,888**	**58**	**12,201**	**150**	**15,239**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-18	600V #14 7/C CU XLPE LSZH		131.97 LF	-	-	328	4	832	120	1,279
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**328**	**4**	**832**	**120**	**1,279**
		600V CABLE & TERMINATION									
	43-20-00-18	600V #6 3/C W/G CU EPR TS-CPE		130.00 LF	-	-	1,024	8	1,639	236	2,898
		600V CABLE & TERMINATION					**1,024**	**8**	**1,639**	**236**	**2,898**
		CABLE					**1,351**	**12**	**2,471**	**355**	**4,178**
		CONTROL & INSTRUMENTATION									
		MONITORING EQUIPMENT									
	44-25-00-01	CONTINUOUS EMISSION MONITORING SYSTEM (CEMS)	ONE SHELTER AND ONE SET OF STACK MONITORING EQUIPMENT PER STACK	1.00 EA	-	716,776		345	72,547	891	790,213
		MONITORING EQUIPMENT				**716,776**		**345**	**72,547**	**891**	**790,213**
		CONTROL & INSTRUMENTATION				**716,776**		**345**	**72,547**	**891**	**790,213**
		CEMS CONTINUOUS EMISSIONS MONITORING SYSTEM				**716,776**	**6,767**	**440**	**91,173**	**1,884**	**816,601**
FUEL OIL		**FUEL OIL SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	45 FT DIA TANK RING FOUNDATION	642.40 CY	-	-		144	19,313	4,775	24,088
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	107.07 CY	-	-		24	3,219	796	4,015
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	76.05 CY	-	-		17	2,286	565	2,851
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	19.85 CY	-	-		5	689	169	858
	21-17-00-02	GENERAL EARTHWORK EXCAVATION		750.47 CY	-	-		129	17,355	4,265	21,620
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FUEL FORWARDING BUILDING	63.25 CY	-	-		8	1,119	275	1,394
	21-17-00-06	MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	IMPORTED FILL MATERIAL FOR 45 FT DIA TANK BERM	3,602.23 CY	-	-	161,228	269	39,983	48,840	250,051
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FIRE WATER UNDERGROUND	2,814.00 CY	-	-		210	28,201	6,929	35,130
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	POTABLE WATER	324.36 CY	-	-		24	3,251	799	4,049
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL PUMP DISCHARGE	687.55 CY	-	-		51	6,890	1,693	8,584
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL RETURN PIPING FROM TURBINES	880.07 CY	-	-		66	8,820	2,167	10,987
	21-17-00-12	TRENCH EXCAVATION 6FT TO 10FT DEEP, DENSE HARD CLAY USING 0.75 CY EXCAVATOR	DUCT BANK	1,381.51 CY	-	-		119	15,975	3,925	19,900
		EXCAVATION					**161,228**	**1,067**	**147,101**	**75,198**	**383,526**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	45 FT DIA TANK RING FOUNDATION	35.33 CY	-	-		2	327	80	407
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE WATER UNDERGROUND	689.68 CY	-	-		48	6,380	1,568	7,947
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	POTABLE WATER	47.33 CY	-	-		3	438	108	545
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL PUMP DISCHARGE	135.25 CY	-	-		9	1,251	307	1,559
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL RETURN PIPING FROM TURBINES	173.13 CY	-	-		12	1,601	393	1,995
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	17.51 CY	-	-		2	243	60	303
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	DUCT BANK	180.81 CY	-	-		12	1,673	411	2,084
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	89.06 CY	-	-		6	824	202	1,026
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	65.04 CY	-	-		4	602	148	749
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE PROTECTION SKID FOUNDATION	4.00 CY	-	-		1	74	18	92
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL FORWARDING BUILDING	39.39 CY	-	-		2	279	68	347
		DISPOSAL						**102**	**13,691**	**3,364**	**17,055**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	45 FT DIA TANK RING FOUNDATION	48.18 CY	-	-	3,137	11	1,448	358	4,943
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	18.01 CY	-	-	1,173	5	625	134	1,931
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	11.01 CY	-	-	717	3	382	82	1,180
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	11.97 CY	-	-	779	3	360	88	1,227
	21-20-00-01	FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL FORWARDING BUILDING	23.86 CY	-	-		3	422	104	526
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	45 FT DIA TANK RING FOUNDATION	558.89 CY	-	-	36,385	96	12,925	3,176	52,485
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	87.05 CY	-	-	5,667	15	2,013	495	8,175
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	62.04 CY	-	-	4,039	11	1,435	353	5,826
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FIRE WATER UNDERGROUND	1,062.16 CY	-	-		122	16,376	4,024	20,400
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	POTABLE WATER	277.03 CY	-	-		32	4,271	1,049	5,321
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL PUMP DISCHARGE	552.26 CY	-	-		63	8,515	2,092	10,607
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DEMIN WATER PUMP DISCHARGE	552.30 CY	-	-		63	8,515	2,092	10,607
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL RETURN PIPING FROM TURBINES	706.94 CY	-	-		81	10,899	2,678	13,577
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DUCT BANK	1,200.69 CY	-	-		138	18,512	4,549	23,060
	21-20-00-12	SAND BEDDING	45 FT DIA TANK RING FOUNDATION	33.19 CY	-	-	1,148	6	865	213	2,225
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FIRE WATER UNDERGROUND	317.24 CY	-	-	10,972	47	6,358	1,562	18,892
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	POTABLE WATER	46.97 CY	-	-	1,625	9	1,224	301	3,149
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL TRUCK UNLOADING	42.38 CY	-	-	1,466	8	1,104	271	2,841
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL PUMP DISCHARGE	129.57 CY	-	-	4,481	19	2,597	638	7,716
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	DEMIN WATER PUMP DISCHARGE	129.57 CY	-	-	4,481	19	2,597	638	7,716
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL RETURN PIPING FROM TURBINES	165.85 CY	-	-	5,736	25	3,324	817	9,877
		BACKFILL					**81,804**	**781**	**104,767**	**25,713**	**212,284**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-60	SILT FENCE		1,999.49 LF	-	-	5,207	161	21,928	1,287	28,422
		EROSION AND SEDIMENTATION CONTROL					**5,207**	**161**	**21,928**	**1,287**	**28,422**
		POND, CONTAINMENT LINER									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	900.01 SY	-	-	26,367	83	11,277	662	38,306
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	900.01 SY	-	-	10,986	26			10,986
		POND, CONTAINMENT LINER					**37,352**	**109**	**11,277**	**662**	**49,291**
		ROAD, PARKING AREA, & SURFACED AREA									
	21-57-00-01	ASPHALT ROAD	INCLUDING 1.5" ASPHALT SURFACE COURSE, 2.5" BASE COURSE, AND 12" THICK AGGREGATE BASE	1,750.36 SY	246,982	-				11	246,992
	21-57-00-30	PROTECTIVE SAND COVER	4" THICK FOR 58,200 S.F.	755.42 CY	-	-	26,126	868	124,912	59,323	210,362
	21-57-00-40	SUBGRADE PREPARATION	12" THICK FOR 58,200 S.F.	2,262.07 CY	-	-		506	72,801	34,574	107,375
	21-57-00-72	AGGREGATE SURFACING	6" THICK FOR 61,300 S.F.	1,192.49 CY	-	-	76,421	213	30,665	14,563	121,649
	21-57-00-80	GEOTEXTILE FABRIC	58,200 S.F.	6,790.40 SY	-	-	22,650	78	10,636	624	33,910
		ROAD, PARKING AREA, & SURFACED AREA			**246,982**		**125,197**	**1,665**	**239,015**	**109,095**	**720,289**
		SURVEY									
	21-67-00-29	SITE SURVEY		1.00 LS	94,072	-				-	94,072
		SURVEY			**94,072**						**94,072**
		CIVIL WORK			**341,054**		**410,788**	**3,884**	**537,778**	**215,318**	**1,504,939**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	45 FT DIA TANK RING FOUNDATION	34.26 CY	-	-	11,501	98	14,014	2,387	27,903
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	7.88 CY	-	-	2,645	23	3,223	549	6,417
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FUEL FORWARDING BUILDING	56.67 CY	-	-	19,022	62	8,866	1,510	29,398
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	11.74 CY	-	-	3,941	34	4,802	818	9,560
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	3.00 CY	-	-	1,008	9	1,228	137	2,372
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	5.00 CY	-	-	1,679	14	2,046	228	3,954
	22-13-00-20	FLOWABLE FILL, 1500 PSI	DUCT BANK	180.81 CY	-	-	34,946	104	14,791	2,520	52,257
		CONCRETE					**74,742**	**344**	**48,970**	**8,149**	**131,861**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	OILY WATER SEPARATOR	200.04 LB	-	-	1,221	11	1,958	40	3,220

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	45 FT DIA TANK RING FOUNDATION	342.47 LB	-	-	2,090	20	3,353	69	5,512
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	117.36 LB	-	-	716	13	2,298	47	3,061
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	30.01 LB	-	-	183	3	588	13	784
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	50.01 LB	-	-	305	6	979	22	1,307
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FUEL FORWARDING BUILDING	566.67 LB	-	-	3,459	15	2,516	52	6,027
		EMBEDMENT					**7,974**	**69**	**11,692**	**243**	**19,910**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	45 FT DIA TANK RING FOUNDATION	1,109.56 SF	-	-	4,176	255	42,086	3,917	50,179
	22-17-00-10	BUILT UP INSTALL & STRIP	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	144.00 SF	-	-	542	66	10,924	1,017	12,483
	22-17-00-10	BUILT UP INSTALL & STRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	147.99 SF	-	-	557	44	7,297	5,624	13,478
	22-17-00-10	BUILT UP INSTALL & STRIP	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	128.00 SF	-	-	482	38	6,311	4,864	11,657
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	426.59 SF	-	-	1,606	137	22,653	2,108	26,367
	22-17-00-10	BUILT UP INSTALL & STRIP	DUCT BANK	3,411.92 SF	-	-	12,842	784	129,415	12,044	154,301
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	FUEL FORWARDING BUILDING	248.00 SF	-	-	933	7	1,223	114	2,271
		FORMWORK					**21,137**	**1,333**	**219,910**	**29,687**	**270,735**
		PRECAST									
	22-23-00-41	ELECTRICAL PRECAST MANHOLE, 4 FT BY 4 FT BY 6 FT		4.00 EA	-	-	31,274	129	17,278	4,246	52,798
		PRECAST					**31,274**	**129**	**17,278**	**4,246**	**52,798**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	45 FT DIA TANK RING FOUNDATION	7.35 TN	-	-	16,754	170	27,302	3,599	47,655
	22-25-00-10	UNCOATED A615 GR60	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	0.21 TN	-	-	469	10	1,530	99	2,098
	22-25-00-10	UNCOATED A615 GR60	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	0.34 TN	-	-	772	16	2,517	163	3,453
	22-25-00-10	UNCOATED A615 GR60	DUCT BANK	8.03 TN	-	-	18,301	186	29,823	3,931	52,056
	22-25-00-10	UNCOATED A615 GR60	FUEL FORWARDING BUILDING	4.25 TN	-	-	9,684	89	14,313	1,887	25,883
		REINFORCING					**45,982**	**471**	**75,485**	**9,680**	**131,146**
		CONCRETE					**181,109**	**2,345**	**373,335**	**52,005**	**606,449**
		STEEL									
		ROLLED SHAPE									
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	0.36 TN	-	-	3,220	10	1,981	534	5,736
	23-25-00-10	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, TWO COAT PAINTED	ALLOWANCE FOR MISC. COMPONENT SUPPORTS	7.14 TN	-	-	50,565	156	30,616	8,257	89,438
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	3.21 TN	-	-	24,127	70	13,777	3,716	41,620
	23-25-00-99	FABRICATED STEEL INTERNAL TANK IMMERSION HEATER SUPPORTS		9.84 EA	-	-	14,886	339	66,467	17,926	99,279
		ROLLED SHAPE					**92,798**	**576**	**112,842**	**30,434**	**236,073**
		STEEL					**92,798**	**576**	**112,842**	**30,434**	**236,073**
		ARCHITECTURAL									
		PRE-ENGINEERED BUILDING									
	24-35-00-01	SHELL INCLUDING ELECTRICAL & HVAC-STEEL 22 GA 45 FT W X 17 FT L X 18 FT H	FUEL FORWARDING BUILDING	765.00 SF	359,825	-					359,825
		PRE-ENGINEERED BUILDING			**359,825**						**359,825**
		ARCHITECTURAL			**359,825**						**359,825**
		PAINTING & COATING									
		COATING									
	27-13-00-99	COATING - MISC STEEL		1.00 LS	47,036	-					47,036
		COATING			**47,036**						**47,036**
		PAINTING									
	27-17-00-18	PIPE PAINTING, 4 IN DIA	FIRE WATER ABOVE GROUND	399.90 LF	-	-	2,620	61	10,866	2,363	15,849
	27-17-00-21	PIPE PAINTING, 10 IN DIA	FIRE WATER ABOVE GROUND	149.96 LF	-	-	2,343	60	10,685	2,334	15,362
		PAINTING					**4,963**	**121**	**21,551**	**4,697**	**31,210**
		PAINTING & COATING			**47,036**		**4,963**	**121**	**21,551**	**4,697**	**78,246**
		MECHANICAL EQUIPMENT									
		FIRE PROTECTION EQUIPMENT & SYSTEM									
	31-41-00-99	FIRE PROTECTION (DETECTION) SYSTEM ALLOWANCE, INCLUDES ABOVEGROUND BUILDING AND TANK FOAM SUPPRESION SYSTEMS	NOT INCLUDED - USE EXISTING	0.00 LS		-	-				

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PUMP									
	31-75-00-99	PUMP AND FILTER - FUEL OIL KIDNEY FILTER SKID	200 GPM PUMP AND FILTRATION	2.00 EA	-	2,131,963	-	92	16,434	2,061	2,150,458
	31-75-00-99	PUMP - FUEL OIL TRUCK UNLOADING SKID (PUMPS, STRAINER, ETC.)	SKID:2 X100%, 100 GPM, 120 FT, 5 HP, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	762,473	-	55	9,860	1,237	773,570
	31-75-00-99	FUEL OIL FORWARDING PUMP SKID	SKID:2 X 100%, 80GPM, 150 FT, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	108,572	-	55	9,860	1,237	119,669
		PUMP				**3,003,008**		**202**	**36,154**	**4,535**	**3,043,697**
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	45 FT DIA. X 44 FT TALL, 528,000 GAL L.S. DIESEL STORAGE TANK	1.00 EA	1,659,849		-				1,659,849
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	L.S. DIESEL DAY TANK - NOT INCLUDED - RE-USE/SHARE EXISTING L.S. DIESEL DAY TANK	0.00 EA			-				
	31-83-00-99	TANK COATING	45 FT DIA. X 44 FT TALL, 528,000 GAL L.S. DIESEL STORAGE TANK - INCLUDES ALLOWANCE FOR ADDITIONAL INTERNAL TANK BOTTOM COATING	7,811.44 SF	347,127		-				347,127
	31-83-00-99	TANK COATING	L.S. DIESEL DAY TANK - NOT INCLUDED - RE-USE/SHARE EXISTING L.S. DIESEL DAY TANK	0.00 m2			-				
	31-83-00-99	TANK - DEMIN STORAGE TANK, 304L STAINLESS STEEL, AWWA D100	NOT INCLUDED - USE EXISTING	0.00 EA	0	0	-		0	0	0
		TANK			**2,006,976**						**2,006,976**
		MECHANICAL EQUIPMENT			**2,006,976**	**3,003,008**		**202**	**36,154**	**4,535**	**5,050,673**
		PIPING									
		SS 316, ABOVE GROUND, PROCESS AREA									
	35-13-02-18	2 IN DIA, SCH 40S	FALSE START DRAIN	199.95 LF	-	-	37,261	324	65,328	37,944	140,534
	35-13-02-18	2 IN DIA, SCH 40S	MISC. VENTS AND DRAINS	199.95 LF	-	-	37,261	324	65,328	37,944	140,534
	35-13-02-26	4 IN DIA, SCH 40S	FUEL OIL TRUCK UNLOADING	187.45 LF	-	-	38,632	392	79,054	13,707	131,394
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP DISCHARGE	249.94 LF	-	-	82,374	580	116,989	20,285	219,648
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP SUCTION	149.96 LF	-	-	49,424	348	70,194	12,171	131,789
		SS 316, ABOVE GROUND, PROCESS AREA					**244,953**	**1,969**	**396,894**	**122,052**	**763,899**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-40	10 IN DIA, SCH 40	FIRE WATER ABOVE GROUND	74.98 LF	-	-	21,356	207	41,699	7,230	70,286
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**21,356**	**207**	**41,699**	**7,230**	**70,286**
		SS 316, BURIED									
	35-15-02-26	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL TRUCK UNLOADING	249.94 LF	-	-	40,577	423	85,251	14,782	140,610
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL PUMP DISCHARGE	999.74 LF	-	-	268,884	2,244	452,203	78,408	799,495
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL RETURN PIPING FROM TURBINES	1,199.69 LF	-	-	322,661	2,692	542,643	94,090	959,394
		SS 316, BURIED					**632,122**	**5,359**	**1,080,097**	**187,280**	**1,899,499**
		HDPE, BURIED									
	35-15-30-25	8 IN DIA, DR 9	FIRE WATER UNDERGROUND	149.96 LF	-	-	8,604	143	28,842	5,001	42,446
	35-15-30-29	10 IN DIA, DR 9	FIRE WATER UNDERGROUND	999.74 LF	-	-	82,577	1,126	227,028	39,365	348,970
		HDPE, BURIED					**91,181**	**1,270**	**255,870**	**44,366**	**391,416**
		PIPE SUPPORTS, HANGERS									
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 2 IN DIA PIPE		29.00 EA	-	-	10,325	67	13,436	2,330	26,091
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE		9.00 EA	-	-	4,266	41	8,340	1,446	14,052
	35-35-00-06	SINGLE ROD SUPPORT W/O BEAM FOR 6 IN PIPE		17.00 EA	-	-	9,165	117	23,629	4,097	36,892
	35-35-00-08	SINGLE ROD SUPPORT W/O BEAM FOR 10 IN PIPE		2.00 EA	-	-	1,526	18	3,707	643	5,875
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 2 IN PIPE		29.00 EA	-	-	11,505	117	23,514	4,077	39,095
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE		9.00 EA	-	-	5,548	79	15,846	2,747	24,141
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE		17.00 EA	-	-	11,586	188	37,807	6,555	55,949
	35-35-00-32	SINGLE ROD SUPPORT W/ BEAM FOR 10 IN PIPE		2.00 EA	-	-	1,855	31	6,209	1,076	9,140
		PIPE SUPPORTS, HANGERS					**55,776**	**657**	**132,487**	**22,972**	**211,235**
		VALVES									
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	2.00 EA	-	-	5,029	19	3,799	659	9,487
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	5,029	19	3,799	659	9,487
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	1.00 EA	-	-	3,028	8	1,622	281	4,931
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	6,056	16	3,243	562	9,862
	35-45-00-05	6 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	7,125	42	8,386	1,454	16,965
	35-45-00-06	1 IN RELIEF VALVE		6.00 EA	-	-	4,652	18	3,614	627	8,892
	35-45-00-29	8 IN VALVE, CLASS 125 DI POST INDICATOR GATE VALVE	FIRE PROTECTION	9.00 EA	-	-	75,437	103	20,850	3,615	99,902
	35-45-00-29	8 IN BUTTERFLY VALVE, FUSIBLE LINK LUGGED ENDS		2.00 EA	-	-	40,568	24	4,865	844	46,277

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		VALVES					**146,924**	**249**	**50,178**	**8,700**	**205,802**
		STAINLESS STEEL VALVES									
	35-46-00-10	2 IN BALL VALVE, CLASS 600, WELD END		15.00 EA	-	-	12,573	93	18,765	3,254	34,591
	35-46-00-10	2 IN CHECK VALVE, CLASS 600, WELD END		3.00 EA	-	-	3,300	19	3,753	651	7,704
	35-46-00-19	4 IN CHECK VALVE, CLASS 150, WELD END		2.00 EA	-	-	7,544	19	3,799	659	12,002
	35-46-00-20	4 IN GATE VALVE, CLASS 150, WELD END		7.00 EA	-	-	25,963	66	13,297	2,306	41,566
	35-46-00-24	6 IN CHECK VALVE, CLASS 900, WELD END		2.00 EA	-	-	40,485	51	10,340	1,793	52,617
	35-46-00-24	6 IN GATE VALVE, CLASS 150, WELD END		9.00 EA	-	-	59,784	118	23,768	4,121	87,674
	35-46-00-24	6 IN GATE VALVE, CLASS 900, WELD END		7.00 EA	-	-	139,496	180	36,189	6,275	181,960
	35-46-00-24	6 IN GATE VALVE, CLASS 150, MOTOR OPERATED, WELD END		4.00 EA	-	-	88,010	65	13,158	2,282	103,450
		STAINLESS STEEL VALVES					**377,154**	**611**	**123,070**	**21,339**	**521,563**
		MISCELLANEOUS									
	35-99-00-99	6 IN FIRE HYDRANT CAST IRON, CLASS 125	FUEL OIL TANK AREA	2.00 EA	-	-	20,271	14	2,780	482	23,533
	35-99-00-99	PIPING, 10 IN HDPE PIPE TIE-IN TO EXISTING 10 IN HDPE	TIE-IN TO EXISTING PIPING, INCLUDING EXCAVATION AND BACKFILL	1.00 EA		-	838	57	11,583	2,008	14,430
		MISCELLANEOUS					**21,109**	**71**	**14,363**	**2,490**	**37,963**
		PIPING					**1,590,576**	**10,393**	**2,094,658**	**416,429**	**4,101,663**
		INSULATION									
		EQUIPMENT									
	36-15-00-99	INSULATION OF EXISTING L.S. DIESEL DAY TANK	ASSUMED EXISTING - NEW UNIT TO SHARE EXISTING L.S. DIESEL DAY TANK WITH EXISTING UNIT	0.00 m2		-					
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-20	1 IN THICK, 2 IN PIPE		399.90 LF	-	-	7,566	124	20,314	1,906	29,786
	36-17-03-35	1 IN THICK, 4 IN PIPE		887.27 LF	-	-	23,827	351	57,638	5,407	86,873
	36-17-03-41	1.5 IN THICK, 6 IN PIPE		224.94 LF	-	-	9,290	111	18,181	1,706	29,176
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**40,683**	**585**	**96,133**	**9,019**	**145,835**
		INSULATION					**40,683**	**585**	**96,133**	**9,019**	**145,835**
		ELECTRICAL EQUIPMENT									
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION		1.00 EA	94,072	-					94,072
		CATHODIC PROTECTION			**94,072**						**94,072**
		CONTROL & BACKUP POWER									
	41-21-00-99	125V DC, 200A BATTERY CHARGER	ELECTRICAL ROOM	2.00 EA	-	-	122,066	37	6,930	1,102	130,099
	41-21-00-99	UPS 40 KVA INVERTER	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	101,722	23	4,331	689	106,743
	41-21-00-99	125V DC BATTERIES, 400 AH WITH BATTERY RACK	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	203,444	41	7,797	1,240	212,481
	41-21-00-99	120VAC, 225A UPS PANEL, 42 CIRCUITS	ELECTRICAL ROOM - DISTRIBUTE UPS POWER	1.00 EA	-	-	5,493	18	3,465	551	9,509
	41-21-00-99	UPS BYPASS TRANSFORMER, 480-120VAC, 30 KVA	ELECTRICAL ROOM - ALTERNATE AC FEED FOR MAINTENANCE	2.00 EA	-	-	31,432	37	6,930	1,102	39,465
	41-21-00-99	125VDC, 200A DISTRIBUTION PANEL	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	76,902	18	3,465	551	80,918
	41-21-00-99	UPS REMOTE BYPASS SWITCH	ELECTRICAL ROOM - FOR UPS BYPASS TRANSFORMER	2.00 EA	-	-	21,972	18	3,465	551	25,988
		CONTROL & BACKUP POWER					**563,032**	**193**	**36,384**	**5,788**	**605,204**
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-30-00-16	#500 KCMIL CU BARE STRANDED GROUND WIRE	UNDERGROUND GRID INCLUDING TO BURIED GRID	1,499.62 LF	-	-	35,085	190	40,007	5,752	80,844
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	PIGTAILS FROM UG GRID TO BLDG STEEL AND EQUIPMENT (20 CABLES)	199.95 LF	-	-	2,892	24	4,979	716	8,587
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE		799.80 LF	-	-	11,569	26	5,430	781	17,780
	41-31-00-16	EXOTHERMIC WELD	#4/0 AWG WIRE, 20 CABLES, 2 WELDS PER CABLE	40.00 EA	-	-	1,221	92	19,395	2,788	23,404
	41-31-00-16	EXOTHERMIC WELD		8.00 EA	-	-	244	18	3,879	558	4,681
	41-31-00-18	COPPER CLAD GROUND ROD, 20' LONG, 3/4 " DIA.		15.00 EA	-	-	3,052	34	7,273	1,046	11,371
	41-31-00-18	COPPER CLAD GROUND ROD, 15' LONG, 3/4 " DIA.		4.00 EA	-	-	814	9	1,939	279	3,032
	41-31-00-69	STRAP, LUG		8.00 EA	-	-	293	10	2,133	307	2,733
	41-31-00-99	TEST AND DOCUMENTATION		48.00 EA	-	-		8	1,746	0	1,746
		ELECTRICAL EQUIPMENT, GROUNDING					**55,170**	**411**	**86,781**	**12,226**	**154,177**
		HEAT TRACING									
	41-33-00-05	2 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	399.90 LF	-	-	17,532	409	86,308	12,409	116,249
	41-33-00-08	4 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	887.27 LF	-	-	45,326	1,000	210,861	30,316	286,503
	41-33-00-09	6 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR,	224.94 LF	-	-	15,980	292	61,640	8,862	86,483

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		HEAT TRACING									
	41-33-00-30	HEAT TRACING PANEL	STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	6.00 EA	-	-	61,033	166	31,186	4,961	97,181
	41-33-00-59	HEAT TRACE TRANSFORMER 480-208/120V 15 KVA		1.00 EA	-	-	1,628	14	2,599	413	4,640
	41-33-00-99	HEAT TRACING - ENGINEERING & FIELD SUPPORT		1.00 LS	37,629	-					37,629
		HEAT TRACING			**37,629**		**141,500**	**1,880**	**392,594**	**56,962**	**628,685**
		LIGHTNING PROTECTION									
	41-35-00-99	LIGHTNING PROTECTION		1.00 LS	94,072	-					94,072
		LIGHTNING PROTECTION			**94,072**						**94,072**
		EXTERIOR LIGHTING									
	41-38-00-99	LIGHTING - FIXTURES, ACCESSORY	OUTDOOR BUILDING AND AREA LIGHTING	1.00 LS	94,072	-					94,072
		EXTERIOR LIGHTING			**94,072**						**94,072**
		MOTOR CONTROL CENTER (MCC), COMPLETE									
	41-45-00-09	480V, 1200A MOTOR CONTROL CENTER, 6 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER TO BOP LOADS	2.00 EA	-	225,496		184	38,692	475	264,663
		MOTOR CONTROL CENTER (MCC), COMPLETE				**225,496**		**184**	**38,692**	**475**	**264,663**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	OUTDOOR-RATED NEMA 4 480VAC PANEL, 3-PH, 60HZ 800A COPPER BUS, FULLY RATED, 800A MAIN BRKR, W/ 2 - 350A FEEDER BRKR AND 2 - 50A FEEDER BRKRS		1.00 EA	-	-	54,952	32	6,064	965	61,981
	41-47-00-39	TANK HEATER CONTACTOR		1.00 EA	-	-	46,904	17	3,249	517	50,669
		PANEL: CONTROL, DISTRIBUTION, & RELAY					**101,856**	**49**	**9,313**	**1,481**	**112,650**
		POWER TRANSFORMER									
	41-51-00-19	25KVA, 3-PHASE, 480-120/240V DRY TYPE TRANSFORMER	ELECTRICAL ROOM - BUILDING POWER AND LIGHTING	2.00 EA	-		25,146	74	13,808	450	39,404
	41-51-00-99	1200/1650 KVA DRY TYPE TRANSFORMER, 4160/480V, PAD MOUNTED		1.00 EA	-	187,099		218	41,149	6,546	234,794
		POWER TRANSFORMER				**187,099**	**25,146**	**292**	**54,957**	**6,996**	**274,197**
		SWITCHGEAR									
	41-55-00-99	480V, 3200A SWITCHGEAR 2 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO LV MOTOR AND MCC's	1.00 EA	-	409,993		414	77,966	12,403	500,362
	41-55-00-99	4160V, 2000A SWITCHGEAR 3 VERTICAL SECTIONS MAIN-TIE-MAIN	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO MV MOTOR LOADS AND TRANSFORMERS	1.00 EA	-	461,242		437	82,298	13,092	556,632
		SWITCHGEAR				**871,235**		**851**	**160,264**	**25,495**	**1,056,993**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	IN-LINE DIESEL HEATER		2.00 EA	-	-	288,026	92	17,326	2,756	308,108
	41-99-00-09	DIESEL RTD		2.00 EA	-	-	8,451	18	3,465	551	12,467
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**296,477**	**110**	**20,791**	**3,307**	**320,576**
		ELECTRICAL EQUIPMENT			**319,845**	**1,283,830**	**1,183,180**	**3,971**	**799,776**	**112,730**	**3,699,361**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY, ALUMINUM									
	42-13-37-01	12 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		262.43 LF	-	-	13,876	333	70,144	861	84,881
	42-13-37-03	24 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		174.96 LF	-	-	12,080	352	74,016	909	87,005
	42-13-37-05	36 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		612.34 LF	-	-	50,255	1,481	311,489	3,825	365,568
		CABLE TRAY, ALUMINUM					**76,211**	**2,166**	**455,649**	**5,595**	**537,455**
		CONDUIT, ALUMINUM									
	42-15-13-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,749.55 LF	-	-	21,321	432	90,986	1,117	113,424
	42-15-13-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,624.33 LF	-	-	77,416	956	201,227	2,471	281,114
	42-15-13-08	3 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,624.33 LF	-	-	140,684	1,753	368,810	4,529	514,023
	42-15-13-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		874.78 LF	-	-	73,234	730	153,618	1,886	228,738
	42-15-13-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		874.78 LF	-	-	116,124	1,016	213,711	2,624	332,459
		CONDUIT, ALUMINUM					**428,778**	**4,888**	**1,028,352**	**12,627**	**1,469,758**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-14	1 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		53.00 EA	-	-	3,010	61	12,817	157	15,984
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		35.00 EA	-	-	5,797	66	13,965	171	19,934
	42-15-23-20	3 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		18.00 EA	-	-	9,903	41	8,706	107	18,716
	42-15-23-22	4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		9.00 EA	-	-	7,300	26	5,441	67	12,808
	42-15-23-23	5 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		9.00 EA	-	-	20,590	28	5,985	73	26,649
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**46,601**	**223**	**46,914**	**576**	**94,091**
		CONDUIT, PVC									
	42-15-33-15	3 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	1,199.69 LF	-	-	17,427	112	23,505	289	41,221
	42-15-33-21	5 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	2,399.39 LF	-	-	63,214	386	81,253	998	145,465
		CONDUIT, PVC					**80,641**	**498**	**104,758**	**1,286**	**186,685**
		CONDUIT, RGS									
	42-15-37-05	1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,199.69 LF	-	-	30,509	392	82,413	1,012	113,934
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		499.87 LF	-	-	86,848	648	136,267	1,673	224,789
		CONDUIT, RGS					**117,357**	**1,039**	**218,681**	**2,685**	**338,723**
		DUCT BANK/TRENWA									
	42-18-00-01	SPACERS	DUCT BANK	684.00 EA	-	-	4,230	94	19,849	244	24,323
		DUCT BANK/TRENWA					**4,230**	**94**	**19,849**	**244**	**24,323**
		RACEWAY, CABLE TRAY & CONDUIT					**753,819**	**8,908**	**1,874,202**	**23,014**	**2,651,034**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-10	600V #16 2 TW PR CU SHIELDED XLPE LSZH		1,749.55 LF	-	-	3,203	46	9,758	1,403	14,365
	43-10-00-11	600V #16 4 TW PR CU SHIELDED XLPE LSZH		2,624.33 LF	-	-	6,460	87	18,455	2,653	27,568
	43-10-00-11	600V #16 8 TW PR CU SHIELDED XLPE LSZH		1,749.55 LF	-	-	4,307	101	21,213	3,050	28,570
	43-10-00-15	600V #14 2/C CU XLPE LSZH		1,749.55 LF	-	-	1,993	38	8,062	1,159	11,214
	43-10-00-17	600V #14 5/C CU XLPE LSZH		2,624.33 LF	-	-	4,859	69	14,637	2,104	21,600
	43-10-00-18	600V #14 7/C CU XLPE LSZH		599.85 LF	-	-	1,489	18	3,782	544	5,815
	43-10-00-18	600V #14 7/C CU XLPE LSZH		199.95 LF	-	-	496	6	1,261	181	1,938
	43-10-00-20	600V #14 12/C CU XLPE LSZH		1,749.55 LF	-	-	6,692	70	14,849	2,135	23,676
	43-10-00-21	600V #14 19/C CU XLPE LSZH		1,749.55 LF	-	-	9,005	105	22,061	3,172	34,238
	43-10-00-22	ETHERNET CAT 6A CABLE 300V		699.82 LF	-	-	925	105	22,062	3,172	26,159
	43-10-00-27	2 FIBER PATCH CORDS		4.00 EA	-	-	2,116	5	970	139	3,225
	43-10-00-27	24 FIBERSINGLE MODE OPTICAL FIBER PATCH PANEL		42.00 EA	-	-	1,964	5	1,018	146	3,129
	43-10-00-29	24 FIBER SINGLE MODE OPTICAL FIBER ARMORED RISER RATED		1,224.69 LF	-	-	12,757	58	12,176	1,751	26,683
	43-10-00-80	TERMINATION - FIBER OPTIC		252.00 EA	-	-	3,845	174	36,657	5,270	45,772
	43-10-00-83	TERMINATION - ETHERNET		7.00 EA	-	-	28	3	594	85	708
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		820.00 EA	-	-	2,002	47	9,940	1,429	13,371
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		1,330.00 EA	-	-	4,600	153	32,244	4,636	41,480
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		28.00 EA	-	-	97	3	679	98	873
	43-10-00-99	TEST AND DOCUMENTATION		2,428.00 EA	-	-		140	29,432	4,232	33,664
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**66,839**	**1,232**	**259,850**	**37,360**	**364,049**
		600V CABLE & TERMINATION									
	43-20-00-08	600V #10 3/C CU XLPE LSZH		3,499.10 LF	-	-	14,451	113	23,758	3,416	41,625
	43-20-00-21	600V #4 3/C CU EPR TS-CPE		1,749.55 LF	-	-	14,593	109	22,911	3,294	40,798
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		199.95 LF	-	-	2,095	17	3,540	509	6,143
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		599.85 LF	-	-	6,285	50	10,619	1,527	18,430
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		10.00 LF	-	-	149	2	339	49	537
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		10.00 LF	-	-	149	2	339	49	537
	43-20-00-38	600V #4/0 3/C CU		874.78 LF	-	-	26,624	98	20,577	2,958	50,159
	43-20-00-45	600V #500 KCMIL 1/C CU		599.85 LF	-	-	9,958	43	9,164	1,318	20,440
	43-20-00-45	600V #500 KCMIL 1/C CU		299.92 LF	-	-	4,979	22	4,582	659	10,220
	43-20-00-46	600V #500 KCMIL 3-1/C CU TRIPLEXED EPR TS-CPE		1,749.55 LF	-	-	97,099	227	47,942	6,893	151,934
	43-20-00-47	600V #750 KCMIL 1/C CU		7,198.16 LF	-	-	577,422	687	144,881	20,830	743,133
	43-20-00-81	TERMINATION - COMPRESSION LUG, #10, 1 HOLE, COPPER		106.00 EA	-	-	474	30	6,425	924	7,823

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		600V CABLE & TERMINATION									
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		54.00 EA	-	-	1,016	31	6,546	941	8,503
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		16.00 EA	-	-	301	9	1,940	279	2,519
	43-20-00-85	TERMINATION - COMPRESSION LUG, #2, 2 HOLE, COPPER		20.00 EA	-	-	448	14	2,909	418	3,775
	43-20-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		22.00 EA	-	-	806	28	5,867	844	7,516
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		54.00 EA	-	-	4,175	137	28,802	4,141	37,117
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		24.00 EA	-	-	1,855	61	12,801	1,840	16,497
	43-20-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		18.00 EA	-	-	2,270	63	13,223	1,901	17,394
	43-20-00-99	TEST AND DOCUMENTATION		286.00 EA	-	-		49	10,401	1,495	11,896
		600V CABLE & TERMINATION					**765,150**	**1,790**	**377,564**	**54,283**	**1,196,997**
		5/8KV CABLE & TERMINATION									
	43-40-00-11	5/8KV #500 KCMIL 3-1/C CU TRIPLEXED		559.86 LF	-	-	36,083	99	20,908	3,006	59,997
	43-40-00-12	5/8KV #750 KCMIL 1/C CU		11,756.99 LF	-	-	303,052	1,311	276,553	39,761	619,367
	43-40-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		18.00 EA	-	-	1,392	68	14,401	2,070	17,863
	43-40-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		34.00 EA	-	-	4,289	178	37,464	5,386	47,139
	43-40-00-99	TEST AND DOCUMENTATION		50.00 EA	-	-		29	6,061	871	6,932
		5/8KV CABLE & TERMINATION					**344,816**	**1,685**	**355,387**	**51,095**	**751,298**
		CABLE					**1,176,804**	**4,707**	**992,801**	**142,738**	**2,312,344**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH CONTROLLERS	ELECTRICAL ROOM - DSC MAIN CONTROLLER	1.00 EA		60,360		28	5,982	261	66,603
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH I/O CARDS	ELECTRICAL ROOM - DSC I/O MODULES, ASSUME 250 I/O POINTS PER CABINET,PROGRAMMING INCLUDED WITHIN MANHOURS	2.00 EA		804,801		552	119,639	5,225	929,665
	44-13-00-09	INTERMEDIATE TERMINATION CABINET	ELECTRICAL ROOM - MARSHALLING CABINETS TO WIRE DSC MODULES AND FIELD CABLES	4.00 EA		120,720		74	15,477	190	136,387
		CONTROL SYSTEM				**985,881**		**653**	**141,097**	**5,676**	**1,132,655**
		FLOW DEVICES									
	44-21-20-27	FLOW METER, DIFFERENTIAL PRESSURE ORIFICE FLOW TYPE, WITH 3 VALVE MANIFOLD, DIRECT MOUNT		1.00 EA	-	-	11,300	13	2,916	127	14,344
		FLOW DEVICES					**11,300**	**13**	**2,916**	**127**	**14,344**
		LEVEL DEVICES									
	44-21-30-06	LEVEL TRANSMITTER, GUIDED WAVE RADAR LIQUID LEVEL TYPE, FLANGE MOUNT		2.00 EA	-	-	19,754	46	9,970	435	30,159
	44-21-30-13	LEVEL GUAGE		2.00 EA	-	-	3,450	34	7,477	327	11,254
		LEVEL DEVICES					**23,204**	**80**	**17,447**	**762**	**41,413**
		PRESSURE DEVICES									
	44-21-40-10	PRESSURE TRANSMITTER, GAUGE TYPE, WITH 2 VALVE MANIFOLD		4.00 EA	-	-	37,566	51	10,967	479	49,012
		PRESSURE DEVICES					**37,566**	**51**	**10,967**	**479**	**49,012**
		CONTROL & INSTRUMENTATION				**985,881**	**72,070**	**797**	**172,428**	**7,045**	**1,237,424**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	CRAFT STARTUP SUPPORT		1.00 EA	-	-		1,724	308,129	0	308,129
		CRAFT PERSONNEL						**1,724**	**308,129**	**0**	**308,129**
		CONSTRUCTION INDIRECT						**1,724**	**308,129**	**0**	**308,129**
		FUEL OIL FUEL OIL SYSTEM			**3,074,735**	**5,272,719**	**5,506,791**	**38,215**	**7,419,786**	**1,017,963**	**22,291,995**
SCR		**SCR SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	AMMONIA STORAGE TANK AND UNLOADING	100.28 CY	-	-		17	2,319	570	2,889
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	TEMPERING AIR BLOWER AND DUCTWORK	51.15 CY	-	-		9	1,183	291	1,474
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	SCR (W/STACK)	298.70 CY	-	-		51	6,908	1,697	8,605
		EXCAVATION						**78**	**10,410**	**2,558**	**12,968**
		BACKFILL									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	AMMONIA STORAGE TANK AND UNLOADING	23.80 CY	-	-	1,549	4	550	135	2,235
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	TEMPERING AIR BLOWER AND DUCTWORK	17.80 CY	-	-	1,158	3	412	101	1,671
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	SCR (W/STACK)	71.16 CY	-	-	4,633	12	1,646	404	6,683
		BACKFILL					**7,341**	**19**	**2,608**	**641**	**10,589**
		CIVIL WORK					**7,341**	**97**	**13,017**	**3,199**	**23,557**
		CONCRETE									
		CONCRETE									
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	AMMONIA STORAGE TANK AND UNLOADING	63.46 CY	-	-	21,304	91	12,979	2,211	36,494
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	TEMPERING AIR BLOWER AND DUCTWORK	30.69 CY	-	-	10,301	44	6,276	1,069	17,646
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	SCR (W/STACK)	221.96 CY	-	-	74,506	319	45,393	7,733	127,633
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	AMMONIA STORAGE TANK AND UNLOADING	1.48 CY	-	-	496	3	423	72	991
	22-13-00-20	MUD MAT, 1500 PSI	AMMONIA STORAGE TANK AND UNLOADING	11.92 CY	-	-	2,303	7	975	166	3,444
	22-13-00-20	MUD MAT, 1500 PSI	TEMPERING AIR BLOWER AND DUCTWORK	5.70 CY	-	-	1,102	3	467	80	1,649
	22-13-00-20	MUD MAT, 1500 PSI	SCR (W/STACK)	35.57 CY	-	-	6,875	20	2,910	496	10,281
	22-13-00-80	CONCRETE WALL, 4500 PSI	AMMONIA STORAGE TANK AND UNLOADING	7.66 CY	-	-	2,571	18	2,506	427	5,503
		CONCRETE					**119,458**	**505**	**71,928**	**12,254**	**203,640**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	AMMONIA STORAGE TANK AND UNLOADING	411.92 LB	-	-	2,514	24	4,033	83	6,630
	22-15-00-10	EMBEDMENTS, CARBON STEEL	TEMPERING AIR BLOWER AND DUCTWORK	200.04 LB	-	-	1,221	11	1,958	40	3,220
	22-15-00-10	EMBEDMENTS, CARBON STEEL	SCR (W/STACK)	1,533.62 LB	-	-	9,361	88	15,014	308	24,683
		EMBEDMENT					**13,096**	**123**	**21,006**	**431**	**34,532**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	AMMONIA STORAGE TANK AND UNLOADING	259.69 SF	-	-	977	60	9,850	917	11,744
	22-17-00-10	BUILT UP INSTALL & STRIP	TEMPERING AIR BLOWER AND DUCTWORK	257.59 SF	-	-	970	59	9,771	909	11,649
	22-17-00-10	BUILT UP INSTALL & STRIP	SCR (W/STACK)	724.48 SF	-	-	2,727	167	27,480	2,558	32,764
		FORMWORK					**4,674**	**285**	**47,100**	**4,384**	**56,158**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	AMMONIA STORAGE TANK AND UNLOADING	5.28 TN	-	-	12,038	122	19,616	2,586	34,239
	22-25-00-10	UNCOATED A615 GR60	TEMPERING AIR BLOWER AND DUCTWORK	2.26 TN	-	-	5,145	52	8,384	1,105	14,634
	22-25-00-10	UNCOATED A615 GR60	SCR (W/STACK)	15.84 TN	-	-	36,093	367	58,814	7,753	102,660
		REINFORCING					**53,275**	**542**	**86,814**	**11,444**	**151,533**
		CONCRETE					**190,503**	**1,456**	**226,848**	**28,513**	**445,863**
		MECHANICAL EQUIPMENT									
		NOX CONTROL EQUIPMENT									
	31-53-00-35	AQUEOUS AMMONIA HORIZ STORAGE TANK, 32,000 GAL, STAINLESS STEEL		1.00 EA		175,437	-	115	20,542	2,577	198,556
	31-53-00-35	AMMONIA TRANSFER SKID, WITH 2X100% TRANSFER CENTRIFUGAL PUMPS, CONTROLS & ACCESSORIES		1.00 EA		49,109	-	80	14,379	1,804	65,292
		NOX CONTROL EQUIPMENT				**224,546**		**195**	**34,921**	**4,381**	**263,847**
		COMBUSTION TURBINE									
	31-85-00-99	HTSCR/CO CATALYST SYSTEM		1.00 LT		5,912,628		5,575	1,123,557	194,815	7,231,000
		COMBUSTION TURBINE				**5,912,628**		**5,575**	**1,123,557**	**194,815**	**7,231,000**
		MECHANICAL EQUIPMENT				**6,137,174**		**5,770**	**1,158,478**	**199,196**	**7,494,848**
		PIPING									
		STAINLESS STEEL VALVES									
	35-46-00-03	0.75 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	AMMONIA	4.00 EA	-	-	1,738	12	2,502	434	4,674
	35-46-00-09	2 IN CHECK VALVE, CLASS 150, MANUAL, WELD END	AMMONIA	1.00 EA	-	-	1,562	6	1,112	193	2,866
	35-46-00-10	2 IN ISOLATION VALVE, CLASS 150, OPERATED, WELD END	AMMONIA	4.00 EA	-	-	70,609	25	5,004	868	76,481
		STAINLESS STEEL VALVES					**73,909**	**43**	**8,618**	**1,494**	**84,021**
		PIPING					**73,909**	**43**	**8,618**	**1,494**	**84,021**
		SCR SCR SYSTEM				**6,137,174**	**271,752**	**7,366**	**1,406,961**	**232,401**	**8,048,288**

EXHIBIT B. 1 X PC SPRINT SIMPLE CYCLE TURBINE – UNALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/20024
Reviewed By	GA
Approved By	BA
Estimate No.	36484C
Factor table	_4 Productivity 1.15

Area	Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		BASE							
	21.00.00	CIVIL WORK	972,846		378,164	7,338	347,140	419,252	2,117,403
	22.00.00	CONCRETE			695,209	9,760	514,613	124,686	1,334,508
	23.00.00	STEEL			180,869	714	48,325	17,541	246,734
	24.00.00	ARCHITECTURAL	476,580						476,580
	27.00.00	PAINTING & COATING	136,000		5,423	190	11,369	4,930	157,722
	31.00.00	MECHANICAL EQUIPMENT		58,681,618	10,741	13,023	826,398	244,089	59,762,846
	35.00.00	PIPING			815,234	15,448	1,045,391	575,064	2,435,690
	36.00.00	INSULATION			133,286	2,681	147,941	27,617	308,845
	41.00.00	ELECTRICAL EQUIPMENT	360,319	15,258,333	661,350	18,301	1,219,039	374,702	17,873,744
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			494,210	9,084	642,025	15,687	1,151,922
	43.00.00	CABLE			472,604	9,347	662,347	201,998	1,336,949
	44.00.00	CONTROL & INSTRUMENTATION	831,752		371,282	2,301	164,285	18,192	1,385,511
	61.00.00	CONSTRUCTION INDIRECT				1,138	68,321	0	68,321
	71.00.00	PROJECT INDIRECT	262,562						262,562
		1 BASE	3,040,059	73,939,951	4,218,373	89,326	5,697,195	2,023,759	88,919,337
BIO		BIODIESEL SYSTEM							
	21.00.00	CIVIL WORK			19,450	159	6,920	3,082	29,451
	22.00.00	CONCRETE			13,009	353	18,970	4,233	36,212
	31.00.00	MECHANICAL EQUIPMENT	976,527	2,856,000		138	9,339	3,222	3,845,088
	36.00.00	INSULATION	124,845						124,845
	41.00.00	ELECTRICAL EQUIPMENT			26,049	64	4,074	1,290	31,414
		BIO BIODIESEL SYSTEM	1,101,372	2,856,000	58,508	714	39,304	11,827	4,067,011
CEMS		CONTINUOUS EMISSIONS MONITORING SYSTEM							
	21.00.00	CIVIL WORK			59	2	69	34	162
	22.00.00	CONCRETE			1,631	24	1,260	293	3,183
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			1,931	58	4,099	100	6,130
	43.00.00	CABLE			903	12	830	238	1,971
	44.00.00	CONTROL & INSTRUMENTATION		513,570		345	24,372	596	538,538
		CEMS CONTINUOUS EMISSIONS MONITORING SYSTEM		513,570	4,524	440	30,630	1,260	549,984
FUEL OIL		FUEL OIL SYSTEM							
	21.00.00	CIVIL WORK	246,531		274,607	3,884	180,669	143,939	845,746
	22.00.00	CONCRETE			121,069	2,345	125,423	34,765	281,258
	23.00.00	STEEL			62,034	576	37,910	20,345	120,288
	24.00.00	ARCHITECTURAL	260,100						260,100
	27.00.00	PAINTING & COATING	34,000		3,318	121	7,240	3,140	47,697
	31.00.00	MECHANICAL EQUIPMENT	1,450,744	2,151,656		202	12,146	3,032	3,617,578
	35.00.00	PIPING			1,063,281	10,393	703,709	278,380	2,045,370
	36.00.00	INSULATION			27,196	585	32,296	6,029	65,522
	41.00.00	ELECTRICAL EQUIPMENT	231,200	919,865	790,942	3,971	268,688	75,359	2,286,054
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			503,919	8,908	629,646	15,384	1,148,950
	43.00.00	CABLE			786,680	4,707	333,536	95,419	1,215,635
	44.00.00	CONTROL & INSTRUMENTATION		706,384	48,178	797	57,928	4,709	817,199
	61.00.00	CONSTRUCTION INDIRECT				1,724	103,517	0	103,517
		FUEL OIL FUEL OIL SYSTEM	2,222,575	3,777,905	3,681,225	38,215	2,492,709	680,500	12,854,914
SCR		SCR SYSTEM							
	21.00.00	CIVIL WORK			4,907	97	4,373	2,138	11,419
	22.00.00	CONCRETE			127,349	1,456	76,211	19,060	222,620
	31.00.00	MECHANICAL EQUIPMENT		4,397,287		5,770	389,196	133,161	4,919,643
	35.00.00	PIPING			49,407	43	2,895	999	53,301
		SCR SCR SYSTEM		4,397,287	181,663	7,366	472,675	155,358	5,206,983
		TOTAL DIRECT	6,364,005	85,484,713	8,144,293	136,060	8,732,513	2,872,704	111,598,228

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	8,732,513		136,060
Material Costs	8,144,293		
Subcontract Costs	6,364,005		
Construction Equipment Costs	2,872,704		
Process Equipment Costs	85,484,713		
Total Direct Cost	**111,598,228**	**111,598,228**	
.			
General Conditions			
Additional Labor Costs			
90-1 Labor Supervision	524,000		
90-2 Show-up Time	174,700		
90-3 Cost Due To OT 5-10's	1,945,100		
90-5 Per Diem	2,721,200		
Site Overheads			
91-1 Construction Management	2,042,500		
91-2 Field Office Expenses	1,255,600		
91-3 Material&Quality Control	318,200		
91-4 Site Services	261,400		
91-5 Safety	201,300		
91-6 Temporary Facilities	153,200		
91-7 Temporary Utilities	167,800		
91-8 Mobilization/Demob.	161,400		
91-9 Legal Expenses/Claims	23,800		
Other Construction Indirects			
92-1 Small Tools & Consumables	422,900		
92-2 Scaffolding	305,700		
92-3 General Liability Insurance	101,900		
92-4 Construction Equipment Mob/Demob	143,600		
92-5 Freight on Material	407,200		
92-7 Sales Tax			
	11,331,500	**122,929,728**	
Project Indirect Costs			
93-1 EPC Engineering Services	1,572,300		
93-3 Start-Up/Commissioning	1,048,200		
93-4 Start-Up/Spare Parts	157,200		
93-5 EPC G&A	3,668,700		
93-5 EPC Fee	5,885,600		
93-6 Owners Cost	3,881,300		
93-7 Warehouse Spares	1,000,000		
	17,213,300	**140,143,028**	
Contingency			
94-1 Contingency on Construction Equipment	754,100		
94-2 Contingency on Material	2,137,900		
94-3 Contingency on Labor+General Conditions	4,878,300		
94-4 Contingency on Subcontract	1,272,800		
94-5 Contingency on Process Equipment	17,096,900		
94-6 Contingency on Project Indirect	4,303,300		
	30,443,300	**170,586,328**	
Escalation			
96-1 Escalation on Construction Equipment			
96-2 Escalation on Material			
96-3 Escalation on Labor+General Conditions			
96-4 Escalation on Subcontract			
96-5 Escalation on Process Equipment			
96-6 Escalation on Project Indirect			
		170,586,328	
Total		**170,586,328**	

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		**BASE**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	COMBUSTION TURBINE	519.49 CY	-	-		90	4,036	1,973	6,009
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	GENERATOR STEP-UP TRANSFORMER (1 CTG)	53.09 CY	-	-		9	412	202	614
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	UNIT AUXILIARY TRANSFORMER	26.22 CY	-	-		5	204	100	303
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FIN FAN COOLERS	67.17 CY	-	-		12	522	255	777
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	MV PDC	148.49 CY	-	-		26	1,154	564	1,718
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	CT DRAINS TANK	138.09 CY	-	-		24	1,073	525	1,597
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	CONTROL PACKAGE	59.59 CY	-	-		10	463	226	689
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	DEMIN WATER PUMPS	16.01 CY	-	-		3	124	61	185
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	GENERATOR CIRCUIT BREAKER	32.02 CY	-	-		6	249	122	370
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ISOLATED PHASE BUS DUCT	43.16 CY	-	-		7	335	164	499
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ADDITIONAL CT SKIDS/EQUIPMENT	75.80 CY	-	-		13	589	288	877
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	55.25 CY	-	-		7	328	161	489
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	NEW ELECTRICAL ROOM/BUILDING	55.25 CY	-	-		7	328	161	489
	21-17-00-11	TRENCH EXCAVATION 6 FT TO 10 FT DEEP	CONCRETE DUCT BANKS	3,597.03 CY	-	-		269	12,111	5,921	18,032
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP	MISCELLANEOUS MECHANICAL BURIED PIPING	3,334.63 CY	-	-		249	11,227	5,489	16,716
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP	UNDERGROUND DRAINAGE PIPING	2,804.10 CY	-	-		209	9,441	4,616	14,057
	21-17-00-29	REMOVE 6 IN GRAVEL AND GEOTEXTILE	RESTORE CONSTRUCTION LAYDOWN AREA 1	8,982.89 CY	-	-		413	20,614	50,104	70,718
	21-17-00-29	REMOVE TEMPORARY DRAINGE DITCHES AND SEDIMENT TRAPS	RESTORE CONSTRUCTION LAYDOWN AREA 1	867.68 LF	-	-		15	747	1,816	2,564
		EXCAVATION						**1,372**	**63,957**	**72,747**	**136,704**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL, 8 MILE CYCLE	RESTORE CONSTRUCTION LAYDOWN AREAS	19,812.28 CY	-	-		1,365	68,193	165,751	233,943
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	34.90 CY	-	-		2	83	41	124
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	NEW ELECTRICAL ROOM/BUILDING	34.90 CY	-	-		2	83	41	124
		DISPOSAL						**1,369**	**68,359**	**165,832**	**234,190**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	20.35 CY	-	-		3	121	59	180
	21-20-00-01	FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	NEW ELECTRICAL ROOM/BUILDING	20.35 CY	-	-		3	121	59	180
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	COMBUSTION TURBINE	125.41 CY	-	-	5,458	22	974	476	6,909
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	GENERATOR STEP-UP TRANSFORMER (1 CTG)	14.56 CY	-	-	634	3	113	55	802
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	UNIT AUXILIARY TRANSFORMER	7.07 CY	-	-	308	1	55	27	389
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	FIN FAN COOLERS	18.34 CY	-	-	798	3	142	70	1,010
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	MV PDC	41.64 CY	-	-	1,812	7	324	158	2,294
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	CT DRAINS TANK	7.56 CY	-	-	329	1	59	29	416
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	CONTROL PACKAGE	16.38 CY	-	-	713	3	127	62	902
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	DEMIN WATER PUMPS	2.36 CY	-	-	103	0	18	9	130
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	GENERATOR CIRCUIT BREAKER	6.94 CY	-	-	302	1	54	26	382
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ISOLATED PHASE BUS DUCT	7.41 CY	-	-	322	1	58	28	408
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ADDITIONAL CT SKIDS/EQUIPMENT	13.77 CY	-	-	599	2	107	52	758
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	MISC PIPE SUPPORTS, RACKS	70.47 CY	-	-	3,067	12	547	268	3,882
	21-20-00-02	FOUNDATION BACKFILL, FROST FREE FILL	MV PDC	57.46 CY	-			10	446	218	665
	21-20-00-11	TRENCH BACKFILL AND BEDDING, PREVIOUSLY EXCAVATED MATERIAL	CONCRETE DUCT BANKS	3,046.47 CY	-	-		350	15,779	7,715	23,494
	21-20-00-11	TRENCH BACKFILL AND BEDDING, PREVIOUSLY EXCAVATED MATERIAL	MISCELLANEOUS MECHANICAL BURIED PIPING	9,616.22 CY	-	-		1,105	49,808	24,353	74,161
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DRAINAGE DITCH AND CULVERTS	1,533.47 CY	-	-		176	7,943	3,883	11,826
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING FROM BORROW PIT ONSITE	MISCELLANEOUS PIPING ALLOWANCE	176.11 CY	-	-		32	1,423	696	2,119
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	EFFLUENT PIPING	266.15 CY	-			40	1,792	876	2,668
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	UNDERGROUND DRAINAGE PIPING	1,609.42 CY	-	-		240	10,837	5,298	16,135
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	DRAINAGE DITCH AND CULVERTS	1,740.18 CY	-			260	11,717	5,729	17,446
		BACKFILL					**14,443**	**2,275**	**102,566**	**50,147**	**167,156**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-11	CRUSHED ROCK SURFACING, 6" DEEP	DRAINAGE DITCH AND CULVERTS	16,917.25 SY	-	-	121,940	292	14,105	13,330	149,376
	21-41-00-31	STRAW BALE	INSTALL AND REMOVE	132.00 EA	-	-	2,693	76	3,473	405	6,571
	21-41-00-60	SILT FENCE	SITE PREPARATION	8,247.89 LF	-	-	14,356	237	10,853	1,267	26,476
	21-41-00-99	STONE CHECK DAMS		122.00 EA	-	-	16,592	140	6,745	1,402	24,739
		EROSION AND SEDIMENTATION CONTROL					**155,582**	**745**	**35,176**	**16,404**	**207,162**
		FENCEWORK									
	21-43-00-10	FABRIC, WIRE & POSTS, CHAIN LINK FENCE, GALVANIZED, 6 FT TALL, 6 GAGE 3 STRANDS OF BARB WIRE, 2 IN POST AT 10 FT O.C.	TEMPORARY FENCING	2,728.40 LF	-	-	87,571	314	14,361	1,676	103,608
	21-43-00-29	DOUBLE SWING GATE 40 FT WIDE	TEMPORARY FENCING	2.00 EA	-	-	12,240	74	4,211	172	16,623

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		FENCEWORK									
	21-43-00-30	MAN GATE, 4 FT WIDE BY 7 FT TALL	TEMPORARY FENCING	2.00 EA	-	-	1,496	28	1,579	64	3,140
	21-43-00-99	REMOVE TEMPORARY CHAIN LINK FENCE INCLUDING GATES	RESTORE CONSTRUCTION LAYDOWN AREA 1	2,728.40 LF	-	-		94	4,308	503	4,811
		FENCEWORK					**101,307**	**509**	**24,459**	**2,416**	**128,182**
		LANDSCAPING									
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING TOPSOIL FROM PILE & FERTILIZER		24,043.99 SY	-	-	29,418	332	16,560	40,251	86,229
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING 4 IN TOPSOIL FROM PILE & FERTILIZER	RESTORE CONSTRUCTION LAYDOWN AREA 1	41,712.33 SY	-	-	51,036	575	28,729	69,828	149,592
	21-47-00-10	MISC SITE IMPROVEMENTS		1.00 LS	40,800	-					40,800
		LANDSCAPING			**40,800**		**80,454**	**907**	**45,288**	**110,079**	**276,621**
		ROAD, PARKING AREA, & SURFACED AREA									
	21-57-00-01	ASPHALT ROADS	1,500 FEET	4,000.03 SY	344,070	-					344,070
	21-57-00-02	AGGREGATE ROADS		1,000.01 SY	62,559	-					62,559
	21-57-00-80	GEOTEXTILE FABRIC	CRUSHED STONE SURFACING	10,000.08 SY	-	-	22,299	115	5,262	614	28,175
	21-57-00-99	TEMPORARY LAY DOWN AND PARKING AREAS		1.00 AC	117,417	-					117,417
		ROAD, PARKING AREA, & SURFACED AREA			**524,046**		**22,299**	**115**	**5,262**	**614**	**552,221**
		CIVIL WORK,TESTING									
	21-98-00-69	INDEPENDENT EARTHWORK TESTING CONTRACTOR	ALLOWANCE ESTIMATED BASED ON RECENT EXPERIENCE	1.00 LS	272,000	-					272,000
		CIVIL WORK,TESTING			**272,000**						**272,000**
		CIVIL WORK, MISCELLANEOUS									
	21-99-00-19	DEWATERING	ALLOWANCE	1.00 LS	136,000	-					136,000
	21-99-00-99	STABILIZED CONSTRUCTION ENTRANCE/EXIT		2.00 EA	-	-	4,080	46	2,073	1,014	7,167
		CIVIL WORK, MISCELLANEOUS			**136,000**		**4,080**	**46**	**2,073**	**1,014**	**143,167**
		CIVIL WORK			**972,846**		**378,164**	**7,338**	**347,140**	**419,252**	**2,117,403**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	50.07 CY	-	-	11,237	55	2,632	892	14,761
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	NEW ELECTRICAL ROOM/BUILDING	50.07 CY	-	-	11,237	55	2,632	892	14,761
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	COMBUSTION TURBINE	402.75 CY	-	-	90,377	578	27,672	9,380	127,429
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	35.11 CY	-	-	7,878	50	2,412	818	11,108
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	UNIT AUXILIARY TRANSFORMER	15.84 CY	-	-	3,553	23	1,088	369	5,010
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FIN FAN COOLERS	43.29 CY	-	-	9,714	62	2,974	1,008	13,697
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	MV PDC	110.77 CY	-	-	24,857	159	7,611	2,580	35,047
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	CT DRAINS TANK	12.79 CY	-	-	2,871	18	879	298	4,048
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	DEMIN WATER PUMPS	6.33 CY	-	-	1,420	9	435	147	2,002
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	GENERATOR CIRCUIT BREAKER	17.26 CY	-	-	3,873	25	1,186	402	5,461
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ISOLATED PHASE BUS DUCT	19.89 CY	-	-	4,463	29	1,367	463	6,293
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	40.72 CY	-	-	9,137	58	2,798	948	12,883
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	MISC PIPE SUPPORTS, RACKS	177.18 CY	-	-	39,760	254	12,174	4,127	56,061
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	DUCT BANKS	759.72 CY	-	-	170,482	1,091	52,199	17,694	240,375
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	10.17 CY	-	-	2,281	20	978	331	3,591
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	UNIT AUXILIARY TRANSFORMER	4.69 CY	-	-	1,052	9	451	153	1,656
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	MV PDC	12.85 CY	-	-	2,882	26	1,236	419	4,537
	22-13-00-20	MUD MAT, 1500 PSI	COMBUSTION TURBINE	62.71 CY	-	-	8,102	36	1,723	584	10,409
	22-13-00-20	MUD MAT, 1500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	7.28 CY	-	-	941	4	200	68	1,208
	22-13-00-20	MUD MAT, 1500 PSI	UNIT AUXILIARY TRANSFORMER	3.53 CY	-	-	456	2	97	33	586
	22-13-00-20	MUD MAT, 1500 PSI	FIN FAN COOLERS	9.17 CY	-	-	1,185	5	252	85	1,522
	22-13-00-20	MUD MAT, 1500 PSI	MV PDC	20.80 CY	-	-	2,688	12	572	194	3,453
	22-13-00-20	MUD MAT, 1500 PSI	CT DRAINS TANK	3.79 CY	-	-	489	2	104	35	629
	22-13-00-20	MUD MAT, 1500 PSI	CONTROL PACKAGE	8.19 CY	-	-	1,058	5	225	76	1,359
	22-13-00-20	MUD MAT, 1500 PSI	DEMIN WATER PUMPS	1.19 CY	-	-	154	1	33	11	197
	22-13-00-20	MUD MAT, 1500 PSI	GENERATOR CIRCUIT BREAKER	3.47 CY	-	-	448	2	95	32	576
	22-13-00-20	MUD MAT, 1500 PSI	ISOLATED PHASE BUS DUCT	3.70 CY	-	-	478	2	102	35	615
	22-13-00-20	MUD MAT, 1500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	6.88 CY	-	-	888	4	189	64	1,141
	22-13-00-20	MUD MAT, 1500 PSI	MISC PIPE SUPPORTS, RACKS	35.20 CY	-	-	4,548	20	967	328	5,843
	22-13-00-80	CONCRETE WALL, 4500 PSI	GENERATOR STEP-UP TRANSFORMER (1 CTG)	38.05 CY	-	-	8,539	87	4,183	1,418	14,140
	22-13-00-80	CONCRETE WALL, 4500 PSI	UNIT AUXILIARY TRANSFORMER	19.45 CY	-	-	4,364	45	2,138	725	7,227
	22-13-00-80	CONCRETE WALL, 4500 PSI	CT DRAINS TANK	2.79 CY	-	-	625	6	306	104	1,035

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE					**432,038**	**2,757**	**131,909**	**44,715**	**608,662**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	COMBUSTION TURBINE	2,800.53 LB	-	-	11,427	161	9,211	376	21,014
	22-15-00-10	EMBEDMENTS, CARBON STEEL	GENERATOR STEP-UP TRANSFORMER (1 CTG)	274.61 LB	-	-	1,120	16	903	37	2,061
	22-15-00-10	EMBEDMENTS, CARBON STEEL	UNIT AUXILIARY TRANSFORMER	132.02 LB	-	-	539	8	434	18	991
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FIN FAN COOLERS	301.02 LB	-	-	1,228	17	990	40	2,259
	22-15-00-10	EMBEDMENTS, CARBON STEEL	MV PDC	792.15 LB	-	-	3,232	46	2,605	106	5,944
	22-15-00-10	EMBEDMENTS, CARBON STEEL	CT DRAINS TANK	100.02 LB	-	-	408	6	329	13	751
	22-15-00-10	EMBEDMENTS, CARBON STEEL	CONTROL PACKAGE	266.72 LB	-	-	1,088	15	877	36	2,001
	22-15-00-10	EMBEDMENTS, CARBON STEEL	DEMIN WATER PUMPS	44.01 LB	-	-	180	3	145	6	330
	22-15-00-10	EMBEDMENTS, CARBON STEEL	GENERATOR CIRCUIT BREAKER	133.36 LB	-	-	544	8	439	18	1,001
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ISOLATED PHASE BUS DUCT	133.36 LB	-	-	544	8	439	18	1,001
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ADDITIONAL CT SKIDS/EQUIPMENT	273.05 LB	-	-	1,114	16	898	37	2,049
	22-15-00-10	EMBEDMENTS, CARBON STEEL	MISC PIPE SUPPORTS, RACKS	1,188.22 LB	-	-	4,848	68	3,908	160	8,916
	22-15-00-10	EMBEDMENTS, CARBON STEEL	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	500.74 LB	-	-	2,043	13	747	31	2,821
	22-15-00-10	EMBEDMENTS, CARBON STEEL	NEW ELECTRICAL ROOM/BUILDING	500.74 LB	-	-	2,043	13	747	31	2,821
		EMBEDMENT					**30,358**	**396**	**22,673**	**926**	**53,957**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	COMBUSTION TURBINE	1,157.16 SF	-	-	2,911	266	14,746	2,731	20,388
	22-17-00-10	BUILT UP INSTALL & STRIP	GENERATOR STEP-UP TRANSFORMER (1 CTG)	2,431.17 SF	-	-	6,117	559	30,980	5,737	42,834
	22-17-00-10	BUILT UP INSTALL & STRIP	UNIT AUXILIARY TRANSFORMER	1,138.48 SF	-	-	2,864	262	14,507	2,687	20,058
	22-17-00-10	BUILT UP INSTALL & STRIP	FIN FAN COOLERS	290.73 SF	-	-	731	67	3,705	686	5,122
	22-17-00-10	BUILT UP INSTALL & STRIP	MV PDC	922.16 SF	-	-	2,320	212	11,751	2,176	16,247
	22-17-00-10	BUILT UP INSTALL & STRIP	CT DRAINS TANK	459.99 SF	-	-	1,157	106	5,862	1,086	8,104
	22-17-00-10	BUILT UP INSTALL & STRIP	CONTROL PACKAGE	224.25 SF	-	-	564	52	2,858	529	3,951
	22-17-00-10	BUILT UP INSTALL & STRIP	DEMIN WATER PUMPS	53.13 SF	-	-	134	12	677	125	936
	22-17-00-10	BUILT UP INSTALL & STRIP	GENERATOR CIRCUIT BREAKER	193.19 SF	-	-	486	44	2,462	456	3,404
	22-17-00-10	BUILT UP INSTALL & STRIP	ISOLATED PHASE BUS DUCT	275.99 SF	-	-	694	63	3,517	651	4,863
	22-17-00-10	BUILT UP INSTALL & STRIP	ADDITIONAL CT SKIDS/EQUIPMENT	418.59 SF	-	-	1,053	96	5,334	988	7,375
	22-17-00-10	BUILT UP INSTALL & STRIP	MISC PIPE SUPPORTS, RACKS	2,914.49 SF	-	-	7,333	670	37,139	6,878	51,350
	22-17-00-10	BUILT UP INSTALL & STRIP	DUCT BANKS	8,095.80 SF	-	-	20,369	1,861	103,163	19,105	142,637
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	208.00 SF	-	-	523	6	345	64	932
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	NEW ELECTRICAL ROOM/BUILDING	208.00 SF	-	-	523	6	345	64	932
		FORMWORK					**47,782**	**4,283**	**237,389**	**43,962**	**329,133**
		PRECAST									
	22-23-00-50	MANHOLE - 4 FT ID BY 5 FT DEEP	SANITARY SEWER	2.00 EA	-	-	5,603	41	1,866	912	8,381
	22-23-00-50	CATCH BASIN - 4 FT X 4 FT BY 4 FT DEEP	STORM WATER SYSTEM	5.00 EA	-	-	11,732	92	4,146	2,027	17,905
	22-23-00-50	MANHOLE - 5 FT ID BY 5 FT DEEP	STORM WATER SYSTEM	3.00 EA	-	-	12,607	69	3,110	1,520	17,237
	22-23-00-50	MANHOLE - 6 FT ID BY 6 FT DEEP	STORM WATER SYSTEM	3.00 EA	-	-	19,961	83	3,732	1,824	25,517
		PRECAST					**49,904**	**285**	**12,853**	**6,284**	**69,041**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	COMBUSTION TURBINE	29.65 TN	-	-	45,157	687	36,980	9,700	91,838
	22-25-00-10	UNCOATED A615 GR60	GENERATOR STEP-UP TRANSFORMER (1 CTG)	6.87 TN	-	-	10,461	159	8,567	2,247	21,276
	22-25-00-10	UNCOATED A615 GR60	UNIT AUXILIARY TRANSFORMER	3.32 TN	-	-	5,056	77	4,140	1,086	10,282
	22-25-00-10	UNCOATED A615 GR60	FIN FAN COOLERS	2.99 TN	-	-	4,547	69	3,723	977	9,247
	22-25-00-10	UNCOATED A615 GR60	MV PDC	8.94 TN	-	-	13,620	207	11,154	2,926	27,701
	22-25-00-10	UNCOATED A615 GR60	CT DRAINS TANK	1.22 TN	-	-	1,851	28	1,516	398	3,764
	22-25-00-10	UNCOATED A615 GR60	CONTROL PACKAGE	2.76 TN	-	-	4,196	64	3,437	901	8,534
	22-25-00-10	UNCOATED A615 GR60	DEMIN WATER PUMPS	0.43 TN	-	-	653	10	535	140	1,329
	22-25-00-10	UNCOATED A615 GR60	GENERATOR CIRCUIT BREAKER	1.20 TN	-	-	1,825	28	1,494	392	3,711
	22-25-00-10	UNCOATED A615 GR60	ISOLATED PHASE BUS DUCT	1.47 TN	-	-	2,242	34	1,836	482	4,560
	22-25-00-10	UNCOATED A615 GR60	ADDITIONAL CT SKIDS/EQUIPMENT	2.82 TN	-	-	4,292	65	3,515	922	8,730
	22-25-00-10	UNCOATED A615 GR60	MISC PIPE SUPPORTS, RACKS	12.67 TN	-	-	19,294	294	15,801	4,145	39,240
	22-25-00-10	UNCOATED A615 GR60	DUCT BANKS	6.89 TN	-	-	10,490	160	8,591	2,253	21,335
	22-25-00-10	UNCOATED A615 GR60	BUILDING EXTENSION FOR PUMPS AND AIR COMPRESSORS	3.76 TN	-	-	5,721	79	4,250	1,115	11,085
	22-25-00-10	UNCOATED A615 GR60	NEW ELECTRICAL ROOM/BUILDING	3.76 TN	-	-	5,721	79	4,250	1,115	11,085
		REINFORCING					**135,128**	**2,040**	**109,789**	**28,799**	**273,716**
		CONCRETE					**695,209**	**9,760**	**514,613**	**124,686**	**1,334,508**
		STEEL									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		GALLERY									
	23-17-00-10	PLAIN, GALVANIZED GRATING, 1 1/4" DEEP WITH 3/8" CHECKERED PLATE	CT DRAINS TANK	100.00 SF	-	-	3,719	23	1,614	230	5,563
	23-17-00-11	SERRATED, GALVANIZED GRATING, 1 1/2" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	MV PDC	65.99 SF	-	-	2,709	15	1,065	152	3,926
	23-17-00-11	SERRATED, GALVANIZED GRATING, 1 1/2" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	MISC PLATFORMS	175.99 SF	-	-	7,223	40	2,841	405	10,469
	23-17-00-12	2 1/2" PLAIN, GALVANIZED GRATING	GENERATOR STEP-UP TRANSFORMERS - STD	377.52 SF	-	-	28,556	95	6,703	955	36,214
	23-17-00-12	2 1/2" PLAIN, GALVANIZED GRATING	UATS	181.49 SF	-	-	13,729	46	3,222	459	17,410
	23-17-00-20	DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	MV PDC	57.74 LF	-	-	5,014	12	839	120	5,973
	23-17-00-20	DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	MISC PLATFORMS	87.98 LF	-	-	7,641	18	1,278	182	9,101
	23-17-00-30	LADDER W/O CAGE	MISC PLATFORMS	6.60 LF	-	-	555	3	213	30	798
	23-17-00-31	LADDER WITH CAGE	MISC PLATFORMS	6.60 LF	-	-	832	5	373	53	1,258
	23-17-00-35	METAL GRATING STAIR TREADS 4 FT WIDE, INCLUDING STRINGER, HANDRAIL NOT INCLUDED	MV PDC	17.00 EA	-	-	10,002	29	2,058	293	12,353
	23-17-00-35	METAL GRATING STAIR TREADS 4 FT WIDE, INCLUDING STRINGER, HANDRAIL NOT INCLUDED	MISC PLATFORMS	9.00 EA	-	-	5,295	16	1,089	155	6,540
		GALLERY					**85,274**	**303**	**21,295**	**3,035**	**109,605**
		ROLLED SHAPE									
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	GENERATOR STEP-UP TRANSFORMERS (STD)	0.18 TN	-	-	1,110	5	343	184	1,637
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	UNIT AUX TRANSFORMER	0.09 TN	-	-	537	3	166	89	792
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	MV PDC	0.06 TN	-	-	356	2	110	59	525
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	CT DRAINS TANK	0.39 TN	-	-	2,340	11	723	388	3,451
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	GENERATOR CIRCUIT BREAKER	0.18 TN	-	-	1,073	5	332	178	1,583
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	ISOLATED PHASE BUS DUCT	0.09 TN	-	-	543	3	168	90	801
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	MISC PIPE SUPPORTS, RACKS, CABLE TRAY STEEL	0.71 TN	-	-	4,263	20	1,318	707	6,289
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	MISC PLATFORMS	0.20 TN	-	-	1,188	6	367	197	1,752
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	GENERATOR STEP-UP TRANSFORMERS (STD)	0.92 TN	-	-	4,613	20	1,324	710	6,648
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	UNIT AUX TRANSFORMER	0.44 TN	-	-	2,219	10	637	342	3,197
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MV PDC	0.62 TN	-	-	3,107	14	892	479	4,477
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	CT DRAINS TANK	0.39 TN	-	-	1,948	8	559	300	2,807
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	GENERATOR CIRCUIT BREAKER	0.36 TN	-	-	1,792	8	514	276	2,582
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	ISOLATED PHASE BUS DUCT	0.46 TN	-	-	2,314	10	664	356	3,335
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MISC PIPE SUPPORTS, RACKS, CABLE TRAY STEEL	6.36 TN	-	-	31,936	139	9,165	4,918	46,019
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MISC PLATFORMS	1.77 TN	-	-	8,870	39	2,545	1,366	12,781
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	GENERATOR STEP-UP TRANSFORMERS (STD)	2.57 TN	-	-	11,607	46	3,052	1,638	16,298
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	UNIT AUX TRANSFORMER	1.24 TN	-	-	5,580	22	1,468	788	7,835
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	CT DRAINS TANK	0.77 TN	-	-	3,487	14	917	492	4,896
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	GENERATOR CIRCUIT BREAKER	0.18 TN	-	-	803	3	211	113	1,127
	23-25-00-21	HEAVY AND EXTRA HEAVY WEIGHT MEMBERS, 41 LB/LF TO 395 LB/LF, GALVANIZED	ISOLATED PHASE BUS DUCT	1.31 TN	-	-	5,910	24	1,554	834	8,298
		ROLLED SHAPE					**95,595**	**411**	**27,029**	**14,506**	**137,130**
		STEEL					**180,869**	**714**	**48,325**	**17,541**	**246,734**
		ARCHITECTURAL									
		PRE-ENGINEERED BUILDING									
	24-35-00-01	SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA 200 FT 100 FT 20 FT	NEW ELECTRICAL ROOM/BUILDING	676.00 SF	239,980	-					239,980
	24-35-00-01	SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA 200 FT 100 FT 20 FT	EXISTING BUILDING EXTENSION FOR WATER PUMPS AND AIR COMPRESSORS	676.00 SF	236,600	-					236,600
		PRE-ENGINEERED BUILDING			**476,580**						**476,580**
		ARCHITECTURAL			**476,580**						**476,580**
		PAINTING & COATING									
		PAINTING									
	27-17-00-14	PIPE PAINTING, 1.5 IN DIA		65.19 LF	-	-	121	5	327	141	589
	27-17-00-17	PIPE PAINTING, 3 IN DIA		394.58 LF	-	-	1,342	47	2,790	1,213	5,344
	27-17-00-17	PIPE PAINTING, 3 IN DIA		17.15 LF	-	-	58	2	121	53	232
	27-17-00-17	PIPE PAINTING, 3 IN DIA		27.45 LF	-	-	93	3	194	84	372

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PAINTING									
	27-17-00-18	PIPE PAINTING, 4 IN DIA		363.70 LF	-	-	1,593	56	3,320	1,437	6,349
	27-17-00-19	PIPE PAINTING, 6 IN DIA		10.29 LF	-	-	66	2	138	60	264
	27-17-00-21	PIPE PAINTING, 10 IN DIA		205.87 LF	-	-	2,150	75	4,479	1,943	8,572
	27-17-00-61	EQUIPMENT, TOUCH UP PAINTING	ALLOWANCE	1.00 LS	136,000	-					136,000
		PAINTING			**136,000**		**5,423**	**190**	**11,369**	**4,930**	**157,722**
		PAINTING & COATING			**136,000**		**5,423**	**190**	**11,369**	**4,930**	**157,722**
		MECHANICAL EQUIPMENT									
		COMPRESSOR & ACCESSORIES									
	31-17-00-99	1X100% AIR COMPRESSORS, 250 SCFM, 125 PSIG INCLUDING AFTERCOOLERS AND MOISTURE SEPARATORS		1.00 EA	-	163,278	-	172	10,352	2,584	176,214
	31-17-00-99	WET AIR RECEIVER, 500 GALLONS	EQUIPMENT COST INCLUDED WITH COMPRESSORS	1.00 EA	-		-	28	1,656	413	2,070
	31-17-00-99	DRY AIR RECEIVER, 500 GALLONS	EQUIPMENT COST INCLUDED WITH COMPRESSORS	1.00 EA	-		-	28	1,656	413	2,070
	31-17-00-99	1X100% AIR DRYERS W/FILTERS, 200 SCFM, 150 PSIG	EQUIPMENT COST INCLUDED WITH COMPRESSORS	1.00 EA	-		-	28	1,656	413	2,070
		COMPRESSOR & ACCESSORIES				**163,278**		**255**	**15,321**	**3,824**	**182,423**
		NOX CONTROL EQUIPMENT									
	31-53-00-35	AMMONIA TRUCK UNLOADING SKID W/ CONTROLS & ACCESSORIES		1.00 EA		57,700	-	69	4,141	1,034	62,874
		NOX CONTROL EQUIPMENT				**57,700**		**69**	**4,141**	**1,034**	**62,874**
		BLACK START GENERATOR									
	31-65-00-99	CAT 700 KW DIESEL GENERATOR	PRICING PROVIDED BY TOROMONT CAT	1.00 LS	-	357,459	-	126	7,591	1,895	366,945
		BLACK START GENERATOR				**357,459**		**126**	**7,591**	**1,895**	**366,945**
		PUMP									
	31-75-00-99	2X100% SS PUMPS, 120 GPM, 100' TDH	DEMIN. TRANSFER PUMPS	1.00 EA	-	29,023	-	37	2,208	551	31,783
	31-75-00-99	SUMP PUMPS, 150 GALLONS, 35 FT HEAD, 15 HP	CTG UNIT 1 TRANSFORMERS SUMP PUMPS	1.00 EA	-	22,272	-	37	2,208	551	25,031
		PUMP				**51,295**		**74**	**4,417**	**1,102**	**56,814**
		TANK									
	31-83-00-05	WATER WASH DRAINS TANK, 5000 GALLONS	DOUBLE WALLED, UNDERGROUND TANK WITH LEAK DETECTION	1.00 EA	-	24,270		69	4,457	1,695	30,422
		TANK				**24,270**		**69**	**4,457**	**1,695**	**30,422**
		COMBUSTION TURBINE									
	31-85-00-99	COMBUSTION GAS TURBINE GENERATORS (CTGS), LM6000PC SPRINT	INCLUDING DUAL FUEL CAPABILITY, AIR INLET FILTER, ANTI-ICING SYSTEM, FINAL FUEL FILTER SKID, PCM, LUBE OIL SYSTEM, FIN FAN COOLERS	1.00 EA		48,640,964	-	6,667	400,267	99,911	49,141,142
	31-85-00-99	FIELD TECHNICAL ASSISTANCE INCLUDING ADDITIONAL ALLOWANCE FOR TIME AND TRAVEL	INCLUDED ABOVE	1.00 EA			-				
	31-85-00-99	LOGISTICS BY CTG VENDOR		1.00 LT		2,040,000					2,040,000
	31-85-00-99	CT STACK	ALLOWANCE FOR CREDIT TO REMOVE CT SIMPLE CYCLE STACK FROM GE SCOPE - STACK IS PROVIDED WITH HTSCR/CO CATALYST SYSTEM SEPARATELY, WHICH WAS NOT QUOTED BY GE	(1.00) LT		(151,111)					(151,111)
	31-85-00-99	ALLOWANCE FOR INTERCONNECTING PIPING FOR ALL CTG AUXILIARY SYSTEMS		1.00 LT			10,741	4,384	296,812	102,406	409,959
	31-85-00-99	SYNCHRONOUS CONDENSER CAPABILITY	PRICING PROVIDED BY GE	1.00 LT		7,497,761		1,379	93,393	32,222	7,623,377
		COMBUSTION TURBINE				**58,027,615**	**10,741**	**12,430**	**790,472**	**234,539**	**59,063,366**
		WATER TREATING									
	31-93-00-30	DEMINERALIZER	COST NOT INCLUDED - ASSUME USING EXISTING	0.00 LS	-	-	-				
		MECHANICAL EQUIPMENT, MISCELLANEOUS									
	31-99-00-09	DI FINAL FILTER SKID (20 MICRON FINAL FILTERS) DOWNSTREAM OF DEMINERALIZED WATER STORAGE TANK	COST NOT INCLUDED - ASSUME USING EXISTING	0.00 LS	-		-				
		MECHANICAL EQUIPMENT				**58,681,618**	**10,741**	**13,023**	**826,398**	**244,089**	**59,762,846**
		PIPING									
		SS 304, ABOVE GROUND, PROCESS AREA									
	35-13-01-06	0.75 IN DIA, SCH 40S		1,399.64 LF	-	-	35,025	1,625	110,048	127,004	272,077
	35-13-01-18	2 IN DIA, SCH 40S		314.92 LF	-	-	30,194	511	34,567	39,951	104,712
	35-13-01-22	3 IN DIA, SCH 40S		799.80 LF	-	-	58,846	1,499	101,487	35,015	195,348
	35-13-01-30	6 IN DIA, SCH 40S		39.99 LF	-	-	6,777	93	6,289	2,170	15,235
		SS 304, ABOVE GROUND, PROCESS AREA					**130,841**	**3,728**	**252,391**	**204,139**	**587,371**
		SS 316, ABOVE GROUND, PROCESS AREA									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		SS 316, ABOVE GROUND, PROCESS AREA									
	35-13-02-14	1.5 IN DIA, SCH 40S		199.95 LF	-	-	16,751	297	20,080	23,252	60,082
	35-13-02-22	3 IN DIA, SCH 40S		469.88 LF	-	-	44,924	881	59,624	20,571	125,119
		SS 316, ABOVE GROUND, PROCESS AREA					**61,675**	**1,177**	**79,703**	**43,823**	**185,202**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-14	1.5 IN DIA, SCH 80		399.90 LF	-	-	9,028	524	35,489	40,867	85,384
	35-13-10-18	2 IN DIA, SCH 80		519.87 LF	-	-	16,686	741	50,183	57,706	124,575
	35-13-10-25	3 IN DIA, SCH 40		639.84 LF	-	-	25,148	986	66,745	23,028	114,921
	35-13-10-29	4 IN DIA, SCH 40		399.90 LF	-	-	20,667	680	46,074	15,896	82,637
	35-13-10-33	6 IN DIA, SCH 40, GALVANIZED, MECHANICAL JOINT		169.96 LF	-	-	13,383	215	14,554	5,021	32,958
	35-13-10-33	6 IN DIA, SCH 40		89.98 LF	-	-	7,085	167	11,277	3,891	22,253
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**91,997**	**3,313**	**224,323**	**146,410**	**462,729**
		SS 304, BURIED									
	35-15-01-17	2 IN DIA, SCH 10S, WRAPPED	2" UG SS304	299.92 LF	-	-	15,989	290	19,613	19,288	54,890
	35-15-01-26	4 IN DIA, SCH 40S, WRAPPED	4" UG SS304	224.94 LF	-	-	19,610	238	16,110	5,558	41,278
		SS 304, BURIED					**35,599**	**528**	**35,723**	**24,847**	**96,169**
		SS 316, BURIED									
	35-15-02-22	3 IN DIA, SCH 40S, WRAPPED	3" UG SS316	149.96 LF	-	-	11,136	143	9,690	3,343	24,168
		SS 316, BURIED					**11,136**	**143**	**9,690**	**3,343**	**24,168**
		CARBON STEEL, BURIED									
	35-15-10-26	3 IN DIA, SCH 80, WRAPPED	3" UG CARBON STEEL	549.86 LF	-	-	23,406	474	32,104	11,076	66,587
		CARBON STEEL, BURIED					**23,406**	**474**	**32,104**	**11,076**	**66,587**
		HDPE, BURIED									
	35-15-30-09	3/4 IN DIA, DR 9	3/4" UG HDPE	89.98 LF	-	-	477	54	3,642	1,257	5,376
	35-15-30-09	2 IN DIA, DR 9	2" UG HDPE	449.89 LF	-	-	2,386	269	18,212	6,283	26,881
	35-15-30-09	1.5 IN DIA, DR 9	1.5" UG HDPE	799.80 LF	-	-	4,242	478	32,376	11,170	47,789
	35-15-30-13	3 IN DIA, DR 9	3" UG HDPE	399.90 LF	-	-	2,665	349	23,660	8,163	34,488
	35-15-30-17	4 IN DIA, DR 9	4" UG HDPE	49.99 LF	-	-	462	26	1,790	618	2,870
	35-15-30-21	6 IN DIA, DR 9	6" UG HDPE	724.81 LF	-	-	13,702	575	38,933	13,433	66,068
	35-15-30-29	10 IN DIA, DR 9		199.95 LF	-	-	11,040	225	15,254	5,263	31,558
		HDPE, BURIED					**34,975**	**1,977**	**133,867**	**46,187**	**215,029**
		CHDPE, BURIED									
	35-15-31-99	12 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	49.99 LF	-	-	689	5	302	90	1,081
	35-15-31-99	18 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	99.97 LF	-	-	2,492	13	868	260	3,620
	35-15-31-99	24 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	149.96 LF	-	-	5,654	22	1,429	428	7,511
	35-15-31-99	30 IN DIA, CHDPE	STORMWATER DRAINAGE PIPING	199.95 LF	-	-	10,132	37	2,383	713	13,229
	35-15-31-99	24 IN DIA, CHDPE	STORMWATER DRAINAGE CULVERTS	199.95 LF	-	-	7,538	30	1,906	570	10,014
	35-15-31-99	18 IN DIA, CHDPE	STORMWATER DRAINAGE CULVERTS	149.96 LF	-	-	3,739	20	1,302	390	5,430
	35-15-31-99	48 IN DIA, CHDPE	STORMWATER DRAINAGE CULVERTS	249.94 LF	-	-	30,143	55	3,511	1,051	34,705
		CHDPE, BURIED					**60,388**	**182**	**11,700**	**3,502**	**75,590**
		PIPE SUPPORTS, HANGERS									
	35-35-00-01	SINGLE ROD SUPPORT W/O BEAM FOR 1 IN AND BELOW DIA PIPE		100.00 EA	-	-	23,800	230	15,566	5,370	44,736
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 1-1/2 IN AND 2 IN DIA PIPE		115.00 EA	-	-	27,370	264	17,900	6,176	51,446
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 2 IN DIA PIPE		60.00 EA	-	-	14,280	138	9,339	3,222	26,842
	35-35-00-04	SINGLE ROD SUPPORT W/O BEAM FOR 3 IN PIPE		106.00 EA	-	-	29,120	366	24,749	8,539	62,408
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE		20.00 EA	-	-	6,338	92	6,226	2,148	14,712
	35-35-00-06	SINGLE ROD SUPPORT W/O BEAM FOR 6 IN PIPE		13.00 EA	-	-	4,685	90	6,071	2,094	12,850
	35-35-00-07	SINGLE ROD SUPPORT W/O BEAM FOR 8 IN PIPE		8.00 EA	-	-	3,014	64	4,358	1,504	8,876
	35-35-00-25	SINGLE ROD SUPPORT W/ BEAM FOR 1 IN AND BELOW DIA PIPE		100.00 EA	-	-	26,112	402	27,240	9,398	62,750
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN		115.00 EA	-	-	30,498	463	31,326	10,808	72,632
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 2 IN PIPE		60.00 EA	-	-	15,912	241	16,344	5,639	37,895
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE		106.00 EA	-	-	39,212	804	54,448	18,786	112,445
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE		20.00 EA	-	-	8,242	175	11,830	4,082	24,153
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE		13.00 EA	-	-	5,923	143	9,713	3,351	18,987
	35-35-00-31	SINGLE ROD SUPPORT W/ BEAM FOR 8 IN PIPE		8.00 EA	-	-	3,895	114	7,721	2,664	14,279
		PIPE SUPPORTS, HANGERS					**238,400**	**3,586**	**242,830**	**83,781**	**565,011**
		VALVES									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		VALVES									
	35-45-00-07	1.5 IN VALVE, CLASS 600, MANUAL, WELD END	SW	3.00 EA	-	-	2,097	9	630	218	2,945
	35-45-00-15	3 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	CA	2.00 EA	-	-	2,451	10	669	231	3,351
	35-45-00-15	3 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	ANTI-ICING	2.00 EA	-	-	2,451	10	669	231	3,351
	35-45-00-23	6 IN ISOLATION VALVE, CLASS 150, MANUAL, MECHANICAL JOINT	FIRE PROTECTION	6.00 EA	-	-	21,785	45	3,035	1,047	25,868
	35-45-00-25	6 IN HYDRANT, CLASS 150, MANUAL, FLANGE END	FIRE PROTECTION	6.00 EA	-	-	21,785	90	6,071	2,094	29,950
		VALVES					**50,569**	**164**	**11,075**	**3,821**	**65,465**
		STAINLESS STEEL VALVES									
	35-46-00-07	1.5 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	PW	4.00 EA	-	-	2,542	18	1,214	419	4,175
	35-46-00-09	2 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	CA	3.00 EA	-	-	2,179	17	1,121	387	3,686
	35-46-00-15	3 IN CHECK VALVE, CLASS 150, MANUAL, WELD END	DEMIN WATER	2.00 EA	-	-	5,083	14	981	338	6,402
	35-46-00-15	3 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	DEMIN WATER	8.00 EA	-	-	13,071	58	3,923	1,353	18,347
		STAINLESS STEEL VALVES					**22,874**	**107**	**7,238**	**2,497**	**32,610**
		MISCELLANEOUS VALVES									
	35-49-00-99	1.5 IN DIA HOSE STATIONS	SW	3.00 EA		-	32,678	34	2,335	806	35,818
	35-49-00-99	3 IN Y-STRAINER, CLASS 150, 304 SS, MANUAL, FLANGE END	PW	2.00 EA		-	6,899	18	1,245	430	8,574
	35-49-00-99	8 IN Y-STRAINER, CLASS 150, 304 SS, MANUAL, FLANGE END	DEMIN WATER	1.00 EA		-	13,797	17	1,167	403	15,368
		MISCELLANEOUS VALVES					**53,374**	**70**	**4,747**	**1,638**	**59,759**
		PIPING					**815,234**	**15,448**	**1,045,391**	**575,064**	**2,435,690**
		INSULATION									
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-99	LARGE BORE PIPING		1,999.49 LF	-	-	104,855	2,031	112,060	20,919	237,834
	36-17-03-99	SMALL BORE PIPING		1,099.72 LF	-	-	28,431	650	35,882	6,698	71,011
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**133,286**	**2,681**	**147,941**	**27,617**	**308,845**
		INSULATION					**133,286**	**2,681**	**147,941**	**27,617**	**308,845**
		ELECTRICAL EQUIPMENT									
		CABLE BUS									
	41-10-00-01	3000 A, 5KV CABLE BUS		76.98 LF	-	123,675		310	19,609	6,207	149,491
	41-10-00-01	3200 A, 480V CABLE BUS		43.99 LF	-	32,006		162	10,244	3,243	45,493
		CABLE BUS				**155,680**		**472**	**29,853**	**9,450**	**194,983**
		BUS DUCT									
	41-13-00-19	1,200 AMPS, 13.8 KV RATED	INCLUDED IN THE MAIN BUS BELOW	0.00 LF	-						
	41-13-00-19	3,500 AMPS, 13.8 KV RATED	SINGLE PHASE	162.76 LF	95,119						95,119
		BUS DUCT			**95,119**						**95,119**
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION SYSTEM (RECTIFIERS, CONDUCTOR, LINEAR ANODE SYSTEM)	2500 FT OF COATED, WRAPPED, CARBON STEEL PIPE WITH LINEAR ANODE SYSTEM OF 25 ANODES, 1-208V 3 PH 15 KVA RECTIFIER, & 10 TEST STATIONS, FURNISH AND ERECT SUBCONTRACTOR COST	1.00 LS	102,000	-					102,000
		CATHODIC PROTECTION			**102,000**						**102,000**
		COMMUNICATION SYSTEM									
	41-17-00-99	COMMUNICATIONS - PHONE LINE (CABLES INCLUDED UNDER 43.00.00)	4 PHONES FOR CTG PDCS; MV & LV PDC, GAS COMP BLDG, ADMIN/CONTROL BLDG	1.00 LS	-		3,078	152	9,605	3,040	15,723
	41-17-00-99	COMMUNICATIONS - PHONE CONNECTION ALLOWANCE	FROM MAIN DISTRIBUTION PANEL INSIDE THE ADMIN BLDG TO THE INTERFACE WITH TELECOM COMPANY	1.00 LS	74,800						74,800
	41-17-00-99	PAGE PARTY, GAI-TRONICS	ALLOWANCE ESTIMATED BASED ON RECENT EXPERIENCE	1.00 LS	-	59,840		1,770	112,059	35,471	207,371
		COMMUNICATION SYSTEM			**74,800**	**59,840**	**3,078**	**1,922**	**121,665**	**38,512**	**297,894**
		CONTROL & BACKUP POWER									
	41-21-00-09	125V DC BATTERIES, 1800 AH	INCL THE FOLLOWING: (2) 125V BATTERY CHARGER, 100A,480V PANELS & 50KVA INVERTER & UPS, AC & DC PANELS	0.66 LS	-	190,964		137	8,644	2,736	202,344
	41-21-00-19	40KVA UPS WITH BYPASS	40KVA, 3PH, 120-208V OUTPUT	0.66 LS		86,146		36	2,305	730	89,181
		CONTROL & BACKUP POWER				**277,111**		**173**	**10,949**	**3,466**	**291,525**
		GENERATOR NEUTRAL GROUNDING & PROTECTION									
	41-27-00-19	13.8KV, 3,500A, CT GENERATOR CIRCUIT BREAKER		1.00 EA	-	767,256		172	10,914	3,455	781,624
		GENERATOR NEUTRAL GROUNDING & PROTECTION				**767,256**		**172**	**10,914**	**3,455**	**781,624**

Estimate No.: 36484C
Project No.: A14782.003
Estimate Date: 09/24/20024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-30-00-16	#500 KCMIL CU INSULATED STRANDED GROUND WIRE	G	98.97 LF	-	-	1,548	6	403	115	2,066
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	G	3,958.99 LF	-	-	38,282	127	9,031	2,584	49,896
	41-31-00-08	#500 KCMIL CU BARE STRANDED GROUND WIRE	G	4,948.73 LF	-	-	67,302	267	18,949	5,421	91,672
	41-31-00-14	#4/0 CU INSULATED STRANDED GROUND WIRE	G	3,299.16 LF	-	-	22,210	140	9,945	2,845	34,999
	41-31-00-16	EXOTHERMIC WELD	#4/0 AWG WIRE	396.00 EA	-	-	8,078	910	64,507	18,454	91,040
	41-31-00-16	EXOTHERMIC WELD	250-500 KCMIL WIRE	495.00 EA	-	-	10,098	1,138	80,634	23,068	113,800
	41-31-00-18	COPPER CLAD GROUND ROD, 20' LONG, 3/4 " DIA.		330.00 EA	-	-	44,880	759	53,756	15,379	114,015
	41-31-00-19	CADWELD		132.00 EA	-	-	2,693	303	21,502	6,151	30,347
	41-31-00-29	CABLE TRAY GROUND CONNECTIONS		297.00 EA	-	-	7,271	256	18,143	5,190	30,603
	41-31-00-99	GROUNDING ALLOWANCE	INCLUDES GROUND GRID, CADWELDS, GROUND RODS, GROUND CABLE/STRAPS	0.66 LS	-	-	59,840	506	35,837	10,252	105,930
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING TEST	TEST & DOCUMENTATIONS	0.66 LT	-	-		137	9,676	2,768	12,444
		ELECTRICAL EQUIPMENT, GROUNDING					**262,201**	**4,550**	**322,382**	**92,228**	**676,812**
		HEAT TRACING									
	41-33-00-04	SMALL BORE PIPING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	1,099.72 LF	-	-	31,034	1,075	76,154	21,786	128,974
	41-33-00-08	LARGE BORE PIPING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	1,999.49 LF	-	-	68,282	2,253	159,638	45,670	273,590
	41-33-00-59	HEAT TRACE TRANSFORMER 480-208/120V 15 KVA		2.00 EA	-	-	2,176	28	1,746	553	4,475
	41-33-00-99	HEAT TRACING - ENGINEERING & FIELD SUPPORT		1.00 LS	40,800	-					40,800
		HEAT TRACING			**40,800**		**101,492**	**3,355**	**237,539**	**68,009**	**447,839**
		LIGHTNING PROTECTION									
	41-35-00-99	LIGHTNING PROTECTION	ALLOWANCE	1.00 LS	47,600	-					47,600
		LIGHTNING PROTECTION			**47,600**						**47,600**
		EXTERIOR LIGHTING									
	41-38-00-99	30 FT ALUMINUM ROADWAY POLE WITH ONE ARM & 200 WATT LED FIXTURE		30.00 EA		-	153,490	552	34,924	11,055	199,469
	41-38-00-99	STANCHION MOUNT FIXTURES, OUTDOOR RATED, 80W LED (AND SUPPORTS)		27.00 EA		-	35,251	93	5,893	1,866	43,010
	41-38-00-99	WALL MOUNT FIXTURES, OUTDOOR RATED, 80 W LED (AND SUPPORTS)		15.00 EA		-	23,256	52	3,274	1,036	27,567
	41-38-00-99	LIGHT FIXTURE ON POLES ALLOWANCE		1.00 LS		-	33,660	431	27,284	8,637	69,581
		EXTERIOR LIGHTING					**245,657**	**1,128**	**71,376**	**22,593**	**339,626**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	BOP PROTECTIVE RELAY PANELS - ALLOWANCE	PROTECTIVE RELAYS, METERS, ETHERNET SWITCHES	1.00 LS	-	75,130		143	9,080	2,874	87,084
	41-47-00-09	MAIN DC DISTRIBUTION BOARD AND DC SUB PANELS	125V DC, 1200A, 3 MAIN, 12 FEEDER	1.00 LS	-	110,817		36	2,270	719	113,805
	41-47-00-99	MAIN UPS DISTRIBUTION BOARD	3PH, 120-208V, 1-MIAN, 16-FEEDER	1.00 LS	-	49,802		19	1,211	383	51,396
	41-47-00-99	MISCELLANEOUS DISCONNECT SWITCHES		1.00 LS	-		9,165	574	36,321	11,497	56,983
		PANEL: CONTROL, DISTRIBUTION, & RELAY				**235,749**	**9,165**	**772**	**48,882**	**15,473**	**309,269**
		POWER TRANSFORMER									
	41-51-00-99	UAT TRANSFORMERS (9/12/15, 13.8-4.16KV) ONAN AT 65 DEG-C		1.00 EA	-	630,360		575	36,379	11,516	678,255
	41-51-00-99	4.16KV-480V STATION SERVICE TRANSFORMER, 1.5/2.2 MVA		1.00 EA	-	280,160		736	46,566	14,740	341,465
	41-51-00-99	69/15 KV, 60 MVA, GSU	INCLUDING ALLOWANCES FOR FREIGHT AND LOAD TAP CHANGER	2.00 EA		10,800,000		2,989	189,172	59,881	11,049,053
		POWER TRANSFORMER				**11,710,520**		**4,299**	**272,117**	**86,136**	**12,068,773**
		POWER DISTRIBUTION CENTER (PDC)									
	41-52-00-10	PDC FOR MV SWGR COMPLETE WITH HVAC, PANEL BOARDS, UTILITIES, LIGHTS, FIRE DECT		1.00 EA	-	730,934		402	26,475	14,208	771,617
		POWER DISTRIBUTION CENTER (PDC)				**730,934**		**402**	**26,475**	**14,208**	**771,617**
		SWITCHGEAR									
	41-55-00-09	4160V MV SWGR	3000A BUS, 50 KA, 3-3000A BKRS, 6-1200A BKRS, & 4-400A MV MCC STARTERS	1.00 EA	-	452,171		195	12,369	3,915	468,455
	41-55-00-09	480V LV SWGR	3200A BUS, 65 kV, 3-3200A BKRS, 2-1200A BKRS, 1-1600A, 6-800A BKRS	1.00 EA	-	65,532		37	2,328	737	68,597
	41-55-00-79	480V MCCs	6-800A MCCs & 2-1200A MCCs	6.00 EA	-	595,745		305	19,296	6,108	621,149
		SWITCHGEAR				**1,113,448**		**537**	**33,993**	**10,760**	**1,158,201**
		WIRING DEVICE									
	41-57-00-99	120V AC WEATHERPROOF RECEPTACLES, GFCI TYPE	OUTDOOR LIGHTING	24.00 EA	-	-	1,632	34	2,183	691	4,506
	41-57-00-99	120 VAC GFCI RECEPTACLES		52.00 EA	-	-	3,536	75	4,729	1,497	9,762

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MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		WIRING DEVICE									
	41-57-00-99	480VAC POWER OUTLETS (60 AMPS), OUTDOOR RATED		9.00 EA	-	-	3,182	62	3,929	1,244	8,355
		WIRING DEVICE					**8,350**	**171**	**10,841**	**3,432**	**22,623**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	600 V ELECTRICAL EQUIPMENT UPGRADE FROM 480 V	ALLOWANCE BASED ON 10% OF PROCESS EQUIPMENT, MATERIAL, AND INSTALLATION HOURS OF 480 V EQUIPMENT IN ESTIMATE	1.00 LS	-	207,797	31,407	348	22,053	6,981	268,238
		ELECTRICAL EQUIPMENT, MISCELLANEOUS				**207,797**	**31,407**	**348**	**22,053**	**6,981**	**268,238**
		ELECTRICAL EQUIPMENT			**360,319**	**15,258,333**	**661,350**	**18,301**	**1,219,039**	**374,702**	**17,873,744**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY COVER, ALUMINUM									
	42-13-02-01	12 IN WIDE INCLUDING FITTINGS		104.26 LF	-	-	1,321	1	85	2	1,408
	42-13-02-02	18 IN WIDE INCLUDING FITTINGS		44.87 LF	-	-	725	2	113	3	841
	42-13-02-05	36 IN WIDE INCLUDING FITTINGS		213.78 LF	-	-	5,536	43	3,040	74	8,650
	42-13-02-05	36 IN WIDE INCLUDING FITTINGS	VENTED TYPE	92.38 LF	-	-	2,392	19	1,314	32	3,738
		CABLE TRAY COVER, ALUMINUM					**9,974**	**64**	**4,552**	**111**	**14,637**
		CABLE TRAY, ALUMINUM									
	42-13-37-01	12 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		315.66 LF	-	-	11,158	401	28,345	693	40,195
	42-13-37-01	12 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		274.49 LF	-	-	9,702	379	26,767	654	37,123
	42-13-37-03	24 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		135.66 LF	-	-	6,262	273	19,281	471	26,014
	42-13-37-05	36 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		646.90 LF	-	-	35,490	1,564	110,551	2,701	148,743
	42-13-37-99	CABLE TRAY DIVIDER STRIP		68.62 LF	-	-	165	1	61	2	228
		CABLE TRAY, ALUMINUM					**62,777**	**2,618**	**185,006**	**4,520**	**252,303**
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-12	3/4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		765.00 EA	-	-	20,642	659	46,612	1,139	68,393
	42-15-23-17	1-1/2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		26.00 EA	-	-	1,889	37	2,640	65	4,593
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		13.00 EA	-	-	1,439	25	1,743	43	3,225
	42-15-23-20	3 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		7.00 EA	-	-	2,575	16	1,137	28	3,740
	42-15-23-23	5 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		3.00 EA	-	-	4,588	9	670	16	5,275
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**31,132**	**747**	**52,803**	**1,290**	**85,225**
		CONDUIT, PVC									
	42-15-33-19	4 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		17,182.00 LF	-	-	216,150	1,995	141,019	3,446	360,614
	42-15-33-21	5 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,323.88 LF	-	-	23,316	213	15,062	368	38,746
	42-15-33-23	6 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		135.13 LF	-	-	3,280	32	2,295	56	5,632
		CONDUIT, PVC					**242,746**	**2,241**	**158,376**	**3,870**	**404,991**
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		7,752.99 LF	-	-	57,571	1,729	122,224	2,986	182,781
	42-15-37-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		395.90 LF	-	-	4,243	109	7,689	188	12,120
	42-15-37-05	1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		237.54 LF	-	-	4,038	78	5,482	134	9,654
	42-15-37-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,111.46 LF	-	-	47,582	855	60,397	1,476	109,455
	42-15-37-08	3 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		316.72 LF	-	-	14,904	235	16,601	406	31,910
	42-15-37-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		158.36 LF	-	-	10,047	147	10,385	254	20,686
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		79.18 LF	-	-	9,196	103	7,251	177	16,625
		CONDUIT, RGS					**147,580**	**3,255**	**230,029**	**5,620**	**383,230**
		CONDUIT, MISCELLANEOUS									
	42-15-99-98	CONDUIT TRENCHING	USING ELECTRICAL TRENCHING MACHINE, INCLUDES BACKFILL	923.76 LF	-	-		159	11,260	275	11,535
		CONDUIT, MISCELLANEOUS						**159**	**11,260**	**275**	**11,535**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		RACEWAY, CABLE TRAY & CONDUIT					**494,210**	**9,084**	**642,025**	**15,687**	**1,151,922**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-01	600V #16 1 TRIAD CU SHIELDED XLPE LSZH		2,535.86 LF	-	-	2,035	52	3,719	1,064	6,818
	43-10-00-01	600V #16 2 TRIAD CU SHIELDED XLPE LSZH		127.74 LF	-	-	103	3	187	54	343
	43-10-00-02	600V #16 4 TRIAD CU SHIELDED XLPE LSZH		1,268.99 LF	-	-	5,039	74	5,272	1,508	11,820
	43-10-00-03	600V #16 8 TRIAD CU SHIELDED XLPE LSZH		1,268.99 LF	-	-	3,987	74	5,272	1,508	10,767
	43-10-00-09	600V #16 1 TW PR CU KX SHIELDED XLPE LSZH		8,869.45 LF	-	-	2,051	153	10,838	3,101	15,989
	43-10-00-09	600V #16 1 TW PR CU SHIELDED XLPE CPE		12,669.81 LF	-	-	2,929	218	15,482	4,429	22,841
	43-10-00-10	600V #16 2 TW PR CU KX SHIELDED XLPE LSZH		760.92 LF	-	-	931	20	1,426	408	2,765
	43-10-00-10	600V #16 2 TW PR CU SHIELDED XLPE CPE		2,027.79 LF	-	-	2,482	54	3,800	1,087	7,369
	43-10-00-11	600V #16 4 TW PR CU SHIELDED XLPE LSZH		1,268.99 LF	-	-	2,088	42	2,998	858	5,944
	43-10-00-11	600V #16 4 TW PR CU KX SHIELDED XLPE CPE		888.40 LF	-	-	1,462	30	2,099	600	4,161
	43-10-00-12	600V #16 8 TW PR CU SHIELDED XLPE LSZH		1,141.51 LF	-	-	2,406	68	4,836	1,383	8,626
	43-10-00-12	600V #16 8 TW PR CU KX SHIELDED XLPE CPE		508.07 LF	-	-	1,071	30	2,152	616	3,839
	43-10-00-13	600V #16 12 TW PR CU SHIELDED XLPE CPE		888.40 LF	-	-	1,897	56	3,981	1,139	7,017
	43-10-00-15	600V #14 2/C CU XLPE LSZH		190.03 LF	-	-	145	4	294	84	523
	43-10-00-16	600V #14 3/C CU XLPE LSZH		10,136.33 LF	-	-	8,547	221	15,691	4,489	28,727
	43-10-00-17	600V #14 4/C CU XLPE LSZH		5,069.09 LF	-	-	6,274	134	9,498	2,717	18,489
	43-10-00-17	600V #14 5/C CU XLPE LSZH		5,702.52 LF	-	-	7,057	151	10,685	3,057	20,800
	43-10-00-18	600V #14 7/C CU XLPE LSZH		5,069.09 LF	-	-	8,411	152	10,737	3,072	22,219
	43-10-00-18	600V #14 7/C CU XLPE LSZH		395.90 LF	-	-	657	12	839	240	1,735
	43-10-00-20	600V #14 12/C CU XLPE LSZH		7,602.84 LF	-	-	19,439	306	21,679	6,202	47,320
	43-10-00-23	#24 4 TW PR CU CATEGORY 5e PLENUM RATED JACKET		1,506.00 LF	-	-	1,045	26	1,840	526	3,411
	43-10-00-24	RG-62/U TYPE SHIELDED COAXIAL CABLE		127.74 LF	-	-	47	2	156	45	248
	43-10-00-31	6 FIBER 62.5 µM MULTI MODE OPTICAL FIBER ARMORED RISER RATED		888.40 LF	-	-	4,531	46	3,264	3,464	11,259
	43-10-00-31	12 FIBER 62.5 µM MULTI MODE OPTICAL FIBER ARMORED RISER RATED		1,902.43 LF	-	-	9,702	99	6,990	7,417	24,110
	43-10-00-32	24 FIBER 62.5 µM MULTI MODE OPTICAL FIBER ARMORED RISER RATED		1,647.47 LF	-	-	11,763	98	6,979	6,562	25,304
	43-10-00-80	TERMINATION - FIBER OPTIC		635.00 EA	-	-	6,477	438	31,032	8,878	46,386
	43-10-00-81	TERMINATION - RG6 COAXIAL CABLE		8.00 EA	-	-	9	2	163	47	219
	43-10-00-83	TERMINATION - ETHERNET		8.00 EA	-	-	22	3	228	65	315
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		4,244.00 EA	-	-	6,926	244	17,283	4,944	29,154
	43-10-00-84	TERMINATION - COMPRESSION LUG, #18 AND SMALLER, 1 HOLE, COPPER		964.00 EA	-	-	1,573	55	3,926	1,123	6,622
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		2,438.00 EA	-	-	5,637	280	19,857	5,681	31,175
	43-10-00-99	TEST CONTROL/INSTRUMENTATION WIRE		8,078.00 EA	-	-		464	32,897	9,411	42,308
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**126,742**	**3,614**	**256,103**	**85,779**	**468,623**
		600V CABLE & TERMINATION									
	43-20-00-08	600V #10 3/C CU XLPE LSZH		6,336.23 LF	-	-	17,493	197	13,937	3,987	35,417
	43-20-00-08	600V #10 3/C CU W/G XLPE LSZH		422.82 LF	-	-	1,167	13	930	266	2,363
	43-20-00-10	600V #10 4/C CU XLPE LSZH		2,534.02 LF	-	-	7,513	82	5,780	1,654	14,947
	43-20-00-10	600V #10 5/C CU XLPE CPE		141.73 LF	-	-	420	5	323	92	836
	43-20-00-10	600V #10 7/C CU XLPE CPE		211.41 LF	-	-	627	7	482	138	1,247
	43-20-00-10	600V #10 10/C CU XLPE CPE		283.46 LF	-	-	840	9	647	185	1,672
	43-20-00-13	600V #8 3/C CU W/G EPR TS-CPE		857.11 LF	-	-	3,031	32	2,235	639	5,905
	43-20-00-13	600V #8 4/C CU W/G EPR TS-CPE		422.82 LF	-	-	1,495	16	1,102	315	2,913
	43-20-00-13	600V #8 3/C CU W/G EPR TS-CPE		987.11 LF	-	-	3,490	36	2,573	736	6,800
	43-20-00-17	600V #6 3/C CU EPR TS-CPE		987.11 LF	-	-	4,430	52	3,699	1,058	9,188
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		422.82 LF	-	-	2,961	35	2,515	719	6,195
	43-20-00-26	600V #2 3/C W/G CU EPR TS-CPE		1,691.01 LF	-	-	14,765	122	8,679	2,483	25,927
	43-20-00-30	600V #1/0 3/C W/G CU EPR TS-CPE		3,521.12 LF	-	-	36,730	316	22,376	6,401	65,507
	43-20-00-35	600V #2/0 3/C W/G CU EPR TS-CPE		706.28 LF	-	-	11,229	80	5,639	1,613	18,481
	43-20-00-39	600V #4/0 3/C W/GND CU		3,521.12 LF	-	-	106,214	445	31,555	9,027	146,796
	43-20-00-43	600V #350 KCMIL 1/C CU EPR TS-CPE		845.64 LF	-	-	6,958	60	4,271	1,222	12,451
	43-20-00-45	600V #500 KCMIL 1/C CU		2,111.46 LF	-	-	23,432	153	10,837	3,100	37,369
	43-20-00-81	TERMINATION - COMPRESSION LUG, #10, 1 HOLE, COPPER		1,520.00 EA	-	-	4,548	437	30,950	8,854	44,353
	43-20-00-82	TERMINATION - COMPRESSION LUG, #8, 2 HOLE, COPPER		570.00 EA	-	-	5,039	197	13,928	3,984	22,951
	43-20-00-83	TERMINATION - COMPRESSION LUG, #6, 2 HOLE, COPPER		380.00 EA	-	-	4,651	175	12,380	3,542	20,573
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		664.00 EA	-	-	8,353	382	27,041	7,736	43,130
	43-20-00-85	TERMINATION - COMPRESSION LUG, #2, 2 HOLE, COPPER		476.00 EA	-	-	7,121	328	23,262	6,655	37,037
	43-20-00-86	TERMINATION - COMPRESSION LUG, #1/0, 2 HOLE, COPPER		380.00 EA	-	-	7,106	314	22,284	6,375	35,765

Estimate No.: 36484C
Project No.: A14782.003
Estimate Date: 09/24/20024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		600V CABLE & TERMINATION									
	43-20-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		380.00 EA	-	-	9,302	480	34,045	9,740	53,088
	43-20-00-90	TERMINATION - COMPRESSION LUG, #250, 2 HOLE, COPPER		96.00 EA	-	-	2,742	152	10,790	3,087	16,619
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		58.00 EA	-	-	2,997	147	10,393	2,973	16,363
	43-20-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		38.00 EA	-	-	3,204	132	9,378	2,683	15,265
	43-20-00-99	TEST AND DOCUMENTATION		4,752.00 EA	-	-		819	58,056	16,609	74,665
		600V CABLE & TERMINATION					**297,859**	**5,223**	**370,088**	**105,876**	**773,823**
		5/8KV CABLE & TERMINATION									
	43-40-00-04	5/8KV #4/0 3/C CU TRIPLEXED EPR TS-CPE		844.58 LF	-	-	18,642	129	9,151	2,618	30,412
	43-40-00-10	5/8KV #500 KCMIL 1/C CU EPR TS-CPE		2,375.39 LF	-	-	27,750	232	16,449	4,706	48,905
	43-40-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		32.00 EA	-	-	783	61	4,300	1,230	6,314
	43-40-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		16.00 EA	-	-	827	61	4,300	1,230	6,358
	43-40-00-99	TEST AND DOCUMENTATION		48.00 EA	-	-		28	1,955	559	2,514
		5/8KV CABLE & TERMINATION					**48,003**	**510**	**36,156**	**10,344**	**94,503**
		CABLE					**472,604**	**9,347**	**662,347**	**201,998**	**1,336,949**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS)	TOTAL SYSTEM COST, BOTH HARDWARE AND PROGRAMMING	1.00 LS	831,752						831,752
	44-13-00-09	CABINET	INCLUDED ABOVE	13.00 EA				359	25,412	7,270	32,682
	44-13-00-11	TESTING, CALIBRATION AND DOCUMENTATION BASED ON I/O COUNT		824.00 EA	-	-		947	67,113	1,920	69,033
		CONTROL SYSTEM			**831,752**			**1,306**	**92,525**	**9,190**	**933,467**
		INSTRUMENT PANEL AND RACK									
	44-17-00-01	INSTRUMENT TUBING - 0.25 & 0.5 IN DIA, 0.065 IN WALL, 316SS, INCLUDES FITTINGS, VALVES, AND SUPPORTS		1,161.30 LF	-	-	68,229	200	14,590	1,268	84,087
	44-17-00-30	INSTRUMENT PEDESTAL	FOR 2 OR 3 INSTRUMENTS ON RACK VARIOUS SIZES + FLOOR MTG HDWR (ALLOWANCE)	20.00 EA	-	-	21,797	138	9,749	238	31,784
		INSTRUMENT PANEL AND RACK					**90,026**	**338**	**24,339**	**1,506**	**115,871**
		INSTRUMENT									
	44-21-00-20	DIFFERENTIAL PRESSURE TRANSMITTER	PDIT - WITH 5 VALVE MANIFOLD PER DEVICE	7.00 EA	-	-	49,043	97	7,034	611	56,688
	44-21-00-32	FLOW ELEMENT	FE - ORIFICE	5.00 EA	-	-	15,569	23	1,675	146	17,390
	44-21-00-37	FLOW INDICATING TRANSMITTER	FT/FIT - WITH INTEGRAL 5-VALVE MANIFOLD	5.00 EA	-	-	35,031	69	5,024	437	40,492
	44-21-00-47	LEVEL INDICATING TRANSMITTER	LIT (DP)	2.00 EA	-	-	14,012	9	670	58	14,740
	44-21-00-62	PRESSURE INDICATOR	PI - WITH MANIFOLD	4.00 EA	-	-	6,228	37	2,680	233	9,140
	44-21-00-64	PRESSURE TRANSMITTER	PT/PIT - WITH 2 VALVE MANIFOLD PER DEVICE	20.00 EA	-	-	108,985	184	13,398	1,164	123,547
	44-21-00-96	THERMOCOUPLE	TE	12.00 EA	-	-	8,407	41	2,932	839	12,178
	44-21-00-96	TEMPERATURE INDICATING TRANSMITTER	TIT	12.00 EA	-	-	38,375	83	5,864	1,678	45,917
	44-21-99-95	THERMOWELLS	TEW INCLUDING TESTING	12.00 EA	-	-	5,605	28	1,955	559	8,119
		INSTRUMENT					**281,256**	**570**	**41,231**	**5,725**	**328,211**
		CONTROL & INSTRUMENTATION, TESTING									
	44-98-00-09	INSTRUMENT TESTING AND CALIBRATION	FIELD MOUNTED DEVICES	76.00 EA	-	-		87	6,190	1,771	7,961
		CONTROL & INSTRUMENTATION, TESTING						**87**	**6,190**	**1,771**	**7,961**
		CONTROL & INSTRUMENTATION			**831,752**		**371,282**	**2,301**	**164,285**	**18,192**	**1,385,511**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	CRAFT STARTUP SUPPORT		1.00 EA	-	-		1,138	68,321	0	68,321
		CRAFT PERSONNEL						**1,138**	**68,321**	**0**	**68,321**
		CONSTRUCTION INDIRECT						**1,138**	**68,321**	**0**	**68,321**
		PROJECT INDIRECT									
		FREIGHT									
	71-27-00-25	HEAVY HAUL	SUBCONTRACT FOR MAJOR EQUIPMENT OFFLOADING & STAGING - ALLOWANCE	1.00 LS	136,000	-				-	136,000
		FREIGHT			**136,000**						**136,000**
		PROJECT INDIRECT, USER DEFINED									
	71-99-00-99	SITE GEOTECHNICAL		1.00 LS	35,904	-				-	35,904

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PROJECT INDIRECT, USER DEFINED									
	71-99-00-99	SITE TOPOGRAPHIC SURVEY		1.00 LS	58,344	-				-	58,344
	71-99-00-99	INDEPENDANT CQA EARTHWORK TESTING CONTRACTOR	GAS TURBINE/GENERATOR & ACCESSORY MODULE	1.00 LS	32,314	-				-	32,314
		PROJECT INDIRECT, USER DEFINED			**126,562**						**126,562**
		PROJECT INDIRECT			**262,562**						**262,562**
		1 BASE			**3,040,059**	**73,939,951**	**4,218,373**	**89,326**	**5,697,195**	**2,023,759**	**88,919,337**
BIO		**BIODIESEL SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	322.76 CY	-	-		72	3,260	1,604	4,864
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	9.88 CY	-	-		3	115	56	171
		EXCAVATION						**75**	**3,375**	**1,660**	**5,035**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.75 CY	-	-		1	55	27	82
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-		0	18	9	27
		DISPOSAL						**2**	**73**	**36**	**109**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	24.21 CY	-	-	1,053	5	244	120	1,418
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	5.96 CY	-	-	259	1	60	29	349
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	280.80 CY	-	-	12,220	48	2,182	1,067	15,469
	21-20-00-12	SAND BEDDING	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	16.68 CY	-	-	386	3	146	71	603
		BACKFILL					**13,919**	**58**	**2,632**	**1,288**	**17,839**
		POND, CONTAINMENT LINER									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	3,904	18	839	98	4,842
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	1,627	6			1,627
		POND, CONTAINMENT LINER					**5,531**	**24**	**839**	**98**	**6,468**
		CIVIL WORK					**19,450**	**159**	**6,920**	**3,082**	**29,451**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.21 CY	-	-	3,863	49	2,365	802	7,030
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-	880	11	539	183	1,602
		CONCRETE					**4,743**	**61**	**2,904**	**985**	**8,632**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	172.07 LB	-	-	702	10	566	23	1,291
		EMBEDMENT					**702**	**10**	**566**	**23**	**1,291**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	557.48 SF	-	-	1,403	128	7,104	1,316	9,822
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	212.35 SF	-	-	534	68	3,788	702	5,024
		FORMWORK					**1,937**	**197**	**10,892**	**2,017**	**14,846**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	3.69 TN	-	-	5,627	86	4,608	1,209	11,443
		REINFORCING					**5,627**	**86**	**4,608**	**1,209**	**11,443**
		CONCRETE					**13,009**	**353**	**18,970**	**4,233**	**36,212**
		MECHANICAL EQUIPMENT									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, 304L STAINLESS STEEL, AWWA D100	22 FT DIA. X 18 FT TALL, 50,000 GAL - BIO-DIESEL DAY TANK	1.00 EA	976,527		-				976,527
		TANK			**976,527**						**976,527**
		COMBUSTION TURBINE									
	31-85-00-99	BIODIESEL COMPATIBILITY PACKAGE	ALLOWANCE FOR OEM SUPPLY COST ADDER TO STANDARD DUAL FUEL CAPABILITY	1.00 LT		2,856,000		138	9,339	3,222	2,868,562
		COMBUSTION TURBINE				**2,856,000**		**138**	**9,339**	**3,222**	**2,868,562**
		MECHANICAL EQUIPMENT			**976,527**	**2,856,000**		**138**	**9,339**	**3,222**	**3,845,088**
		INSULATION									
		EQUIPMENT									
	36-15-00-99	INSULATION OF NEW BIO-DIESEL DAY TANK	ALLOWANCE FOR RE-PURPOSED EXISTING SS TANK TO BE USED AS BIO-DIESEL TANK	1,999.95 SF	124,845	-					124,845
		EQUIPMENT			**124,845**						**124,845**
		INSULATION			**124,845**						**124,845**
		ELECTRICAL EQUIPMENT									
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	TANK IMMERSION HEATER	BIO-DIESEL DAY TANK	2.00 EA	-	-	20,400	46	2,910	921	24,232
	41-99-00-09	TANK RTD	BIO-DIESEL DAY TANK	2.00 EA	-	-	5,649	18	1,164	369	7,182
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**26,049**	**64**	**4,074**	**1,290**	**31,414**
		ELECTRICAL EQUIPMENT					**26,049**	**64**	**4,074**	**1,290**	**31,414**
		BIO BIODIESEL SYSTEM			**1,101,372**	**2,856,000**	**58,508**	**714**	**39,304**	**11,827**	**4,067,011**
CEMS		**CONTINUOUS EMISSIONS MONITORING SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ADDITIONAL CT SKIDS/EQUIPMENT	7.50 CY	-	-		1	58	28	87
		EXCAVATION						**1**	**58**	**28**	**87**
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ADDITIONAL CT SKIDS/EQUIPMENT	1.36 CY	-	-	59	0	11	5	75
		BACKFILL					**59**	**0**	**11**	**5**	**75**
		CIVIL WORK					**59**	**2**	**69**	**34**	**162**
		CONCRETE									
		CONCRETE									
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	4.03 CY	-	-	904	6	277	94	1,274
	22-13-00-20	MUD MAT, 1500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	0.68 CY	-	-	88	0	19	6	113
		CONCRETE					**992**	**6**	**295**	**100**	**1,387**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ADDITIONAL CT SKIDS/EQUIPMENT	27.01 LB	-	-	110	2	89	4	203
		EMBEDMENT					**110**	**2**	**89**	**4**	**203**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	ADDITIONAL CT SKIDS/EQUIPMENT	41.40 SF	-	-	104	10	528	98	729
		FORMWORK					**104**	**10**	**528**	**98**	**729**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	ADDITIONAL CT SKIDS/EQUIPMENT	0.28 TN	-	-	425	6	348	91	864
		REINFORCING					**425**	**6**	**348**	**91**	**864**
		CONCRETE					**1,631**	**24**	**1,260**	**293**	**3,183**
		RACEWAY, CABLE TRAY & CONDUIT									
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		260.00 LF	-	-	1,931	58	4,099	100	6,130

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONDUIT, RGS					**1,931**	**58**	**4,099**	**100**	**6,130**
		RACEWAY, CABLE TRAY & CONDUIT					**1,931**	**58**	**4,099**	**100**	**6,130**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-18	600V #14 7/C CU XLPE LSZH		131.97 LF	-	-	219	4	280	80	578
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**219**	**4**	**280**	**80**	**578**
		600V CABLE & TERMINATION									
	43-20-00-18	600V #6 3/C W/G CU EPR TS-CPE		130.00 LF	-	-	684	8	551	158	1,392
		600V CABLE & TERMINATION					**684**	**8**	**551**	**158**	**1,392**
		CABLE					**903**	**12**	**830**	**238**	**1,971**
		CONTROL & INSTRUMENTATION									
		MONITORING EQUIPMENT									
	44-25-00-01	CONTINUOUS EMISSION MONITORING SYSTEM (CEMS)	ONE SHELTER AND ONE SET OF STACK MONITORING EQUIPMENT PER STACK	1.00 EA	-	513,570		345	24,372	596	538,538
		MONITORING EQUIPMENT				**513,570**		**345**	**24,372**	**596**	**538,538**
		CONTROL & INSTRUMENTATION				**513,570**		**345**	**24,372**	**596**	**538,538**
		CEMS CONTINUOUS EMISSIONS MONITORING SYSTEM				**513,570**	**4,524**	**440**	**30,630**	**1,260**	**549,984**
FUEL OIL		**FUEL OIL SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	45 FT DIA TANK RING FOUNDATION	642.40 CY	-	-		144	6,488	3,192	9,680
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	107.07 CY	-	-		24	1,081	532	1,613
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	76.05 CY	-	-		17	768	378	1,146
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	19.85 CY	-	-		5	231	113	344
	21-17-00-02	GENERAL EARTHWORK EXCAVATION		750.47 CY	-	-		129	5,831	2,851	8,681
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FUEL FORWARDING BUILDING	63.25 CY	-	-		8	376	184	560
	21-17-00-06	MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	IMPORTED FILL MATERIAL FOR 45 FT DIA TANK BERM	3,602.23 CY	-	-	107,779	269	13,433	32,649	153,861
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FIRE WATER UNDERGROUND	2,814.00 CY	-	-		210	9,474	4,632	14,106
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	POTABLE WATER	324.36 CY	-	-		24	1,092	534	1,626
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL PUMP DISCHARGE	687.55 CY	-	-		51	2,315	1,132	3,447
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL RETURN PIPING FROM TURBINES	880.07 CY	-	-		66	2,963	1,449	4,412
	21-17-00-12	TRENCH EXCAVATION 6FT TO 10FT DEEP, DENSE HARD CLAY USING 0.75 CY EXCAVATOR	DUCT BANK	1,381.51 CY	-	-		119	5,367	2,624	7,991
		EXCAVATION					**107,779**	**1,067**	**49,419**	**50,269**	**207,467**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	45 FT DIA TANK RING FOUNDATION	35.33 CY	-	-		2	110	54	163
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE WATER UNDERGROUND	689.68 CY	-	-		48	2,143	1,048	3,191
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	POTABLE WATER	47.33 CY	-	-		3	147	72	219
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL PUMP DISCHARGE	135.25 CY	-	-		9	420	206	626
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL RETURN PIPING FROM TURBINES	173.13 CY	-	-		12	538	263	801
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	17.51 CY	-	-		2	82	40	122
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	DUCT BANK	180.81 CY	-	-		12	562	275	837
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	89.06 CY	-	-		6	277	135	412
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	65.04 CY	-	-		4	202	99	301
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE PROTECTION SKID FOUNDATION	4.00 CY	-	-		1	25	12	37
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL FORWARDING BUILDING	39.39 CY	-	-		2	94	46	139
		DISPOSAL						**102**	**4,599**	**2,249**	**6,848**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	45 FT DIA TANK RING FOUNDATION	48.18 CY	-	-	2,097	11	487	239	2,823
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	18.01 CY	-	-	784	5	210	89	1,083
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	11.01 CY	-	-	479	3	128	55	662
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	11.97 CY	-	-	521	3	121	59	701
	21-20-00-01	FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL FORWARDING BUILDING	23.86 CY	-	-		3	142	69	211
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	45 FT DIA TANK RING FOUNDATION	558.89 CY	-	-	24,323	96	4,342	2,123	30,788
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	87.05 CY	-	-	3,789	15	676	331	4,796
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	62.04 CY	-	-	2,700	11	482	236	3,418
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FIRE WATER UNDERGROUND	1,062.16 CY	-	-		122	5,502	2,690	8,191
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	POTABLE WATER	277.03 CY	-	-		32	1,435	702	2,136
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL PUMP DISCHARGE	552.26 CY	-	-		63	2,860	1,399	4,259
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DEMIN WATER PUMP DISCHARGE	552.30 CY	-	-		63	2,861	1,399	4,259
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL RETURN PIPING FROM TURBINES	706.94 CY	-	-		81	3,662	1,790	5,452
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DUCT BANK	1,200.69 CY	-	-		138	6,219	3,041	9,260
	21-20-00-12	SAND BEDDING	45 FT DIA TANK RING FOUNDATION	33.19 CY	-	-	767	6	291	142	1,200
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FIRE WATER UNDERGROUND	317.24 CY	-	-	7,335	47	2,136	1,044	10,515
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	POTABLE WATER	46.97 CY	-	-	1,086	9	411	201	1,698
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL TRUCK UNLOADING	42.38 CY	-	-	980	8	371	181	1,532
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL PUMP DISCHARGE	129.57 CY	-	-	2,996	19	872	427	4,295
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	DEMIN WATER PUMP DISCHARGE	129.57 CY	-	-	2,996	19	872	427	4,295
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL RETURN PIPING FROM TURBINES	165.85 CY	-	-	3,834	25	1,117	546	5,497
		BACKFILL					**54,685**	**781**	**35,197**	**17,189**	**107,071**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-60	SILT FENCE		1,999.49 LF	-	-	3,481	161	7,367	860	11,708
		EROSION AND SEDIMENTATION CONTROL					**3,481**	**161**	**7,367**	**860**	**11,708**
		POND, CONTAINMENT LINER									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	900.01 SY	-	-	17,626	83	3,789	442	21,857
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	900.01 SY	-	-	7,344	26			7,344
		POND, CONTAINMENT LINER					**24,970**	**109**	**3,789**	**442**	**29,201**
		ROAD, PARKING AREA, & SURFACED AREA									
	21-57-00-01	ASPHALT ROAD	INCLUDING 1.5" ASPHALT SURFACE COURSE, 2.5" BASE COURSE, AND 12" THICK AGGREGATE BASE	1,750.36 SY	178,531	-				7	178,538
	21-57-00-30	PROTECTIVE SAND COVER	4" THICK FOR 58,200 S.F.	755.42 CY	-	-	17,465	868	41,965	39,657	99,087
	21-57-00-40	SUBGRADE PREPARATION	12" THICK FOR 58,200 S.F.	2,262.07 CY	-	-		506	24,458	23,113	47,570
	21-57-00-72	AGGREGATE SURFACING	6" THICK FOR 61,300 S.F.	1,192.49 CY	-	-	51,086	213	10,302	9,736	71,124
	21-57-00-80	GEOTEXTILE FABRIC	58,200 S.F.	6,790.40 SY	-	-	15,142	78	3,573	417	19,132
		ROAD, PARKING AREA, & SURFACED AREA			**178,531**		**83,693**	**1,665**	**80,298**	**72,929**	**415,451**
		SURVEY									
	21-67-00-29	SITE SURVEY		1.00 LS	68,000	-				-	68,000
		SURVEY			**68,000**						**68,000**
		CIVIL WORK			**246,531**		**274,607**	**3,884**	**180,669**	**143,939**	**845,746**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	45 FT DIA TANK RING FOUNDATION	34.26 CY	-	-	7,688	98	4,708	1,596	13,992
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	7.88 CY	-	-	1,768	23	1,083	367	3,218
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FUEL FORWARDING BUILDING	56.67 CY	-	-	12,716	62	2,978	1,010	16,704
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	11.74 CY	-	-	2,634	34	1,613	547	4,794
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	3.00 CY	-	-	674	9	413	91	1,178
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	5.00 CY	-	-	1,123	14	687	152	1,963
	22-13-00-20	FLOWABLE FILL, 1500 PSI	DUCT BANK	180.81 CY	-	-	23,361	104	4,969	1,684	30,015
		CONCRETE					**49,964**	**344**	**16,452**	**5,448**	**71,864**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	OILY WATER SEPARATOR	200.04 LB	-	-	816	11	658	27	1,501

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	45 FT DIA TANK RING FOUNDATION	342.47 LB	-	-	1,397	20	1,126	46	2,570
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	117.36 LB	-	-	479	13	772	32	1,282
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	30.01 LB	-	-	122	3	197	9	329
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	50.01 LB	-	-	204	6	329	15	548
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FUEL FORWARDING BUILDING	566.67 LB	-	-	2,312	15	845	35	3,192
		EMBEDMENT					**5,331**	**69**	**3,928**	**163**	**9,422**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	45 FT DIA TANK RING FOUNDATION	1,109.56 SF	-	-	2,792	255	14,139	2,618	19,549
	22-17-00-10	BUILT UP INSTALL & STRIP	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	144.00 SF	-	-	362	66	3,670	680	4,712
	22-17-00-10	BUILT UP INSTALL & STRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	147.99 SF	-	-	372	44	2,452	3,759	6,583
	22-17-00-10	BUILT UP INSTALL & STRIP	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	128.00 SF	-	-	322	38	2,120	3,251	5,694
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	EMBEDDED HDPE CONCRETE ANCHOR FOR 45 FT DIA TANK BERM	426.59 SF	-	-	1,073	137	7,610	1,409	10,093
	22-17-00-10	BUILT UP INSTALL & STRIP	DUCT BANK	3,411.92 SF	-	-	8,584	784	43,477	8,052	60,114
	22-17-00-10	BUILT UP INSTALL & STRIP, PLYWOOD AND LUMBER BRACING	FUEL FORWARDING BUILDING	248.00 SF	-	-	624	7	411	76	1,111
		FORMWORK					**14,130**	**1,333**	**73,880**	**19,846**	**107,855**
		PRECAST									
	22-23-00-41	ELECTRICAL PRECAST MANHOLE, 4 FT BY 4 FT BY 6 FT		4.00 EA	-	-	20,906	129	5,805	2,838	29,549
		PRECAST					**20,906**	**129**	**5,805**	**2,838**	**29,549**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	45 FT DIA TANK RING FOUNDATION	7.35 TN	-	-	11,200	170	9,172	2,406	22,778
	22-25-00-10	UNCOATED A615 GR60	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	0.21 TN	-	-	314	10	514	66	894
	22-25-00-10	UNCOATED A615 GR60	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	0.34 TN	-	-	516	16	846	109	1,471
	22-25-00-10	UNCOATED A615 GR60	DUCT BANK	8.03 TN	-	-	12,234	186	10,019	2,628	24,882
	22-25-00-10	UNCOATED A615 GR60	FUEL FORWARDING BUILDING	4.25 TN	-	-	6,474	89	4,808	1,261	12,543
		REINFORCING					**30,738**	**471**	**25,359**	**6,471**	**62,568**
		CONCRETE					**121,069**	**2,345**	**125,423**	**34,765**	**281,258**
		STEEL									
		ROLLED SHAPE									
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	0.36 TN	-	-	2,153	10	666	357	3,176
	23-25-00-10	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, TWO COAT PAINTED	ALLOWANCE FOR MISC. COMPONENT SUPPORTS	7.14 TN	-	-	33,802	156	10,286	5,520	49,607
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	3.21 TN	-	-	16,128	70	4,629	2,484	23,241
	23-25-00-99	FABRICATED STEEL INTERNAL TANK IMMERSION HEATER SUPPORTS		9.84 EA	-	-	9,951	339	22,330	11,984	44,265
		ROLLED SHAPE					**62,034**	**576**	**37,910**	**20,345**	**120,288**
		STEEL					**62,034**	**576**	**37,910**	**20,345**	**120,288**
		ARCHITECTURAL									
		PRE-ENGINEERED BUILDING									
	24-35-00-01	SHELL INCLUDING ELECTRICAL & HVAC-STEEL 22 GA 45 FT W X 17 FT L X 18 FT H	FUEL FORWARDING BUILDING	765.00 SF	260,100	-					260,100
		PRE-ENGINEERED BUILDING			**260,100**						**260,100**
		ARCHITECTURAL			**260,100**						**260,100**
		PAINTING & COATING									
		COATING									
	27-13-00-99	COATING - MISC STEEL		1.00 LS	34,000	-					34,000
		COATING			**34,000**						**34,000**
		PAINTING									
	27-17-00-18	PIPE PAINTING, 4 IN DIA	FIRE WATER ABOVE GROUND	399.90 LF	-	-	1,751	61	3,651	1,580	6,981
	27-17-00-21	PIPE PAINTING, 10 IN DIA	FIRE WATER ABOVE GROUND	149.96 LF	-	-	1,566	60	3,590	1,560	6,716
		PAINTING					**3,318**	**121**	**7,240**	**3,140**	**13,697**
		PAINTING & COATING			**34,000**		**3,318**	**121**	**7,240**	**3,140**	**47,697**
		MECHANICAL EQUIPMENT									
		FIRE PROTECTION EQUIPMENT & SYSTEM									
	31-41-00-99	FIRE PROTECTION (DETECTION) SYSTEM ALLOWANCE, INCLUDES ABOVEGROUND BUILDING AND TANK FOAM SUPPRESION SYSTEMS	NOT INCLUDED - USE EXISTING	0.00 LS		-	-				

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PUMP									
	31-75-00-99	PUMP AND FILTER - FUEL OIL KIDNEY FILTER SKID	200 GPM PUMP AND FILTRATION	2.00 EA	-	1,527,552	-	92	5,521	1,378	1,534,451
	31-75-00-99	PUMP - FUEL OIL TRUCK UNLOADING SKID (PUMPS, STRAINER, ETC.)	SKID:2 X100%, 100 GPM, 120 FT, 5 HP, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	546,312	-	55	3,313	827	550,451
	31-75-00-99	FUEL OIL FORWARDING PUMP SKID	SKID:2 X 100%, 80GPM, 150 FT, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	77,792	-	55	3,313	827	81,931
		PUMP				**2,151,656**		**202**	**12,146**	**3,032**	**2,166,834**
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	45 FT DIA. X 44 FT TALL, 528,000 GAL L.S. DIESEL STORAGE TANK	1.00 EA	1,199,823		-				1,199,823
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	L.S. DIESEL DAY TANK - NOT INCLUDED - RE-USE/SHARE EXISTING L.S. DIESEL DAY TANK	0.00 EA			-				
	31-83-00-99	TANK COATING	45 FT DIA. X 44 FT TALL, 528,000 GAL L.S. DIESEL STORAGE TANK - INCLUDES ALLOWANCE FOR ADDITIONAL INTERNAL TANK BOTTOM COATING	7,811.44 SF	250,921		-				250,921
	31-83-00-99	TANK COATING	L.S. DIESEL DAY TANK - NOT INCLUDED - RE-USE/SHARE EXISTING L.S. DIESEL DAY TANK	0.00 m2			-				
	31-83-00-99	TANK - DEMIN STORAGE TANK, 304L STAINLESS STEEL, AWWA D100	NOT INCLUDED - USE EXISTING	0.00 EA	0	0	-		0	0	0
		TANK			**1,450,744**						**1,450,744**
		MECHANICAL EQUIPMENT			**1,450,744**	**2,151,656**		**202**	**12,146**	**3,032**	**3,617,578**
		PIPING									
		SS 316, ABOVE GROUND, PROCESS AREA									
	35-13-02-18	2 IN DIA, SCH 40S	FALSE START DRAIN	199.95 LF	-	-	24,909	324	21,947	25,366	72,222
	35-13-02-18	2 IN DIA, SCH 40S	MISC. VENTS AND DRAINS	199.95 LF	-	-	24,909	324	21,947	25,366	72,222
	35-13-02-26	4 IN DIA, SCH 40S	FUEL OIL TRUCK UNLOADING	187.45 LF	-	-	25,825	392	26,559	9,163	61,547
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP DISCHARGE	249.94 LF	-	-	55,066	580	39,303	13,560	107,929
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP SUCTION	149.96 LF	-	-	33,040	348	23,582	8,136	64,758
		SS 316, ABOVE GROUND, PROCESS AREA					**163,748**	**1,969**	**133,338**	**81,591**	**378,677**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-40	10 IN DIA, SCH 40	FIRE WATER ABOVE GROUND	74.98 LF	-	-	14,276	207	14,009	4,833	33,119
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**14,276**	**207**	**14,009**	**4,833**	**33,119**
		SS 316, BURIED									
	35-15-02-26	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL TRUCK UNLOADING	249.94 LF	-	-	27,125	423	28,641	9,882	65,647
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL PUMP DISCHARGE	999.74 LF	-	-	179,746	2,244	151,919	52,415	384,081
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL RETURN PIPING FROM TURBINES	1,199.69 LF	-	-	215,695	2,692	182,303	62,898	460,897
		SS 316, BURIED					**422,566**	**5,359**	**362,863**	**125,195**	**910,624**
		HDPE, BURIED									
	35-15-30-25	8 IN DIA, DR 9	FIRE WATER UNDERGROUND	149.96 LF	-	-	5,751	143	9,690	3,343	18,784
	35-15-30-29	10 IN DIA, DR 9	FIRE WATER UNDERGROUND	999.74 LF	-	-	55,202	1,126	76,271	26,315	157,788
		HDPE, BURIED					**60,953**	**1,270**	**85,961**	**29,658**	**176,572**
		PIPE SUPPORTS, HANGERS									
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 2 IN DIA PIPE		29.00 EA	-	-	6,902	67	4,514	1,557	12,973
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE		9.00 EA	-	-	2,852	41	2,802	967	6,620
	35-35-00-06	SINGLE ROD SUPPORT W/O BEAM FOR 6 IN PIPE		17.00 EA	-	-	6,127	117	7,938	2,739	16,804
	35-35-00-08	SINGLE ROD SUPPORT W/O BEAM FOR 10 IN PIPE		2.00 EA	-	-	1,020	18	1,245	430	2,695
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 2 IN PIPE		29.00 EA	-	-	7,691	117	7,900	2,725	18,316
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE		9.00 EA	-	-	3,709	79	5,323	1,837	10,869
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE		17.00 EA	-	-	7,745	188	12,701	4,382	24,829
	35-35-00-32	SINGLE ROD SUPPORT W/ BEAM FOR 10 IN PIPE		2.00 EA	-	-	1,240	31	2,086	720	4,046
		PIPE SUPPORTS, HANGERS					**37,286**	**657**	**44,510**	**15,357**	**97,152**
		VALVES									
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	2.00 EA	-	-	3,362	19	1,276	440	5,079
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	3,362	19	1,276	440	5,079
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	1.00 EA	-	-	2,024	8	545	188	2,757
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	4,048	16	1,090	376	5,514
	35-45-00-05	6 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	4,763	42	2,817	972	8,552
	35-45-00-06	1 IN RELIEF VALVE		6.00 EA	-	-	3,110	18	1,214	419	4,743
	35-45-00-29	8 IN VALVE, CLASS 125 DI POST INDICATOR GATE VALVE	FIRE PROTECTION	9.00 EA	-	-	50,429	103	7,004	2,417	59,850
	35-45-00-29	8 IN BUTTERFLY VALVE, FUSIBLE LINK LUGGED ENDS		2.00 EA	-	-	27,119	24	1,634	564	29,318

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		VALVES					**98,217**	**249**	**16,857**	**5,816**	**120,891**
		STAINLESS STEEL VALVES									
	35-46-00-10	2 IN BALL VALVE, CLASS 600, WELD END		15.00 EA	-	-	8,405	93	6,304	2,175	16,884
	35-46-00-10	2 IN CHECK VALVE, CLASS 600, WELD END		3.00 EA	-	-	2,206	19	1,261	435	3,902
	35-46-00-19	4 IN CHECK VALVE, CLASS 150, WELD END		2.00 EA	-	-	5,043	19	1,276	440	6,760
	35-46-00-20	4 IN GATE VALVE, CLASS 150, WELD END		7.00 EA	-	-	17,356	66	4,467	1,541	23,365
	35-46-00-24	6 IN CHECK VALVE, CLASS 900, WELD END		2.00 EA	-	-	27,063	51	3,474	1,198	31,736
	35-46-00-24	6 IN GATE VALVE, CLASS 150, WELD END		9.00 EA	-	-	39,965	118	7,985	2,755	50,705
	35-46-00-24	6 IN GATE VALVE, CLASS 900, WELD END		7.00 EA	-	-	93,251	180	12,158	4,195	109,604
	35-46-00-24	6 IN GATE VALVE, CLASS 150, MOTOR OPERATED, WELD END		4.00 EA	-	-	58,834	65	4,421	1,525	64,779
		STAINLESS STEEL VALVES					**252,123**	**611**	**41,346**	**14,265**	**307,734**
		MISCELLANEOUS									
	35-99-00-99	6 IN FIRE HYDRANT CAST IRON, CLASS 125	FUEL OIL TANK AREA	2.00 EA	-	-	13,551	14	934	322	14,807
	35-99-00-99	PIPING, 10 IN HDPE PIPE TIE-IN TO EXISTING 10 IN HDPE	TIE-IN TO EXISTING PIPING, INCLUDING EXCAVATION AND BACKFILL	1.00 EA		-	560	57	3,891	1,343	5,794
		MISCELLANEOUS					**14,111**	**71**	**4,825**	**1,665**	**20,601**
		PIPING					**1,063,281**	**10,393**	**703,709**	**278,380**	**2,045,370**
		INSULATION									
		EQUIPMENT									
	36-15-00-99	INSULATION OF EXISTING L.S. DIESEL DAY TANK	ASSUMED EXISTING - NEW UNIT TO SHARE EXISTING L.S. DIESEL DAY TANK WITH EXISTING UNIT	0.00 m2		-					
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-20	1 IN THICK, 2 IN PIPE		399.90 LF	-	-	5,058	124	6,825	1,274	13,157
	36-17-03-35	1 IN THICK, 4 IN PIPE		887.27 LF	-	-	15,928	351	19,364	3,615	38,907
	36-17-03-41	1.5 IN THICK, 6 IN PIPE		224.94 LF	-	-	6,210	111	6,108	1,140	13,458
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**27,196**	**585**	**32,296**	**6,029**	**65,522**
		INSULATION					**27,196**	**585**	**32,296**	**6,029**	**65,522**
		ELECTRICAL EQUIPMENT									
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION		1.00 EA	68,000	-					68,000
		CATHODIC PROTECTION			**68,000**						**68,000**
		CONTROL & BACKUP POWER									
	41-21-00-99	125V DC, 200A BATTERY CHARGER	ELECTRICAL ROOM	2.00 EA	-	-	81,600	37	2,328	737	84,665
	41-21-00-99	UPS 40 KVA INVERTER	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	68,000	23	1,455	461	69,916
	41-21-00-99	125V DC BATTERIES, 400 AH WITH BATTERY RACK	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	136,000	41	2,619	829	139,448
	41-21-00-99	120VAC, 225A UPS PANEL, 42 CIRCUITS	ELECTRICAL ROOM - DISTRIBUTE UPS POWER	1.00 EA	-	-	3,672	18	1,164	369	5,205
	41-21-00-99	UPS BYPASS TRANSFORMER, 480-120VAC, 30 KVA	ELECTRICAL ROOM - ALTERNATE AC FEED FOR MAINTENANCE	2.00 EA	-	-	21,012	37	2,328	737	24,077
	41-21-00-99	125VDC, 200A DISTRIBUTION PANEL	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	51,408	18	1,164	369	52,941
	41-21-00-99	UPS REMOTE BYPASS SWITCH	ELECTRICAL ROOM - FOR UPS BYPASS TRANSFORMER	2.00 EA	-	-	14,688	18	1,164	369	16,221
		CONTROL & BACKUP POWER					**376,380**	**193**	**12,223**	**3,869**	**392,473**
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-30-00-16	#500 KCMIL CU BARE STRANDED GROUND WIRE	UNDERGROUND GRID INCLUDING TO BURIED GRID	1,499.62 LF	-	-	23,454	190	13,440	3,845	40,740
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	PIGTAILS FROM UG GRID TO BLDG STEEL AND EQUIPMENT (20 CABLES)	199.95 LF	-	-	1,933	24	1,673	479	4,085
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE		799.80 LF	-	-	7,734	26	1,824	522	10,080
	41-31-00-16	EXOTHERMIC WELD	#4/0 AWG WIRE, 20 CABLES, 2 WELDS PER CABLE	40.00 EA	-	-	816	92	6,516	1,864	9,196
	41-31-00-16	EXOTHERMIC WELD		8.00 EA	-	-	163	18	1,303	373	1,839
	41-31-00-18	COPPER CLAD GROUND ROD, 20' LONG, 3/4 " DIA.		15.00 EA	-	-	2,040	34	2,443	699	5,182
	41-31-00-18	COPPER CLAD GROUND ROD, 15' LONG, 3/4 " DIA.		4.00 EA	-	-	544	9	652	186	1,382
	41-31-00-69	STRAP, LUG		8.00 EA	-	-	196	10	717	205	1,118
	41-31-00-99	TEST AND DOCUMENTATION		48.00 EA	-	-		8	586	0	587
		ELECTRICAL EQUIPMENT, GROUNDING					**36,880**	**411**	**29,155**	**8,173**	**74,208**
		HEAT TRACING									
	41-33-00-05	2 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	399.90 LF	-	-	11,720	409	28,996	8,295	49,011
	41-33-00-08	4 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	887.27 LF	-	-	30,300	1,000	70,840	20,266	121,406
	41-33-00-09	6 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR,	224.94 LF	-	-	10,683	292	20,708	5,924	37,315

Estimate No.: 36484C
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Estimate Date: 09/24/20024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
1X0 SC LM6000 PC SPRINT PLUS SYNCH CONDENSER

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		HEAT TRACING									
			STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE								
	41-33-00-30	HEAT TRACING PANEL		6.00 EA	-	-	40,800	166	10,477	3,316	54,594
	41-33-00-59	HEAT TRACE TRANSFORMER 480-208/120V 15 KVA		1.00 EA	-	-	1,088	14	873	276	2,237
	41-33-00-99	HEAT TRACING - ENGINEERING & FIELD SUPPORT		1.00 LS	27,200	-					27,200
		HEAT TRACING			**27,200**		**94,591**	**1,880**	**131,894**	**38,078**	**291,763**
		LIGHTNING PROTECTION									
	41-35-00-99	LIGHTNING PROTECTION		1.00 LS	68,000	-					68,000
		LIGHTNING PROTECTION			**68,000**						**68,000**
		EXTERIOR LIGHTING									
	41-38-00-99	LIGHTING - FIXTURES, ACCESSORY	OUTDOOR BUILDING AND AREA LIGHTING	1.00 LS	68,000	-					68,000
		EXTERIOR LIGHTING			**68,000**						**68,000**
		MOTOR CONTROL CENTER (MCC), COMPLETE									
	41-45-00-09	480V, 1200A MOTOR CONTROL CENTER, 6 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER TO BOP LOADS	2.00 EA	-	161,568		184	12,999	318	174,884
		MOTOR CONTROL CENTER (MCC), COMPLETE				**161,568**		**184**	**12,999**	**318**	**174,884**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	OUTDOOR-RATED NEMA 4 480VAC PANEL, 3-PH, 60HZ 800A COPPER BUS, FULLY RATED, 800A MAIN BRKR, W/ 2 - 350A FEEDER BRKR AND 2 - 50A FEEDER BRKRS		1.00 EA	-	-	36,735	32	2,037	645	39,417
	41-47-00-39	TANK HEATER CONTACTOR		1.00 EA	-	-	31,355	17	1,091	345	32,792
		PANEL: CONTROL, DISTRIBUTION, & RELAY					**68,089**	**49**	**3,129**	**990**	**72,208**
		POWER TRANSFORMER									
	41-51-00-19	25KVA, 3-PHASE, 480-120/240V DRY TYPE TRANSFORMER	ELECTRICAL ROOM - BUILDING POWER AND LIGHTING	2.00 EA	-		16,810	74	4,639	301	21,749
	41-51-00-99	1200/1650 KVA DRY TYPE TRANSFORMER, 4160/480V, PAD MOUNTED		1.00 EA	-	134,057		218	13,824	4,376	152,257
		POWER TRANSFORMER				**134,057**	**16,810**	**292**	**18,463**	**4,677**	**174,006**
		SWITCHGEAR									
	41-55-00-99	480V, 3200A SWITCHGEAR 2 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO LV MOTOR AND MCC's	1.00 EA	-	293,760		414	26,193	8,291	328,244
	41-55-00-99	4160V, 2000A SWITCHGEAR 3 VERTICAL SECTIONS MAIN-TIE-MAIN	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO MV MOTOR LOADS AND TRANSFORMERS	1.00 EA	-	330,480		437	27,648	8,752	366,880
		SWITCHGEAR				**624,240**		**851**	**53,841**	**17,043**	**695,124**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	IN-LINE DIESEL HEATER		2.00 EA	-	-	192,542	92	5,821	1,842	200,205
	41-99-00-09	DIESEL RTD		2.00 EA	-	-	5,649	18	1,164	369	7,182
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**198,192**	**110**	**6,985**	**2,211**	**207,388**
		ELECTRICAL EQUIPMENT			**231,200**	**919,865**	**790,942**	**3,971**	**268,688**	**75,359**	**2,286,054**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY, ALUMINUM									
	42-13-37-01	12 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		262.43 LF	-	-	9,276	333	23,565	576	33,417
	42-13-37-03	24 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		174.96 LF	-	-	8,076	352	24,866	608	33,549
	42-13-37-05	36 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		612.34 LF	-	-	33,595	1,481	104,646	2,557	140,797
		CABLE TRAY, ALUMINUM					**50,946**	**2,166**	**153,077**	**3,740**	**207,764**
		CONDUIT, ALUMINUM									
	42-15-13-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,749.55 LF	-	-	14,253	432	30,567	747	45,566
	42-15-13-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,624.33 LF	-	-	51,752	956	67,603	1,652	121,007
	42-15-13-08	3 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,624.33 LF	-	-	94,045	1,753	123,903	3,027	220,976
	42-15-13-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		874.78 LF	-	-	48,956	730	51,609	1,261	101,826
	42-15-13-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		874.78 LF	-	-	77,628	1,016	71,797	1,754	151,179
		CONDUIT, ALUMINUM					**286,633**	**4,888**	**345,479**	**8,441**	**640,554**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-14	1 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		53.00 EA	-	-	2,012	61	4,306	105	6,423
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		35.00 EA	-	-	3,875	66	4,692	115	8,681
	42-15-23-20	3 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		18.00 EA	-	-	6,620	41	2,925	71	9,617
	42-15-23-22	4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		9.00 EA	-	-	4,880	26	1,828	45	6,752
	42-15-23-23	5 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		9.00 EA	-	-	13,764	28	2,011	49	15,824
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**31,152**	**223**	**15,761**	**385**	**47,298**
		CONDUIT, PVC									
	42-15-33-15	3 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	1,199.69 LF	-	-	11,650	112	7,897	193	19,739
	42-15-33-21	5 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	2,399.39 LF	-	-	42,258	386	27,297	667	70,222
		CONDUIT, PVC					**53,907**	**498**	**35,194**	**860**	**89,961**
		CONDUIT, RGS									
	42-15-37-05	1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,199.69 LF	-	-	20,395	392	27,687	676	48,758
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		499.87 LF	-	-	58,057	648	45,780	1,119	104,955
		CONDUIT, RGS					**78,452**	**1,039**	**73,467**	**1,795**	**153,714**
		DUCT BANK/TRENWA									
	42-18-00-01	SPACERS	DUCT BANK	684.00 EA	-	-	2,828	94	6,668	163	9,659
		DUCT BANK/TRENWA					**2,828**	**94**	**6,668**	**163**	**9,659**
		RACEWAY, CABLE TRAY & CONDUIT					**503,919**	**8,908**	**629,646**	**15,384**	**1,148,950**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-10	600V #16 2 TW PR CU SHIELDED XLPE LSZH		1,749.55 LF	-	-	2,141	46	3,278	938	6,358
	43-10-00-11	600V #16 4 TW PR CU SHIELDED XLPE LSZH		2,624.33 LF	-	-	4,319	87	6,200	1,774	12,292
	43-10-00-11	600V #16 8 TW PR CU SHIELDED XLPE LSZH		1,749.55 LF	-	-	2,879	101	7,127	2,039	12,045
	43-10-00-15	600V #14 2/C CU XLPE LSZH		1,749.55 LF	-	-	1,332	38	2,708	775	4,816
	43-10-00-17	600V #14 5/C CU XLPE LSZH		2,624.33 LF	-	-	3,248	69	4,917	1,407	9,572
	43-10-00-18	600V #14 7/C CU XLPE LSZH		599.85 LF	-	-	995	18	1,271	363	2,629
	43-10-00-18	600V #14 7/C CU XLPE LSZH		199.95 LF	-	-	332	6	424	121	876
	43-10-00-20	600V #14 12/C CU XLPE LSZH		1,749.55 LF	-	-	4,473	70	4,989	1,427	10,889
	43-10-00-21	600V #14 19/C CU XLPE LSZH		1,749.55 LF	-	-	6,020	105	7,412	2,120	15,552
	43-10-00-22	ETHERNET CAT 6A CABLE 300V		699.82 LF	-	-	619	105	7,412	2,120	10,151
	43-10-00-27	2 FIBER PATCH CORDS		4.00 EA	-	-	1,414	5	326	93	1,833
	43-10-00-27	24 FIBERSINGLE MODE OPTICAL FIBER PATCH PANEL		42.00 EA	-	-	1,313	5	342	98	1,753
	43-10-00-29	24 FIBER SINGLE MODE OPTICAL FIBER ARMORED RISER RATED		1,224.69 LF	-	-	8,528	58	4,091	1,170	13,789
	43-10-00-80	TERMINATION - FIBER OPTIC		252.00 EA	-	-	2,570	174	12,315	3,523	18,408
	43-10-00-83	TERMINATION - ETHERNET		7.00 EA	-	-	19	3	200	57	276
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		820.00 EA	-	-	1,338	47	3,339	955	5,633
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		1,330.00 EA	-	-	3,075	153	10,833	3,099	17,007
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		28.00 EA	-	-	65	3	228	65	358
	43-10-00-99	TEST AND DOCUMENTATION		2,428.00 EA	-	-		140	9,888	2,829	12,717
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**44,681**	**1,232**	**87,298**	**24,974**	**156,953**
		600V CABLE & TERMINATION									
	43-20-00-08	600V #10 3/C CU XLPE LSZH		3,499.10 LF	-	-	9,660	113	7,982	2,283	19,925
	43-20-00-21	600V #4 3/C CU EPR TS-CPE		1,749.55 LF	-	-	9,756	109	7,697	2,202	19,655
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		199.95 LF	-	-	1,400	17	1,189	340	2,930
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		599.85 LF	-	-	4,201	50	3,567	1,021	8,789
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		10.00 LF	-	-	100	2	114	33	246
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		10.00 LF	-	-	100	2	114	33	246
	43-20-00-38	600V #4/0 3/C CU		874.78 LF	-	-	17,798	98	6,913	1,978	26,688
	43-20-00-45	600V #500 KCMIL 1/C CU		599.85 LF	-	-	6,657	43	3,079	881	10,616
	43-20-00-45	600V #500 KCMIL 1/C CU		299.92 LF	-	-	3,328	22	1,539	440	5,308
	43-20-00-46	600V #500 KCMIL 3-1/C CU TRIPLEXED EPR TS-CPE		1,749.55 LF	-	-	64,910	227	16,106	4,608	85,624
	43-20-00-47	600V #750 KCMIL 1/C CU		7,198.16 LF	-	-	386,000	687	48,674	13,925	448,598
	43-20-00-81	TERMINATION - COMPRESSION LUG, #10, 1 HOLE, COPPER		106.00 EA	-	-	317	30	2,158	617	3,093

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		600V CABLE & TERMINATION									
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		54.00 EA	-	-	679	31	2,199	629	3,508
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		16.00 EA	-	-	201	9	652	186	1,039
	43-20-00-85	TERMINATION - COMPRESSION LUG, #2, 2 HOLE, COPPER		20.00 EA	-	-	299	14	977	280	1,556
	43-20-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		22.00 EA	-	-	539	28	1,971	564	3,073
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		54.00 EA	-	-	2,791	137	9,676	2,768	15,235
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		24.00 EA	-	-	1,240	61	4,300	1,230	6,771
	43-20-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		18.00 EA	-	-	1,518	63	4,442	1,271	7,231
	43-20-00-99	TEST AND DOCUMENTATION		286.00 EA	-	-		49	3,494	1,000	4,494
		600V CABLE & TERMINATION					**511,494**	**1,790**	**126,844**	**36,288**	**674,626**
		5/8KV CABLE & TERMINATION									
	43-40-00-11	5/8KV #500 KCMIL 3-1/C CU TRIPLEXED		559.86 LF	-	-	24,121	99	7,024	2,009	33,155
	43-40-00-12	5/8KV #750 KCMIL 1/C CU		11,756.99 LF	-	-	202,587	1,311	92,909	26,580	322,076
	43-40-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		18.00 EA	-	-	930	68	4,838	1,384	7,152
	43-40-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		34.00 EA	-	-	2,867	178	12,586	3,601	19,054
	43-40-00-99	TEST AND DOCUMENTATION		50.00 EA	-	-		29	2,036	583	2,619
		5/8KV CABLE & TERMINATION					**230,505**	**1,685**	**119,394**	**34,157**	**384,056**
		CABLE					**786,680**	**4,707**	**333,536**	**95,419**	**1,215,635**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH CONTROLLERS	ELECTRICAL ROOM - DSC MAIN CONTROLLER	1.00 EA		43,248		28	2,010	175	45,432
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH I/O CARDS	ELECTRICAL ROOM - DSC I/O MODULES, ASSUME 250 I/O POINTS PER CABINET,PROGRAMMING INCLUDED WITHIN MANHOURS	2.00 EA		576,640		552	40,193	3,493	620,326
	44-13-00-09	INTERMEDIATE TERMINATION CABINET	ELECTRICAL ROOM - MARSHALLING CABINETS TO WIRE DSC MODULES AND FIELD CABLES	4.00 EA		86,496		74	5,199	127	91,822
		CONTROL SYSTEM				**706,384**		**653**	**47,402**	**3,795**	**757,581**
		FLOW DEVICES									
	44-21-20-27	FLOW METER, DIFFERENTIAL PRESSURE ORIFICE FLOW TYPE, WITH 3 VALVE MANIFOLD, DIRECT MOUNT		1.00 EA	-	-	7,554	13	980	85	8,619
		FLOW DEVICES					**7,554**	**13**	**980**	**85**	**8,619**
		LEVEL DEVICES									
	44-21-30-06	LEVEL TRANSMITTER, GUIDED WAVE RADAR LIQUID LEVEL TYPE, FLANGE MOUNT		2.00 EA	-	-	13,205	46	3,349	291	16,846
	44-21-30-13	LEVEL GUAGE		2.00 EA	-	-	2,307	34	2,512	218	5,037
		LEVEL DEVICES					**15,512**	**80**	**5,862**	**509**	**21,883**
		PRESSURE DEVICES									
	44-21-40-10	PRESSURE TRANSMITTER, GAUGE TYPE, WITH 2 VALVE MANIFOLD		4.00 EA	-	-	25,113	51	3,684	320	29,117
		PRESSURE DEVICES					**25,113**	**51**	**3,684**	**320**	**29,117**
		CONTROL & INSTRUMENTATION				**706,384**	**48,178**	**797**	**57,928**	**4,709**	**817,199**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	CRAFT STARTUP SUPPORT		1.00 EA	-	-		1,724	103,517	0	103,517
		CRAFT PERSONNEL						**1,724**	**103,517**	**0**	**103,517**
		CONSTRUCTION INDIRECT						**1,724**	**103,517**	**0**	**103,517**
		FUEL OIL FUEL OIL SYSTEM			**2,222,575**	**3,777,905**	**3,681,225**	**38,215**	**2,492,709**	**680,500**	**12,854,914**
SCR		**SCR SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	AMMONIA STORAGE TANK AND UNLOADING	100.28 CY	-	-		17	779	381	1,160
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	TEMPERING AIR BLOWER AND DUCTWORK	51.15 CY	-	-		9	397	194	592
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	SCR (W/STACK)	298.70 CY	-	-		51	2,321	1,135	3,455
		EXCAVATION						**78**	**3,497**	**1,710**	**5,207**
		BACKFILL									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	AMMONIA STORAGE TANK AND UNLOADING	23.80 CY	-	-	1,036	4	185	90	1,311
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	TEMPERING AIR BLOWER AND DUCTWORK	17.80 CY	-	-	774	3	138	68	980
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	SCR (W/STACK)	71.16 CY	-	-	3,097	12	553	270	3,920
		BACKFILL					**4,907**	**19**	**876**	**428**	**6,212**
		CIVIL WORK					**4,907**	**97**	**4,373**	**2,138**	**11,419**
		CONCRETE									
		CONCRETE									
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	AMMONIA STORAGE TANK AND UNLOADING	63.46 CY	-	-	14,241	91	4,360	1,478	20,080
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	TEMPERING AIR BLOWER AND DUCTWORK	30.69 CY	-	-	6,886	44	2,108	715	9,709
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	SCR (W/STACK)	221.96 CY	-	-	49,807	319	15,250	5,169	70,226
	22-13-00-15	EQUIPMENT PAD OR PEDESTAL, 4500 PSI	AMMONIA STORAGE TANK AND UNLOADING	1.48 CY	-	-	331	3	142	48	522
	22-13-00-20	MUD MAT, 1500 PSI	AMMONIA STORAGE TANK AND UNLOADING	11.92 CY	-	-	1,540	7	327	111	1,978
	22-13-00-20	MUD MAT, 1500 PSI	TEMPERING AIR BLOWER AND DUCTWORK	5.70 CY	-	-	737	3	157	53	947
	22-13-00-20	MUD MAT, 1500 PSI	SCR (W/STACK)	35.57 CY	-	-	4,596	20	978	331	5,905
	22-13-00-80	CONCRETE WALL, 4500 PSI	AMMONIA STORAGE TANK AND UNLOADING	7.66 CY	-	-	1,718	18	842	285	2,846
		CONCRETE					**79,856**	**505**	**24,165**	**8,191**	**112,212**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	AMMONIA STORAGE TANK AND UNLOADING	411.92 LB	-	-	1,681	24	1,355	55	3,091
	22-15-00-10	EMBEDMENTS, CARBON STEEL	TEMPERING AIR BLOWER AND DUCTWORK	200.04 LB	-	-	816	11	658	27	1,501
	22-15-00-10	EMBEDMENTS, CARBON STEEL	SCR (W/STACK)	1,533.62 LB	-	-	6,257	88	5,044	206	11,508
		EMBEDMENT					**8,754**	**123**	**7,057**	**288**	**16,099**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	AMMONIA STORAGE TANK AND UNLOADING	259.69 SF	-	-	653	60	3,309	613	4,575
	22-17-00-10	BUILT UP INSTALL & STRIP	TEMPERING AIR BLOWER AND DUCTWORK	257.59 SF	-	-	648	59	3,282	608	4,538
	22-17-00-10	BUILT UP INSTALL & STRIP	SCR (W/STACK)	724.48 SF	-	-	1,823	167	9,232	1,710	12,764
		FORMWORK					**3,124**	**285**	**15,824**	**2,930**	**21,878**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	AMMONIA STORAGE TANK AND UNLOADING	5.28 TN	-	-	8,047	122	6,590	1,729	16,366
	22-25-00-10	UNCOATED A615 GR60	TEMPERING AIR BLOWER AND DUCTWORK	2.26 TN	-	-	3,439	52	2,817	739	6,995
	22-25-00-10	UNCOATED A615 GR60	SCR (W/STACK)	15.84 TN	-	-	24,127	367	19,759	5,183	49,069
		REINFORCING					**35,614**	**542**	**29,165**	**7,650**	**72,430**
		CONCRETE					**127,349**	**1,456**	**76,211**	**19,060**	**222,620**
		MECHANICAL EQUIPMENT									
		NOX CONTROL EQUIPMENT									
	31-53-00-35	AQUEOUS AMMONIA HORIZ STORAGE TANK, 32,000 GAL, STAINLESS STEEL		1.00 EA		125,701	-	115	6,901	1,723	134,324
	31-53-00-35	AMMONIA TRANSFER SKID, WITH 2X100% TRANSFER CENTRIFUGAL PUMPS, CONTROLS & ACCESSORIES		1.00 EA		35,186	-	80	4,831	1,206	41,223
		NOX CONTROL EQUIPMENT				**160,887**		**195**	**11,732**	**2,928**	**175,547**
		COMBUSTION TURBINE									
	31-85-00-99	HTSCR/CO CATALYST SYSTEM		1.00 LT		4,236,400		5,575	377,464	130,232	4,744,096
		COMBUSTION TURBINE				**4,236,400**		**5,575**	**377,464**	**130,232**	**4,744,096**
		MECHANICAL EQUIPMENT				**4,397,287**		**5,770**	**389,196**	**133,161**	**4,919,643**
		PIPING									
		STAINLESS STEEL VALVES									
	35-46-00-03	0.75 IN ISOLATION VALVE, CLASS 150, MANUAL, WELD END	AMMONIA	4.00 EA	-	-	1,162	12	841	290	2,292
	35-46-00-09	2 IN CHECK VALVE, CLASS 150, MANUAL, WELD END	AMMONIA	1.00 EA	-	-	1,044	6	374	129	1,546
	35-46-00-10	2 IN ISOLATION VALVE, CLASS 150, OPERATED, WELD END	AMMONIA	4.00 EA	-	-	47,201	25	1,681	580	49,462
		STAINLESS STEEL VALVES					**49,407**	**43**	**2,895**	**999**	**53,301**
		PIPING					**49,407**	**43**	**2,895**	**999**	**53,301**
		SCR SCR SYSTEM				**4,397,287**	**181,663**	**7,366**	**472,675**	**155,358**	**5,206,983**

EXHIBIT C. ADDITION OF SYNCHRONOUS CAPABILITY TO EXISTING LM6000 – ALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
ADDITION OF SYNCHRONOUS CONDENSING CAPABILITY TO EXISTING LM6000

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/2024
Reviewed By	GA
Approved By	BA
Estimate No.	36500C
Factor table	_4 Productivity 1.15

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
ADDITION OF SYNCHRONOUS CONDENSING CAPABILITY TO EXISTING LM6000

Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Constuction Equipment Cost	Total Cost
11.00.00	DEMOLITION				4,425	603,114		603,114
22.00.00	CONCRETE			34,271	805	114,366	18,663	167,300
23.00.00	STEEL			6,201	287	56,203	14,513	76,917
31.00.00	MECHANICAL EQUIPMENT	1,332,600	9,976,092		1,891	337,227	40,522	11,686,441
35.00.00	PIPING			11,424	287	57,797	9,600	78,821
41.00.00	ELECTRICAL EQUIPMENT			91,390	345	64,840	9,880	166,110
42.00.00	RACEWAY, CABLE TRAY & CONDUIT	130,647		125,998	800	167,966	1,987	426,598
61.00.00	CONSTRUCTION INDIRECT	76,047			747	154,313		230,360
	TOTAL COST	**1,539,294**	**9,976,092**	**269,284**	**9,587**	**1,555,826**	**95,166**	**13,435,661**

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	1,555,826		9,587
Material Costs	269,284		
Subcontract Costs	1,539,294		
Construction Equipment Costs	95,166		
Process Equipment Costs	9,976,092		
Total Direct Cost	**13,435,662**	**13,435,662**	
.			
General Conditions			
Additional Labor Costs			
Site Overheads			
Other Construction Indirects			
		13,435,662	
Project Indirect Costs			
		13,435,662	
Contingency			
		13,435,662	
Escalation			
Total		**13,435,662**	

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
ADDITION OF SYNCHRONOUS CONDENSING CAPABILITY TO EXISTING LM6000

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
11.00.00		DEMOLITION									
	11.31.00	MECHANICAL EQUIPMENT									
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF EXISTING LM6000 GENERATOR TO ACCOMODATE RELOCATION		1.00 EA	-	-		2,299	313,306		313,306
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF EXISTING LM6000 INLET AIR FILTER		1.00 EA	-	-		690	93,992		93,992
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF AUXILIARY SKID, LIQUID FUEL SKID, CO2 SKID		3.00 EA	-	-		517	70,494		70,494
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF CONTROLS HOUSE		1.00 EA	-	-		920	125,322		125,322
		MECHANICAL EQUIPMENT						4,425	603,114		603,114
		DEMOLITION						4,425	603,114		603,114
22.00.00		CONCRETE									
	22.99.00	CONCRETE, MISCELLANEOUS									
		EXTENSION OF EXISTING GENERATOR FOUNDATION	INCLUDING GROUT AND INSTALLATION OF NEW ANCHOR BOLTS ON ALREADY-EXPANDED FOUNDATION (PREVIOUSLY TO ACCOMODATE THIS CHANGE)	1.00 LT	-	-	34,271	805	114,366	18,663	167,300
		CONCRETE, MISCELLANEOUS					34,271	805	114,366	18,663	167,300
		CONCRETE					34,271	805	114,366	18,663	167,300
23.00.00		STEEL									
	23.25.00	ROLLED SHAPE									
		MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	ALLOWANCE FOR MODIFICATIONS TO INLET AIR FILTER SUPPORT STRUCTURE	1.00 TN	-	-	6,201	287	56,203	14,513	76,917
		ROLLED SHAPE					6,201	287	56,203	14,513	76,917
		STEEL					6,201	287	56,203	14,513	76,917
31.00.00		MECHANICAL EQUIPMENT									
	31.63.00	GENERATOR									
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLY ONLY - GE RETROFIT PACKAGE FOR EXISTING CT	1.00 LS		9,976,092	-				9,976,092
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - SSS CLUTCH SIZE 260T	1.00 LS			-	575	102,501	12,317	114,817
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - CLUTCH LUBE OIL CONSOLE	1.00 LS			-	46	8,200	985	9,185
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - EXTENSION TO EXISTING CO2 FIRE EXTINGUISHING SYSTEM (MECHANICAL AND ELECTRICAL INSTALLATION) - SCOPE BY SPECIALTY CONTRACTOR	1.00 LS			-	92	16,400	1,971	18,371
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - GROUTING AND CHOCKFAST EPOXY GROUT FOR THE CLUTCH MODULE AND RELOCATED GENERATOR UNIT	1.00 LS			-	144	25,625	3,079	28,704
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - FLASHINGS BETWEEN THE ENCLOSURE SECTIONS	1.00 LS			-	57	10,250	1,232	11,482
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - LOAD COUPLINGS AND COUPLING GUARDS	1.00 LS			-	172	30,750	3,695	34,445
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - ALIGNMENT OF THE ROTATING STRING FOR THERMAL DISPLACEMENT DURING OPERATION	1.00 LS			-	172	30,750	3,695	34,445
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - CONTROL SYSTEM UPGRADED HARDWARE & SOFTWARE	1.00 LS			-	402	71,750	8,622	80,372
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE - ENGINEERING	1.00 LS			-				
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	FREIGHT TO SITE	1.00 LS	88,840		-				88,840
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	FS TECH ADVISORY SERVICES	1.00 LS	1,243,760		-				1,243,760
		RE-SETTING OF EXISTING GENERATOR		1.00 LS			-	230	41,000	4,927	45,927
		GENERATOR			1,332,600	9,976,092		1,891	337,227	40,522	11,686,441
		MECHANICAL EQUIPMENT			1,332,600	9,976,092		1,891	337,227	40,522	11,686,441
35.00.00		PIPING									
	35.99.00	MISCELLANEOUS									
		PIPING MODIFICATIONS	INCLUDING INSULATION AND HEAT TRACING	1.00 LS	-	-	11,424	287	57,797	9,600	78,821
		MISCELLANEOUS					11,424	287	57,797	9,600	78,821
		PIPING					11,424	287	57,797	9,600	78,821

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
41.00.00		**ELECTRICAL EQUIPMENT**									
	41.13.00	**BUS DUCT**									
		ISO PHASE, FORCE COOLED	MODIFICATION TO RECONNECT TO RELOCATED GENERATOR	1.00 LS	-	-	91,390	345	64,840	9,880	166,110
		BUS DUCT					**91,390**	**345**	**64,840**	**9,880**	**166,110**
		ELECTRICAL EQUIPMENT					**91,390**	**345**	**64,840**	**9,880**	**166,110**
42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
	42.99.00	**RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS**									
		ELECTRICAL INSTRUMENTATION, & CONTROLS CONNECTIONS, CABLES AND ASSOCIATED DCS SYSTEM MODIFICATIONS	INCLUDING ADDITIONAL CABLE	1.00 LS	130,647	-	125,998	800	167,966	1,987	426,598
		RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS			**130,647**		**125,998**	**800**	**167,966**	**1,987**	**426,598**
		RACEWAY, CABLE TRAY & CONDUIT			**130,647**		**125,998**	**800**	**167,966**	**1,987**	**426,598**
61.00.00		**CONSTRUCTION INDIRECT**									
	61.13.00	**CONSTRUCTION EQUIPMENT**									
		CRANE		2.00 MO	76,047	-				-	76,047
		CONSTRUCTION EQUIPMENT			**76,047**						**76,047**
	61.15.00	**CRAFT PERSONNEL**									
		START-UP CRAFT SUPPORT	ELECTRICIANS	1.00 LS	-	-		230	48,389	-	48,389
		START-UP CRAFT SUPPORT	MILLWRIGHTS	1.00 LS	-	-		287	56,176	-	56,176
		START-UP CRAFT SUPPORT	I&C TECHNICIANS	1.00 LS	-	-		230	49,748	-	49,748
		CRAFT PERSONNEL						**747**	**154,313**		**154,313**
		CONSTRUCTION INDIRECT			**76,047**			**747**	**154,313**		**230,360**

EXHIBIT D. ADDITION OF SYNCHRONOUS CAPABILITY TO EXISTING LM6000 – UNALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
ADDITION OF SYNCHRONOUS CONDENSING CAPABILITY TO EXISTING LM6000

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/2024
Reviewed By	GA
Approved By	BA
Estimate No.	36500C
Factor table	_4 Productivity 1.15

MARITIME ELECTRIC COMPANY LTD
CHARLOTTETOWN, PEI
ADDITION OF SYNCHRONOUS CONDENSING CAPABILITY TO EXISTING LM6000

Sargent & Lundy

Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Constuction Equipment Cost	Total Cost
11.00.00	DEMOLITION				4,425	203,032		203,032
22.00.00	CONCRETE			20,400	805	38,500	13,051	71,951
23.00.00	STEEL			3,691	287	18,920	10,149	32,760
31.00.00	MECHANICAL EQUIPMENT	1,020,000	7,497,762		1,891	113,524	28,337	8,659,622
35.00.00	PIPING			6,800	287	19,457	6,713	32,970
41.00.00	ELECTRICAL EQUIPMENT			54,400	345	21,828	6,909	83,137
42.00.00	RACEWAY, CABLE TRAY & CONDUIT	100,000		75,000	800	56,544	1,390	232,934
61.00.00	CONSTRUCTION INDIRECT	58,208			747	51,948		110,156
	TOTAL DIRECT COST	1,178,208	7,497,762	160,291	9,587	523,753	66,548	9,426,561

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	523,753		9,587
Material Costs	160,291		
Subcontract Costs	1,178,208		
Construction Equipment Costs	66,548		
Process Equipment Costs	7,497,762		
Total Direct Cost	**9,426,562**	**9,426,562**	
.			
General Conditions			
Additional Labor Costs			
90-1 Labor Supervision	31,900		
90-2 Show-up Time	10,600		
90-3 Cost Due To OT 5-10's	120,900		
90-5 Per Diem	191,800		
Site Overheads			
91-1 Construction Management	124,500		
91-2 Field Office Expenses	76,500		
91-3 Pre-Operational Testing	19,400		
91-4 Site Services	15,900		
91-5 Safety	12,300		
91-6 Temporary Facilities	9,300		
91-7 Temporary Utilities	10,200		
91-8 Mobilization/Demob.	9,800		
91-9 Legal Expenses/Claims	1,500		
Other Construction Indirects			
92-1 Small Tools & Consumables	26,600		
92-3 General Liability Insurance	6,200		
92-4 Construction Equipment Mob/Demob	3,300		
92-5 Freight on Material	14,300		
	685,000	**10,111,562**	
Project Indirect Costs			
93-1 EPC Engineering Services	185,200		
93-3 EPC Start-Up/Commissioning	52,900		
93-4 EPC Start-Up/Spare Parts	7,900		
93-5 EPC G&A	113,800		
93-5 EPC Risk Fee & Profit	198,600		
93-6 Owners Cost	315,100		
93-7 Warehouse Spares	100,000		
	973,500	**11,085,062**	
Contingency			
94-1 Contingency on Construction Equipment	17,100		
94-2 Contingency on Material	74,900		
94-3 Contingency on Labor+General Conditions	300,000		
94-4 Contingency on Subcontract	215,600		
94-5 Contingency on Process Equipment	1,499,600		
94-6 Contingency on Project Indirect	243,400		
	2,350,600	**13,435,662**	
Escalation			
96-1 Escalation on Construction Equipment			
96-2 Escalation on Material			
96-3 Escalation on Labor+General Conditions			
96-4 Escalation on Subcontract			
96-5 Escalation on Process Equipment			
96-6 Escalation on Project Indirect			
		13,435,662	
Total		**13,435,662**	

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
11.00.00		**DEMOLITION**									
	11.31.00	**MECHANICAL EQUIPMENT**									
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF EXISTING LM6000 GENERATOR TO ACCOMODATE RELOCATION		1.00 EA	-	-		2,299	105,471		105,471
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF EXISTING LM6000 INLET AIR FILTER		1.00 EA	-	-		690	31,641		31,641
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF AUXILIARY SKID, LIQUID FUEL SKID, CO2 SKID		3.00 EA	-	-		517	23,731		23,731
		DISCONNECTION,REMOVAL, AND RE-INSTALLATION OF CONTROLS HOUSE		1.00 EA	-	-		920	42,189		42,189
		MECHANICAL EQUIPMENT						**4,425**	**203,032**		**203,032**
		DEMOLITION						**4,425**	**203,032**		**203,032**
22.00.00		**CONCRETE**									
	22.99.00	**CONCRETE, MISCELLANEOUS**									
		EXTENSION OF EXISTING GENERATOR FOUNDATION	INCLUDING GROUT AND INSTALLATION OF NEW ANCHOR BOLTS ON ALREADY-EXPANDED FOUNDATION (PREVIOUSLY TO ACCOMODATE THIS CHANGE)	1.00 LT	-	-	20,400	805	38,500	13,051	71,951
		CONCRETE, MISCELLANEOUS					**20,400**	**805**	**38,500**	**13,051**	**71,951**
		CONCRETE					**20,400**	**805**	**38,500**	**13,051**	**71,951**
23.00.00		**STEEL**									
	23.25.00	**ROLLED SHAPE**									
		MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	ALLOWANCE FOR MODIFICATIONS TO INLET AIR FILTER SUPPORT STRUCTURE	1.00 TN	-	-	3,691	287	18,920	10,149	32,760
		ROLLED SHAPE					**3,691**	**287**	**18,920**	**10,149**	**32,760**
		STEEL					**3,691**	**287**	**18,920**	**10,149**	**32,760**
31.00.00		**MECHANICAL EQUIPMENT**									
	31.63.00	**GENERATOR**									
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLY ONLY - GE RETROFIT PACKAGE FOR EXISTING CT	1.00 LS		7,497,762	-				7,497,762
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - SSS CLUTCH SIZE 260T	1.00 LS			-	575	34,506	8,613	43,119
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - CLUTCH LUBE OIL CONSOLE	1.00 LS			-	46	2,760	689	3,450
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - EXTENSION TO EXISTING CO2 FIRE EXTINGUISHING SYSTEM (MECHANICAL AND ELECTRICAL INSTALLATION) - SCOPE BY SPECIALTY CONTRACTOR	1.00 LS			-	92	5,521	1,378	6,899
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - GROUTING AND CHOCKFAST EPOXY GROUT FOR THE CLUTCH MODULE AND RELOCATED GENERATOR UNIT	1.00 LS			-	144	8,626	2,153	10,780
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - FLASHINGS BETWEEN THE ENCLOSURE SECTIONS	1.00 LS			-	57	3,451	861	4,312
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - LOAD COUPLINGS AND COUPLING GUARDS	1.00 LS			-	172	10,352	2,584	12,936
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - ALIGNMENT OF THE ROTATING STRING FOR THERMAL DISPLACEMENT DURING OPERATION	1.00 LS			-	172	10,352	2,584	12,936
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE, INSTALLATION ONLY - CONTROL SYSTEM UPGRADED HARDWARE & SOFTWARE	1.00 LS			-	402	24,154	6,029	30,183
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	SUPPLIED WITH PACKAGE - ENGINEERING	1.00 LS			-				
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	FREIGHT TO SITE	1.00 LS	68,000		-				68,000
		SYNCHRONOUS CONDENSING SYSTEM FOR LM6000PC	FS TECH ADVISORY SERVICES	1.00 LS	952,000		-				952,000
		RE-SETTING OF EXISTING GENERATOR		1.00 LS			-	230	13,802	3,445	17,248
		GENERATOR			**1,020,000**	**7,497,762**		**1,891**	**113,524**	**28,337**	**8,659,622**
		MECHANICAL EQUIPMENT			**1,020,000**	**7,497,762**		**1,891**	**113,524**	**28,337**	**8,659,622**
35.00.00		**PIPING**									
	35.99.00	**MISCELLANEOUS**									
		PIPING MODIFICATIONS	INCLUDING INSULATION AND HEAT TRACING	1.00 LS	-	-	6,800	287	19,457	6,713	32,970
		MISCELLANEOUS					**6,800**	**287**	**19,457**	**6,713**	**32,970**
		PIPING					**6,800**	**287**	**19,457**	**6,713**	**32,970**

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
41.00.00		**ELECTRICAL EQUIPMENT**									
	41.13.00	**BUS DUCT**									
		ISO PHASE, FORCE COOLED	MODIFICATION TO RECONNECT TO RELOCATED GENERATOR	1.00 LS	-	-	54,400	345	21,828	6,909	83,137
		BUS DUCT					**54,400**	**345**	**21,828**	**6,909**	**83,137**
		ELECTRICAL EQUIPMENT					**54,400**	**345**	**21,828**	**6,909**	**83,137**
42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
	42.99.00	**RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS**									
		ELECTRICAL INSTRUMENTATION, & CONTROLS CONNECTIONS, CABLES AND ASSOCIATED DCS SYSTEM MODIFICATIONS	INCLUDING ADDITIONAL CABLE	1.00 LS	100,000	-	75,000	800	56,544	1,390	232,934
		RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS			**100,000**		**75,000**	**800**	**56,544**	**1,390**	**232,934**
		RACEWAY, CABLE TRAY & CONDUIT			**100,000**		**75,000**	**800**	**56,544**	**1,390**	**232,934**
61.00.00		**CONSTRUCTION INDIRECT**									
	61.13.00	**CONSTRUCTION EQUIPMENT**									
		CRANE		2.00 MO	58,208	-				-	58,208
		CONSTRUCTION EQUIPMENT			**58,208**						**58,208**
	61.15.00	**CRAFT PERSONNEL**									
		START-UP CRAFT SUPPORT	ELECTRICIANS	1.00 LS	-	-		230	16,290	-	16,290
		START-UP CRAFT SUPPORT	MILLWRIGHTS	1.00 LS	-	-		287	18,911	-	18,911
		START-UP CRAFT SUPPORT	I&C TECHNICIANS	1.00 LS	-	-		230	16,747	-	16,747
		CRAFT PERSONNEL						**747**	**51,948**		**51,948**
		CONSTRUCTION INDIRECT			**58,208**			**747**	**51,948**		**110,156**

EXHIBIT E. SUBSTATION UPGRADES – ALLOCATED ESTIMATE

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/2024
Reviewed By	GA
Approved By	BA
Estimate No.	36503C
Factor table	_4 Productivity 1.15

MARITIME ELECTRIC COMPANY LTD
EXISTING SUBSTATION LOCATION
EXISTING SUBSTATION UPGRADE

Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Constuction Equipment Cost	Total Cost
21.00.00	CIVIL WORK	83,892		64,440	531	74,392	32,414	255,138
22.00.00	CONCRETE			129,228	4,035	661,806	88,285	879,318
23.00.00	STEEL			737,761	1,260	258,418	57,177	1,053,355
24.00.00	ARCHITECTURAL	20,233						20,233
34.00.00	HVAC			33,000	184	35,893	2,884	71,778
41.00.00	ELECTRICAL EQUIPMENT		5,213,515	422,355	1,579	312,027	51,721	5,999,618
42.00.00	RACEWAY, CABLE TRAY & CONDUIT			19,897	56	12,100	160	32,157
43.00.00	CABLE			65,577	512	110,694	17,098	193,369
51.00.00	SUBSTATION, SWITCHYARD & TRANSMISSION LINE		1,604,222	26,196	2,041	402,703	12,654	2,045,775
	TOTAL	104,125	6,817,737	1,498,455	10,198	1,868,032	262,393	10,550,742

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	1,868,032		10,198
Material Costs	1,498,455		
Subcontract Costs	104,125		
Construction Equipment Costs	262,393		
Process Equipment Costs	6,817,737		
Total Direct Cost	**10,550,742**	**10,550,742**	
.			
General Conditions			
Additional Labor Costs			
Site Overheads			
Other Construction Indirects			
		10,550,742	
Project Indirect Costs			
		10,550,742	
Contingency			
		10,550,742	
Escalation			
Total		**10,550,742**	

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
21.00.00		**CIVIL WORK**									
	21.17.00	**EXCAVATION**									
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	623.39 CY	-	-		98	13,444	5,106	18,550
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	46.35 CY	-	-		8	1,100	290	1,390
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	258.28 CY	-	-		45	6,127	1,617	7,745
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	27.02 CY	-	-		5	641	169	810
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	CONTROL BUILDING FOUNDATION EXTENSION	128.08 CY	-	-		22	3,038	802	3,840
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	7.49 CY	-	-		6	816	216	1,032
		TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	TRENCH FOR UNDERGROUND CONDUIT	455.23 CY	-	-		34	4,680	1,235	5,915
		EXCAVATION						**217**	**29,846**	**9,436**	**39,282**
	21.19.00	**DISPOSAL**									
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	623.39 CY	-	-		43	5,915	1,562	7,477
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	46.35 CY	-	-		3	440	116	556
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	258.28 CY	-	-		18	2,451	647	3,098
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, ON SITE	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	8.76 CY	-	-		1	83	22	104
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	CONTROL BUILDING FOUNDATION EXTENSION	128.08 CY	-	-		9	1,215	321	1,536
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	7.49 CY	-	-		2	327	86	413
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	TRENCH FOR UNDERGROUND CONDUIT	78.10 CY	-	-		5	741	196	937
		DISPOSAL						**81**	**11,171**	**2,949**	**14,121**
	21.20.00	**BACKFILL**									
		FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	18.26 CY	-	-		3	433	114	548
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	25.99 CY	-	-	1,794	4	616	163	2,573
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	195.00 CY	-	-	13,459	34	4,626	1,221	19,306
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	CONTROL BUILDING FOUNDATION EXTENSION	43.53 CY	-	-	3,004	8	1,033	273	4,310
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	6.48 CY	-	-	447	1	154	41	641
		TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	TRENCH FOR UNDERGROUND CONDUIT	490.93 CY	-	-		56	7,764	2,050	9,814
		TRENCH BACKFILL, SAND BEDDING	TRENCH FOR UNDERGROUND CONDUIT	76.28 CY	-	-	2,797	11	1,568	414	4,779
		BACKFILL					**21,501**	**118**	**16,194**	**4,275**	**41,971**
	21.21.00	**MASS FILL**									
		BACKFILL WITH CRUSHED STONE	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	568.35 CY	-	-	30,647	23	3,484	4,573	38,704
		MASS FILL					**30,647**	**23**	**3,484**	**4,573**	**38,704**
	21.45.00	**GRADING**									
		ROUGH GRADING, COMMON EARTH, SMALL VOLUME		500.31 CY	-	-		46	7,011	9,201	16,212
		GRADING						**46**	**7,011**	**9,201**	**16,212**
	21.54.00	**CAISSON**									
		CAISSON - 3'-0" DIA X 15'-0" LONG	138KV DISC SW CAISSONS - (2) CAISSONS PER DISC SW= 3.93CY EACH CAISSON X 8 = 31.44 TOTAL CY X $1,200	1.00 LS	83,892	-					83,892
		CAISSON			**83,892**						**83,892**
	21.55.00	**POND**									
		60 MIL THICK HDPE SMOOTH LINER	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	249.00 SY	-	-	7,734	23	3,201	202	11,136
		POND					**7,734**	**23**	**3,201**	**202**	**11,136**
	21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
		AASHTO #57 BASE STONE	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	7.48 CY	-	-	646	3	494	252	1,391
		AASHTO #57 BASE STONE	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	16.43 CY	-	-	1,417	7	1,083	553	3,053
		AASHTO #57 BASE STONE	CONTROL BUILDING FOUNDATION EXTENSION	28.92 CY	-	-	2,495	13	1,907	973	5,375
		ROAD, PARKING AREA, & SURFACED AREA					**4,558**	**24**	**3,484**	**1,778**	**9,819**
		CIVIL WORK			**83,892**		**64,440**	**531**	**74,392**	**32,414**	**255,138**
22.00.00		**CONCRETE**									
	22.13.00	**CONCRETE**									
		MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	147.09 CY	-	-	52,348	211	30,858	5,648	88,854
		MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	11.01 CY	-	-	3,917	16	2,309	423	6,649
		MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	2.78 CY	-	-	989	4	583	107	1,679
		MAT FOUNDATION 5 FT THICK OR THICKER, 4500 PSI	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	12.89 CY	-	-	4,587	15	2,163	396	7,146
		MAT FOUNDATION 5 FT THICK OR THICKER, 4500 PSI	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	46.36 CY	-	-	16,499	53	7,781	1,424	25,704
		MAT FOUNDATION 5 FT THICK OR THICKER, 4500 PSI	CONTROL BUILDING FOUNDATION EXTENSION	42.13 CY	-	-	14,992	48	7,070	1,294	23,357

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE					**93,333**	**347**	**50,764**	**9,291**	**153,389**
	22.15.00	**EMBEDMENT**									
		EMBEDMENTS, CARBON STEEL	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	59.51 LB	-	-	385	3	598	13	996
		EMBEDMENTS, CARBON STEEL	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	216.04 LB	-	-	1,398	12	2,170	48	3,615
		EMBEDMENTS, CARBON STEEL	CONTROL BUILDING FOUNDATION EXTENSION	275.05 LB	-	-	1,780	16	2,762	61	4,603
		EMBEDMENTS, CARBON STEEL	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	27.78 LB	-	-	180	2	279	6	465
		ANCHOR BOLT, CARBON STEEL	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	8.00 EA	-	-	431	18	3,214	71	3,716
		EMBEDMENT					**4,174**	**52**	**9,023**	**199**	**13,396**
	22.17.00	**FORMWORK**									
		BUILT UP INSTALL & STRIP	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	1,588.96 SF	-	-	6,340	517	87,562	8,755	102,658
		BUILT UP INSTALL & STRIP	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	223.12 SF	-	-	890	52	8,782	878	10,551
		BUILT UP INSTALL & STRIP	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	1,061.26 SF	-	-	4,235	247	41,773	4,177	50,184
		BUILT UP INSTALL & STRIP	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	120.00 SF	-	-	479	28	4,723	472	5,674
		BUILT UP INSTALL & STRIP	CONTROL BUILDING FOUNDATION EXTENSION	234.00 SF	-	-	934	54	9,211	921	11,065
		BUILT UP INSTALL & STRIP	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	60.00 SF	-	-	239	20	3,306	331	3,876
		FORMWORK					**13,117**	**918**	**155,357**	**15,534**	**184,009**
	22.25.00	**REINFORCING**									
		UNCOATED A615 GR60	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	0.88 TN	-	-	2,114	20	3,333	472	5,918
		UNCOATED A615 GR60	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	3.09 TN	-	-	7,453	72	11,750	1,664	20,867
		UNCOATED A615 GR60	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	0.74 TN	-	-	1,797	17	2,834	401	5,032
		UNCOATED A615 GR60	CONTROL BUILDING FOUNDATION EXTENSION	2.81 TN	-	-	6,791	65	10,706	1,516	19,013
		UNCOATED A615 GR60	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	0.19 TN	-	-	449	4	708	100	1,258
		REINFORCING	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	22,098.15 LB	-	-		2,540	417,330	59,106	476,436
		REINFORCING					**18,604**	**2,718**	**446,661**	**63,260**	**528,525**
		CONCRETE					**129,228**	**4,035**	**661,806**	**88,285**	**879,318**
23.00.00		**STEEL**									
	23.17.00	**GALLERY**									
		GALVANIZED GRATING, 1 3/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	1,687.96 SF	-	-	99,392	388	83,188	6,402	188,982
		GALLERY					**99,392**	**388**	**83,188**	**6,402**	**188,982**
	23.25.00	**ROLLED SHAPE**									
		STEEL SUPPORT	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	3.57 TN	-	-	26,804	78	15,703	4,550	47,057
		ROLLED SHAPE					**26,804**	**78**	**15,703**	**4,550**	**47,057**
	23.99.00	**STEEL, MISCELLANEOUS**									
		EMBEDDED STEEL	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	798.15 LB	-	-	6,456	92	18,431	5,341	30,228
		STEEL STRUCTURE FOR 69KV DISC. SWITCH STANDS	(8) DISC. SWITCH STANDS - EACH = 7,000 LBS	56,010.53 LB	-	-	453,023	515	103,493	29,988	586,503
		138KV STEEL STRUCTURE FOR BUS SUPPORT	138KV BUS SUPPORT - EACH STRUCT = 2,200 LBS X 4	8,801.65 LB	-	-	71,189	61	12,197	3,534	86,921
		RISER	EACH RISER 5,000 LBS X 2	10,001.88 LB	-	-	80,897	126	25,406	7,362	113,664
		STEEL, MISCELLANEOUS					**611,564**	**794**	**159,527**	**46,225**	**817,316**
		STEEL					**737,761**	**1,260**	**258,418**	**57,177**	**1,053,355**
24.00.00		**ARCHITECTURAL**									
	24.35.00	**PRE-ENGINEERED BUILDING**									
		CONTROL BUILDING EXTENSION		1.00 LS	20,233	-					20,233
		PRE-ENGINEERED BUILDING			**20,233**						**20,233**
		ARCHITECTURAL			**20,233**						**20,233**
34.00.00		**HVAC**									
	34.99.00	**HVAC, MISCELLANEOUS**									
		UPDATED HVAC SYSTEM		1.00 LS	-	-	33,000	184	35,893	2,884	71,778
		HVAC, MISCELLANEOUS					**33,000**	**184**	**35,893**	**2,884**	**71,778**
		HVAC					**33,000**	**184**	**35,893**	**2,884**	**71,778**
41.00.00		**ELECTRICAL EQUIPMENT**									
	41.21.00	**CONTROL & BACKUP POWER**									

Estimate No.: 36503C
Project No.: A14782.003
Estimate Date: 09/24/2024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
EXISTING SUBSTATION LOCATION
EXISTING SUBSTATION UPGRADE

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
	41.21.00	**CONTROL & BACKUP POWER**									
		BATTERY CHARGER		1.00 EA	-	-	79,805	18	3,555	608	83,967
		BATTERY SYSTEM		1.00 LS	-	-	56,079	34	6,665	1,139	63,883
		125VDC PANELBOARD		1.00 EA	-	-	12,113	18	3,969	52	16,134
		CONTROL & BACKUP POWER					**147,998**	**71**	**14,188**	**1,799**	**163,985**
	41.31.00	**ELECTRICAL EQUIPMENT, GROUNDING**									
		GROUNDING FOR BREAKERS & SWITCHES	INCLUDES EXPANDED GROUND GRID	1.00 LS	-	-	58,236	276	59,686	9,219	127,141
		ELECTRICAL EQUIPMENT, GROUNDING					**58,236**	**276**	**59,686**	**9,219**	**127,141**
	41.38.00	**EXTERIOR LIGHTING**									
		LIGHTING ACCESSORY - STAND ALONE SECURITY LIGHTS		6.00 LS	-	-	6,471	28	5,332	911	12,714
		EXTERIOR LIGHTING					**6,471**	**28**	**5,332**	**911**	**12,714**
	41.47.00	**PANEL: CONTROL, DISTRIBUTION, & RELAY**									
		LINE PANEL BREAKER CONTROL PANEL	INCLUDES (2) SEL-351, (4) SEL-2411 & (1) SEL-3530	3.00 EA	-	-	209,650	55	10,664	1,823	222,136
		PANEL: CONTROL, DISTRIBUTION, & RELAY					**209,650**	**55**	**10,664**	**1,823**	**222,136**
	41.51.00	**POWER TRANSFORMER**									
		TRANSFORMER - 69/138KV, 75MVA		1.00 EA	-	5,213,515		1,149	222,158	37,969	5,473,642
		POWER TRANSFORMER				**5,213,515**		**1,149**	**222,158**	**37,969**	**5,473,642**
		ELECTRICAL EQUIPMENT				**5,213,515**	**422,355**	**1,579**	**312,027**	**51,721**	**5,999,618**
42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
	42.15.33	**CONDUIT, PVC**									
		6 IN DIA, SCH 80 INCLUDING COUPLINGS AND ELBOWS		500.00 LF	-	-	19,897	56	12,100	160	32,157
		CONDUIT, PVC					**19,897**	**56**	**12,100**	**160**	**32,157**
		RACEWAY, CABLE TRAY & CONDUIT					**19,897**	**56**	**12,100**	**160**	**32,157**
43.00.00		**CABLE**									
	43.20.00	**600V CABLE & TERMINATION**									
		12/C #10, 600V SHLD		5,000.00 LF	-	-	51,366	362	78,356	12,103	141,826
		7/C #14, 600V SHLD		5,000.00 LF	-	-	14,211	149	32,337	4,995	51,543
		600V CABLE & TERMINATION					**65,577**	**512**	**110,694**	**17,098**	**193,369**
		CABLE					**65,577**	**512**	**110,694**	**17,098**	**193,369**
51.00.00		**SUBSTATION, SWITCHYARD & TRANSMISSION LINE**									
	51.10.00	**BUSBAR**									
		4 IN ALUMINUM BUS TUBE IN SWITCHYARD, SCH 40		700.00 LF	-	-	22,043	402	86,843	1,146	110,032
		BUSBAR					**22,043**	**402**	**86,843**	**1,146**	**110,032**
	51.13.02	**CONDUCTORS**									
		#740 KCMIL AAC CONDUCTOR		899.77 LF	-	-	4,153	18	3,805	588	8,545
		CONDUCTORS					**4,153**	**18**	**3,805**	**588**	**8,545**
	51.15.27	**CIRCUIT BREAKER**									
		138KV, 3000A CIRCUIT BREAKER	138KV CIRCUIT BREAKER	2.00 EA	-	485,107		230	44,263	1,549	530,920
		69KV, 2000A CIRCUIT BREAKER	69KV CIRCUIT BREAKER	3.00 EA	-	452,893		345	66,395	2,324	521,611
		CIRCUIT BREAKER				**938,000**		**575**	**110,658**	**3,873**	**1,052,531**
	51.15.53	**DISCONNECT SWITCH**									
		69KV, 2000A, GANG OPERATED, VERTICAL BREAK DISCONNECT SWITCH		6.00 EA	-	337,372		552	106,232	3,718	447,322
		69KV, 2000A, MOTOR OPERATED, VERTICAL BREAK DISCONNECT SWITCH		2.00 LS	-	143,526		184	35,410	1,239	180,175
		138KV DISCONNECT SWITCH - MOTOR OPERATED		4.00 EA	-	164,792		276	53,116	1,859	219,766
		DISCONNECT SWITCH				**645,690**		**1,011**	**194,758**	**6,816**	**847,263**
	51.15.83	**POTENTIAL DEVICE**									
		69KV POTENTIAL DEVICE - PT		3.00 EA	-	20,532		34	6,639	232	27,404
		POTENTIAL DEVICE				**20,532**		**34**	**6,639**	**232**	**27,404**
		SUBSTATION, SWITCHYARD & TRANSMISSION LINE				**1,604,222**	**26,196**	**2,041**	**402,703**	**12,654**	**2,045,775**

EXHIBIT F. SUBSTATION UPGRADES – UNALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
EXISTING SUBSTATION LOCATION
EXISTING SUBSTATION UPGRADE

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/2024
Reviewed By	GA
Approved By	BA
Estimate No.	36503C
Factor table	_4 Productivity 1.15

MARITIME ELECTRIC COMPANY LTD
EXISTING SUBSTATION LOCATION
EXISTING SUBSTATION UPGRADE

Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Constuction Equipment Cost	Total Cost
21.00.00	CIVIL WORK	56,954		40,632	531	24,364	19,661	141,611
22.00.00	CONCRETE			81,483	4,035	216,747	53,551	351,781
23.00.00	STEEL			465,184	1,260	84,634	34,682	584,500
24.00.00	ARCHITECTURAL	13,736						13,736
34.00.00	HVAC			20,808	184	11,755	1,750	34,313
41.00.00	ELECTRICAL EQUIPMENT		3,500,000	266,310	1,579	102,192	31,373	3,899,874
42.00.00	RACEWAY, CABLE TRAY & CONDUIT			12,546	56	3,963	97	16,606
43.00.00	CABLE			41,349	512	36,253	10,371	87,973
51.00.00	SUBSTATION, SWITCHYARD & TRANSMISSION LINE		1,076,966	16,518	2,041	131,889	7,676	1,233,048
	TOTAL DIRECT	70,690	4,576,966	944,829	10,198	611,796	159,160	6,363,442

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	611,796		10,198
Material Costs	944,829		
Subcontract Costs	70,690		
Construction Equipment Costs	159,160		
Process Equipment Costs	4,576,966		
Total Direct Cost	**6,363,441**	**6,363,441**	
.			
General Conditions			
Additional Labor Costs			
90-1 Labor Supervision	36,700		
90-2 Show-up Time	12,200		
90-3 Cost Due To OT 5-10's	137,400		
90-5 Per Diem	204,000		
Site Overheads			
91-1 Construction Management	143,100		
91-2 Field Office Expenses	88,000		
91-3 Material&Quality Control	22,300		
91-4 Site Services	18,300		
91-5 Safety	14,100		
91-6 Temporary Facilities	10,700		
91-7 Temporary Utilities	11,800		
91-8 Mobilization/Demob.	11,300		
91-9 Legal Expenses/Claims	1,700		
Other Construction Indirects			
92-1 Small Tools & Consumables	30,100		
92-3 General Liability Insurance	7,100		
92-4 Construction Equipment Mob/Demob	15,900		
92-5 Freight on Material	47,200		
	811,900	**7,175,341**	
Project Indirect Costs			
93-1 Engineering Services	294,000		
93-3 Start-Up/Commissioning	73,500		
93-4 Start-up Spare Parts	11,000		
93-5 EPC G&A	257,300		
93-5 EPC Wrap & Fee	431,100		
93-6 Owners Cost	234,300		
93-7 Warehouse Spares	150,000		
	1,451,200	**8,626,541**	
Contingency			
94-1 Contingency on Construction Equipment	43,800		
94-2 Contingency on Material	248,000		
94-3 Contingency on Labor+General Conditions	340,100		
94-4 Contingency on Subcontract	14,100		
94-5 Contingency on Process Equipment	915,400		
94-6 Contingency on Project Indirect	362,800		
	1,924,200	**10,550,741**	
Escalation			
96-1 Escalation on Construction Equipment			
96-2 Escalation on Material			
96-3 Escalation on Labor+General Conditions			
96-4 Escalation on Subcontract			
96-5 Escalation on Process Equipment			
96-6 Escalation on Project Indirect			
		10,550,741	
Total		**10,550,741**	

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
21.00.00		**CIVIL WORK**									
	21.17.00	**EXCAVATION**									
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	623.39 CY	-	-		98	4,403	3,097	7,500
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	46.35 CY	-	-		8	360	176	536
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	258.28 CY	-	-		45	2,007	981	2,988
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	27.02 CY	-	-		5	210	103	312
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	CONTROL BUILDING FOUNDATION EXTENSION	128.08 CY	-	-		22	995	487	1,482
		FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	7.49 CY	-	-		6	267	131	398
		TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	TRENCH FOR UNDERGROUND CONDUIT	455.23 CY	-	-		34	1,533	749	2,282
		EXCAVATION						**217**	**9,775**	**5,724**	**15,499**
	21.19.00	**DISPOSAL**									
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	623.39 CY	-	-		43	1,937	947	2,884
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	46.35 CY	-	-		3	144	70	214
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	258.28 CY	-	-		18	803	392	1,195
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, ON SITE	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	8.76 CY	-	-		1	27	13	40
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	CONTROL BUILDING FOUNDATION EXTENSION	128.08 CY	-	-		9	398	195	593
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	7.49 CY	-	-		2	107	52	159
		DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	TRENCH FOR UNDERGROUND CONDUIT	78.10 CY	-	-		5	243	119	361
		DISPOSAL						**81**	**3,659**	**1,789**	**5,448**
	21.20.00	**BACKFILL**									
		FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	18.26 CY	-	-		3	142	69	211
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	25.99 CY	-	-	1,131	4	202	99	1,432
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	195.00 CY	-	-	8,486	34	1,515	741	10,742
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	CONTROL BUILDING FOUNDATION EXTENSION	43.53 CY	-	-	1,894	8	338	165	2,398
		FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	6.48 CY	-	-	282	1	50	25	357
		TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	TRENCH FOR UNDERGROUND CONDUIT	490.93 CY	-	-		56	2,543	1,243	3,786
		TRENCH BACKFILL, SAND BEDDING	TRENCH FOR UNDERGROUND CONDUIT	76.28 CY	-	-	1,764	11	514	251	2,528
		BACKFILL					**13,557**	**118**	**5,304**	**2,593**	**21,454**
	21.21.00	**MASS FILL**									
		BACKFILL WITH CRUSHED STONE	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	568.35 CY	-	-	19,324	23	1,141	2,774	23,239
		MASS FILL					**19,324**	**23**	**1,141**	**2,774**	**23,239**
	21.45.00	**GRADING**									
		ROUGH GRADING, COMMON EARTH, SMALL VOLUME		500.31 CY	-	-		46	2,296	5,581	7,877
		GRADING						**46**	**2,296**	**5,581**	**7,877**
	21.54.00	**CAISSON**									
		CAISSON - 3'-0" DIA X 15'-0" LONG	138KV DISC SW CAISSONS - (2) CAISSONS PER DISC SW= 3.93CY EACH CAISSON X 8 = 31.44 TOTAL CY X $1,200	1.00 LS	56,954	-					56,954
		CAISSON			**56,954**						**56,954**
	21.55.00	**POND**									
		60 MIL THICK HDPE SMOOTH LINER	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	249.00 SY	-	-	4,876	23	1,048	122	6,047
		POND					**4,876**	**23**	**1,048**	**122**	**6,047**
	21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
		AASHTO #57 BASE STONE	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	7.48 CY	-	-	407	3	162	153	722
		AASHTO #57 BASE STONE	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	16.43 CY	-	-	894	7	355	335	1,584
		AASHTO #57 BASE STONE	CONTROL BUILDING FOUNDATION EXTENSION	28.92 CY	-	-	1,573	13	625	590	2,788
		ROAD, PARKING AREA, & SURFACED AREA					**2,874**	**24**	**1,141**	**1,078**	**5,093**
		CIVIL WORK			**56,954**		**40,632**	**531**	**24,364**	**19,661**	**141,611**
22.00.00		**CONCRETE**									
	22.13.00	**CONCRETE**									
		MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	147.09 CY	-	-	33,007	211	10,106	3,426	46,539
		MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	11.01 CY	-	-	2,470	16	756	256	3,483
		MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	2.78 CY	-	-	624	4	191	65	880
		MAT FOUNDATION 5 FT THICK OR THICKER, 4500 PSI	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	12.89 CY	-	-	2,892	15	708	240	3,841
		MAT FOUNDATION 5 FT THICK OR THICKER, 4500 PSI	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	46.36 CY	-	-	10,403	53	2,548	864	13,816
		MAT FOUNDATION 5 FT THICK OR THICKER, 4500 PSI	CONTROL BUILDING FOUNDATION EXTENSION	42.13 CY	-	-	9,453	48	2,316	785	12,554

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE					**58,850**	**347**	**16,626**	**5,636**	**81,111**
	22.15.00	**EMBEDMENT**									
		EMBEDMENTS, CARBON STEEL	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	59.51 LB	-	-	243	3	196	8	447
		EMBEDMENTS, CARBON STEEL	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	216.04 LB	-	-	881	12	711	29	1,621
		EMBEDMENTS, CARBON STEEL	CONTROL BUILDING FOUNDATION EXTENSION	275.05 LB	-	-	1,122	16	905	37	2,064
		EMBEDMENTS, CARBON STEEL	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	27.78 LB	-	-	113	2	91	4	208
		ANCHOR BOLT, CARBON STEEL	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	8.00 EA	-	-	272	18	1,053	43	1,368
		EMBEDMENT					**2,632**	**52**	**2,955**	**121**	**5,708**
	22.17.00	**FORMWORK**									
		BUILT UP INSTALL & STRIP	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	1,588.96 SF	-	-	3,998	517	28,677	5,311	37,986
		BUILT UP INSTALL & STRIP	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	223.12 SF	-	-	561	52	2,876	533	3,970
		BUILT UP INSTALL & STRIP	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	1,061.26 SF	-	-	2,670	247	13,681	2,534	18,885
		BUILT UP INSTALL & STRIP	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	120.00 SF	-	-	302	28	1,547	286	2,135
		BUILT UP INSTALL & STRIP	CONTROL BUILDING FOUNDATION EXTENSION	234.00 SF	-	-	589	54	3,017	559	4,164
		BUILT UP INSTALL & STRIP	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	60.00 SF	-	-	151	20	1,083	201	1,434
		FORMWORK					**8,271**	**918**	**50,881**	**9,423**	**68,575**
	22.25.00	**REINFORCING**									
		UNCOATED A615 GR60	69KV BREAKER FOUNDATION - (3) 10' X 10.5' X 4' DEEP	0.88 TN	-	-	1,333	20	1,091	286	2,711
		UNCOATED A615 GR60	69KV DISC. SW. STAND - (8) 10' X 16' X 5.5' DEEP	3.09 TN	-	-	4,699	72	3,848	1,009	9,557
		UNCOATED A615 GR60	138KV BREAKER FOUNDATION - (2) 10' X 10' X 1.5' DEEP	0.74 TN	-	-	1,133	17	928	243	2,305
		UNCOATED A615 GR60	CONTROL BUILDING FOUNDATION EXTENSION	2.81 TN	-	-	4,282	65	3,506	920	8,708
		UNCOATED A615 GR60	RISER FOUNDATIONS - (2) 5' X 5' X 1.5' DEEP	0.19 TN	-	-	283	4	232	61	576
		REINFORCING	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	22,098.15 LB	-	-		2,540	136,679	35,852	172,531
		REINFORCING					**11,730**	**2,718**	**146,285**	**38,372**	**196,387**
		CONCRETE					**81,483**	**4,035**	**216,747**	**53,551**	**351,781**
23.00.00		**STEEL**									
	23.17.00	**GALLERY**									
		GALVANIZED GRATING, 1 3/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	1,687.96 SF	-	-	62,670	388	27,245	3,883	93,798
		GALLERY					**62,670**	**388**	**27,245**	**3,883**	**93,798**
	23.25.00	**ROLLED SHAPE**									
		STEEL SUPPORT	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	3.57 TN	-	-	16,901	78	5,143	2,760	24,804
		ROLLED SHAPE					**16,901**	**78**	**5,143**	**2,760**	**24,804**
	23.99.00	**STEEL, MISCELLANEOUS**									
		EMBEDDED STEEL	FOUNDATION PEDESTAL WITH BERM FOR (1) 69/138KV TRANSFORMER	798.15 LB	-	-	4,070	92	6,036	3,240	13,346
		STEEL STRUCTURE FOR 69KV DISC. SWITCH STANDS	(8) DISC. SWITCH STANDS - EACH = 7,000 LBS	56,010.53 LB	-	-	285,647	515	33,895	18,190	337,732
		138KV STEEL STRUCTURE FOR BUS SUPPORT	138KV BUS SUPPORT - EACH STRUCT = 2,200 LBS X 4	8,801.65 LB	-	-	44,887	61	3,995	2,144	51,026
		RISER	EACH RISER 5,000 LBS X 2	10,001.88 LB	-	-	51,008	126	8,321	4,465	63,794
		STEEL, MISCELLANEOUS					**385,613**	**794**	**52,247**	**28,039**	**465,898**
		STEEL					**465,184**	**1,260**	**84,634**	**34,682**	**584,500**
24.00.00		**ARCHITECTURAL**									
	24.35.00	**PRE-ENGINEERED BUILDING**									
		CONTROL BUILDING EXTENSION		1.00 LS	13,736	-					13,736
		PRE-ENGINEERED BUILDING			**13,736**						**13,736**
		ARCHITECTURAL			**13,736**						**13,736**
34.00.00		**HVAC**									
	34.99.00	**HVAC, MISCELLANEOUS**									
		UPDATED HVAC SYSTEM		1.00 LS	-	-	20,808	184	11,755	1,750	34,313
		HVAC, MISCELLANEOUS					**20,808**	**184**	**11,755**	**1,750**	**34,313**
		HVAC					**20,808**	**184**	**11,755**	**1,750**	**34,313**
41.00.00		**ELECTRICAL EQUIPMENT**									
	41.21.00	**CONTROL & BACKUP POWER**									

MARITIME ELECTRIC COMPANY LTD
EXISTING SUBSTATION LOCATION
EXISTING SUBSTATION UPGRADE

Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
	41.21.00	**CONTROL & BACKUP POWER**									
		BATTERY CHARGER		1.00 EA	-	-	50,320	18	1,164	369	51,853
		BATTERY SYSTEM		1.00 LS	-	-	35,360	34	2,183	691	38,234
		125VDC PANELBOARD		1.00 EA	-	-	7,638	18	1,300	32	8,969
		CONTROL & BACKUP POWER					**93,318**	**71**	**4,647**	**1,091**	**99,056**
	41.31.00	**ELECTRICAL EQUIPMENT, GROUNDING**									
		GROUNDING FOR BREAKERS & SWITCHES	INCLUDES EXPANDED GROUND GRID	1.00 LS	-	-	36,720	276	19,548	5,592	61,860
		ELECTRICAL EQUIPMENT, GROUNDING					**36,720**	**276**	**19,548**	**5,592**	**61,860**
	41.38.00	**EXTERIOR LIGHTING**									
		LIGHTING ACCESSORY - STAND ALONE SECURITY LIGHTS		6.00 LS	-	-	4,080	28	1,746	553	6,379
		EXTERIOR LIGHTING					**4,080**	**28**	**1,746**	**553**	**6,379**
	41.47.00	**PANEL: CONTROL, DISTRIBUTION, & RELAY**									
		LINE PANEL BREAKER CONTROL PANEL	INCLUDES (2) SEL-351, (4) SEL-2411 & (1) SEL-3530	3.00 EA	-	-	132,192	55	3,492	1,105	136,790
		PANEL: CONTROL, DISTRIBUTION, & RELAY					**132,192**	**55**	**3,492**	**1,105**	**136,790**
	41.51.00	**POWER TRANSFORMER**									
		TRANSFORMER - 69/138KV, 75MVA		1.00 EA	-	3,500,000		1,149	72,759	23,031	3,595,790
		POWER TRANSFORMER				**3,500,000**		**1,149**	**72,759**	**23,031**	**3,595,790**
		ELECTRICAL EQUIPMENT				**3,500,000**	**266,310**	**1,579**	**102,192**	**31,373**	**3,899,874**
42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
	42.15.33	**CONDUIT, PVC**									
		6 IN DIA, SCH 80 INCLUDING COUPLINGS AND ELBOWS		500.00 LF	-	-	12,546	56	3,963	97	16,606
		CONDUIT, PVC					**12,546**	**56**	**3,963**	**97**	**16,606**
		RACEWAY, CABLE TRAY & CONDUIT					**12,546**	**56**	**3,963**	**97**	**16,606**
43.00.00		**CABLE**									
	43.20.00	**600V CABLE & TERMINATION**									
		12/C #10, 600V SHLD		5,000.00 LF	-	-	32,388	362	25,662	7,342	65,392
		7/C #14, 600V SHLD		5,000.00 LF	-	-	8,961	149	10,591	3,030	22,581
		600V CABLE & TERMINATION					**41,349**	**512**	**36,253**	**10,371**	**87,973**
		CABLE					**41,349**	**512**	**36,253**	**10,371**	**87,973**
51.00.00		**SUBSTATION, SWITCHYARD & TRANSMISSION LINE**									
	51.10.00	**BUSBAR**									
		4 IN ALUMINUM BUS TUBE IN SWITCHYARD, SCH 40		700.00 LF	-	-	13,899	402	28,442	695	43,036
		BUSBAR					**13,899**	**402**	**28,442**	**695**	**43,036**
	51.13.02	**CONDUCTORS**									
		#740 KCMIL AAC CONDUCTOR		899.77 LF	-	-	2,619	18	1,246	356	4,221
		CONDUCTORS					**2,619**	**18**	**1,246**	**356**	**4,221**
	51.15.27	**CIRCUIT BREAKER**									
		138KV, 3000A CIRCUIT BREAKER	138KV CIRCUIT BREAKER	2.00 EA	-	325,668		230	14,497	940	341,104
		69KV, 2000A CIRCUIT BREAKER	69KV CIRCUIT BREAKER	3.00 EA	-	304,042		345	21,745	1,409	327,196
		CIRCUIT BREAKER				**629,710**		**575**	**36,241**	**2,349**	**668,300**
	51.15.53	**DISCONNECT SWITCH**									
		69KV, 2000A, GANG OPERATED, VERTICAL BREAK DISCONNECT SWITCH		6.00 EA	-	226,489		552	34,792	2,255	263,536
		69KV, 2000A, MOTOR OPERATED, VERTICAL BREAK DISCONNECT SWITCH		2.00 LS	-	96,353		184	11,597	752	108,702
		138KV DISCONNECT SWITCH - MOTOR OPERATED		4.00 EA	-	110,630		276	17,396	1,128	129,153
		DISCONNECT SWITCH				**433,472**		**1,011**	**63,785**	**4,134**	**501,391**
	51.15.83	**POTENTIAL DEVICE**									
		69KV POTENTIAL DEVICE - PT		3.00 EA	-	13,784		34	2,174	141	16,099
		POTENTIAL DEVICE				**13,784**		**34**	**2,174**	**141**	**16,099**
		SUBSTATION, SWITCHYARD & TRANSMISSION LINE				**1,076,966**	**16,518**	**2,041**	**131,889**	**7,676**	**1,233,048**

EXHIBIT G. 10 MW / 40 MWH BESS

MARITIME ELECTRIC COMPANY LTD
GREENFIELD SITE
10 MW / 40 MWH BATTERY ENERGY STORAGE (BESS)

Estimator	LT
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	9/10/2024
Reviewed By	TC
Approved By	TC
Estimate No.	36501C
Factor table	_4 Productivity 1.15

MARITIME ELECTRIC COMPANY LTD
GREENFIELD SITE
10 MW / 40 MWH BATTERY ENERGY STORAGE (BESS)

Area	Description	Total Cost
1	BALANCE OF PLANT	1,249,840
2	CIVIL WORK	376,720
3	MAJOR BESS EQUIPMENT PROCUREMENT	17,251,600
4	BALANCE OF SYSTEM (BOS)/BALANCE OF PLANT (BOP) PROCUREMENT	76,160
5	STRUCTURAL/BESS INSTALLATION	1,483,760
6	MV SYSTEM INSTALLATION	175,440
7	SCADA/DAS STATION INSTALL	159,120
8	TESTING AND COMMISSIONING	295,120
9	SUBSTATION (NOT INCLUDED - SEE SUBSTATION ESTIMATE)	
10	FREIGHT AND SALES TAXES	2,985,200
11	CONTINGENCY	1,196,800
12	OWNERS COST	1,387,200
	TOTAL PROJECT COST	**26,636,960**

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs			
Material Costs			
Subcontract Costs	26,636,960		
Construction Equipment Costs			
Process Equipment Costs			
Total Direct Cost	**26,636,960**	**26,636,960**	
.			
General Conditions			
Additional Labor Costs			
		26,636,960	
Project Indirect Costs			
		26,636,960	
Contingency			
		26,636,960	
Total		**26,636,960**	

EXHIBIT H. 5 X 18 MW WÄRTSILÄ ENGINES – ALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/2024
Reviewed By	GA
Approved By	BA
Estimate No.	36641C
Factor table	_4 Productivity 1.15

Estimate No.: 36641C
Project No.: A14782.003
Estimate Date: 09/24/2024
Prep./Rev/App.: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		BASE							
	21.00.00	CIVIL WORK	2,808,760	141,983	589,525	4,174	593,050	279,861	4,413,179
	22.00.00	CONCRETE			3,559,240	40,232	5,789,110	979,788	10,328,137
	23.00.00	STEEL			464,587	1,532	311,634	56,112	832,332
	24.00.00	ARCHITECTURAL	8,581,392	4,911,412		2,784	475,373	71,980	14,040,157
	27.00.00	PAINTING & COATING			85,252	3,422	613,298	48,914	747,464
	31.00.00	MECHANICAL EQUIPMENT	4,462,096	107,861,719	113,020	14,537	2,620,475	328,838	115,386,148
	34.00.00	HVAC	580,289	3,887,914		6,835	1,311,754	98,151	5,878,107
	35.00.00	PIPING			2,752,112	29,211	5,937,373	1,291,258	9,980,743
	36.00.00	INSULATION	185,311		544,453	7,216	1,195,459	112,192	2,037,416
	41.00.00	ELECTRICAL EQUIPMENT		16,094,788	2,548,818	19,949	4,099,642	604,243	23,347,491
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT	11,926		1,007,938	18,103	3,841,417	47,186	4,908,467
	43.00.00	CABLE			2,577,286	18,926	4,026,383	579,091	7,182,760
	44.00.00	CONTROL & INSTRUMENTATION			76,138	545	117,922	8,402	202,462
	61.00.00	CONSTRUCTION INDIRECT				4,017	822,775		822,775
	71.00.00	PROJECT INDIRECT	267,867						267,867
		1 BASE	16,897,641	132,897,816	14,318,367	171,483	31,755,664	4,506,017	200,375,506
BIO		BIODIESEL SYSTEM							
	21.00.00	CIVIL WORK			29,357	159	20,776	4,651	54,785
	22.00.00	CONCRETE			19,635	353	56,955	6,390	82,980
	31.00.00	MECHANICAL EQUIPMENT	1,364,099						1,364,099
	36.00.00	INSULATION	141,731						141,731
	41.00.00	ELECTRICAL EQUIPMENT			43,014	64	12,233	1,947	57,193
		BIO BIODIESEL SYSTEM	1,505,830		92,006	576	89,964	12,988	1,700,788
CEMS		CONTINUOUS EMISSIIONS MONITORING SYSTEM							
	21.00.00	CIVIL WORK			402	7	930	229	1,561
	22.00.00	CONCRETE			11,075	107	17,018	1,988	30,081
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			6,725	134	28,398	349	35,472
	43.00.00	CABLE			4,689	28	5,870	844	11,403
	44.00.00	CONTROL & INSTRUMENTATION		3,178,042		402	87,990	3,844	3,269,876
		CEMS CONTINUOUS EMISSIIONS MONITORING SYSTEM		3,178,042	22,891	677	140,206	7,254	3,348,393
FUEL OIL		FUEL OIL SYSTEM							
	21.00.00	CIVIL WORK	94,988	213,686	367,430	3,204	439,683	146,041	1,261,829
	22.00.00	CONCRETE			301,560	3,761	601,341	88,475	991,376
	23.00.00	STEEL			121,223	692	136,771	36,901	294,894
	27.00.00	PAINTING & COATING	53,194		6,656	161	28,816	6,281	94,946
	31.00.00	MECHANICAL EQUIPMENT	4,120,875	3,022,971		202	36,466	4,576	7,184,888
	35.00.00	PIPING			2,187,115	13,720	2,788,575	543,917	5,519,607
	36.00.00	INSULATION			51,355	708	117,284	11,007	179,646
	41.00.00	ELECTRICAL EQUIPMENT	401,421	2,059,977	1,485,910	5,149	1,047,959	148,969	5,144,235
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			985,133	11,719	2,486,783	30,546	3,502,463
	43.00.00	CABLE			2,590,893	6,317	1,343,855	193,279	4,128,026
	44.00.00	CONTROL & INSTRUMENTATION		1,211,879	118,573	861	187,920	7,720	1,526,092
	61.00.00	CONSTRUCTION INDIRECT				2,299	414,388	0	414,388
		FUEL OIL FUEL OIL SYSTEM	4,670,478	6,508,513	8,215,847	48,793	9,629,840	1,217,712	30,242,390
SCR		SCR SYSTEM							
	22.00.00	CONCRETE			149,123	1,565	224,779	38,306	412,208
	31.00.00	MECHANICAL EQUIPMENT		8,092,962		3,910	704,857	88,451	8,886,269
	35.00.00	PIPING			17,988	139	28,192	4,891	51,070
		SCR SCR SYSTEM		8,092,962	167,111	5,614	957,827	131,648	9,349,548
		TOTAL	23,073,949	150,677,333	22,816,222	227,143	42,573,502	5,875,619	245,016,625

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	42,573,502		227,143
Material Costs	22,816,222		
Subcontract Costs	23,073,949		
Construction Equipment Costs	5,875,619		
Process Equipment Costs	150,677,333		
Total Direct Cost	**245,016,625**	**245,016,625**	
.			
General Conditions			
Additional Labor Costs			
Site Overheads			
Other Construction Indirects			
		245,016,625	
Project Indirect Costs			
		245,016,625	
Contingency			
		245,016,625	
Escalation			
Total		**245,016,625**	

Estimate No.: 36641C
Project No.: A14782.003
Estimate Date: 09/24/2024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		**BASE**									
		CIVIL WORK									
		STRIP & STOCKPILE TOPSOIL									
	21-14-00-20	STRIP 6" DEEP, 500 FT HAUL		6.00 AC	-	-		221	33,089	40,433	73,522
		STRIP & STOCKPILE TOPSOIL						**221**	**33,089**	**40,433**	**73,522**
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	MISCELLANEOUS FOUNDATIONS	56.04 CY	-	-		10	1,307	321	1,628
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FIRE WATER TANK FOUNDATION	235.35 CY	-	-		41	5,490	1,349	6,839
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	STORM SEWER PIPE TRENCH	1,809.16 CY	-	-		135	18,287	4,495	22,782
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	OILY SEWER PIPE TRENCH	1,031.75 CY	-	-		77	10,429	2,564	12,993
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	POTABLE WATER	578.29 CY	-	-		43	5,845	1,437	7,282
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	SANITARY SEWER PIPE TRENCH	486.04 CY	-	-		36	4,913	1,208	6,121
		EXCAVATION						**342**	**46,272**	**11,374**	**57,645**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	STORM SEWER PIPE TRENCH	528.16 CY	-	-		36	4,928	1,211	6,139
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	OILY SEWER PIPE TRENCH	177.45 CY	-	-		12	1,656	407	2,063
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	POTABLE WATER	84.38 CY	-	-		6	787	194	981
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	MISCELLANEOUS FOUNDATIONS	56.04 CY	-	-		4	523	128	651
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE WATER TANK FOUNDATION	134.48 CY	-	-		9	1,255	308	1,563
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	SANITARY SEWER PIPE TRENCH	79.27 CY	-	-		5	740	182	921
		DISPOSAL						**73**	**9,888**	**2,431**	**12,318**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	MISCELLANEOUS FOUNDATIONS	33.62 CY	-	-	2,209	6	784	193	3,186
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	FIRE WATER TANK FOUNDATION	100.86 CY	-	-	6,625	17	2,353	578	9,557
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	STORM SEWER PIPE TRENCH	1,733.29 CY	-	-		199	26,954	6,625	33,579
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	OILY SEWER PIPE TRENCH	1,112.25 CY	-	-		128	17,296	4,251	21,548
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	POTABLE WATER	638.48 CY	-	-		73	9,929	2,441	12,369
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	SANITARY SEWER PIPE TRENCH	528.27 CY	-	-		61	8,215	2,019	10,234
	21-20-00-12	INFILTRATION SAND		156.10 CY	-	-	5,447	23	3,156	776	9,379
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	STORM SEWER PIPE TRENCH	437.35 CY	-	-	15,262	65	8,841	2,173	26,276
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	OILY SEWER PIPE TRENCH	164.83 CY	-	-	5,752	25	3,332	819	9,903
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	POTABLE WATER	83.75 CY	-	-	2,923	13	1,693	416	5,032
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	SANITARY SEWER PIPE TRENCH	76.75 CY	-	-	2,678	11	1,551	381	4,611
		BACKFILL					**40,896**	**621**	**84,104**	**20,673**	**145,673**
		SANITARY SEWAGE UTILITIES									
	21-38-00-99	SANITARY SEWAGE SEPTIC SYSTEM	ALLOWANCE	1.00 EA	97,838						97,838
		SANITARY SEWAGE UTILITIES			**97,838**						**97,838**
		OIL WATER SEWER SYSTEM									
	21-40-00-99	OIL WATER SEPARATOR WITH INTEGRAL LIFT STATION, 200GPM		1.00 EA	-	141,983		230	31,120	7,649	180,753
		OIL WATER SEWER SYSTEM				**141,983**		**230**	**31,120**	**7,649**	**180,753**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-11	CRUSHED ROCK SURFACING, 12" DEEP	GENERATOR STEP UP TRANSFORMER FOUNDATION	131.04 SY	-	-	2,851	4	547	260	3,658
	21-41-00-12	CRUSHED ROCK SURFACING, 8" DEEP	CRUSHED STONE SURFACING	7,800.06 SY	-	-	113,686	179	26,035	12,369	152,089
	21-41-00-41	50 LB RIPRAP, DUMPED		7.14 SY	-	-	496	0	52	5	554
	21-41-00-99	EROSION AND SEDIMENTATION CONTROL		1.00 LS	170,979	-				-	170,979
		EROSION AND SEDIMENTATION CONTROL			**170,979**		**117,034**	**183**	**26,633**	**12,634**	**327,280**
		FENCEWORK									
	21-43-00-11	FABRIC, WIRE & POSTS, CHAIN LINK FENCE, GALVANIZED, 8 FT TALL, 6 GAGE, 3 STRANDS OF BARB WIRE, 2.5 IN POST AT 10 FT O.C.		2,999.23 LF	-	-	205,019	1,034	142,185	8,345	355,549
	21-43-00-30	MAN GATE, 4 FT WIDE BY 7 FT TALL		3.00 EA	-	-	3,387	41	5,687	334	9,408
	21-43-00-50	VEHICLE GATE, 20 FT WIDE BY 8 FT TALL		2.00 EA	-	-	4,106	55	7,583	445	12,134
		FENCEWORK					**212,512**	**1,131**	**155,456**	**9,124**	**377,091**
		LANDSCAPING									

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		LANDSCAPING									
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING 4 IN TOPSOIL FROM PILE & FERTILIZER		24,043.99 SY	-	-	44,403	332	49,718	60,753	154,874
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING 4 IN TOPSOIL FROM PILE & FERTILIZER	RESTORE CONSTRUCTION LAYDOWN AREA 1	41,712.33 SY	-	-	77,033	575	86,252	105,396	268,681
	21-47-00-10	MISC SITE IMPROVEMENTS		1.00 LS	94,988	-					94,988
		LANDSCAPING			**94,988**		**121,436**	**907**	**135,970**	**166,149**	**518,543**
		POND									
	21-55-00-99	NEW POND - ALLOWANCE	300 FT X 150 FT	1.00 AC	590,468	-					590,468
		POND			**590,468**						**590,468**
		ROAD, PARKING AREA, & SURFACED AREA									
	21-57-00-96	PAVEMENT MARKING - 18 IN WIDE STOP BARS	THERMOPLASTIC WHITE OR YELLOW MATERIAL	131.97 LF	-	-	542	3	522	11	1,074
	21-57-00-96	PAVEMENT MARKING - YELLOW DOUBLE STRIPES		1,319.66 LF	-	-	5,418	30	5,215	107	10,740
	21-57-00-97	ROAD & PARKING SIGN - STOP SIGN		6.00 EA	-	-	2,463	28	4,973	624	8,060
	21-57-00-99	ASPHALT PAVEMENT, 4 IN ASPHALT CONCRETE, 12 IN BASE COURSE, 12 IN LIME STABILIZED SUBBASE, 12 IN SUBGRADE PREP, GEOTEXTILE		990.01 SY	118,960	-					118,960
	21-57-00-99	GRAVEL ROADS, 10 IN BASE COURSE, 12 IN LIME STABILIZED SUBBASE, 12 IN SUBGRADE PREP, GEOTEXTILE		17,490.14 SY	1,528,452	-					1,528,452
	21-57-00-99	PIPE BOLLARD, CONCRETE FILLED/PAINT, 6 IN DIA., 8 FT LONG X 6 FT DIA. HOLE		13.00 EA	-	-	16,278	60	10,272	211	26,761
		ROAD, PARKING AREA, & SURFACED AREA			**1,647,412**		**24,702**	**121**	**20,981**	**953**	**1,694,047**
		WELL									
	21-75-00-99	WATER WELL	ALLOWANCE	1.00 LS	75,991	-					75,991
		WELL			**75,991**						**75,991**
		CIVIL WORK,TESTING									
	21-98-00-99	GEOTECHNICAL SOIL INVESTIGATION		1.00 LS	98,313	-				-	98,313
	21-98-00-99	SURVEYING	ALLOWANCE	1.00 LS	32,771	-				-	32,771
		CIVIL WORK,TESTING			**131,084**						**131,084**
		CIVIL WORK, MISCELLANEOUS									
	21-99-00-99	CRANE MAT		1.00 LS	-	-	72,945	345	49,538	8,442	130,925
		CIVIL WORK, MISCELLANEOUS					**72,945**	**345**	**49,538**	**8,442**	**130,925**
		CIVIL WORK			**2,808,760**	**141,983**	**589,525**	**4,174**	**593,050**	**279,861**	**4,413,179**
		CONCRETE									
		CONCRETE									
	22-13-00-02	CONCRETE FOUNDATION FOR RICE MACHINES	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, REINFORCEMENT, AND EMBEDMENTS	1,188.74 CY	-	-	780,865	8,193	1,177,026	200,587	2,158,478
	22-13-00-02	CONCRETE FOUNDATION FOR ENGINE HALL	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	1,350.84 CY	-	-	887,346	9,310	1,337,529	227,939	2,452,815
	22-13-00-02	CONCRETE FOUNDATION FOR CHIMNEY	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	231.14 CY	-	-	151,835	1,593	228,866	39,003	419,703
	22-13-00-02	CONCRETE FOUNDATION FOR FIN FAN COOLERS	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	726.45 CY	-	-	477,195	5,007	719,293	122,581	1,319,069
	22-13-00-02	CONCRETE FOUNDATION FOR EXHAUST DUCT & CHARGE AIR SUPPORT STRUCTURE	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	396.25 CY	-	-	260,289	2,731	392,342	66,862	719,493
	22-13-00-02	CONCRETE FOUNDATION FOR TRANSFORMERS	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	262.24 CY	-	-	172,263	1,807	259,659	44,251	476,172
	22-13-00-02	CONCRETE FOUNDATION FOR CHEMICAL FEEDS	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	273.17 CY	-	-	179,441	1,883	270,478	46,094	496,013
	22-13-00-02	CONCRETE FOUNDATION FOR ELECTRICAL BUILDING	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	292.68 CY	-	-	192,259	2,017	289,799	49,387	531,444
	22-13-00-02	CONCRETE FOUNDATION FOR MISC	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION.	117.07 CY	-	-	76,904	807	115,920	19,755	212,578

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE									
			FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS								
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	MISCELLANEOUS FOUNDATIONS	56.04 CY	-	-	18,979	80	11,559	1,970	32,508
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FIRE WATER TANK FOUNDATION	161.38 CY	-	-	54,661	232	33,290	5,673	93,623
		CONCRETE					**3,252,036**	**33,661**	**4,835,760**	**824,101**	**8,911,897**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FIRE WATER TANK FOUNDATION	806.55 LB	-	-	4,967	46	7,965	164	13,095
		EMBEDMENT					**4,967**	**46**	**7,965**	**164**	**13,095**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	MISCELLANEOUS FOUNDATIONS	83.99 SF	-	-	319	19	3,213	299	3,831
	22-17-00-10	BUILT UP INSTALL & STRIP	FIRE WATER TANK FOUNDATION	492.79 SF	-	-	1,871	113	18,853	1,755	22,480
		FORMWORK					**2,190**	**133**	**22,066**	**2,054**	**26,311**
		PRECAST									
	22-23-00-50	MANHOLE - 6 FT ID BY 8 FT DEEP	STORM WATER SYSTEM	8.00 EA	-	-	17,001	294	42,273	7,204	66,478
	22-23-00-50	OUTLET STRUCTURE (MANHOLE)	STORM WATER SYSTEM	1.00 EA	-	-	2,125	37	5,284	901	8,310
	22-23-00-50	INLET STRUCTURE (MANHOLE)	STORM SEWER WATER SYSTEM	8.00 EA	-	-	17,001	294	42,273	7,204	66,478
		PRECAST					**36,127**	**625**	**89,829**	**15,309**	**141,265**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	MISCELLANEOUS FOUNDATIONS	1.00 TN	-	-	2,299	23	3,745	494	6,538
	22-25-00-10	UNCOATED A615 GR60	FIRE WATER TANK FOUNDATION	11.00 TN	-	-	25,279	142	22,876	3,017	51,172
	22-25-00-39	W1.4 X W1.4 @ 2" X 2" WIRE REINFORCEMENT		390.07 LB	-	-	1,601	18	2,897	382	4,881
		REINFORCING					**29,179**	**183**	**29,519**	**3,893**	**62,590**
		CONCRETE, MISCELLANEOUS									
	22-99-00-01	EQUIPMENT GROUT	ALLOWANCE	46.20 CY	-	-	204,966	5,021	721,267	122,917	1,049,151
	22-99-00-20	WATERSTOP		623.84 LF	-	-	1,601	39	6,779	139	8,519
	22-99-00-30	JOINT FILLER, 0.5 IN BY 1 INCH		389.90 LF	-	-	2,401	9			2,401
	22-99-00-39	JOINT, FILLER - PREMOLDED 1 INCH THICK		1,325.66 LF	-	-	7,347	67	11,525	237	19,109
	22-99-00-99	UNLOADING STATION	CONCRETE UNLOADING CONTAINMENT ADJACENT TO CHEMICAL FEEDS	39.02 CY		-	18,425	448	64,399	10,975	93,799
		CONCRETE, MISCELLANEOUS					**234,740**	**5,584**	**803,971**	**134,268**	**1,172,979**
		CONCRETE					**3,559,240**	**40,232**	**5,789,110**	**979,788**	**10,328,137**
		STEEL									
		GALLERY									
	23-17-00-11	GALVANIZED GRATING, 1 3/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	GENERATOR STEP UP TRANSFORMER FOUNDATION	1,165.75 SF	-	-	65,329	268	56,491	4,048	125,868
	23-17-00-99	GALLERY - GRATING, STAIRS, HANDRAIL, SUPPORTS, ETC	BOP	7.80 TN	-	-	100,581	402	84,651	6,065	191,298
		GALLERY					**165,910**	**670**	**141,142**	**10,113**	**317,166**
		ROLLED SHAPE									
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MISCELLANEOUS STEEL	39.42 TN	-	-	298,676	863	170,492	45,998	515,166
		ROLLED SHAPE					**298,676**	**863**	**170,492**	**45,998**	**515,166**
		STEEL					**464,587**	**1,532**	**311,634**	**56,112**	**832,332**
		ARCHITECTURAL									
		DOOR (INCL. FRAME & HARDWARE)									
	24-15-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SUPPLY AND INSTALL COST OF BUILDING DOORS	1.00 LS	93,594	307,748					401,342
		DOOR (INCL. FRAME & HARDWARE)			**93,594**	**307,748**					**401,342**
		LOUVER & VENT									
	24-25-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SUPPLY AND INSTALL COST OF ROOFTOP VENTS INCLUDING SILENCERS	1.00 LS	147,611	126,616					274,227
		LOUVER & VENT			**147,611**	**126,616**					**274,227**
		PLUMBING FIXTURE									
	24-33-00-99	BUILDING PLUMBING AND MISCELLANEOUS ACCESSORIES	ALLOWANCE	1.00 LS	218,473	-					218,473
		PLUMBING FIXTURE			**218,473**						**218,473**
		PRE-ENGINEERED BUILDING									

Estimate No.: 36641C
Project No.: A14782.003
Estimate Date: 09/24/2024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PRE-ENGINEERED BUILDING									
	24-35-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SIZED FOR 5 ENGINES TOTAL - SUPPLY AND INSTALL COST INCLUDES PRIMARY AND SECONDARY FRAMING SYSTEMS, ROOFING, SIDING, ACCESSORIES, AND LINER PANELS	19,304.53 SF	6,234,605						6,234,605
	24-35-00-99	ELECTRICAL BUILDING - PRE-ENGINEERED BUILDING 40 FT X 78 FT X 20 FT HIGH	SUPPLY AND INSTALL COST (ALL COMPONENTS)	3,494.34 SF	1,626,417						1,626,417
	24-35-00-99	STORAGE BUILDING	ALLOWANCE FOR POLE-BARN CONSTRUCTION WITH ROLL-UP DOOR AND TWO MAN DOORS, INCLUDING FOUNDATION, POWER, LIGHTING, AND VENTILATION	1.00 LS	236,392						236,392
		PRE-ENGINEERED BUILDING			**8,097,414**						**8,097,414**
		ROOFING									
	24-37-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SOUND ATTENUATION PANELS	19,304.59 SF	-	1,760,356		1,109	152,733	12,111	1,925,201
		ROOFING				**1,760,356**		**1,109**	**152,733**	**12,111**	**1,925,201**
		SIDING									
	24-41-00-29	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SOUND ATTENUATION PANELS	29,159.24 SF	-	2,658,988		1,675	322,639	59,869	3,041,496
		SIDING				**2,658,988**		**1,675**	**322,639**	**59,869**	**3,041,496**
		ARCHITECTURAL, MISCELLANEOUS									
	24-99-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	LADDERS AND ASSOCIATED SAFETY SYSTEM, INCLUDING ANCHORS	1.00 LS	24,300	57,704					82,003
		ARCHITECTURAL, MISCELLANEOUS			**24,300**	**57,704**					**82,003**
		ARCHITECTURAL			**8,581,392**	**4,911,412**		**2,784**	**475,373**	**71,980**	**14,040,157**
		PAINTING & COATING									
		COATING									
	27-13-00-99	ENGINE FOUNDATION PAINTING	EPOXY COATING	7,919.81 SF	-	-	13,005	91	16,316	1,086	30,408
		COATING					**13,005**	**91**	**16,316**	**1,086**	**30,408**
		PAINTING									
	27-17-00-10	PIPE PAINTING, 0.5 IN DIA		351.10 LF	-	-	433	32	5,788	385	6,606
	27-17-00-11	PIPE PAINTING, 0.75 IN DIA		1,136.26 LF	-	-	1,750	129	23,181	1,543	26,474
	27-17-00-12	PIPE PAINTING, 1 IN DIA		565.07 LF	-	-	1,090	81	14,439	961	16,491
	27-17-00-14	PIPE PAINTING, 1.5 IN DIA		274.24 LF	-	-	766	46	8,194	897	9,857
	27-17-00-15	PIPE PAINTING, 2 IN DIA		3,277.78 LF	-	-	11,438	580	104,021	11,341	126,800
	27-17-00-16	PIPE PAINTING, 2.5 IN DIA		840.19 LF	-	-	3,536	164	29,434	1,959	34,929
	27-17-00-17	PIPE PAINTING, 3 IN DIA		1,831.47 LF	-	-	9,399	434	77,748	8,496	95,642
	27-17-00-18	PIPE PAINTING, 4 IN DIA		996.52 LF	-	-	6,587	304	54,419	3,623	64,629
	27-17-00-19	PIPE PAINTING, 6 IN DIA		797.39 LF	-	-	7,742	358	64,085	4,266	76,093
	27-17-00-20	PIPE PAINTING, 8 IN DIA		830.58 LF	-	-	10,503	485	86,950	5,788	103,240
	27-17-00-21	PIPE PAINTING, 10 IN DIA		158.95 LF	-	-	2,506	116	20,734	1,380	24,621
	27-17-00-99	TOUCH UP PAINTING		1.00 LS	-	-	16,498	602	107,988	7,188	131,674
		PAINTING					**72,246**	**3,331**	**596,982**	**47,828**	**717,056**
		PAINTING & COATING					**85,252**	**3,422**	**613,298**	**48,914**	**747,464**
		MECHANICAL EQUIPMENT									
		COMPRESSOR & ACCESSORIES									
	31-17-00-59	AIR RECEIVER - 375 GALLONS	SERVICE AIR	1.00 EA	-	9,243		34	6,216	780	16,239
	31-17-00-99	STARTING AIR COMPRESSOR SKID	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	170	30,665	3,848	34,513
	31-17-00-99	STARTING AIR RECEIVER	EQUIPMENT SUPPLIED BY OEM	3.00 EA	-	-	-	141	25,485	3,198	28,683
	31-17-00-99	INSTRUMENT AIR COMPRESSOR SKID	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	57	10,360	1,300	11,660
	31-17-00-99	INSTRUMENT AIR RECEIVER	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	18	3,315	416	3,731
	31-17-00-99	SERVICE AIR RECEIVER	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	18	3,315	416	3,731
	31-17-00-99	INSTRUMENT AIR DRYERS	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	37	6,630	832	7,462
		COMPRESSOR & ACCESSORIES				**9,243**		**477**	**85,985**	**10,790**	**106,018**
		CRANES & HOISTS									
	31-25-00-05	ENGINE HALL - BRIDGE CRANE	SUPPLY AND INSTALL	1.00 LS	141,310	298,965	-				440,275
	31-25-00-99	BRIDGE CRANE - 6 TN, 100 FT SPAN	POWER GENERATION BUILDING	1.00 EA	-	341,305		184	33,151	4,160	378,616
	31-25-00-99	CRANE RAILS	POWER GENERATION BUILDING	719.82 LF	-	-	35,005	124	22,377	2,808	60,190
		CRANES & HOISTS			**141,310**	**640,270**	**35,005**	**308**	**55,528**	**6,968**	**879,080**
		ENGINE									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		ENGINE									
	31-31-00-99	ENGINE/GENERATOR SETS (13.8 KV, 60 HZ) W/ SPRING MOUNTED BASE FRAMES	DUAL FUEL	5.00 EA	-	106,476,171	-	649	117,065	14,690	106,607,926
	31-31-00-99	ENGINE MAINTENANCE PLATFORMS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-		-	471	84,949	10,660	95,610
	31-31-00-99	AUXILIARY MODULES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	178	32,115	4,030	36,145
	31-31-00-99	AUXILIARY MODULE PLATFORMS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	178	32,115	4,030	36,145
	31-31-00-99	TRUNK ROUTE PIPE RACK	EQUIPMENT SUPPLIED BY OEM	1.00 LS	-	-	-	59	10,619	1,332	11,951
	31-31-00-99	LUBE OIL SEPARATOR UNITS	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	12,846	1,612	14,458
	31-31-00-99	COOLING WATER EXPANSION VESSELS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	42,475	5,330	47,805
	31-31-00-99	LOCAL CONTROL PANELS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-		-	161	29,007	3,640	32,647
	31-31-00-99	CENTRAL COMMON CONTROL PANEL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	39	7,045	884	7,929
	31-31-00-99	CENTRAL ENGINE VISE CONTROL PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	161	29,007	3,640	32,647
	31-31-00-99	RADIATOR DISTRIBUTION PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	201	36,259	4,550	40,809
	31-31-00-99	ENGINE AUXILIARY MODULE PANEL DISTRIBUTION PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	201	36,259	4,550	40,809
	31-31-00-99	FLOW METER TOTALIZER	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	34	6,216	780	6,996
	31-31-00-99	LUBE OIL TANK HEATER PANEL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	28	4,973	624	5,597
	31-31-00-99	AMBIENT AIR SENSOR	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	32	5,801	728	6,529
	31-31-00-99	RADIATOR DU/DF - FILTER PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	103	18,647	2,340	20,987
	31-31-00-99	RADIATOR FREQUENCY CONVERTER PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	132	23,827	2,990	26,817
	31-31-00-99	DC SYSTEM	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	218	39,367	4,940	44,307
	31-31-00-99	ENGINE INLET AIR FILTERS AND WEATHER HOODS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	42,475	5,330	47,805
	31-31-00-99	CHARGE AIR & EXHAUST GAS MODULES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	885	159,539	20,020	179,560
	31-31-00-99	NEUTRAL POINT CUBICLES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	115	20,719	2,600	23,319
	31-31-00-99	COOLING RADIATORS INCLUDING SUPPORT STEEL & GALLERIES	EQUIPMENT SUPPLIED BY OEM	5.00 LS	-	-	-	943	169,899	21,320	191,219
	31-31-00-99	PERFORMANCE TESTING		5.00 LS	1,092,367	-	-				1,092,367
	31-31-00-99	MAINTENANCE WATER TANK WITH TRANSFER PUMPS	EQUIPMENT SUPPLIED BY OEM	1.00 LT	-	-	-	86	15,540	1,950	17,490
	31-31-00-99	DUAL FUEL CAPABILITY	EQUIPMENT SUPPLIED BY OEM INCLUDING BIOFUEL CAPABILITY	5.00 EA	-		-	862	155,395	19,500	174,896
		ENGINE			**1,092,367**	**106,476,171**		**6,281**	**1,132,159**	**142,072**	**108,842,769**
		FIRE PROTECTION EQUIPMENT & SYSTEM									
	31-41-00-30	FIRE EXTINGUISHERS ENGINE HALL	DRY POWDER TYPE	27.00 EA	-	-	41,569	47	8,391	1,053	51,013
	31-41-00-40	6 IN FIRE HYDRANT CAST IRON, CLASS 125		14.00 EA	-	195,286	-	97	17,404	2,184	214,874
	31-41-00-60	ENGINE HALL WET PIPE SPRINKLER SYSTEM	SUBCONTRACT	1.00 LS	503,439	-	-				503,439
	31-41-00-99	FIRE DETECTION SYSTEM	SUBCONTRACT	1.00 LS	379,954	-	-				379,954
	31-41-00-99	FIRE PUMP STATION	SUBCONTRACT, 1X100% DIESEL (2,500 GPM @ 125 PSI), 1x100% ELECTRIC (2,500 GPM @ 125 PSI), 1X100% JOCKEY, PUMPHOUSE	1.00 LS	763,137	-	-				763,137
	31-41-00-99	FIRE/RAW WATER TANK	CAPACITY: APPROX. 250,000 GAL. VERTICAL, INCL STAIRS, LADDERS, MANWAYS, & CATHODIC PROTECTION. CS W/ EPOXY COATING.	1.00 EA	1,386,831	-	-				1,386,831
		FIRE PROTECTION EQUIPMENT & SYSTEM			**3,033,361**	**195,286**	**41,569**	**143**	**25,796**	**3,237**	**3,299,248**
		BLACK START GENERATOR									
	31-65-00-99	CAT 700 KW DIESEL GENERATOR	PRICING PROVIDED BY TOROMONT CAT	1.00 LS	-	504,898	-	126	22,791	2,860	530,549
		BLACK START GENERATOR				**504,898**		**126**	**22,791**	**2,860**	**530,549**
		LUBRICATING OIL SYSTEM									
	31-69-00-99	LUBRICATING OIL STORAGE TANK, FRESH OIL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	12,846	1,612	14,458
	31-69-00-99	LUBRICATING OIL SERVICE TANK	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	12,846	1,612	14,458
	31-69-00-99	LUBRICATING OIL TRANSFER PUMP UNIT, MOBILE	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	57	10,360	1,300	11,660
	31-69-00-99	LUBRICATING OIL TRANSFER PUMP UNIT, STATIONARY	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	57	10,360	1,300	11,660
	31-69-00-99	LUBRICATING OIL STORAGE TANK, USED OIL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	12,846	1,612	14,458
		LUBRICATING OIL SYSTEM						**329**	**59,257**	**7,436**	**66,693**
		CHARGE AIR SYSTEM									
	31-71-00-05	DUCTING, CHARGING AIR	EQUIPMENT SUPPLIED BY OEM	272.93 LF	-	-	-	314	56,564	7,098	63,662
	31-71-00-05	DUCT SUPPORTS	EQUIPMENT SUPPLIED BY OEM	10.00 EA	-	-	-	299	53,870	6,760	60,630
	31-71-00-05	CHARGE AIR FILTER	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	42,475	5,330	47,805
	31-71-00-05	CHARGE AIR PREHEATING UNIT	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	42,475	5,330	47,805
	31-71-00-05	CHARGE AIR SILENCER	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	42,475	5,330	47,805
		CHARGE AIR SYSTEM						**1,320**	**237,858**	**29,848**	**267,707**
		PUMP									
	31-75-00-99	WELL PUMP	100%@300 GPM & 150 TDH	1.00 EA	-	35,852	-	18	3,315	416	39,583
		PUMP				**35,852**		**18**	**3,315**	**416**	**39,583**
		SCREEN									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		SCREEN									
	31-77-00-05	DEBRIS FILTER - SIEVE	INSTRUMENT AIR PIPING	4.00 EA	-	-	411	14	2,486	312	3,209
	31-77-00-05	DEBRIS FILTER - SIEVE	DRAIN PIPING, FLOOR DRAINS	5.00 EA	-	-	513	17	3,108	390	4,011
	31-77-00-05	DEBRIS FILTER - SIEVE	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	616	21	3,729	468	4,813
	31-77-00-05	DEBRIS FILTER - SIEVE	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	1,026	34	6,216	780	8,022
	31-77-00-99	SCREEN - BIRD	INSTRUMENT AIR PIPING	2.00 EA	-	-	308	7	1,243	156	1,707
	31-77-00-99	SCREEN - SIEVE	UREA PIPING SYSTEM	4.00 EA	-	-	411	14	2,486	312	3,209
	31-77-00-99	SCREEN - BIRD	COOLING WATER PIPING SYSTEM	1.00 EA	-	-	154	3	622	78	854
		SCREEN					**3,438**	**110**	**19,891**	**2,496**	**25,825**
		EXHAUST SYSTEM									
	31-81-00-99	EXHAUST GAS SILENCER - VERTICAL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	293	52,834	6,630	59,465
	31-81-00-99	DUCTING, EXHAUST GAS	EQUIPMENT SUPPLIED BY OEM	593.85 LF	-	-	-	1,366	246,146	30,888	277,034
	31-81-00-99	DUCT SUPPORTS (TOWERS)	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	707	127,424	15,990	143,414
	31-81-00-99	BELLOWS	EQUIPMENT SUPPLIED BY OEM	20.00 EA	-	-	-	713	128,460	16,120	144,580
	31-81-00-99	EXHAUST GAS STACK PIPE	EQUIPMENT SUPPLIED BY OEM	371.16 LF	-	-	-	427	76,921	9,653	86,574
	31-81-00-99	DUCT INSULATION & JACKETING	EQUIPMENT SUPPLIED BY OEM	3,108.53 SF		-	-	1,126	202,886	25,460	228,346
	31-81-00-99	EXHAUST PURGE FAN	EQUIPMENT SUPPLIED BY OEM	5.00 EA		-	-	172	31,079	3,900	34,979
	31-81-00-99	RUPTURE DISCS WITH WEATHER COVERS	EQUIPMENT SUPPLIED BY OEM	5.00 EA		-	-	144	25,899	3,250	29,149
	31-81-00-99	EXHAUST GAS SILENCER - HORIZONTAL	EQUIPMENT SUPPLIED BY OEM	5.00 EA		-	-	293	52,834	6,630	59,464
		EXHAUST SYSTEM						**5,240**	**944,485**	**118,521**	**1,063,006**
		WATER TREATING									
	31-93-00-99	WELL WATER TREATMENT SYSTEM	ALLOWANCE	1.00 LS	47,494	-	-				47,494
		WATER TREATING			**47,494**						**47,494**
		MECHANICAL EQUIPMENT, TESTING									
	31-98-00-99	NOISE ASSESSMENT	SUBCONTRACT	1.00 LS	71,004	-	-				71,004
		MECHANICAL EQUIPMENT, TESTING			**71,004**						**71,004**
		MECHANICAL EQUIPMENT, MISCELLANEOUS									
	31-99-00-99	TAGGING		1.00 LS	-	-	31,684	181	32,581	4,088	68,354
	31-99-00-99	MECHANICAL EQUIPMENT - HIGH VELOCITY LUBE OIL FLUSH	LUBE OIL PIPING SYSTEM	1.00 LS	76,561	-	-				76,561
	31-99-00-99	MECHANICAL EQUIPMENT -2" HOSE 100LF FOR SKID FILL	COOLING WATER PIPING SYSTEM	1.00 EA	-	-	1,324	5	829	104	2,257
		MECHANICAL EQUIPMENT, MISCELLANEOUS			**76,561**		**33,009**	**185**	**33,410**	**4,192**	**147,171**
		MECHANICAL EQUIPMENT			**4,462,096**	**107,861,719**	**113,020**	**14,537**	**2,620,475**	**328,838**	**115,386,148**
		HVAC									
		HVAC, MISCELLANEOUS									
	34-99-00-99	AIR HANDLING UNITS, AIR ROTATION UNITS, AND VIBRO ACOUSTICS	ALLOWANCE	2.00 LS	-	2,831,748		487	93,489	6,995	2,932,232
	34-99-00-99	HEATERS	ALLOWANCE	2.00 LS	-	306,135		104	19,944	1,492	327,572
	34-99-00-99	DAMPERS	ALLOWANCE	2.00 LS	-	61,227		87	16,620	1,244	79,091
	34-99-00-99	LOUVERS/GRAVITY RELIEF HOODS	ALLOWANCE	2.00 LS	-	306,135		173	33,241	2,487	341,863
	34-99-00-99	FANS	ALLOWANCE	2.00 LS	-	25,511		139	26,592	1,990	54,093
	34-99-00-99	DUCTWORK	ALLOWANCE	2.00 LS	-	357,157		5,846	1,121,867	83,943	1,562,967
	34-99-00-99	DUCTWORK INSULATION	ALLOWANCE	2.00 LS	580,289						580,289
		HVAC, MISCELLANEOUS			**580,289**	**3,887,914**		**6,835**	**1,311,754**	**98,151**	**5,878,107**
		HVAC			**580,289**	**3,887,914**		**6,835**	**1,311,754**	**98,151**	**5,878,107**
		PIPING									
		SS 304, ABOVE GROUND, PROCESS AREA									
	35-13-01-06	0.75 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	1,834.09 LF	-	-	69,275	2,130	432,890	251,197	753,362
	35-13-01-10	1 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	611.37 LF	-	-	31,500	780	158,584	91,862	281,947
	35-13-01-22	3 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	126.64 LF	-	-	14,064	237	48,239	8,368	70,672
	35-13-01-38	10 IN DIA, SCH 40S, 2 SS 12'V X 9' H RISERS	FIRE PROTECTION PIPING SYSTEM	91.71 LF	-	-	59,807	336	68,364	11,860	140,031
		SS 304, ABOVE GROUND, PROCESS AREA					**174,647**	**3,484**	**708,077**	**363,287**	**1,246,010**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-06	0.75 IN DIA, SCH 80	HOT DRAINS IFC	193.89 LF	-	-	3,940	210	42,590	7,389	53,919
	35-13-10-06	0.75 IN DIA, SCH 80	SERVICE AIR PIPING	497.83 LF	-	-	10,117	538	109,356	18,971	138,443
	35-13-10-06	0.75 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	52.41 LF	-	-	1,065	57	11,512	1,997	14,574
	35-13-10-10	1 IN DIA, SCH 80	HOT DRAINS IFC	89.09 LF	-	-	2,103	104	21,234	3,684	27,021
	35-13-10-10	1 IN DIA, SCH 80	SERVICE AIR PIPING	15.72 LF	-	-	371	18	3,747	650	4,768

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-10	1 IN DIA, SCH 80	LUBE OIL PIPING SYSTEM	34.06 LF	-	-	804	40	8,119	1,409	10,332
	35-13-10-14	1.5 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	274.24 LF	-	-	9,345	366	74,341	12,897	96,582
	35-13-10-18	2 IN DIA, SCH 80	HOT DRAINS IFC	75.11 LF	-	-	3,639	109	22,116	3,837	29,592
	35-13-10-18	2 IN DIA, SCH 80	SERVICE AIR PIPING	1,220.10 LF	-	-	59,109	1,768	359,256	62,323	480,687
	35-13-10-18	2 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	382.54 LF	-	-	18,532	554	112,638	19,540	150,710
	35-13-10-18	2 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	304.81 LF	-	-	14,767	442	89,750	15,570	120,087
	35-13-10-21	2.5 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	840.19 LF	-	-	44,498	1,207	245,427	42,576	332,501
	35-13-10-25	3 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	488.22 LF	-	-	28,963	752	152,882	26,522	208,367
	35-13-10-29	4 IN DIA, SCH 40	HOT DRAINS IFC	26.20 LF	-	-	2,044	45	9,062	1,572	12,678
	35-13-10-29	4 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	59.39 LF	-	-	4,633	101	20,541	3,563	28,737
	35-13-10-33	6 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	72.49 LF	-	-	8,616	134	27,274	4,731	40,621
	35-13-10-33	6 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	680.36 LF	-	-	80,865	1,259	255,977	44,407	381,248
	35-13-10-33	6 IN DIA, SCH 40	FIRE PROTECTION PIPING SYSTEM	44.54 LF	-	-	5,294	82	16,758	2,907	24,960
	35-13-10-37	8 IN DIA, SCH 40	FIRE PROTECTION PIPING SYSTEM	44.54 LF	-	-	7,699	98	19,985	3,467	31,151
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**306,403**	**7,884**	**1,602,564**	**278,011**	**2,186,978**
		SS 304, STRAIGHT RUN									
	35-14-01-18	2 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	305.68 LF	-	-	24,535	309	62,862	31,704	119,101
		SS 304, STRAIGHT RUN					**24,535**	**309**	**62,862**	**31,704**	**119,101**
		CARBON STEEL, STRAIGHT RUN									
	35-14-10-18	2 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	907.44 LF	-	-	29,991	803	163,284	28,326	221,601
	35-14-10-25	3 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	1,310.07 LF	-	-	48,138	949	192,872	33,459	274,469
	35-14-10-29	4 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	436.69 LF	-	-	21,962	351	71,434	12,392	105,789
	35-14-10-29	4 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	349.35 LF	-	-	17,570	281	57,148	9,914	84,632
	35-14-10-37	8 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	786.04 LF	-	-	93,586	850	172,666	29,954	296,207
		CARBON STEEL, STRAIGHT RUN					**211,247**	**3,234**	**657,405**	**114,046**	**982,698**
		HDPE, BURIED									
	35-15-30-10	2 IN DIA, DR 11	POTABLE WATER	698.70 LF	-	-	4,877	361	73,475	12,746	91,098
	35-15-30-18	4 IN DIA, DR 11	SANITARY SEWER PIPING	698.70 LF	-	-	8,319	321	65,311	11,330	84,960
	35-15-30-29	10 IN DIA, DR 9	FIRE PROTECTION PIPING SYSTEM	1,746.75 LF	-	-	145,579	1,968	400,031	69,397	615,006
	35-15-30-57	24 IN DIA, DR 9	STORM SEWER BYPASS PIPING	436.69 LF	-	-	164,942	818	166,340	28,856	360,138
	35-15-30-57	24 IN DIA, DR 9	OUTLET PIPING	69.87 LF	-	-	26,391	131	26,615	4,617	57,623
		HDPE, BURIED					**350,107**	**3,600**	**731,771**	**126,947**	**1,208,825**
		CHDPE, BURIED									
	35-15-31-01	12 IN	STORM SEWER PIPING	436.69 LF	-	-	11,654	251	51,024	8,852	71,530
	35-15-31-99	24 IN	STORM SEWER PIPING	436.69 LF	-	-	25,100	402	81,639	14,163	120,902
		CHDPE, BURIED					**36,753**	**653**	**132,663**	**23,014**	**192,431**
		CAST IRON, BURIED									
	35-15-37-99	8 IN DIA CAST IRON SOIL PIPE	OILY WATER SEWER SYSTEM	1,746.75 LF	-	-	163,937	1,205	244,917	42,488	451,341
		CAST IRON, BURIED					**163,937**	**1,205**	**244,917**	**42,488**	**451,341**
		PIPE SUPPORTS, HANGERS									
	35-35-00-01	SINGLE ROD SUPPORT W/O BEAM FOR 1 IN AND BELOW DIA PIPE	ALLOWANCE	825.00 EA	-	-	296,369	1,897	385,486	66,874	748,728
	35-35-00-04	SINGLE ROD SUPPORT W/O BEAM FOR 3 IN PIPE	STARTING AIR	14.00 EA	-	-	5,805	48	9,812	1,702	17,320
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE	STARTING AIR	30.00 EA	-	-	14,349	138	28,035	4,864	47,248
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	FUEL GAS SYSTEM	20.97 EA	-	-	8,392	84	17,144	2,974	28,510
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	FUEL GAS SYSTEM	5.24 EA	-	-	2,098	21	4,286	744	7,128
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	CLOSED COOLING WATER	53.00 EA	-	-	21,215	213	43,338	7,518	72,072
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN DETAIL 2	CLOSED COOLING WATER	27.00 EA	-	-	10,808	109	22,078	3,830	36,716
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	LUBE OIL SYSTEM	157.00 EA	-	-	62,846	632	128,379	22,271	213,495
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	LUBE OIL SYSTEM	37.00 EA	-	-	14,811	149	30,255	5,249	50,314
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	SERVICE WATER SYSTEM	26.00 EA	-	-	10,408	105	21,260	3,688	35,356
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	SERVICE WATER SYSTEM	14.00 EA	-	-	5,604	56	11,448	1,986	19,038
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	INSTRUMENT/SERVICE AIR SYSTEM	40.00 EA	-	-	16,012	161	32,708	5,674	54,394
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	INSTRUMENT/SERVICE AIR SYSTEM	14.00 EA	-	-	5,604	56	11,448	1,986	19,038
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	SANITARY SYSTEM	10.00 EA	-	-	4,003	40	8,177	1,419	13,598
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	SERVICE WATER SYSTEM	93.00 EA	-	-	37,227	374	76,046	13,192	126,465
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE - DETAIL 1	FUEL GAS SYSTEM	8.74 EA	-	-	4,878	66	13,470	2,337	20,685
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE - DETAIL 1	SERVICE WATER SYSTEM	39.00 EA	-	-	21,776	296	60,136	10,432	92,344
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE - DETAIL 2	SERVICE WATER SYSTEM	16.00 EA	-	-	8,934	121	24,671	4,280	37,885

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PIPE SUPPORTS, HANGERS									
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 3	LUBE OIL SYSTEM	26.00 EA	-	-	16,172	227	46,165	8,009	70,345
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 1	INSTRUMENT/SERVICE AIR SYSTEM	93.00 EA	-	-	57,845	812	165,128	28,646	251,619
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 2	INSTRUMENT/SERVICE AIR SYSTEM	29.00 EA	-	-	18,038	253	51,492	8,933	78,462
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 1	SANITARY SYSTEM	11.00 EA	-	-	6,842	96	19,531	3,388	29,761
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE - DETAIL 4	CLOSED COOLING WATER	105.00 EA	-	-	72,206	1,159	235,497	40,854	348,557
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE - DETAIL 2	CLOSED COOLING WATER	74.00 EA	-	-	50,888	817	165,969	28,792	245,650
		PIPE SUPPORTS, HANGERS					**773,128**	**7,931**	**1,611,959**	**279,641**	**2,664,728**
		VALVES									
	35-45-00-05	LARGE BORE - 10" POST INDICATOR VALVE	FIRE PROTECTION PIPING SYSTEM	10.00 EA	-	-	73,998	73	14,905	2,586	91,489
	35-45-00-05	LARGE BORE - 4" GATE	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	23,674	24	4,906	851	29,431
	35-45-00-05	LARGE BORE - 3" CHECK, S&L-CHECK00	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	3,472	10	2,103	365	5,940
	35-45-00-05	LARGE BORE - 3" GLOBE S&L-GLOBE00	LUBE OIL PIPING SYSTEM	16.00 EA	-	-	14,511	28	5,607	973	21,091
	35-45-00-05	LARGE BORE - 3" QUARTER TURN S&L-QTURN00	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	56,620	10	2,103	365	59,087
	35-45-00-05	LARGE BORE - 4" GLOBE	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	13,081	17	3,504	608	17,194
	35-45-00-05	LARGE BORE - 3" BUTTERFLY	COOLING WATER PIPING SYSTEM	105.00 EA	-	-	117,422	181	36,796	6,383	160,602
	35-45-00-05	8 IN POST INDICATOR VALVE	OILY WATER SEWER SYSTEM	7.00 EA	-	-	25,531	64	13,083	2,270	40,884
	35-45-00-05	LARGE BORE - 3" BALL	STARTING AIR	19.00 EA	-	-	50,818	48	9,766	1,694	62,278
	35-45-00-10	SMALL BORE - 2" BALL	SERVICE AIR PIPING	10.00 EA	-	-	5,286	18	3,661	635	9,582
	35-45-00-10	SMALL BORE - 1" PRV	SERVICE AIR PIPING	6.00 EA	-	-	5,074	14	2,804	486	8,364
	35-45-00-10	SMALL BORE - 1/2" QUARTER TURN	SERVICE AIR PIPING	10.00 EA	-	-	365	17	3,504	608	4,477
	35-45-00-10	SMALL BORE - 3/4" QUARTER TURN	SERVICE AIR PIPING	18.00 EA	-	-	1,007	31	6,308	1,094	8,409
	35-45-00-10	SMALL BORE - 2" BALL	CLASS 600, INSTRUMENT AIR PIPING	3.00 EA	-	-	4,780	5	1,098	191	6,069
	35-45-00-10	SMALL BORE - 1" GLOBE	CLASS 600, INSTRUMENT AIR PIPING	31.00 EA	-	-	22,236	53	10,864	1,885	34,984
	35-45-00-10	SMALL BORE - 1/2" GLOBE	CLASS 600, INSTRUMENT AIR PIPING	18.00 EA	-	-	7,615	31	6,308	1,094	15,018
	35-45-00-10	SMALL BORE - 1/2" QUARTER TURN	CLASS 600, INSTRUMENT AIR PIPING	26.00 EA	-	-	20,230	45	9,112	1,581	30,922
	35-45-00-10	SMALL BORE - 2" CHECK (2OIA-V0021)	CLASS 600, INSTRUMENT AIR PIPING	5.00 EA	-	-	7,598	9	1,752	304	9,655
	35-45-00-10	SMALL BORE - 2" BALL	LUBE OIL PIPING SYSTEM	38.00 EA	-	-	60,479	69	14,056	2,438	76,973
	35-45-00-10	SMALL BORE - 1 1/2" GLOBE, S&L-GLOBE00	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	1,824	10	2,103	365	4,291
	35-45-00-10	SMALL BORE - 2" BALL	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	5,286	17	3,504	608	9,398
	35-45-00-10	SMALL BORE - 2" QUARTER TURN (20WM-V0004) DIAPHRAM OPERATED	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	10,018	17	3,504	608	14,130
	35-45-00-99	VALVE - 3" GLOBE	CLASS 600, INSTRUMENT AIR PIPING	10.00 EA	-	-	135,289	17	3,504	608	139,401
		VALVES					**666,214**	**811**	**164,856**	**28,599**	**859,670**
		MISCELLANEOUS									
	35-99-00-99	12 IN AREA DRAIN	FOUNDATIONS - OIL WATER SEPARATOR	2.00 EA	-	-	5,736	12	2,383	413	8,533
	35-99-00-99	PIPING, MISCELLANEOUS - 1" AUTOMATED DRAIN TRAP	INSTRUMENT AIR PIPING	2.00 EA	-	-	4,584	5	934	162	5,681
	35-99-00-99	PIPING, MISCELLANEOUS - 10" THRUST BLOCKS	FIRE PROTECTION PIPING SYSTEM	14.00 LS	-	-	15,705	20	4,164	722	20,591
	35-99-00-99	PIPING, MISCELLANEOUS - 4" FLOOR DRAIN	DRAIN PIPING, FLOOR DRAINS	5.00 EA	-	-	942	17	3,504	608	5,054
	35-99-00-99	PIPING, MISCELLANEOUS - 4" CLEAN OUT	DRAIN PIPING, FLOOR DRAINS	2.00 EA	-	-	1,199	5	934	162	2,296
	35-99-00-99	PIPING, MISCELLANEOUS - 12" 90 DEG ELBOW	DRAIN PIPING, FLOOR DRAINS	2.00 EA	-	-	2,359	4	724	126	3,209
	35-99-00-99	PIPING, MISCELLANEOUS - 12" 45 DEG ELBOW	DRAIN PIPING, FLOOR DRAINS	3.00 EA	-	-	2,938	5	1,069	185	4,193
	35-99-00-99	PIPING, MISCELLANEOUS - P TRAP	DRAIN PIPING, FLOOR DRAINS	2.00 EA	-	-	280	5	935	162	1,377
	35-99-00-99	PIPING, MISCELLANEOUS - 3" TRUCK UNLOADING CONNECTOR	LUBE OIL PIPING SYSTEM	2.00 EA	-	-	765	9	1,869	324	2,958
	35-99-00-99	PIPING, MISCELLANEOUS - BREATHER VENT (20LO-M0001 6" TEDECO MODEL M1067EMFV OR EQUIVALENT	LUBE OIL PIPING SYSTEM	2.00 EA	-	-	1,657	7	1,402	243	3,302
	35-99-00-99	PIPING, MISCELLANEOUS - 10" THRUST BLOCKS	FIRE PROTECTION PIPING SYSTEM	8.00 LS	-	-	8,974	12	2,379	413	11,766
		MISCELLANEOUS					**45,141**	**100**	**20,298**	**3,521**	**68,960**
		PIPING					**2,752,112**	**29,211**	**5,937,373**	**1,291,258**	**9,980,743**
		INSULATION									
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-99	LARGE BORE PIPING	LUBE OIL/UREA PUMP HOUSE PRE-ENGINEERED BUILDINGS	4,587.84 LF	-	-	370,409	4,660	771,959	72,447	1,214,816
	36-17-03-99	SMALL BORE PIPING	LUBE OIL/UREA PUMP HOUSE PRE-ENGINEERED BUILDINGS	4,323.21 LF	-	-	172,075	2,556	423,500	39,745	635,320
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**542,484**	**7,216**	**1,195,459**	**112,192**	**1,850,136**
		INSULATION, MISCELLANEOUS									
	36-99-00-99	EXHAUST DUCT INSULATION		2,375.94 SF	185,311	-					185,311
	36-99-00-99	6 IN ROOF INSULATION AND 3 IN WALL INSULATION	LUBE OIL/UREA PUMP HOUSE PRE-ENGINEERED BUILDINGS	1,257.95 SF	-	-	1,969				1,969
		INSULATION, MISCELLANEOUS			**185,311**		**1,969**				**187,280**
		INSULATION			**185,311**		**544,453**	**7,216**	**1,195,459**	**112,192**	**2,037,416**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		ELECTRICAL EQUIPMENT									
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION		1.00 LS	-	-	264,397	154	32,865	4,727	301,989
		CATHODIC PROTECTION					**264,397**	**154**	**32,865**	**4,727**	**301,989**
		COMMUNICATION SYSTEM									
	41-17-00-29	TELEPHONE - TERMINAL BOX	COMMUNICATION	20.00 EA	-	-	118,034	536	101,926	16,220	236,180
	41-17-00-51	HANDSET/SPEAKER AMPLIFIER WITH HANDSET, PRESSBAR AND MAGNETIC HOOKSWITCH, CLASS 1 DIV 2, GAI-TRONICS	COMMUNICATION	47.00 EA	-	-	63,677	270	57,465	8,265	129,407
	41-17-00-53	HORN, GAI-TRONIC, WEATHER PROOF	COMMUNICATION	5.00 EA	-	-	2,104	11	2,445	352	4,901
	41-17-00-54	SPEAKER AMPLIFIER, INDOOR WITH ENCLOSURE, CLASS I DIV 2, GAI-TRONICS	COMMUNICATION	7.00 EA	-	-	5,389	16	3,423	492	9,304
	41-17-00-55	SPEAKER AMPLIFIER, WEATHERPROOF WITH ALUMINUM ENCLOSURE, CLASS I DIV 2, GAI-TRONICS	COMMUNICATION	7.00 EA	-	-	8,191	20	4,279	615	13,085
		COMMUNICATION SYSTEM					**197,394**	**854**	**169,539**	**25,944**	**392,878**
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	PIGTAILS	1,135.39 LF	-	-	16,571	37	7,776	1,118	25,465
	41-31-00-08	#500 KCMIL CU BARE STRANDED GROUND WIRE	GROUND GRID	26,201.29 LF	-	-	537,845	1,416	301,211	43,321	882,378
	41-31-00-16	EXOTHERMIC WELD, FENCE GROUNDING CONNECTION	UNDERGROUND ELECTRICAL	208.00 EA	-	-	6,405	478	101,726	14,631	122,761
	41-31-00-16	EXOTHERMIC WELD, GATE GROUNDING CONNECTION	UNDERGROUND ELECTRICAL	110.00 EA	-	-	3,387	253	53,797	7,737	64,922
	41-31-00-18	COPPER CLAD GROUND ROD, 15' LONG, 3/4 " DIA.	UNDERGROUND ELECTRICAL	172.00 EA	-	-	52,961	395	84,119	12,098	149,179
	41-31-00-19	CADWELD		1,079.00 EA	-	-	44,299	620	131,926	18,974	195,198
	41-31-00-49	CONNECTION - EQUIPMENTCONNECTOR	UNDERGROUND ELECTRICAL	495.00 EA	-	-	35,564	398	84,731	12,186	132,481
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 35"4/0 GROUND TAIL	UNDERGROUND ELECTRICAL	492.00 EA	-	-	75,747	1,018	216,558	31,146	323,452
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 15' #4 GROUND TAIL	UNDERGROUND ELECTRICAL	71.00 EA	-	-	2,186	82	17,362	2,497	22,045
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 1-1/*2" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	612.00 EA	-	-	8,166	211	44,896	6,457	59,519
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 2" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	3,975.00 EA	-	-	89,757	1,371	291,606	41,940	423,303
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 3" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	917.00 EA	-	-	48,472	632	134,542	19,350	202,364
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 5" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	917.00 EA	-	-	99,296	843	179,389	25,801	304,486
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - ENCASEMENT FOR BELOW GRADE GRC	UNDERGROUND ELECTRICAL	9,669.00 EA	-	-	352,306	3,334	709,317	102,017	1,163,639
	41-31-00-99	TESTING	TEST & DOCUMENTATION	1.00 LT	-	-		25	5,341	768	6,109
		ELECTRICAL EQUIPMENT, GROUNDING					**1,372,963**	**11,113**	**2,364,295**	**340,043**	**4,077,301**
		HEAT TRACING									
	41-33-00-02	3/4 IN PIPE HEAT TRACING - ALLOWANCE	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	524.03 LF	-	-	19,814	470	99,976	14,379	134,170
	41-33-00-09	6 IN PIPE HEAT TRACING - ALLOWANCE	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	1,004.39 LF	-	-	71,997	1,305	277,605	39,926	389,528
		HEAT TRACING					**91,811**	**1,775**	**377,581**	**54,305**	**523,698**
		LIGHTNING PROTECTION									
	41-35-00-01	GROUND CONDUCTOR - #4/0 BARE CONDUCTOR	PERIMETER LIGHTNING GROUND	3,144.15 LF	-	-	45,889	101	19,235	3,061	68,186
	41-35-00-99	LIGHTNING PROTECTION		1.00 LS	-	-	111,364	60	12,817	1,843	126,025
		LIGHTNING PROTECTION					**157,253**	**161**	**32,053**	**4,904**	**194,210**
		LIGHTING ACCESSORY (FIXTURE)									
	41-37-00-19	FLOURESCENT - BLDG GENERAL LIGHTING, WIRE & CONDUITS FOR MAINT/ CONTROL RM	LIGHTING, ALLOWANCE	7,075.99 SF	-	-	83,521	813	154,575	24,598	262,695
	41-37-00-59	OUTDOOR INCL. POLE - POLE MOUNTED FIXTURES	LIGHTING	11.00 EA	-	-	103,870	506	96,115	15,295	215,281
		LIGHTING ACCESSORY (FIXTURE)					**187,392**	**1,319**	**250,690**	**39,894**	**477,976**
		MOTOR CONTROL CENTER (MCC), COMPLETE									
	41-45-00-99	MOTOR CONTROL CENTER (MCC), COMPLETE - BOP	ASSUMED: 800A, 480V, 5 VER. SEC. & ARC FLASH RESISTANT TYPE	3.00 EA	-	544,589		193	36,699	5,840	587,128
	41-45-00-99	MOTOR CONTROL CENTER (MCC), COMPLETE - OEM	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-		322	61,164	9,733	70,898
		MOTOR CONTROL CENTER (MCC), COMPLETE				**544,589**		**515**	**97,863**	**15,574**	**658,026**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	A.C. DISTRIBUTION - 240V, 100A 4X PANEL		4.00 EA	-	-	25,184	14	2,621	417	28,222

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	A.C. DISTRIBUTION - 480V PANEL BOARD		4.00 EA	-	-	51,557	14	2,621	417	54,596
	41-47-00-09	A.C. DISTRIBUTION - 150A 208/120V LIGHTING & RECEPTACLE	LIGHTING	4.00 EA	-	-	50,566	18	3,495	556	54,617
	41-47-00-09	2000A, 13.8KV, 3 PHASE	INSTALL NEW DISCONNECT SWITCH BY GSU TRANSFORMER IN NEMA 4X ENCLSURE INCLUDING SUPPORTING HDWR (ALLOWANCE)	2.00 LT	-	92,782		55	10,446	340	103,568
		PANEL: CONTROL, DISTRIBUTION, & RELAY				**92,782**	**127,307**	**101**	**19,183**	**1,731**	**241,003**
		POWER TRANSFORMER									
	41-51-00-99	40 KVA, 480V/277V POWER TRANSFORMER		1.00 EA	-	11,156		55	10,446	340	21,942
	41-51-00-99	70 KVA, 480V/277V POWER TRANSFORMER		1.00 EA	-	20,081		74	13,980	2,225	36,286
	41-51-00-99	TESTING AND DOCUMENTATION		1.00 LT	-			172	36,680	5,275	41,955
	41-51-00-99	69/15 KV, 60 MVA, GSU	INCLUDING ALLOWANCES FOR FREIGHT AND LOAD TAP CHANGER	2.00 EA		15,254,602		2,989	567,954	90,382	15,912,937
		POWER TRANSFORMER				**15,285,838**		**3,290**	**629,060**	**98,222**	**16,013,120**
		SWITCHGEAR, COMPLETE									
	41-55-00-99	TEST, BREAKER CURRENT ADJUSTMENT, CALIBRATION	TEST & DOCUMENTATIONS	1.00 LS	-			51	9,749	318	10,067
		SWITCHGEAR, COMPLETE						**51**	**9,749**	**318**	**10,067**
		WIRING DEVICE									
	41-57-00-09	RECEPTACLE - 120V RECEPTACLE & SWITCH	LIGHTING	114.00 EA	-	-	35,102	262	49,805	7,926	92,833
	41-57-00-29	WELDING RECEPTACLE - 60A, 480V		14.00 EA	-	-	20,117	32	6,116	973	27,207
	41-57-00-99	WIRING DEVICE - BLOCK HEATER OUTLETS	LIGHTING	9.00 EA	-	-	9,237	52	9,830	1,564	20,632
		WIRING DEVICE					**64,457**	**346**	**65,752**	**10,463**	**140,672**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	600 V ELECTRICAL EQUIPMENT UPGRADE FROM 480 V	ALLOWANCE	1.00 LS	-	171,579	85,843	268	51,011	8,118	316,551
		ELECTRICAL EQUIPMENT, MISCELLANEOUS				**171,579**	**85,843**	**268**	**51,011**	**8,118**	**316,551**
		ELECTRICAL EQUIPMENT				**16,094,788**	**2,548,818**	**19,949**	**4,099,642**	**604,243**	**23,347,491**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY, GALVANIZED STEEL									
	42-13-47-06	12 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		1,746.75 LF	-	-	116,427	2,229	473,041	5,811	595,278
	42-13-47-07	18 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		1,746.75 LF	-	-	135,862	2,591	549,750	6,753	692,364
	42-13-47-10	36 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		4,366.88 LF	-	-	522,792	10,543	2,237,351	27,483	2,787,626
		CABLE TRAY, GALVANIZED STEEL					**775,081**	**15,363**	**3,260,142**	**40,046**	**4,075,268**
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	2" DROP-OFF CONDUIT TO 13.8 KV SIDE OF 1500KVA XFMR	3.00 EA	-	-	501	6	1,207	15	1,724
	42-15-23-22	4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	BETWEEN GSU XFMR & 2000A DISCONNECT SW ENCLOSURE	3.00 EA	-	-	2,455	9	1,829	22	4,307
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**2,957**	**14**	**3,037**	**37**	**6,031**
		CONDUIT, PVC									
	42-15-33-19	4 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	(2) CONDUIT FROM PULL BOX TO DUCT BANK FOR GSU XFMR MAIN FEEDER & CONTROL CABLE (15FT x 2)	262.01 LF	-	-	4,975	30	6,456	79	11,511
		CONDUIT, PVC					**4,975**	**30**	**6,456**	**79**	**11,511**
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	LIGHTING	7,511.04 LF	-	-	84,185	1,675	355,503	4,367	444,055
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	COMMUNICATION	273.38 LF	-	-	3,064	61	12,939	159	16,162
	42-15-37-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	LIGHTING	873.38 LF	-	-	14,128	240	50,926	626	65,679
	42-15-37-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	2" DROP-OFF CONDUIT FROM CABLE TRAY TO 13.4KV SIDE OF 1500KVA XFMR	43.67 LF	-	-	1,485	18	3,750	46	5,281
	42-15-37-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	POWER & CONTROL - (2) CONDUIT FROM CABLE TRAY TO PULL BOXEX (25FT x 2)	174.68 LF	-	-	16,727	162	34,391	422	51,541
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	5" DROP-OFF CONDUIT FROM CABLE TRAY TO 480V SIDE OF 1500KVA XFMR (10FT x 3 CONDUIT)	87.34 LF	-	-	15,311	113	24,014	295	39,620
		CONDUIT, RGS					**134,899**	**2,269**	**481,524**	**5,915**	**622,339**
		CONDUIT BOX									
	42-17-00-39	PULL BOX	FOR GSU XFMR 15KV MAIN FEEDER CABLE RUN (32" W x 32" L x 20" D IN NEMA4X INCLUDING, (2) 4" HOLES, MYERS HUB, SUPPORT WALL MTG HDWR)	3.00 EA	-	-	6,774	41	8,781	108	15,663

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONDUIT BOX									
	42-17-00-39	PULL BOX	FOR GSU XFMR CONTROL/COMMUNICATION CABLE (24" W x 22" L x 12" D IN NEMA4X INCLUDING, (2) 4" HOLES, MYERS HUB, SUPPORT WALL MTG HDWR)	2.00 EA	-	-	2,669	18	3,903	48	6,619
	42-17-00-99	HOLES & VARIOUS CABLE GRIP CONNECTORS	INSTALL ON (2) 15KV & (24) 480V SWGR ENCLOSURE	24.00 EA	-	-	3,695	41	8,781	108	12,584
		CONDUIT BOX					**13,138**	**101**	**21,464**	**264**	**34,866**
		DUCT BANK									
	42-18-00-99	DUCT BANK - 3X3X3 HANDHOLE	UNDERGROUND ELECTRICAL	6.00 EA	-	-	59,120	103	21,952	270	81,341
	42-18-00-99	CONCRETE DUCT BANK	20" W x 12" H CONCRETE ENCASEMENT + (2) 4" PVC, EXCAVATION, BACKFILL & DISPOSAL	87.34 LF	-	-	9,561	150	31,749	390	41,700
	42-18-00-99	UNDERGOUND DEEP SCAN SURVEY	SERVICE BY SUBCONTRACTOR	218.34 LF	11,926	-					11,926
		DUCT BANK			**11,926**		**68,681**	**253**	**53,701**	**660**	**134,967**
		RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS									
	42-99-00-99	ADDITIONAL CONDUIT AND BOXES PER BOM		1.00 LS	-	-	8,208	71	15,093	185	23,486
		RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS					**8,208**	**71**	**15,093**	**185**	**23,486**
		RACEWAY, CABLE TRAY & CONDUIT			**11,926**		**1,007,938**	**18,103**	**3,841,417**	**47,186**	**4,908,467**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-04	300V #16 1 TW PR TYPE E SHIELDED THERMOCOUPLE XLPE CPE	COMMUNICATION	2,305.71 LF	-	-	17,560	34	7,331	1,054	25,946
	43-10-00-23	#24 4 TW PR CU CATEGORY 5e PLENUM RATED JACKET		12,576.62 LF	-	-	13,691	246	52,291	7,521	73,503
	43-10-00-23	#24 4 TW PR CU CATEGORY 5e PLENUM RATED JACKET - INSTALL ONLY		262.01 LF	-	-		5	1,089	157	1,246
	43-10-00-80	TERMINATION - FIBER OPTIC		367.00 EA	-	-	5,650	316	67,308	9,680	82,638
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		4,404.00 EA	-	-	10,848	253	53,846	7,744	72,439
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 4 PR SHIELDED		1,048.05 LF	-	-	2,618	18	3,845	553	7,016
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 12 PR SHIELDED 300V		1,991.30 LF	-	-	11,521	69	14,660	2,108	28,289
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 2 PR SPOS		16,978.44 LF	-	-	34,801	390	83,061	11,946	129,809
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 2 PR SPOS		14,672.72 LF	-	-	19,105	337	71,781	10,324	101,210
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 4PR SPOS		733.64 LF	-	-	3,336	17	3,589	516	7,441
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 8PR SPOS		1,886.49 LF	-	-	12,968	2,234	475,271	68,355	556,594
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 8 PR SPOS , MATERAL ONLY		3,668.18 LF	-	-	25,215	0	90	13	25,319
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 8 PR SPOS		1,467.27 LF	-	-	9,616	34	7,178	1,032	17,827
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 8PR SPOS, MATERIA ONLY		3,248.96 LF	-	-	21,294	0	80	12	21,385
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - 2 STRAND 50/125 FO		1,781.69 LF	-	-	4,374	61	13,074	1,880	19,329
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - 2 STRAND 50/125 FO INSTALL ONLY		5,449.87 LF	-	-		188	39,992	5,752	45,744
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 4 PR SHLD, MATERIAL ONLY		3,668.18 LF	-	-	9,163	0	90	13	9,267
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 12PR SHIELDED 300 V, MATERIA ONLY		2,724.93 LF	-	-	15,765	0	67	10	15,842
	43-10-00-99	CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - AND WIRE TAP		105.00 EA	-	-	2,155	60	12,838	1,846	16,840
	43-10-00-99	TEST AND DOCUMENTATION	.05 MH PER TERMINATION	4,877.00 EA	-	-		280	59,629	8,576	68,205
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**219,683**	**4,546**	**967,113**	**139,094**	**1,325,889**
		600V CABLE & TERMINATION									
	43-20-00-02	600V #12 2/C CU SHIELDED XLPE LSZH, MATERIAL RUN		2,724.93 LF	-	-	5,426				5,426
	43-20-00-02	600V #12 2/C CU SHIELDED XLPE LSZH		6,288.31 LF	-	-	12,521	116	24,608	3,539	40,668
	43-20-00-03	600V #12 3/C CU SHIELDED XLPE LSZH	LIGHTING	16,768.83 LF	-	-	42,340	366	77,935	11,209	131,484
	43-20-00-03	600V #12 3/C CU SHIELDED XLPE LSZH		5,240.26 LF	-	-	13,231	114	24,355	3,503	41,089
	43-20-00-05	600V #12 12/C CU SHIELDED XLPE LSZH		5,554.67 LF	-	-	50,969	294	62,498	8,989	122,456
	43-20-00-07	600V #10 2/C CU XLPE LSZH		1,048.05 LF	-	-	3,163	20	4,358	627	8,147
	43-20-00-07	600V #10 2/C CU XLPE LSZH		3,458.57 LF	-	-	10,436	68	14,380	2,068	26,885
	43-20-00-08	600V #10 3/C CU XLPE LSZH	LIGHTING	5,240.26 LF	-	-	20,116	121	25,636	3,687	49,439
	43-20-00-10	600V #10 4/C CU XLPE LSZH		15,720.77 LF	-	-	80,355	434	92,285	13,273	185,913
	43-20-00-10	600V #10 4/C CU XLPE LSZH		1,886.49 LF	-	-	9,643	52	11,074	1,593	22,310

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		600V CABLE & TERMINATION									
	43-20-00-10	600V #10 4/C CU XLPE LSZH		4,192.21 LF	-	-	21,428	116	24,609	3,539	49,577
	43-20-00-14	600V #8 3/C W/G CU EPR TS-CPE		7,250.77 LF	-	-	55,220	283	60,300	8,673	124,193
	43-20-00-18	600V #6 3/C W/G CU EPR TS-CPE		3,144.15 LF	-	-	41,565	170	36,145	5,199	82,909
	43-20-00-26	600V #2 3/C W/G CU EPR TS-CPE		5,240.26 LF	-	-	130,268	386	82,030	11,798	224,096
	43-20-00-28	600V #1/0 1/C CU XLPE LSZH		2,096.10 LF	-	-	13,339	63	13,330	1,917	28,586
	43-20-00-32	600V #2/0 1/C CU EPR TS-CPE		524.03 LF	-	-	4,152	17	3,717	535	8,404
	43-20-00-44	600V #350 KCMIL 3-1/C CU TRIPLEXED		2,620.13 LF	-	-	218,314	331	70,495	10,139	298,949
	43-20-00-45	600V #500 KCMIL 1/C CU		3,668.18 LF	-	-	100,223	253	53,833	7,742	161,799
	43-20-00-47	600V #750 KCMIL 1/C CU EPR TS-CPE	1/C#750 WIRE RUNS TROUGH CABLE TRAY FROM XFMR TO 480V SWGR (4 x 3= 12 x 50FT=600FT) x 2 LINEUPS	2,096.10 LF	-	-	319,828	181	38,452	5,530	363,811
	43-20-00-98	600V CABLE - #12 4/C		209.61 LF	-	-	752	6	1,282	184	2,218
	43-20-00-98	600V CABLE - #10 2/C W/GND		15,720.77 LF	-	-	54,708	2,169	461,427	66,364	582,500
	43-20-00-98	600V CABLE - #14 2/C		7,860.39 LF	-	-	14,265	181	38,454	5,531	58,250
	43-20-00-98	600V CABLE - #14 2/C SHLD		7,650.77 LF	-	-	10,778	176	37,429	5,383	53,590
	43-20-00-98	600V CABLE - #16 2/C		384.29 LF	-	-	747	9	1,880	270	2,897
	43-20-00-98	600V CABLE - #16 2/C SHLD		6,288.31 LF	-	-	9,665	145	30,763	4,425	44,853
	43-20-00-98	600V CABLE - #14 3/C		2,096.10 LF	-	-	5,236	48	10,254	1,475	16,966
	43-20-00-98	600V CABLE - #16 3/C		524.03 LF	-	-	1,141	12	2,564	369	4,073
	43-20-00-98	600V CABLE - #14 4/C		2,096.10 LF	-	-	6,220	72	15,382	2,212	23,814
	43-20-00-98	600V CABLE - #14 4/C, MATERIAL RUN		2,305.71 LF	-	-	6,842	0	57	8	6,906
	43-20-00-98	600V CABLE - #14 4/C SHLD		12,576.62 LF	-	-	21,482	434	92,290	13,274	127,046
	43-20-00-98	600V CABLE - #16 4/C		1,048.05 LF	-	-	2,976	36	7,691	1,106	11,773
	43-20-00-98	600V CABLE - #16 7/C		4,401.82 LF	-	-	18,137	152	32,301	4,646	55,084
	43-20-00-98	600V CABLE - #16 12/C		1,467.27 LF	-	-	14,566	67	14,355	2,065	30,986
	43-20-00-98	600V CABLE - #16 12/C MATERIA RUN		3,353.76 LF	-	-	23,198	0	83	12	23,293
	43-20-00-99	600V TERMINATION -		5,242.00 EA	-	-	8,070	1,506	320,460	46,090	374,621
	43-20-00-99	TEST AND DOCUMENTATION	.15 MH PER TERMINATION	5,242.00 EA	-	-		904	192,276	27,654	219,930
		600V CABLE & TERMINATION					**1,351,322**	**9,302**	**1,978,989**	**284,626**	**3,614,937**
		2000V VFD CABLE & TERMINATION									
	43-30-00-01	2000V #10 3/C W/3G CU SHIELDED, VFD CABLE		7,397.50 LF	-	-	61,432	374	79,615	11,451	152,497
	43-30-00-02	2000V #8 3/C W/3G CU SHIELDED, VFD CABLE		524.03 LF	-	-	5,359	30	6,409	922	12,689
	43-30-00-05	2000V #2 3/C W/3G CU SHIELDED, VFD CABLE		1,109.19 LF	-	-	22,141	105	22,247	3,200	47,587
	43-30-00-07	2000V #2/0 3/C W/3G CU SHIELDED, VFD CABLE		6,349.45 LF	-	-	205,769	847	180,155	25,911	411,834
	43-30-00-08	2000V #4/0 3/C W/3G CU SHIELDED, VFD CABLE		1,109.19 LF	-	-	49,159	191	40,696	5,853	95,708
	43-30-00-84	TERMINATION - 2000 V		218.00 EA	-	-	4,139	125	26,654	3,834	34,627
	43-30-00-99	TEST AND DOCUMENTATION	.3 MH PER TERMINATION	218.00 EA	-	-		75	15,992	2,300	18,293
		2000V VFD CABLE & TERMINATION					**347,999**	**1,747**	**371,767**	**53,469**	**773,235**
		15KV CABLE & TERMINATION									
	43-50-00-04	15KV #2/0 3-1/C CU TRIPLEXED	FOR MAIN FEEDER TO 1500KVA XFMR FROM 15KV SWGR, (50FT CABLE TRAY + 10FT TERM.) X 2	104.80 LF	-	-	1,936	11	2,256	324	4,516
	43-50-00-04	15KV #4/0 3-1/C CU TRIPLEXED	FOR (2) MAIN FEEDER TO GSU XFMR (55FT DUCT+ 40FT CABLE TRAY +10FT TERM.)	174.68 LF	-	-	3,227	24	5,170	744	9,140
	43-50-00-10	15KV #500 KCMIL 1/C CU		18,402.04 LF	-	-	628,956	2,560	544,626	78,330	1,251,912
	43-50-00-89	TERMINATION - COMPRESSION LUG, #2/0, 2 HOLE, COPPER	INCLUDING WIRE TAG AT EACH TEMINATION @ 1500KVA XFMR & 15KV SWGR	9.00 EA	-	-	333	13	2,751	396	3,479
	43-50-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER	INCLUDING WIRE TAG AT EACH TEMINATION @ SWGR, OUTDOOR DIS. SW, GSU XFMR	11.00 EA	-	-	406	21	4,438	638	5,483
	43-50-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		94.08 EA	-	-	7,339	357	75,919	10,919	94,176
	43-50-00-99	15KV TEST AND DOCUMENTATION	.5 MANHOUR PER TERMINATION	114.24 EA	-	-		66	13,968	2,009	15,977
		15KV CABLE & TERMINATION					**642,197**	**3,051**	**649,127**	**93,360**	**1,384,684**
		CABLE, MISCELLANEOUS									
	43-99-00-99	ADDITIONAL CABLE AND FITTING PER BOM		1.00 LS	-	-	16,086	279	59,387	8,541	84,015
		CABLE, MISCELLANEOUS					**16,086**	**279**	**59,387**	**8,541**	**84,015**
		CABLE					**2,577,286**	**18,926**	**4,026,383**	**579,091**	**7,182,760**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-99	PLANT CONTROL SYSTEM INCLUDING UPS	FURNISHED WITH OEM EQUIPMENT	1.00 LS	-	-		222	48,537	2,121	50,657
		CONTROL SYSTEM						**222**	**48,537**	**2,121**	**50,657**
		INSTRUMENT									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		INSTRUMENT									
	44-21-00-32	FLOW ELEMENT, 20WM-FE-0001	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	6,660	41	8,781	108	15,549
	44-21-00-37	FLOW TRANSMITTER, 20WM-FT-0001	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	28,544	62	13,576	593	42,712
	44-21-00-62	PRESSURE INDICATOR PI (20SAPI0015)	SERVICE AIR PIPING	5.00 EA	-	-	529	6	1,257	55	1,841
	44-21-00-62	PRESSURE INDICATOR, 22WC-PI-0002	COOLING WATER PIPING SYSTEM	1.00 EA	-	-	655	2	503	22	1,180
	44-21-00-62	PRESSURE INDICATOR, 22WC-PI-0005	COOLING WATER PIPING SYSTEM	2.00 EA	-	-	1,311	5	1,006	44	2,360
	44-21-00-62	PRESSURE INDICATOR, 23WC-PI-0002	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	5,899	21	4,525	198	10,622
	44-21-00-62	PRESSURE INDICATOR, 23WC-PI-0005	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	5,899	21	4,525	198	10,622
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-0001 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-0003 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-0006 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-004 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0001 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0003 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0004 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0006 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,330	21	4,402	633	8,365
		INSTRUMENT					**76,138**	**323**	**69,385**	**6,282**	**151,805**
		CONTROL & INSTRUMENTATION					**76,138**	**545**	**117,922**	**8,402**	**202,462**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	START-UP CRAFT SUPPORT	ELECTRICIANS	1.00 LS	-	-		803	170,899	-	170,899
	61-15-00-99	START-UP CRAFT SUPPORT	PIPE FITTERS	1.00 LS	-	-		803	163,278	-	163,278
	61-15-00-99	START-UP CRAFT SUPPORT	MILLWRIGHTS	1.00 LS	-	-		703	138,880	-	138,880
	61-15-00-99	START-UP CRAFT SUPPORT	BOILERMAKERS	1.00 LS	-	-		301	59,520	-	59,520
	61-15-00-99	START-UP CRAFT SUPPORT	I&C TECHNICIANS	1.00 LS	-	-		803	175,699	-	175,699
	61-15-00-99	START-UP CRAFT SUPPORT	HIGH VOLTAGE RELAY TECHICIANS	1.00 LS	-	-		602	114,500	-	114,500
		CRAFT PERSONNEL						**4,017**	**822,775**		**822,775**
		CONSTRUCTION INDIRECT						**4,017**	**822,775**		**822,775**
		PROJECT INDIRECT									
		PROJECT INDIRECT									
	71-99-00-99	SITE GEOTECHNICAL		1.00 LS	75,991	-				-	75,991
	71-99-00-99	SITE TOPOGRAPHIC SURVEY		1.00 LS	123,485	-				-	123,485
	71-99-00-99	INDEPENDANT CQA EARTHWORK TESTING CONTRACTOR		1.00 LS	68,392	-				-	68,392
		PROJECT INDIRECT			**267,867**						**267,867**
		PROJECT INDIRECT			**267,867**						**267,867**
		1 BASE			**16,897,641**	**132,897,816**	**14,318,367**	**171,483**	**31,755,664**	**4,506,017**	**200,375,506**
BIO		**BIODIESEL SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	322.76 CY	-	-		72	9,787	2,421	12,208
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	9.88 CY	-	-		3	346	85	431
		EXCAVATION						**75**	**10,133**	**2,506**	**12,638**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.75 CY	-	-		1	166	41	206
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-		0	55	14	68
		DISPOSAL						**2**	**221**	**54**	**275**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	24.21 CY	-	-	1,590	5	734	182	2,506
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	5.96 CY	-	-	391	1	181	44	616
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	280.80 CY	-	-	18,445	48	6,550	1,610	26,605
	21-20-00-12	SAND BEDDING	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	16.68 CY	-	-	582	3	438	108	1,128

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL					**21,009**	**58**	**7,903**	**1,944**	**30,855**
		POND									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	5,893	18	2,520	148	8,561
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	2,455	6			2,455
		POND					**8,349**	**24**	**2,520**	**148**	**11,016**
		CIVIL WORK					**29,357**	**159**	**20,776**	**4,651**	**54,785**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.21 CY	-	-	5,830	49	7,101	1,210	14,142
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-	1,329	11	1,618	276	3,223
		CONCRETE					**7,159**	**61**	**8,720**	**1,486**	**17,365**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	172.07 LB	-	-	1,060	10	1,699	35	2,794
		EMBEDMENT					**1,060**	**10**	**1,699**	**35**	**2,794**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	557.48 SF	-	-	2,117	128	21,328	1,986	25,431
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	212.35 SF	-	-	806	68	11,374	1,059	13,239
		FORMWORK					**2,924**	**197**	**32,702**	**3,045**	**38,670**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	3.69 TN	-	-	8,493	86	13,834	1,824	24,152
		REINFORCING					**8,493**	**86**	**13,834**	**1,824**	**24,152**
		CONCRETE					**19,635**	**353**	**56,955**	**6,390**	**82,980**
		MECHANICAL EQUIPMENT									
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, 304L STAINLESS STEEL, AWWA D100	22 FT DIA. X 18 FT TALL, 50,000 GAL - BIO-DIESEL DAY TANK	1.00 EA	1,364,099		-				1,364,099
		TANK			**1,364,099**						**1,364,099**
		MECHANICAL EQUIPMENT			**1,364,099**						**1,364,099**
		INSULATION									
		EQUIPMENT									
	36-15-00-99	INSULATION OF NEW 22 FT DIA. X 18 FT TALL, 50,000 GAL - BIO-DIESEL DAY TANK		1,625.36 SF	141,731	-					141,731
		EQUIPMENT			**141,731**						**141,731**
		INSULATION			**141,731**						**141,731**
		ELECTRICAL EQUIPMENT									
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	TANK IMMERSION HEATER	BIO-DIESEL DAY TANK	2.00 EA	-	-	34,487	46	8,738	1,391	44,615
	41-99-00-09	TANK RTD	BIO-DIESEL DAY TANK	2.00 EA	-	-	8,527	18	3,495	556	12,578
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**43,014**	**64**	**12,233**	**1,947**	**57,193**
		ELECTRICAL EQUIPMENT					**43,014**	**64**	**12,233**	**1,947**	**57,193**
		BIO BIODIESEL SYSTEM			**1,505,830**		**92,006**	**576**	**89,964**	**12,988**	**1,700,788**
CEMS		**CONTINUOUS EMISSIIONS MONITORING SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ADDITIONAL CT SKIDS/EQUIPMENT	33.74 CY	-	-		6	787	193	980
		EXCAVATION						**6**	**787**	**193**	**980**

Estimate No.: 36641C
Project No.: A14782.003
Estimate Date: 09/24/2024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ADDITIONAL CT SKIDS/EQUIPMENT	6.13 CY	-	-	402	1	143	35	580
		BACKFILL					**402**	**1**	**143**	**35**	**580**
		CIVIL WORK					**402**	**7**	**930**	**229**	**1,561**
		CONCRETE									
		CONCRETE									
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	18.12 CY	-	-	6,137	26	3,738	637	10,512
	22-13-00-20	MUD MAT, 1500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	3.06 CY	-	-	597	2	253	43	892
		CONCRETE					**6,734**	**28**	**3,990**	**680**	**11,404**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ADDITIONAL CT SKIDS/EQUIPMENT	121.53 LB	-	-	748	7	1,200	25	1,973
		EMBEDMENT					**748**	**7**	**1,200**	**25**	**1,973**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	ADDITIONAL CT SKIDS/EQUIPMENT	186.30 SF	-	-	708	43	7,127	664	8,498
		FORMWORK					**708**	**43**	**7,127**	**664**	**8,498**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	ADDITIONAL CT SKIDS/EQUIPMENT	1.26 TN	-	-	2,885	29	4,700	620	8,205
		REINFORCING					**2,885**	**29**	**4,700**	**620**	**8,205**
		CONCRETE					**11,075**	**107**	**17,018**	**1,988**	**30,081**
		RACEWAY, CABLE TRAY & CONDUIT									
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		600.00 LF	-	-	6,725	134	28,398	349	35,472
		CONDUIT, RGS					**6,725**	**134**	**28,398**	**349**	**35,472**
		RACEWAY, CABLE TRAY & CONDUIT					**6,725**	**134**	**28,398**	**349**	**35,472**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-18	600V #14 7/C CU XLPE LSZH		400.00 LF	-	-	1,642	12	2,544	366	4,552
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**1,642**	**12**	**2,544**	**366**	**4,552**
		600V CABLE & TERMINATION									
	43-20-00-14	600V #8 3/C W/G CU EPR TS-CPE		400.00 LF	-	-	3,046	16	3,327	478	6,851
		600V CABLE & TERMINATION					**3,046**	**16**	**3,327**	**478**	**6,851**
		CABLE					**4,689**	**28**	**5,870**	**844**	**11,403**
		CONTROL & INSTRUMENTATION									
		MONITORING EQUIPMENT									
	44-25-00-01	CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) - NOX MONITORING SYSTEM	FURNISHED WITH OEM EQUIPMENT	5.00 LS	-	3,178,042		402	87,990	3,844	3,269,876
		MONITORING EQUIPMENT				**3,178,042**		**402**	**87,990**	**3,844**	**3,269,876**
		CONTROL & INSTRUMENTATION				**3,178,042**		**402**	**87,990**	**3,844**	**3,269,876**
		CEMS CONTINUOUS EMISSIIONS MONITORING SYSTEM				**3,178,042**	**22,891**	**677**	**140,206**	**7,254**	**3,348,393**
FUEL OIL		**FUEL OIL SYSTEM**									
		CIVIL WORK									
		STRIP & STOCKPILE TOPSOIL									
	21-14-00-15	STRIP 6" DEEP, 300 FT HAUL	ACCESS ROAD, UNLOADING AREA AND TANK AREA	3.45 AC	-	-		63	9,513	11,624	21,137
		STRIP & STOCKPILE TOPSOIL						**63**	**9,513**	**11,624**	**21,137**

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MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	55 FT DIA TANK RING FOUNDATION	800.18 CY	-	-		179	24,264	6,001	30,265
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	107.07 CY	-	-		24	3,247	803	4,050
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	76.05 CY	-	-		17	2,306	570	2,876
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	TRUCK UNLOADING PAD 8" THICK	26.21 CY	-	-		7	917	225	1,142
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	24.70 CY	-	-		6	864	212	1,077
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE		750.47 CY	-	-		129	17,505	4,303	21,808
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	TRUCK UNLOADING PUMP SKID FOUNDATION	81.05 CY	-	-		14	1,891	465	2,355
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FIRE PROTECTION SKID FOUNDATION	48.03 CY	-	-		8	1,120	275	1,396
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	322.76 CY	-	-		72	9,787	2,421	12,208
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	9.88 CY	-	-		3	346	85	431
	21-17-00-06	MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	IMPORTED FILL MATERIAL FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	1,793.11 CY	-	-	80,936	134	20,075	24,530	125,541
	21-17-00-06	MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	IMPORTED FILL MATERIAL FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	1,793.11 CY	-	-	80,936	134	20,075	24,530	125,541
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FIRE WATER UNDERGROUND	3,151.68 CY	-	-		235	31,858	7,831	39,689
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	POTABLE WATER	324.36 CY	-	-		24	3,279	806	4,085
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL TRUCK UNLOADING	252.90 CY	-	-		19	2,556	628	3,185
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL PUMP DISCHARGE	687.55 CY	-	-		51	6,950	1,708	8,658
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL RETURN PIPING FROM TURBINES	880.07 CY	-	-		66	8,896	2,187	11,083
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	OILY WATER DRAINAGE	479.97 CY	-	-		36	4,852	1,193	6,044
	21-17-00-12	TRENCH EXCAVATION 6FT TO 10FT DEEP, DENSE HARD CLAY USING 0.75 CY EXCAVATOR	DUCT BANK	1,547.29 CY	-	-		133	18,046	4,436	22,482
	21-17-00-16	EXCAVATION 4 FT TO 10 FT DEEP	OILY-WATER AND SANITARY DRAINAGE STRUCTURE	171.11 CY	-	-		29	3,991	981	4,972
		EXCAVATION					**161,871**	**1,322**	**182,825**	**84,191**	**428,887**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	55 FT DIA TANK RING FOUNDATION	44.01 CY	-	-		3	411	101	512
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE WATER UNDERGROUND	772.44 CY	-	-		53	7,207	1,772	8,979
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	POTABLE WATER	47.33 CY	-	-		3	442	109	550
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL TRUCK UNLOADING	43.39 CY	-	-		3	405	100	504
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL PUMP DISCHARGE	135.25 CY	-	-		9	1,262	310	1,572
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL RETURN PIPING FROM TURBINES	173.13 CY	-	-		12	1,615	397	2,012
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	9.81 CY	-	-		1	137	34	171
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	OILY WATER DRAINAGE	69.68 CY	-	-		5	650	160	810
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	DUCT BANK	202.51 CY	-	-		14	1,889	464	2,354
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	TRUCK UNLOADING PAD 8" THICK	5.00 CY	-	-		1	93	23	116
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	89.06 CY	-	-		6	831	204	1,035
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	65.04 CY	-	-		4	607	149	756
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	TRUCK UNLOADING PUMP SKID FOUNDATION	8.01 CY	-	-		1	149	37	186
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE PROTECTION SKID FOUNDATION	4.00 CY	-	-		1	75	18	93
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	17.75 CY	-	-		1	166	41	206
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	3.92 CY	-	-		0	55	14	68
		DISPOSAL						**118**	**15,994**	**3,931**	**19,925**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	55 FT DIA TANK RING FOUNDATION	60.01 CY	-	-	3,942	13	1,820	450	6,212
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	18.01 CY	-	-	1,183	5	630	135	1,948
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	11.01 CY	-	-	723	3	385	83	1,191
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	TRUCK UNLOADING PAD 8" THICK	3.83 CY	-	-	252	1	179	44	474
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 50 FT DIA TANK BERM	14.89 CY	-	-	978	3	452	111	1,541
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	TRUCK UNLOADING PUMP SKID FOUNDATION	7.00 CY	-	-	460	2	327	80	867
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	FIRE PROTECTION SKID FOUNDATION	5.00 CY	-	-	329	2	233	57	619
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	24.21 CY	-	-	1,590	5	734	182	2,506
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 20 FT DIA L.S. DIESEL DAY TANK BERM	5.32 CY	-	-	349	1	161	40	550

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	OILY WATER SEPARATOR	20.11 CY	-	-	1,321	3	469	115	1,906
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	55 FT DIA TANK RING FOUNDATION	696.15 CY	-	-	45,729	120	16,239	3,991	65,959
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	TRUCK UNLOADING PUMP SKID FOUNDATION	66.04 CY	-	-	4,338	11	1,540	379	6,257
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	FIRE PROTECTION SKID FOUNDATION	39.02 CY	-	-	2,563	9	1,183	291	4,038
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	87.05 CY	-	-	5,718	15	2,031	499	8,248
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	62.04 CY	-	-	4,075	11	1,447	356	5,878
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	280.80 CY	-	-	18,445	48	6,550	1,610	26,605
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FIRE WATER UNDERGROUND	2,379.25 CY	-	-		273	36,999	9,094	46,093
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	POTABLE WATER	277.03 CY	-	-		32	4,308	1,059	5,367
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL TRUCK UNLOADING	209.52 CY	-	-		24	3,258	801	4,059
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL PUMP DISCHARGE	552.26 CY	-	-		63	8,588	2,111	10,699
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DEMIN WATER PUMP DISCHARGE	552.30 CY	-	-		63	8,589	2,111	10,700
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL RETURN PIPING FROM TURBINES	706.94 CY	-	-		81	10,993	2,702	13,696
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	OILY WATER DRAINAGE	410.29 CY	-	-		47	6,380	1,568	7,949
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DUCT BANK	1,344.78 CY	-	-		154	20,912	5,140	26,053
	21-20-00-12	SAND BEDDING	55 FT DIA TANK RING FOUNDATION	41.34 CY	-	-	1,443	8	1,087	267	2,796
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FIRE WATER UNDERGROUND	710.61 CY	-	-	24,798	106	14,365	3,531	42,694
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	POTABLE WATER	46.97 CY	-	-	1,639	9	1,235	303	3,177
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL TRUCK UNLOADING	42.38 CY	-	-	1,479	8	1,114	274	2,866
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL PUMP DISCHARGE	129.57 CY	-	-	4,522	19	2,619	644	7,785
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	DEMIN WATER PUMP DISCHARGE	129.57 CY	-	-	4,522	19	2,619	644	7,785
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL RETURN PIPING FROM TURBINES	165.85 CY	-	-	5,788	25	3,353	824	9,964
	21-20-00-12	SAND BEDDING	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	16.68 CY	-	-	582	3	438	108	1,128
	21-20-00-16	BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	OILY-WATER AND SANITARY DRAINAGE STRUCTURE	76.05 CY	-	-		13	1,774	436	2,210
		BACKFILL					**136,770**	**1,204**	**163,012**	**40,040**	**339,822**
		EQUIPMENT									
	21-37-00-99	UNDERGROUND OIL WATER SEPARATOR 500 GPM WITH 2x250 GPM INTEGRAL PUMPS	OILY WATER SYSTEM	1.00 LS	-	213,686		138	24,863	3,120	241,670
		EQUIPMENT				**213,686**		**138**	**24,863**	**3,120**	**241,670**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-60	SILT FENCE		1,999.49 LF	-	-	5,254	161	22,118	1,298	28,670
		EROSION AND SEDIMENTATION CONTROL					**5,254**	**161**	**22,118**	**1,298**	**28,670**
		POND									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	1,244.33 SY	-	-	36,782	114	15,727	923	53,432
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	199.36 SY	-	-	5,893	18	2,520	148	8,561
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	1,244.33 SY	-	-	15,326	36			15,326
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	199.36 SY	-	-	2,455	6			2,455
		POND					**60,456**	**174**	**18,246**	**1,071**	**79,774**
		SURVEY									
	21-67-00-29	SITE SURVEY		1.00 LS	94,988	-				-	94,988
		SURVEY			**94,988**						**94,988**
		CIVIL WORK, MISCELLANEOUS									
	21-99-00-99	STABILIZED CONSTRUCTION ENTRANCE/EXIT	STABILIZED CONSTRUCTION ENTRANCE	1.00 EA	-	-	3,079	23	3,112	765	6,956
		CIVIL WORK, MISCELLANEOUS					**3,079**	**23**	**3,112**	**765**	**6,956**
		CIVIL WORK			**94,988**	**213,686**	**367,430**	**3,204**	**439,683**	**146,041**	**1,261,829**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	55 FT DIA TANK RING FOUNDATION	42.68 CY	-	-	14,455	123	17,606	3,000	35,062
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	TRUCK UNLOADING PAD 8" THICK	92.06 CY	-	-	31,180	132	18,990	3,236	53,406

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 50 FT DIA TANK BERM	8.76 CY	-	-	2,966	25	3,612	616	7,194
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	17.21 CY	-	-	5,830	49	7,101	1,210	14,142
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	3.92 CY	-	-	1,329	11	1,618	276	3,223
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	OILY WATER SEPARATOR	25.02 CY	-	-	8,473	36	5,160	879	14,513
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	11.74 CY	-	-	3,976	34	4,843	825	9,645
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	12.47 CY	-	-	4,224	36	5,145	877	10,247
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	6.00 CY	-	-	2,034	17	2,477	422	4,933
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	3.00 CY	-	-	1,017	9	1,239	138	2,393
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	5.00 CY	-	-	1,695	14	2,064	230	3,989
	22-13-00-20	MUD MAT, 1500 PSI	OILY WATER SEPARATOR	10.11 CY	-	-	1,971	6	834	142	2,947
	22-13-00-20	FLOWABLE FILL, 1500 PSI	DUCT BANK	202.51 CY	-	-	39,492	116	16,709	2,848	59,049
	22-13-00-70	PIPE THRUST BLOCK, 4500 PSI	FIRE PROTECTION - VALVE SUPPORTS	6.60 EA	-	-	2,235	23	4,102	515	6,853
		CONCRETE					**120,877**	**631**	**91,503**	**15,215**	**227,594**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	OILY WATER SEPARATOR	200.04 LB	-	-	1,232	11	1,975	41	3,248
	22-15-00-10	EMBEDMENTS, CARBON STEEL	55 FT DIA TANK RING FOUNDATION	426.58 LB	-	-	2,627	25	4,212	86	6,926
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	117.36 LB	-	-	723	13	2,318	48	3,088
	22-15-00-10	EMBEDMENTS, CARBON STEEL	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	124.69 LB	-	-	768	14	2,463	51	3,281
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	60.01 LB	-	-	370	7	1,185	24	1,579
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	30.01 LB	-	-	185	3	593	13	791
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	50.01 LB	-	-	308	6	988	22	1,318
	22-15-00-10	EMBEDMENTS, CARBON STEEL	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	172.07 LB	-	-	1,060	10	1,699	35	2,794
		EMBEDMENT					**7,272**	**90**	**15,433**	**320**	**23,024**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	OILY WATER SEPARATOR	180.00 SF	-	-	684	41	6,886	641	8,211
	22-17-00-10	BUILT UP INSTALL & STRIP	55 FT DIA TANK RING FOUNDATION	1,382.08 SF	-	-	5,249	318	52,875	4,923	63,047
	22-17-00-10	BUILT UP INSTALL & STRIP	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	144.00 SF	-	-	547	66	11,018	1,026	12,591
	22-17-00-10	BUILT UP INSTALL & STRIP	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	104.00 SF	-	-	395	31	5,173	482	6,049
	22-17-00-10	BUILT UP INSTALL & STRIP	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	84.00 SF	-	-	319	25	4,178	389	4,886
	22-17-00-10	BUILT UP INSTALL & STRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	147.99 SF	-	-	562	44	7,361	5,674	13,597
	22-17-00-10	BUILT UP INSTALL & STRIP	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	128.00 SF	-	-	486	38	6,366	4,907	11,759
	22-17-00-10	BUILT UP INSTALL & STRIP	TRUCK UNLOADING PAD 8" THICK	166.75 SF	-	-	633	54	8,931	832	10,396
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	473.99 SF	-	-	1,800	153	25,388	2,364	29,551
	22-17-00-10	BUILT UP INSTALL & STRIP	DUCT BANK	3,821.35 SF	-	-	14,512	878	146,197	13,611	174,320
	22-17-00-10	BUILT UP INSTALL & STRIP	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	557.48 SF	-	-	2,117	128	21,328	1,986	25,431
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	212.35 SF	-	-	806	68	11,374	1,059	13,239
		FORMWORK					**28,110**	**1,845**	**307,074**	**37,893**	**373,077**
		PRECAST									
	22-23-00-39	PRECAST CONCRETE TRENCH	PRECAST CONCRETE TRENCH (POTABLE WATER) 2 FT X 2 FT INCLUDING GRATING COVER	49.99 LF	-	-	29,744	46	6,894	8,424	45,061
	22-23-00-41	ELECTRICAL PRECAST MANHOLE, 4 FT BY 4 FT BY 6 FT		4.00 EA	-	-	30,943	129	17,427	4,284	52,654
	22-23-00-50	MANHOLE - 3 FT ID BY 4 FT DEEP	OILY WATER SYSTEM	3.00 EA	-	-	8,397	55	7,469	1,836	17,702
	22-23-00-50	PRECAST CONCRETE OUTLET STRUCTURE	OUTLET STRUCTURE 8 FT DIA.	1.00 EA	-	-	2,125	17	2,334	574	5,033
		PRECAST					**71,209**	**247**	**34,124**	**15,117**	**120,450**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	OILY WATER SEPARATOR	1.70 TN	-	-	3,897	39	6,348	837	11,082
	22-25-00-10	UNCOATED A615 GR60	55 FT DIA TANK RING FOUNDATION	9.16 TN	-	-	21,057	212	34,301	4,523	59,882
	22-25-00-10	UNCOATED A615 GR60	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	0.79 TN	-	-	1,805	36	5,880	775	8,460
	22-25-00-10	UNCOATED A615 GR60	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	0.40 TN	-	-	922	19	3,004	396	4,322
	22-25-00-10	UNCOATED A615 GR60	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	0.84 TN	-	-	1,929	39	6,284	829	9,042
	22-25-00-10	UNCOATED A615 GR60	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	0.21 TN	-	-	474	10	1,543	100	2,117
	22-25-00-10	UNCOATED A615 GR60	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	0.34 TN	-	-	779	16	2,539	165	3,483
	22-25-00-10	UNCOATED A615 GR60	TRUCK UNLOADING PAD 8" THICK	6.11 TN	-	-	14,052	283	45,780	6,037	65,869
	22-25-00-10	UNCOATED A615 GR60	DUCT BANK	9.00 TN	-	-	20,685	209	33,695	4,443	58,823
	22-25-00-10	UNCOATED A615 GR60	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	3.69 TN	-	-	8,493	86	13,834	1,824	24,152
		REINFORCING					**74,093**	**948**	**153,208**	**19,930**	**247,231**
		CONCRETE					**301,560**	**3,761**	**601,341**	**88,475**	**991,376**

Estimate No.: 36641C
Project No.: A14782.003
Estimate Date: 09/24/2024
Prep/Rev/Appr: CK/JM/GA/BA

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Sargent & Lundy

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		STEEL									
		ROLLED SHAPE									
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	0.61 TN	-	-	5,570	17	3,425	924	9,920
	23-25-00-10	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, TWO COAT PAINTED	ALLOWANCE FOR MISC. COMPONENT SUPPORTS	8.00 TN	-	-	57,144	175	34,587	9,332	101,063
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	5.51 TN	-	-	41,718	121	23,813	6,425	71,956
	23-25-00-99	FABRICATED STEEL INTERNAL TANK IMMERSION HEATER SUPPORTS		11.00 EA	-	-	16,790	379	74,945	20,220	111,955
		ROLLED SHAPE					**121,223**	**692**	**136,771**	**36,901**	**294,894**
		STEEL					**121,223**	**692**	**136,771**	**36,901**	**294,894**
		PAINTING & COATING									
		COATING									
	27-13-00-99	COATING - MISC STEEL		1.00 LS	53,194	-					53,194
		COATING			**53,194**						**53,194**
		PAINTING									
	27-17-00-18	PIPE PAINTING, 4 IN DIA	FIRE WATER ABOVE GROUND	559.86 LF	-	-	3,701	86	15,344	3,338	22,383
	27-17-00-21	PIPE PAINTING, 10 IN DIA	FIRE WATER ABOVE GROUND	187.45 LF	-	-	2,955	75	13,471	2,944	19,370
		PAINTING					**6,656**	**161**	**28,816**	**6,281**	**41,753**
		PAINTING & COATING			**53,194**		**6,656**	**161**	**28,816**	**6,281**	**94,946**
		MECHANICAL EQUIPMENT									
		PUMP									
	31-75-00-99	PUMP AND FILTER - FUEL OIL KIDNEY FILTER SKID	200 GPM PUMP AND FILTRATION	2.00 EA	-	2,136,865	-	92	16,576	2,080	2,155,520
	31-75-00-99	PUMP - FUEL OIL TRUCK UNLOADING SKID (PUMPS, STRAINER, ETC.)	SKID:2 X100%, 100 GPM, 120 FT, 5 HP, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	764,226	-	55	9,945	1,248	775,419
	31-75-00-99	FUEL OIL FORWARDING PUMP SKID	SKID:2 X 100%, 100GPM, 150 FT, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	121,880	-	55	9,945	1,248	133,074
		PUMP				**3,022,971**		**202**	**36,466**	**4,576**	**3,064,013**
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	45 FT DIA. X 35 FT TALL, 412,500 GAL L.S. DIESEL STORAGE TANK	2.00 EA	2,793,777		-				2,793,777
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	22 FT DIA. X 18 FT TALL, 50,000 GAL - L.S. DIESEL DAY TANK	1.00 EA	845,429		-				845,429
	31-83-00-99	TANK COATING	55 FT DIA. X 48 FT TALL, 660,000 GAL L.S. DIESEL STORAGE TANK - INCLUDES ALLOWANCE FOR ADDITIONAL INTERNAL TANK BOTTOM COATING	9,503.54 SF	418,074		-				418,074
	31-83-00-99	TANK COATING	22 FT DIA. X 18 FT TALL, 40,000 GAL - L.S. DIESEL DAY TANK - INCLUDES ALLOWANCE FOR ADDITIONAL INTERNAL TANK BOTTOM COATING	1,445.61 SF	63,594		-				63,594
		TANK			**4,120,875**						**4,120,875**
		MECHANICAL EQUIPMENT			**4,120,875**	**3,022,971**		**202**	**36,466**	**4,576**	**7,184,888**
		PIPING									
		SS 316, ABOVE GROUND, PROCESS AREA									
	35-13-02-18	2 IN DIA, SCH 40S	FALSE START DRAIN	223.94 LF	-	-	42,109	363	73,789	42,880	158,777
	35-13-02-18	2 IN DIA, SCH 40S	MISC. VENTS AND DRAINS	223.94 LF	-	-	42,109	363	73,789	42,880	158,777
	35-13-02-26	4 IN DIA, SCH 40S	FUEL OIL TRUCK UNLOADING	187.45 LF	-	-	38,980	392	79,726	13,831	132,536
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP DISCHARGE	249.94 LF	-	-	83,116	580	117,982	20,467	221,566
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP SUCTION	149.96 LF	-	-	49,870	348	70,789	12,280	132,940
		SS 316, ABOVE GROUND, PROCESS AREA					**256,183**	**2,047**	**416,075**	**132,339**	**804,596**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-40	10 IN DIA, SCH 40	FIRE WATER ABOVE GROUND	83.98 LF	-	-	30,642	232	47,099	8,171	85,912
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**30,642**	**232**	**47,099**	**8,171**	**85,912**
		SS 316, BURIED									
	35-15-02-26	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL TRUCK UNLOADING	249.94 LF	-	-	40,942	423	85,975	14,915	141,832
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL PUMP DISCHARGE	1,119.71 LF	-	-	303,863	2,513	510,767	88,607	903,237
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL RETURN PIPING FROM TURBINES	1,343.66 LF	-	-	364,636	3,016	612,920	106,329	1,083,884
		SS 316, BURIED					**709,441**	**5,951**	**1,209,662**	**209,851**	**2,128,954**
		HDPE, BURIED									
	35-15-30-10	2 IN DIA, DR 11	POTABLE WATER	799.80 LF	-	-	5,582	414	84,106	14,591	104,279
	35-15-30-22	6 IN DIA, DR 11	OILY WATER DRAINAGE	895.77 LF	-	-	21,514	618	125,598	21,789	168,901

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		HDPE, BURIED									
	35-15-30-25	8 IN DIA, DR 9	FIRE WATER UNDERGROUND	167.96 LF	-	-	9,723	160	32,577	5,651	47,951
	35-15-30-29	10 IN DIA, DR 9	FIRE WATER UNDERGROUND	1,119.71 LF	-	-	93,320	1,262	256,430	44,485	394,234
		HDPE, BURIED					**130,138**	**2,454**	**498,711**	**86,516**	**715,365**
		CAST IRON, BURIED									
	35-15-37-99	4 IN DIA	OILY-WATER DRAINAGE	223.94 LF	-	-	19,578	72	14,564	2,527	36,669
	35-15-37-99	6 IN DIA	OILY-WATER DRAINAGE	279.93 LF	-	-	41,875	106	21,515	3,732	67,123
		CAST IRON, BURIED					**61,453**	**178**	**36,079**	**6,259**	**103,791**
		PIPE SUPPORTS, HANGERS									
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 2 IN DIA PIPE		61.00 EA	-	-	21,913	140	28,503	4,945	55,360
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE		57.00 EA	-	-	27,263	262	53,267	9,241	89,771
	35-35-00-06	SINGLE ROD SUPPORT W/O BEAM FOR 6 IN PIPE		9.00 EA	-	-	4,896	62	12,616	2,189	19,700
	35-35-00-08	SINGLE ROD SUPPORT W/O BEAM FOR 10 IN PIPE		1.00 EA	-	-	770	9	1,869	324	2,963
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 2 IN PIPE		61.00 EA	-	-	24,418	245	49,880	8,653	82,950
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE		57.00 EA	-	-	35,453	498	101,208	17,557	154,218
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE		10.00 EA	-	-	6,877	110	22,428	3,891	33,196
	35-35-00-32	SINGLE ROD SUPPORT W/ BEAM FOR 10 IN PIPE		3.00 EA	-	-	2,808	46	9,392	1,629	13,829
		PIPE SUPPORTS, HANGERS					**124,398**	**1,373**	**279,162**	**48,429**	**451,989**
		VALVES									
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	4.00 EA	-	-	6,343	38	7,663	1,329	15,335
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	4.00 EA	-	-	6,343	38	7,663	1,329	15,335
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	2.00 EA	-	-	3,172	16	3,271	567	7,010
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	4.00 EA	-	-	6,343	32	6,542	1,135	14,019
	35-45-00-05	6 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	7,400	42	8,457	1,467	17,325
	35-45-00-06	1 IN RELIEF VALVE		7.00 EA	-	-	5,476	21	4,252	738	10,466
	35-45-00-29	8 IN VALVE, CLASS 125 DI POST INDICATOR GATE VALVE	FIRE PROTECTION	10.00 EA	-	-	84,574	115	23,363	4,053	111,990
	35-45-00-29	8 IN BUTTERFLY VALVE, FUSIBLE LINK LUGGED ENDS		2.00 EA	-	-	40,934	24	4,906	851	46,691
		VALVES					**160,585**	**325**	**66,117**	**11,470**	**238,172**
		STAINLESS STEEL VALVES									
	35-46-00-10	2 IN BALL VALVE, CLASS 600, WELD END		22.00 EA	-	-	18,606	137	27,755	4,815	51,176
	35-46-00-10	2 IN CHECK VALVE, CLASS 600, WELD END		4.00 EA	-	-	4,440	25	5,046	875	10,362
	35-46-00-19	4 IN CHECK VALVE, CLASS 150, WELD END		2.00 EA	-	-	7,612	19	3,832	665	12,108
	35-46-00-20	4 IN GATE VALVE, CLASS 150, WELD END		11.00 EA	-	-	41,166	104	21,073	3,656	65,895
	35-46-00-24	6 IN CHECK VALVE, CLASS 900, WELD END		2.00 EA	-	-	40,849	51	10,428	1,809	53,086
	35-46-00-24	6 IN GATE VALVE, CLASS 150, WELD END		10.00 EA	-	-	67,025	131	26,634	4,620	98,279
	35-46-00-24	6 IN GATE VALVE, CLASS 900, WELD END		11.00 EA	-	-	221,182	282	57,351	9,949	288,483
	35-46-00-24	6 IN GATE VALVE, CLASS 150, MOTOR OPERATED, WELD END		5.00 EA	-	-	111,004	82	16,588	2,878	130,469
	35-46-00-28	8 IN CHECK VALVE, CLASS 150, WELD END		2.00 EA	-	-	23,469	37	7,429	1,289	32,188
	35-46-00-28	8 IN GATE VALVE, CLASS 150, WELD END		5.00 EA	-	-	53,705	91	18,573	3,222	75,500
	35-46-00-28	8 IN GATE VALVE, CLASS 150,WELD END, ELECTRIC MOTOR OPERATED		2.00 EA	-	-	38,904	45	9,065	1,573	49,541
		STAINLESS STEEL VALVES					**627,963**	**1,003**	**203,774**	**35,350**	**867,087**
		MISCELLANEOUS VALVES									
	35-49-00-99	6 IN DIA POST INDICATOR VALVE WITH 12 IN X 6 IN REDUCER	OILY WATER SYSTEM	4.00 EA	-	-	43,843	55	11,214	1,945	57,003
		MISCELLANEOUS VALVES					**43,843**	**55**	**11,214**	**1,945**	**57,003**
		MISCELLANEOUS									
	35-99-00-99	6 IN FIRE HYDRANT CAST IRON, CLASS 125	FUEL OIL TANK AREA	4.00 EA	-	-	39,750	28	5,607	973	46,330
	35-99-00-99	4 IN RUBBER FUEL OIL HOSE	FUEL OIL TANK AREA	29.52 LF	-	-	1,832	17	3,394	589	5,815
	35-99-00-99	PIPING, 10 IN HDPE PIPE TIE-IN TO EXISTING 10 IN HDPE	TIE-IN TO EXISTING PIPING, INCLUDING EXCAVATION AND BACKFILL	1.00 EA		-	887	57	11,681	2,026	14,595
		MISCELLANEOUS					**42,469**	**102**	**20,683**	**3,588**	**66,740**
		PIPING					**2,187,115**	**13,720**	**2,788,575**	**543,917**	**5,519,607**
		INSULATION									
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-20	1 IN THICK, 2 IN PIPE		447.88 LF	-	-	8,550	139	22,948	2,154	33,652
	36-17-03-35	1 IN THICK, 4 IN PIPE		993.75 LF	-	-	26,927	393	65,112	6,111	98,150
	36-17-03-41	1.5 IN THICK, 6 IN PIPE		251.94 LF	-	-	10,499	124	20,538	1,928	32,964
	36-17-03-51	1.5 IN THICK, 10 IN PIPE		83.98 LF	-	-	5,378	52	8,685	815	14,879

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**51,355**	**708**	**117,284**	**11,007**	**179,646**
		INSULATION					**51,355**	**708**	**117,284**	**11,007**	**179,646**
		ELECTRICAL EQUIPMENT									
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION		1.00 EA	106,387	-					106,387
		CATHODIC PROTECTION			**106,387**						**106,387**
		CONTROL & BACKUP POWER									
	41-21-00-99	125V DC, 200A BATTERY CHARGER	ELECTRICAL ROOM	2.00 EA	-	-	123,166	37	6,990	1,112	131,269
	41-21-00-99	UPS 40 KVA INVERTER	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	102,638	23	4,369	695	107,703
	41-21-00-99	125V DC BATTERIES, 400 AH WITH BATTERY RACK	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	205,277	41	7,864	1,251	214,392
	41-21-00-99	120VAC, 225A UPS PANEL, 42 CIRCUITS	ELECTRICAL ROOM - DISTRIBUTE UPS POWER	1.00 EA	-	-	5,132	18	3,495	556	9,183
	41-21-00-99	UPS BYPASS TRANSFORMER, 480-120VAC, 30 KVA	ELECTRICAL ROOM - ALTERNATE AC FEED FOR MAINTENANCE	2.00 EA	-	-	31,099	37	6,990	1,112	39,202
	41-21-00-99	125VDC, 200A DISTRIBUTION PANEL	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	75,439	18	3,495	556	79,491
	41-21-00-99	UPS REMOTE BYPASS SWITCH	ELECTRICAL ROOM - FOR UPS BYPASS TRANSFORMER	2.00 EA	-	-	20,528	18	3,495	556	24,579
		CONTROL & BACKUP POWER					**563,280**	**193**	**36,699**	**5,840**	**605,819**
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-30-00-16	#500 KCMIL CU BARE STRANDED GROUND WIRE	UNDERGROUND GRID INCLUDING TO BURIED GRID	1,679.57 LF	-	-	39,650	212	45,194	6,500	91,344
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	PIGTAILS FROM UG GRID TO BLDG STEEL AND EQUIPMENT (20 CABLES)	223.94 LF	-	-	3,268	26	5,624	809	9,702
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE		895.77 LF	-	-	13,074	29	6,135	882	20,091
	41-31-00-16	EXOTHERMIC WELD	#4/0 AWG WIRE, 20 CABLES, 2 WELDS PER CABLE	45.00 EA	-	-	1,386	103	22,008	3,165	26,559
	41-31-00-16	EXOTHERMIC WELD		9.00 EA	-	-	277	21	4,402	633	5,312
	41-31-00-18	COPPER CLAD GROUND ROD, 20' LONG, 3/4 " DIA.		17.00 EA	-	-	5,235	39	8,314	1,196	14,744
	41-31-00-18	COPPER CLAD GROUND ROD, 15' LONG, 3/4 " DIA.		4.00 EA	-	-	1,232	9	1,956	281	3,469
	41-31-00-69	STRAP, LUG		9.00 EA	-	-	333	11	2,421	348	3,102
	41-31-00-99	TEST AND DOCUMENTATION		54.00 EA	-	-		9	1,981	0	1,981
		ELECTRICAL EQUIPMENT, GROUNDING					**64,454**	**461**	**98,035**	**13,815**	**176,304**
		HEAT TRACING									
	41-33-00-05	2 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	447.88 LF	-	-	19,813	458	97,500	14,023	131,336
	41-33-00-08	4 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	993.75 LF	-	-	51,223	1,120	238,204	34,260	323,686
	41-33-00-09	6 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	251.94 LF	-	-	18,060	327	69,634	10,015	97,708
	41-33-00-10	8 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	251.94 LF	-	-	21,085	368	78,261	11,256	110,602
	41-33-00-11	10 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	74.98 LF	-	-	7,288	122	26,043	3,746	37,076
	41-33-00-30	HEAT TRACING PANEL		5.00 EA	-	-	53,885	138	26,213	4,171	84,270
	41-33-00-99	HEAT TRACE ENGINEERING		1.00 LS	37,995	-					37,995
		HEAT TRACING			**37,995**		**171,354**	**2,533**	**535,855**	**77,470**	**822,674**
		LIGHTNING PROTECTION									
	41-35-00-99	LIGHTNING PROTECTION		1.00 LS	138,303	-					138,303
		LIGHTNING PROTECTION			**138,303**						**138,303**
		EXTERIOR LIGHTING									
	41-38-00-99	LIGHTING - FIXTURES, ACCESSORY	OUTDOOR BUILDING AND AREA LIGHTING	1.00 LS	118,736	-					118,736
		EXTERIOR LIGHTING			**118,736**						**118,736**
		MOTOR CONTROL CENTER (MCC), COMPLETE									
	41-45-00-09	480V, 1500A MOTOR CONTROL CENTER, 7 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER TO BOP LOADS	2.00 EA	-	248,494		207	43,904	539	292,938
		MOTOR CONTROL CENTER (MCC), COMPLETE				**248,494**		**207**	**43,904**	**539**	**292,938**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	OUTDOOR-RATED NEMA 4 480VAC PANEL, 3-PH, 60HZ 800A COPPER BUS, FULLY RATED, 800A MAIN BRKR, W/ 2 - 350A FEEDER BRKR AND 2 - 50A FEEDER BRKRS		1.00 EA	-	-	53,907	32	6,116	973	60,997
	41-47-00-39	TANK HEATER CONTACTOR		2.00 EA	-	-	94,653	34	6,553	1,043	102,249
		PANEL: CONTROL, DISTRIBUTION, & RELAY					**148,560**	**67**	**12,670**	**2,016**	**163,246**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		POWER TRANSFORMER									
	41-51-00-09	30KVA HEAT TRACE TRANSFORMER OUTDOOR RATED NEMA 3R W/ WEATHER SHIELD, 480-120/208VAC, 3-PHASE, 60HZ, COPPER WINDINGS, 150°C RISE WITH 220°C INSULATION		5.00 EA	-	-	176,230	115	21,844	3,476	201,551
	41-51-00-19	25KVA, 3-PHASE, 480-120/240V DRY TYPE TRANSFORMER	ELECTRICAL ROOM - BUILDING POWER AND LIGHTING	2.00 EA	-		24,880	74	13,927	454	39,261
	41-51-00-99	1200/1650 KVA DRY TYPE TRANSFORMER, 4160/480V, PAD MOUNTED		2.00 EA	-	371,346		437	83,009	13,210	467,565
		POWER TRANSFORMER				**371,346**	**201,110**	**625**	**118,780**	**17,140**	**708,376**
		SWITCHGEAR, COMPLETE									
	41-55-00-99	480V, 3200A SWITCHGEAR 4 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO LV MOTOR AND MCC's	1.00 EA	-	677,711		463	88,077	14,016	779,804
	41-55-00-99	4160V, 2000A SWITCHGEAR 5 VERTICAL SECTIONS MAIN-TIE-MAIN	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO MV MOTOR LOADS AND TRANSFORMERS	1.00 EA	-	762,425		489	92,970	14,795	870,190
		SWITCHGEAR, COMPLETE				**1,440,136**		**953**	**181,046**	**28,811**	**1,649,993**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	IN-LINE DIESEL HEATER	L.S. DIESEL STORAGE TANK	2.00 EA	-	-	328,626	92	17,476	2,781	348,882
	41-99-00-09	DIESEL RTD	L.S. DIESEL STORAGE TANK	2.00 EA	-	-	8,527	18	3,495	556	12,579
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**337,153**	**110**	**20,971**	**3,337**	**361,461**
		ELECTRICAL EQUIPMENT			**401,421**	**2,059,977**	**1,485,910**	**5,149**	**1,047,959**	**148,969**	**5,144,235**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY, ALUMINUM									
	42-13-37-01	12 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		356.91 LF	-	-	19,042	453	96,220	1,182	116,444
	42-13-37-03	24 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		237.94 LF	-	-	16,577	478	101,531	1,247	119,355
	42-13-37-05	36 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		832.79 LF	-	-	68,962	2,014	427,284	5,249	501,494
		CABLE TRAY, ALUMINUM					**104,581**	**2,945**	**625,034**	**7,678**	**737,293**
		CONDUIT, ALUMINUM									
	42-15-13-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,379.39 LF	-	-	29,257	588	124,810	1,533	155,600
	42-15-13-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		3,569.09 LF	-	-	106,234	1,301	276,033	3,391	385,659
	42-15-13-08	3 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		3,569.09 LF	-	-	193,054	2,384	505,915	6,214	705,183
	42-15-13-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,189.70 LF	-	-	101,350	993	210,725	2,588	314,664
	42-15-13-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,189.70 LF	-	-	159,352	1,381	293,158	3,601	456,110
		CONDUIT, ALUMINUM					**589,247**	**6,648**	**1,410,641**	**17,328**	**2,017,215**
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-14	1 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		71.00 EA	-	-	4,069	82	17,318	213	21,600
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		47.00 EA	-	-	7,854	89	18,915	232	27,002
	42-15-23-20	3 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		24.00 EA	-	-	13,324	55	11,708	144	25,175
	42-15-23-22	4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		12.00 EA	-	-	9,821	34	7,317	90	17,228
	42-15-23-23	5 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		12.00 EA	-	-	27,701	38	8,049	99	35,849
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**62,769**	**298**	**63,307**	**778**	**126,854**
		CONDUIT, PVC									
	42-15-33-15	3 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	1,343.66 LF	-	-	19,694	125	26,553	326	46,573
	42-15-33-21	5 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	2,687.31 LF	-	-	71,438	433	91,789	1,127	164,355
		CONDUIT, PVC					**91,131**	**558**	**118,343**	**1,454**	**210,928**
		CONDUIT, RGS									
	42-15-37-05	1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,343.66 LF	-	-	34,478	439	93,100	1,144	128,721
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		559.86 LF	-	-	98,147	725	153,938	1,891	253,975
		CONDUIT, RGS					**132,624**	**1,164**	**247,038**	**3,035**	**382,697**
		DUCT BANK									
	42-18-00-01	SPACERS	DUCT BANK	766.00 EA	-	-	4,780	106	22,420	275	27,476

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		DUCT BANK					**4,780**	**106**	**22,420**	**275**	**27,476**
		RACEWAY, CABLE TRAY & CONDUIT					**985,133**	**11,719**	**2,486,783**	**30,546**	**3,502,463**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-10	600V #16 2 TW PR CU SHIELDED XLPE LSZH		2,379.39 LF	-	-	11,136	63	13,386	1,925	26,447
	43-10-00-11	600V #16 4 TW PR CU SHIELDED XLPE LSZH		3,569.09 LF	-	-	20,954	119	25,315	3,641	49,910
	43-10-00-11	600V #16 8 TW PR CU SHIELDED XLPE LSZH		2,379.39 LF	-	-	22,859	137	29,099	4,185	56,143
	43-10-00-15	600V #14 2/C CU XLPE LSZH		2,379.39 LF	-	-	2,931	52	11,058	1,590	15,580
	43-10-00-17	600V #14 5/C CU XLPE LSZH		3,569.09 LF	-	-	11,503	94	20,079	2,888	34,469
	43-10-00-18	600V #14 7/C CU XLPE LSZH		271.83 LF	-	-	1,116	8	1,729	249	3,093
	43-10-00-18	600V #14 7/C CU XLPE LSZH		223.94 LF	-	-	919	7	1,424	205	2,548
	43-10-00-20	600V #14 12/C CU XLPE LSZH		2,379.39 LF	-	-	13,969	96	20,370	2,930	37,269
	43-10-00-21	600V #14 19/C CU XLPE LSZH		2,379.39 LF	-	-	26,913	142	30,263	4,353	61,528
	43-10-00-22	ETHERNET CAT 6A CABLE 300V		951.76 LF	-	-	3,170	142	30,263	4,353	37,786
	43-10-00-27	2 FIBER PATCH CORDS		5.00 EA	-	-	2,775	6	1,223	176	4,174
	43-10-00-27	24 FIBERSINGLE MODE OPTICAL FIBER PATCH PANEL		57.00 EA	-	-	2,825	7	1,394	200	4,419
	43-10-00-29	24 FIBER SINGLE MODE OPTICAL FIBER ARMORED RISER RATED		1,665.57 LF	-	-	12,339	258	54,784	7,879	75,003
	43-10-00-80	TERMINATION - FIBER OPTIC		344.00 EA	-	-	5,296	237	50,472	7,259	63,027
	43-10-00-83	TERMINATION - ETHERNET		10.00 EA	-	-	41	4	856	123	1,020
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		1,114.00 EA	-	-	2,744	64	13,620	1,959	18,324
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		1,808.00 EA	-	-	6,309	208	44,212	6,359	56,880
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		32.00 EA	-	-	112	4	782	113	1,007
	43-10-00-99	TEST AND DOCUMENTATION		3,302.00 EA	-	-		190	40,372	5,807	46,179
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**147,910**	**1,836**	**390,701**	**56,192**	**594,804**
		600V CABLE & TERMINATION									
	43-20-00-08	600V #10 3/C CU XLPE LSZH		4,758.78 LF	-	-	18,267	153	32,590	4,687	55,545
	43-20-00-21	600V #4 3/C CU EPR TS-CPE		2,379.39 LF	-	-	38,391	148	31,428	4,520	74,339
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		223.94 LF	-	-	4,087	19	3,999	575	8,660
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		671.83 LF	-	-	12,260	56	11,996	1,725	25,981
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		11.20 LF	-	-	314	2	383	55	753
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		11.20 LF	-	-	314	2	383	55	753
	43-20-00-38	600V #4/0 3/C CU		1,189.70 LF	-	-	68,796	133	28,226	4,060	101,082
	43-20-00-45	600V #500 KCMIL 1/C CU		671.83 LF	-	-	18,356	49	10,352	1,489	30,197
	43-20-00-45	600V #500 KCMIL 1/C CU		335.92 LF	-	-	9,178	24	5,176	744	15,099
	43-20-00-46	600V #500 KCMIL 3-1/C CU TRIPLEXED EPR TS-CPE		2,379.39 LF	-	-	268,199	309	65,764	9,458	343,421
	43-20-00-47	600V #750 KCMIL 1/C CU		8,061.94 LF	-	-	1,230,109	769	163,669	23,540	1,417,317
	43-20-00-81	TERMINATION - COMPRESSION LUG, #10, 1 HOLE, COPPER		144.00 EA	-	-	650	41	8,803	1,266	10,720
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		72.00 EA	-	-	1,367	41	8,803	1,266	11,436
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		18.00 EA	-	-	342	10	2,201	317	2,859
	43-20-00-85	TERMINATION - COMPRESSION LUG, #2, 2 HOLE, COPPER		22.00 EA	-	-	497	15	3,228	464	4,189
	43-20-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		30.00 EA	-	-	1,109	38	8,070	1,161	10,339
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		72.00 EA	-	-	5,616	182	38,734	5,571	49,921
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		28.00 EA	-	-	2,184	71	15,063	2,166	19,414
	43-20-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		20.00 EA	-	-	2,545	70	14,819	2,131	19,495
	43-20-00-99	TEST AND DOCUMENTATION		388.00 EA	-	-		67	14,232	2,047	16,279
		600V CABLE & TERMINATION					**1,682,583**	**2,199**	**467,919**	**67,298**	**2,217,800**
		5/8KV CABLE & TERMINATION									
	43-40-00-11	5/8KV #500 KCMIL 3-1/C CU TRIPLEXED		761.41 LF	-	-	90,138	135	28,680	4,125	122,943
	43-40-00-12	5/8KV #750 KCMIL 1/C CU		15,989.51 LF	-	-	662,692	1,783	379,362	54,561	1,096,615
	43-40-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		22.00 EA	-	-	1,716	83	17,753	2,553	22,023
	43-40-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		46.00 EA	-	-	5,855	240	51,124	7,353	64,332
	43-40-00-99	TEST AND DOCUMENTATION		68.00 EA	-	-		39	8,314	1,196	9,510
		5/8KV CABLE & TERMINATION					**760,400**	**2,281**	**485,234**	**69,788**	**1,315,422**
		CABLE					**2,590,893**	**6,317**	**1,343,855**	**193,279**	**4,128,026**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH CONTROLLERS	ELECTRICAL ROOM - DSC MAIN CONTROLLER	1.00 EA		74,197		28	6,034	264	80,494

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH I/O CARDS	ELECTRICAL ROOM - DSC I/O MODULES, ASSUME 250 I/O POINTS PER CABINET,PROGRAMMING INCLUDED WITHIN MANHOURS	2.00 EA		989,289		552	120,672	5,272	1,115,233
	44-13-00-09	INTERMEDIATE TERMINATION CABINET	ELECTRICAL ROOM - MARSHALLING CABINETS TO WIRE DSC MODULES AND FIELD CABLES	4.00 EA		148,393		74	15,610	192	164,195
		CONTROL SYSTEM				**1,211,879**		**653**	**142,316**	**5,728**	**1,359,923**
		FLOW DEVICES									
	44-21-20-27	FLOW METER, DIFFERENTIAL PRESSURE ORIFICE FLOW TYPE, WITH 3 VALVE MANIFOLD, DIRECT MOUNT		2.00 EA	-	-	22,158	27	5,883	257	28,298
		FLOW DEVICES					**22,158**	**27**	**5,883**	**257**	**28,298**
		LEVEL DEVICES									
	44-21-30-06	LEVEL TRANSMITTER, GUIDED WAVE RADAR LIQUID LEVEL TYPE, FLANGE MOUNT		2.00 EA	-	-	19,367	46	10,056	439	29,863
	44-21-30-13	LEVEL GUAGE		2.00 EA	-	-	3,383	34	7,542	330	11,254
		LEVEL DEVICES					**22,750**	**80**	**17,598**	**769**	**41,117**
		PRESSURE DEVICES									
	44-21-40-10	PRESSURE TRANSMITTER, GAUGE TYPE, WITH 2 VALVE MANIFOLD		8.00 EA	-	-	73,664	101	22,123	967	96,754
		PRESSURE DEVICES					**73,664**	**101**	**22,123**	**967**	**96,754**
		CONTROL & INSTRUMENTATION				**1,211,879**	**118,573**	**861**	**187,920**	**7,720**	**1,526,092**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	CRAFT STARTUP SUPPORT		1.00 EA	-	-		2,299	414,388	0	414,388
		CRAFT PERSONNEL						**2,299**	**414,388**	**0**	**414,388**
		CONSTRUCTION INDIRECT						**2,299**	**414,388**	**0**	**414,388**
		FUEL OIL FUEL OIL SYSTEM			**4,670,478**	**6,508,513**	**8,215,847**	**48,793**	**9,629,840**	**1,217,712**	**30,242,390**
SCR		**SCR SYSTEM**									
		CONCRETE									
		CONCRETE									
	22-13-00-02	CONCRETE FOUNDATION FOR SCR	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	227.02 CY	-	-	149,123	1,565	224,779	38,306	412,208
		CONCRETE					**149,123**	**1,565**	**224,779**	**38,306**	**412,208**
		CONCRETE					**149,123**	**1,565**	**224,779**	**38,306**	**412,208**
		MECHANICAL EQUIPMENT									
		ENGINE									
	31-31-00-99	ENGINE/GENERATOR SETS (13.8 KV, 60 HZ) W/ SPRING MOUNTED BASE FRAMES	SCR AT 7% OF ENGINE COST - INSTALLATION COVERED IN NOX CONTROL EQUIPMENT BELOW	5.00 EA	-	8,092,962	-				8,092,962
		ENGINE				**8,092,962**					**8,092,962**
		NOX CONTROL EQUIPMENT									
	31-53-00-99	SCR / CO MODULES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	1,029	185,438	23,270	208,709
	31-53-00-99	INSULATION & JACKETING	EQUIPMENT SUPPLIED BY OEM	6,104.86 SF	-	-	-	2,526	455,371	57,144	512,514
		NOX CONTROL EQUIPMENT						**3,555**	**640,809**	**80,414**	**721,223**
		UREA SYSTEM									
	31-63-00-99	UREA STORAGE TANK	EQUIPMENT SUPPLIED BY OEM	1.00 LS	-	-	-	95	17,172	2,155	19,327
	31-63-00-99	UREA FORWARDING SKID	EQUIPMENT SUPPLIED BY OEM	1.00 LS	-	-	-	70	12,531	1,573	14,104
	31-63-00-99	UREA DOSING SKID	EQUIPMENT SUPPLIED BY OEM	2.00 LS	-	-	-	191	34,344	4,310	38,654
		UREA SYSTEM						**355**	**64,048**	**8,037**	**72,085**
		MECHANICAL EQUIPMENT				**8,092,962**		**3,910**	**704,857**	**88,451**	**8,886,269**
		PIPING									
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-18	2 IN DIA, SCH 80	UREA PIPING SYSTEM	83.84 LF	-	-	4,062	121	24,687	4,283	33,032

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**4,062**	**121**	**24,687**	**4,283**	**33,032**
		VALVES									
	35-45-00-10	SMALL BORE - 2" GLOBE (2OUR-V001)	UREA PIPING SYSTEM	4.00 EA	-	-	9,337	7	1,402	243	10,982
	35-45-00-10	SMALL BORE - 3/4" GLOBE (2OUR-V005)	UREA PIPING SYSTEM	2.00 EA	-	-	1,337	3	701	122	2,160
	35-45-00-10	SMALL BORE - 3/8" GLOBE (22UR-V006)	UREA PIPING SYSTEM	2.00 EA	-	-	2,232	3	701	122	3,055
		VALVES					**12,906**	**14**	**2,804**	**486**	**16,196**
		MISCELLANEOUS									
	35-99-00-99	PIPING, MISCELLANEOUS - 2" TRUCK UNLOADING CONNECTOR	UREA PIPING SYSTEM	1.00 EA	-	-	1,020	3	701	122	1,842
		MISCELLANEOUS					**1,020**	**3**	**701**	**122**	**1,842**
		PIPING					**17,988**	**139**	**28,192**	**4,891**	**51,070**
		SCR SCR SYSTEM				**8,092,962**	**167,111**	**5,614**	**957,827**	**131,648**	**9,349,548**

EXHIBIT I. 5 X 18 MW WÄRTSILÄ ENGINES – UNALLOCATED ESTIMATE

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Estimator	CK/JM
Labor rate table	24CNPEI
Project No.	A14782.003
Estimate Date	09/24/2024
Reviewed By	GA
Approved By	BA
Estimate No.	36641C
Factor table	_4 Productivity 1.15

Area	Group	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		BASE							
	21.00.00	CIVIL WORK	2,010,726	100,521	390,572	4,174	197,531	185,416	2,884,766
	22.00.00	CONCRETE			2,358,066	40,232	1,928,219	649,138	4,935,424
	23.00.00	STEEL			307,798	1,532	103,798	37,176	448,771
	24.00.00	ARCHITECTURAL	6,143,218	3,477,197		2,784	158,336	47,689	9,826,440
	27.00.00	PAINTING & COATING			56,481	3,422	204,276	32,407	293,164
	31.00.00	MECHANICAL EQUIPMENT	3,194,310	76,364,274	74,878	14,537	872,820	217,865	80,724,147
	34.00.00	HVAC	415,415	2,752,577		6,835	436,915	65,028	3,669,935
	35.00.00	PIPING			1,823,328	29,211	1,977,602	855,497	4,656,427
	36.00.00	INSULATION	132,660		360,711	7,216	398,180	74,331	965,882
	41.00.00	ELECTRICAL EQUIPMENT		11,394,838	1,688,642	19,949	1,365,496	400,329	14,849,305
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT	8,537		667,779	18,103	1,279,488	31,262	1,987,066
	43.00.00	CABLE			1,707,502	18,926	1,341,095	383,665	3,432,263
	44.00.00	CONTROL & INSTRUMENTATION			50,443	545	39,277	5,567	95,287
	61.00.00	CONSTRUCTION INDIRECT				4,017	274,047		274,047
	71.00.00	PROJECT INDIRECT	191,760						191,760
		1 BASE	12,096,627	94,089,407	9,486,200	171,483	10,577,080	2,985,370	129,234,683
BIO		BIODIESEL SYSTEM							
	21.00.00	CIVIL WORK			19,450	159	6,920	3,082	29,451
	22.00.00	CONCRETE			13,009	353	18,970	4,233	36,212
	31.00.00	MECHANICAL EQUIPMENT	976,527						976,527
	36.00.00	INSULATION	101,462						101,462
	41.00.00	ELECTRICAL EQUIPMENT			28,497	64	4,074	1,290	33,862
		BIO BIODIESEL SYSTEM	1,077,989		60,956	576	29,965	8,605	1,177,514
CEMS		CONTINUOUS EMISSIIONS MONITORING SYSTEM							
	21.00.00	CIVIL WORK			267	7	310	151	728
	22.00.00	CONCRETE			7,338	107	5,668	1,317	14,323
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			4,455	134	9,459	231	14,145
	43.00.00	CABLE			3,106	28	1,955	559	5,621
	44.00.00	CONTROL & INSTRUMENTATION		2,250,000		402	29,307	2,547	2,281,854
		CEMS CONTINUOUS EMISSIIONS MONITORING SYSTEM		2,250,000	15,166	677	46,699	4,806	2,316,671
FUEL OIL		FUEL OIL SYSTEM							
	21.00.00	CIVIL WORK	68,000	151,286	243,430	3,204	146,448	96,756	705,921
	22.00.00	CONCRETE			199,790	3,761	200,293	58,617	458,699
	23.00.00	STEEL			80,312	692	45,555	24,448	150,315
	27.00.00	PAINTING & COATING	38,080		4,410	161	9,598	4,161	56,249
	31.00.00	MECHANICAL EQUIPMENT	2,950,038	2,140,212		202	12,146	3,032	5,105,428
	35.00.00	PIPING			1,449,007	13,720	928,810	360,361	2,738,178
	36.00.00	INSULATION			34,023	708	39,065	7,292	80,381
	41.00.00	ELECTRICAL EQUIPMENT	287,368	1,458,429	984,444	5,149	349,051	98,696	3,177,988
	42.00.00	RACEWAY, CABLE TRAY & CONDUIT			652,670	11,719	828,290	20,238	1,501,198
	43.00.00	CABLE			1,716,518	6,317	447,607	128,053	2,292,177
	44.00.00	CONTROL & INSTRUMENTATION		857,990	78,557	861	62,592	5,115	1,004,253
	61.00.00	CONSTRUCTION INDIRECT				2,299	138,023	0	138,023
		FUEL OIL FUEL OIL SYSTEM	3,343,486	4,607,917	5,443,160	48,793	3,207,478	806,770	17,408,811
SCR		SCR SYSTEM							
	22.00.00	CONCRETE			98,797	1,565	74,869	25,379	199,045
	31.00.00	MECHANICAL EQUIPMENT		5,729,680		3,910	234,772	58,601	6,023,053
	35.00.00	PIPING			11,917	139	9,390	3,240	24,548
		SCR SCR SYSTEM		5,729,680	110,714	5,614	319,030	87,221	6,246,645
		TOTAL DIRECT	16,518,101	106,677,004	15,116,196	227,143	14,180,252	3,892,771	156,384,325

Estimate Totals

Description	Amount	Totals	Hours
Labor Costs	14,180,252		227,143
Material Costs	15,116,196		
Subcontract Costs	16,518,101		
Construction Equipment Costs	3,892,771		
Process Equipment Costs	106,677,004		
Total Direct Cost	**156,384,324**	**156,384,324**	
.			
General Conditions			
Additional Labor Costs			
90-1 Labor Supervision	850,800		
90-2 Show-up Time	283,600		
90-3 Cost Due To OT 5-10's	3,169,400		
90-5 Per Diem	4,542,900		
Site Overheads			
91-1 Construction Management	3,316,700		
91-2 Field Office Expenses	2,038,800		
91-3 Material&Quality Control	516,800		
91-4 Site Services	424,400		
91-5 Safety	326,900		
91-6 Temporary Facilities	248,700		
91-7 Temporary Utilities	272,500		
91-8 Mobilization/Demob.	262,100		
91-9 Legal Expenses/Claims	38,700		
Other Construction Indirects			
92-1 Small Tools & Consumables	690,800		
92-2 Scaffolding	496,400		
92-3 General Liability Insurance	165,500		
92-4 Construction Equipment Mob/Demob	194,600		
92-5 Freight on Material	755,800		
	18,595,400	**174,979,724**	
Project Indirect Costs			
93-1 EPC Engineering Services	2,492,000		
93-3 Start-Up/Commissioning	1,661,300		
93-4 Start-Up/Spare Parts	249,200		
93-5 EPC G&A	5,759,900		
93-5 EPC Fee	9,244,700		
93-6 Owners Cost	5,554,300		
93-7 Warehouse Spares	1,000,000		
	25,961,400	**200,941,124**	
Contingency			
94-1 Contingency on Construction Equipment	1,021,800		
94-2 Contingency on Material	3,968,000		
94-3 Contingency on Labor+General Conditions	7,956,300		
94-4 Contingency on Subcontract	3,303,600		
94-5 Contingency on Process Equipment	21,335,400		
94-6 Contingency on Project Indirect	6,490,400		
	44,075,500	**245,016,624**	
Escalation			
96-1 Escalation on Construction Equipment			
96-2 Escalation on Material			
96-3 Escalation on Labor+General Conditions			
96-4 Escalation on Subcontract			
96-5 Escalation on Process Equipment			
96-6 Escalation on Project Indirect			
		245,016,624	
Total		**245,016,624**	

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
1		**BASE**									
		CIVIL WORK									
		STRIP & STOCKPILE TOPSOIL									
	21-14-00-20	STRIP 6" DEEP, 500 FT HAUL		6.00 AC	-	-		221	11,021	26,788	37,809
		STRIP & STOCKPILE TOPSOIL						**221**	**11,021**	**26,788**	**37,809**
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	MISCELLANEOUS FOUNDATIONS	56.04 CY	-	-		10	435	213	648
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FIRE WATER TANK FOUNDATION	235.35 CY	-	-		41	1,828	894	2,722
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	STORM SEWER PIPE TRENCH	1,809.16 CY	-	-		135	6,091	2,978	9,069
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	OILY SEWER PIPE TRENCH	1,031.75 CY	-	-		77	3,474	1,698	5,172
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	POTABLE WATER	578.29 CY	-	-		43	1,947	952	2,899
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	SANITARY SEWER PIPE TRENCH	486.04 CY	-	-		36	1,636	800	2,436
		EXCAVATION						**342**	**15,412**	**7,535**	**22,947**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	STORM SEWER PIPE TRENCH	528.16 CY	-	-		36	1,641	803	2,444
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	OILY SEWER PIPE TRENCH	177.45 CY	-	-		12	551	270	821
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	POTABLE WATER	84.38 CY	-	-		6	262	128	390
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	MISCELLANEOUS FOUNDATIONS	56.04 CY	-	-		4	174	85	259
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE WATER TANK FOUNDATION	134.48 CY	-	-		9	418	204	622
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	SANITARY SEWER PIPE TRENCH	79.27 CY	-	-		5	246	120	367
		DISPOSAL						**73**	**3,293**	**1,610**	**4,904**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	MISCELLANEOUS FOUNDATIONS	33.62 CY	-	-	1,463	6	261	128	1,852
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	FIRE WATER TANK FOUNDATION	100.86 CY	-	-	4,390	17	784	383	5,556
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	STORM SEWER PIPE TRENCH	1,733.29 CY	-	-		199	8,978	4,389	13,367
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	OILY SEWER PIPE TRENCH	1,112.25 CY	-	-		128	5,761	2,817	8,578
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	POTABLE WATER	638.48 CY	-	-		73	3,307	1,617	4,924
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	SANITARY SEWER PIPE TRENCH	528.27 CY	-	-		61	2,736	1,338	4,074
	21-20-00-12	INFILTRATION SAND		156.10 CY	-	-	3,609	23	1,051	514	5,174
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	STORM SEWER PIPE TRENCH	437.35 CY	-	-	10,111	65	2,945	1,440	14,496
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	OILY SEWER PIPE TRENCH	164.83 CY	-	-	3,811	25	1,110	543	5,463
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	POTABLE WATER	83.75 CY	-	-	1,936	13	564	276	2,776
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	SANITARY SEWER PIPE TRENCH	76.75 CY	-	-	1,774	11	517	253	2,544
		BACKFILL					**27,095**	**621**	**28,013**	**13,696**	**68,804**
		SANITARY SEWAGE UTILITIES									
	21-38-00-99	SANITARY SEWAGE SEPTIC SYSTEM	ALLOWANCE	1.00 EA	70,040						70,040
		SANITARY SEWAGE UTILITIES			**70,040**						**70,040**
		OIL WATER SEWER SYSTEM									
	21-40-00-99	OIL WATER SEPARATOR WITH INTEGRAL LIFT STATION, 200GPM		1.00 EA	-	100,521		230	10,366	5,068	115,955
		OIL WATER SEWER SYSTEM				**100,521**		**230**	**10,366**	**5,068**	**115,955**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-11	CRUSHED ROCK SURFACING, 12" DEEP	GENERATOR STEP UP TRANSFORMER FOUNDATION	131.04 SY	-	-	1,889	4	182	172	2,243
	21-41-00-12	CRUSHED ROCK SURFACING, 8" DEEP	CRUSHED STONE SURFACING	7,800.06 SY	-	-	75,319	179	8,672	8,195	92,185
	21-41-00-41	50 LB RIPRAP, DUMPED		7.14 SY	-	-	329	0	17	4	350
	21-41-00-99	EROSION AND SEDIMENTATION CONTROL		1.00 LS	122,400	-				-	122,400
		EROSION AND SEDIMENTATION CONTROL			**122,400**		**77,537**	**183**	**8,871**	**8,370**	**217,178**
		FENCEWORK									
	21-43-00-11	FABRIC, WIRE & POSTS, CHAIN LINK FENCE, GALVANIZED, 8 FT TALL, 6 GAGE, 3 STRANDS OF BARB WIRE, 2.5 IN POST AT 10 FT O.C.		2,999.23 LF	-	-	135,829	1,034	47,359	5,529	188,716
	21-43-00-30	MAN GATE, 4 FT WIDE BY 7 FT TALL		3.00 EA	-	-	2,244	41	1,894	221	4,359
	21-43-00-50	VEHICLE GATE, 20 FT WIDE BY 8 FT TALL		2.00 EA	-	-	2,720	55	2,526	295	5,541
		FENCEWORK					**140,793**	**1,131**	**51,779**	**6,045**	**198,617**
		LANDSCAPING									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		LANDSCAPING									
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING 4 IN TOPSOIL FROM PILE & FERTILIZER		24,043.99 SY	-	-	29,418	332	16,560	40,251	86,229
	21-47-00-10	SEED & MULCH, INCLUDES SPREADING 4 IN TOPSOIL FROM PILE & FERTILIZER	RESTORE CONSTRUCTION LAYDOWN AREA 1	41,712.33 SY	-	-	51,036	575	28,729	69,828	149,592
	21-47-00-10	MISC SITE IMPROVEMENTS		1.00 LS	68,000	-					68,000
		LANDSCAPING			**68,000**		**80,454**	**907**	**45,288**	**110,079**	**303,821**
		POND									
	21-55-00-99	NEW POND - ALLOWANCE	300 FT X 150 FT	1.00 AC	422,702	-					422,702
		POND			**422,702**						**422,702**
		ROAD, PARKING AREA, & SURFACED AREA									
	21-57-00-96	PAVEMENT MARKING - 18 IN WIDE STOP BARS	THERMOPLASTIC WHITE OR YELLOW MATERIAL	131.97 LF	-	-	359	3	174	7	540
	21-57-00-96	PAVEMENT MARKING - YELLOW DOUBLE STRIPES		1,319.66 LF	-	-	3,590	30	1,737	71	5,398
	21-57-00-97	ROAD & PARKING SIGN - STOP SIGN		6.00 EA	-	-	1,632	28	1,656	413	3,702
	21-57-00-99	ASPHALT PAVEMENT, 4 IN ASPHALT CONCRETE, 12 IN BASE COURSE, 12 IN LIME STABILIZED SUBBASE, 12 IN SUBGRADE PREP, GEOTEXTILE		990.01 SY	85,160	-					85,160
	21-57-00-99	GRAVEL ROADS, 10 IN BASE COURSE, 12 IN LIME STABILIZED SUBBASE, 12 IN SUBGRADE PREP, GEOTEXTILE		17,490.14 SY	1,094,183	-					1,094,183
	21-57-00-99	PIPE BOLLARD, CONCRETE FILLED/PAINT, 6 IN DIA., 8 FT LONG X 6 FT DIA. HOLE		13.00 EA	-	-	10,785	60	3,421	140	14,346
		ROAD, PARKING AREA, & SURFACED AREA			**1,179,344**		**16,365**	**121**	**6,988**	**631**	**1,203,328**
		WELL									
	21-75-00-99	WATER WELL	ALLOWANCE	1.00 LS	54,400	-					54,400
		WELL			**54,400**						**54,400**
		CIVIL WORK,TESTING									
	21-98-00-99	GEOTECHNICAL SOIL INVESTIGATION		1.00 LS	70,380	-				-	70,380
	21-98-00-99	SURVEYING	ALLOWANCE	1.00 LS	23,460	-				-	23,460
		CIVIL WORK,TESTING			**93,840**						**93,840**
		CIVIL WORK, MISCELLANEOUS									
	21-99-00-99	CRANE MAT		1.00 LS	-	-	48,328	345	16,500	5,593	70,421
		CIVIL WORK, MISCELLANEOUS					**48,328**	**345**	**16,500**	**5,593**	**70,421**
		CIVIL WORK			**2,010,726**	**100,521**	**390,572**	**4,174**	**197,531**	**185,416**	**2,884,766**
		CONCRETE									
		CONCRETE									
	22-13-00-02	CONCRETE FOUNDATION FOR RICE MACHINES	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, REINFORCEMENT, AND EMBEDMENTS	1,188.74 CY	-	-	517,338	8,193	392,040	132,895	1,042,273
	22-13-00-02	CONCRETE FOUNDATION FOR ENGINE HALL	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	1,350.84 CY	-	-	587,884	9,310	445,500	151,016	1,184,401
	22-13-00-02	CONCRETE FOUNDATION FOR CHIMNEY	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	231.14 CY	-	-	100,593	1,593	76,230	25,841	202,664
	22-13-00-02	CONCRETE FOUNDATION FOR FIN FAN COOLERS	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	726.45 CY	-	-	316,151	5,007	239,580	81,213	636,944
	22-13-00-02	CONCRETE FOUNDATION FOR EXHAUST DUCT & CHARGE AIR SUPPORT STRUCTURE	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	396.25 CY	-	-	172,446	2,731	130,680	44,298	347,425
	22-13-00-02	CONCRETE FOUNDATION FOR TRANSFORMERS	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	262.24 CY	-	-	114,128	1,807	86,486	29,317	229,931
	22-13-00-02	CONCRETE FOUNDATION FOR CHEMICAL FEEDS	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	273.17 CY	-	-	118,883	1,883	90,090	30,539	239,512
	22-13-00-02	CONCRETE FOUNDATION FOR ELECTRICAL BUILDING	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	292.68 CY	-	-	127,375	2,017	96,525	32,720	256,621
	22-13-00-02	CONCRETE FOUNDATION FOR MISC	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION.	117.07 CY	-	-	50,950	807	38,610	13,088	102,648

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE									
			FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS								
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	MISCELLANEOUS FOUNDATIONS	56.04 CY	-	-	12,574	80	3,850	1,305	17,729
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	FIRE WATER TANK FOUNDATION	161.38 CY	-	-	36,214	232	11,088	3,759	51,060
		CONCRETE					**2,154,538**	**33,661**	**1,610,680**	**545,991**	**4,311,209**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FIRE WATER TANK FOUNDATION	806.55 LB	-	-	3,291	46	2,653	108	6,052
		EMBEDMENT					**3,291**	**46**	**2,653**	**108**	**6,052**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	MISCELLANEOUS FOUNDATIONS	83.99 SF	-	-	211	19	1,070	198	1,480
	22-17-00-10	BUILT UP INSTALL & STRIP	FIRE WATER TANK FOUNDATION	492.79 SF	-	-	1,240	113	6,280	1,163	8,682
		FORMWORK					**1,451**	**133**	**7,350**	**1,361**	**10,162**
		PRECAST									
	22-23-00-50	MANHOLE - 6 FT ID BY 8 FT DEEP	STORM WATER SYSTEM	8.00 EA	-	-	11,264	294	14,080	4,773	30,116
	22-23-00-50	OUTLET STRUCTURE (MANHOLE)	STORM WATER SYSTEM	1.00 EA	-	-	1,408	37	1,760	597	3,765
	22-23-00-50	INLET STRUCTURE (MANHOLE)	STORM SEWER WATER SYSTEM	8.00 EA	-	-	11,264	294	14,080	4,773	30,116
		PRECAST					**23,935**	**625**	**29,920**	**10,142**	**63,997**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	MISCELLANEOUS FOUNDATIONS	1.00 TN	-	-	1,523	23	1,247	327	3,098
	22-25-00-10	UNCOATED A615 GR60	FIRE WATER TANK FOUNDATION	11.00 TN	-	-	16,748	142	7,620	1,999	26,366
	22-25-00-39	W1.4 X W1.4 @ 2" X 2" WIRE REINFORCEMENT		390.07 LB	-	-	1,061	18	965	253	2,279
		REINFORCING					**19,332**	**183**	**9,832**	**2,579**	**31,743**
		CONCRETE, MISCELLANEOUS									
	22-99-00-01	EQUIPMENT GROUT	ALLOWANCE	46.20 CY	-	-	135,794	5,021	240,238	81,436	457,468
	22-99-00-20	WATERSTOP		623.84 LF	-	-	1,061	39	2,258	92	3,411
	22-99-00-30	JOINT FILLER, 0.5 IN BY 1 INCH		389.90 LF	-	-	1,591	9			1,591
	22-99-00-39	JOINT, FILLER - PREMOLDED 1 INCH THICK		1,325.66 LF	-	-	4,868	67	3,839	157	8,863
	22-99-00-99	UNLOADING STATION	CONCRETE UNLOADING CONTAINMENT ADJACENT TO CHEMICAL FEEDS	39.02 CY		-	12,207	448	21,450	7,271	40,928
		CONCRETE, MISCELLANEOUS					**155,520**	**5,584**	**267,784**	**88,956**	**512,260**
		CONCRETE					**2,358,066**	**40,232**	**1,928,219**	**649,138**	**4,935,424**
		STEEL									
		GALLERY									
	23-17-00-11	GALVANIZED GRATING, 1 3/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	GENERATOR STEP UP TRANSFORMER FOUNDATION	1,165.75 SF	-	-	43,282	268	18,816	2,682	64,780
	23-17-00-99	GALLERY - GRATING, STAIRS, HANDRAIL, SUPPORTS, ETC	BOP	7.80 TN	-	-	66,637	402	28,195	4,019	98,851
		GALLERY					**109,919**	**670**	**47,011**	**6,700**	**163,630**
		ROLLED SHAPE									
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	MISCELLANEOUS STEEL	39.42 TN	-	-	197,879	863	56,787	30,475	285,141
		ROLLED SHAPE					**197,879**	**863**	**56,787**	**30,475**	**285,141**
		STEEL					**307,798**	**1,532**	**103,798**	**37,176**	**448,771**
		ARCHITECTURAL									
		DOOR (INCL. FRAME & HARDWARE)									
	24-15-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SUPPLY AND INSTALL COST OF BUILDING DOORS	1.00 LS	67,002	217,880					284,882
		DOOR (INCL. FRAME & HARDWARE)			**67,002**	**217,880**					**284,882**
		LOUVER & VENT									
	24-25-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SUPPLY AND INSTALL COST OF ROOFTOP VENTS INCLUDING SILENCERS	1.00 LS	105,671	89,642					195,314
		LOUVER & VENT			**105,671**	**89,642**					**195,314**
		PLUMBING FIXTURE									
	24-33-00-99	BUILDING PLUMBING AND MISCELLANEOUS ACCESSORIES	ALLOWANCE	1.00 LS	156,400	-					156,400
		PLUMBING FIXTURE			**156,400**						**156,400**
		PRE-ENGINEERED BUILDING									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PRE-ENGINEERED BUILDING									
	24-35-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SIZED FOR 5 ENGINES TOTAL - SUPPLY AND INSTALL COST INCLUDES PRIMARY AND SECONDARY FRAMING SYSTEMS, ROOFING, SIDING, ACCESSORIES, AND LINER PANELS	19,304.53 SF	4,463,208						4,463,208
	24-35-00-99	ELECTRICAL BUILDING - PRE-ENGINEERED BUILDING 40 FT X 78 FT X 20 FT HIGH	SUPPLY AND INSTALL COST (ALL COMPONENTS)	3,494.34 SF	1,164,314						1,164,314
	24-35-00-99	STORAGE BUILDING	ALLOWANCE FOR POLE-BARN CONSTRUCTION WITH ROLL-UP DOOR AND TWO MAN DOORS, INCLUDING FOUNDATION, POWER, LIGHTING, AND VENTILATION	1.00 LS	169,228						169,228
		PRE-ENGINEERED BUILDING			**5,796,750**						**5,796,750**
		ROOFING									
	24-37-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SOUND ATTENUATION PANELS	19,304.59 SF	-	1,246,303		1,109	50,872	8,024	1,305,198
		ROOFING				**1,246,303**		**1,109**	**50,872**	**8,024**	**1,305,198**
		SIDING									
	24-41-00-29	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	SOUND ATTENUATION PANELS	29,159.24 SF	-	1,882,518		1,675	107,464	39,665	2,029,647
		SIDING				**1,882,518**		**1,675**	**107,464**	**39,665**	**2,029,647**
		ARCHITECTURAL, MISCELLANEOUS									
	24-99-00-99	ENGINE HALL - PRE-ENGINEERED BUILDING 198 FT X 97.5 FT X 45 FT HIGH	LADDERS AND ASSOCIATED SAFETY SYSTEM, INCLUDING ANCHORS	1.00 LS	17,395	40,853					58,249
		ARCHITECTURAL, MISCELLANEOUS			**17,395**	**40,853**					**58,249**
		ARCHITECTURAL			**6,143,218**	**3,477,197**		**2,784**	**158,336**	**47,689**	**9,826,440**
		PAINTING & COATING									
		COATING									
	27-13-00-99	ENGINE FOUNDATION PAINTING	EPOXY COATING	7,919.81 SF	-	-	8,616	91	5,435	720	14,771
		COATING					**8,616**	**91**	**5,435**	**720**	**14,771**
		PAINTING									
	27-17-00-10	PIPE PAINTING, 0.5 IN DIA		351.10 LF	-	-	287	32	1,928	255	2,470
	27-17-00-11	PIPE PAINTING, 0.75 IN DIA		1,136.26 LF	-	-	1,159	129	7,721	1,022	9,903
	27-17-00-12	PIPE PAINTING, 1 IN DIA		565.07 LF	-	-	722	81	4,809	637	6,169
	27-17-00-14	PIPE PAINTING, 1.5 IN DIA		274.24 LF	-	-	507	46	2,729	594	3,831
	27-17-00-15	PIPE PAINTING, 2 IN DIA		3,277.78 LF	-	-	7,578	580	34,647	7,514	49,739
	27-17-00-16	PIPE PAINTING, 2.5 IN DIA		840.19 LF	-	-	2,343	164	9,804	1,298	13,444
	27-17-00-17	PIPE PAINTING, 3 IN DIA		1,831.47 LF	-	-	6,227	434	25,896	5,629	37,752
	27-17-00-18	PIPE PAINTING, 4 IN DIA		996.52 LF	-	-	4,364	304	18,126	2,400	24,890
	27-17-00-19	PIPE PAINTING, 6 IN DIA		797.39 LF	-	-	5,129	358	21,345	2,826	29,301
	27-17-00-20	PIPE PAINTING, 8 IN DIA		830.58 LF	-	-	6,958	485	28,961	3,835	39,754
	27-17-00-21	PIPE PAINTING, 10 IN DIA		158.95 LF	-	-	1,660	116	6,906	914	9,481
	27-17-00-99	TOUCH UP PAINTING		1.00 LS	-	-	10,930	602	35,968	4,763	51,661
		PAINTING					**47,865**	**3,331**	**198,841**	**31,688**	**278,393**
		PAINTING & COATING					**56,481**	**3,422**	**204,276**	**32,407**	**293,164**
		MECHANICAL EQUIPMENT									
		COMPRESSOR & ACCESSORIES									
	31-17-00-59	AIR RECEIVER - 375 GALLONS	SERVICE AIR	1.00 EA	-	6,544		34	2,070	517	9,131
	31-17-00-99	STARTING AIR COMPRESSOR SKID	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	170	10,214	2,549	12,763
	31-17-00-99	STARTING AIR RECEIVER	EQUIPMENT SUPPLIED BY OEM	3.00 EA	-	-	-	141	8,488	2,119	10,607
	31-17-00-99	INSTRUMENT AIR COMPRESSOR SKID	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	57	3,451	861	4,312
	31-17-00-99	INSTRUMENT AIR RECEIVER	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	18	1,104	276	1,380
	31-17-00-99	SERVICE AIR RECEIVER	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	18	1,104	276	1,380
	31-17-00-99	INSTRUMENT AIR DRYERS	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	37	2,208	551	2,760
		COMPRESSOR & ACCESSORIES				**6,544**		**477**	**28,640**	**7,149**	**42,332**
		CRANES & HOISTS									
	31-25-00-05	ENGINE HALL - BRIDGE CRANE	SUPPLY AND INSTALL	1.00 LS	101,160	211,662	-				312,822
	31-25-00-99	BRIDGE CRANE - 6 TN, 100 FT SPAN	POWER GENERATION BUILDING	1.00 EA	-	241,638		184	11,042	2,756	255,436
	31-25-00-99	CRANE RAILS	POWER GENERATION BUILDING	719.82 LF	-	-	23,191	124	7,453	1,860	32,505
		CRANES & HOISTS			**101,160**	**453,300**	**23,191**	**308**	**18,495**	**4,617**	**600,763**
		ENGINE									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		ENGINE									
	31-31-00-99	ENGINE/GENERATOR SETS (13.8 KV, 60 HZ) W/ SPRING MOUNTED BASE FRAMES	DUAL FUEL	5.00 EA	-	75,383,329	-	649	38,991	9,733	75,432,053
	31-31-00-99	ENGINE MAINTENANCE PLATFORMS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-		-	471	28,295	7,063	35,357
	31-31-00-99	AUXILIARY MODULES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	178	10,697	2,670	13,367
	31-31-00-99	AUXILIARY MODULE PLATFORMS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	178	10,697	2,670	13,367
	31-31-00-99	TRUNK ROUTE PIPE RACK	EQUIPMENT SUPPLIED BY OEM	1.00 LS	-	-	-	59	3,537	883	4,420
	31-31-00-99	LUBE OIL SEPARATOR UNITS	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	4,279	1,068	5,347
	31-31-00-99	COOLING WATER EXPANSION VESSELS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	14,147	3,531	17,679
	31-31-00-99	LOCAL CONTROL PANELS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-		-	161	9,662	2,412	12,073
	31-31-00-99	CENTRAL COMMON CONTROL PANEL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	39	2,346	586	2,932
	31-31-00-99	CENTRAL ENGINE VISE CONTROL PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	161	9,662	2,412	12,073
	31-31-00-99	RADIATOR DISTRIBUTION PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	201	12,077	3,015	15,092
	31-31-00-99	ENGINE AUXILIARY MODULE PANEL DISTRIBUTION PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	201	12,077	3,015	15,092
	31-31-00-99	FLOW METER TOTALIZER	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	34	2,070	517	2,587
	31-31-00-99	LUBE OIL TANK HEATER PANEL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	28	1,656	413	2,070
	31-31-00-99	AMBIENT AIR SENSOR	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	32	1,932	482	2,415
	31-31-00-99	RADIATOR DU/DF - FILTER PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	103	6,211	1,550	7,761
	31-31-00-99	RADIATOR FREQUENCY CONVERTER PANEL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	132	7,936	1,981	9,917
	31-31-00-99	DC SYSTEM	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	218	13,112	3,273	16,385
	31-31-00-99	ENGINE INLET AIR FILTERS AND WEATHER HOODS	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	14,147	3,531	17,679
	31-31-00-99	CHARGE AIR & EXHAUST GAS MODULES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	885	53,139	13,264	66,403
	31-31-00-99	NEUTRAL POINT CUBICLES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	115	6,901	1,723	8,624
	31-31-00-99	COOLING RADIATORS INCLUDING SUPPORT STEEL & GALLERIES	EQUIPMENT SUPPLIED BY OEM	5.00 LS	-	-	-	943	56,589	14,125	70,715
	31-31-00-99	PERFORMANCE TESTING		5.00 LS	782,000	-	-				782,000
	31-31-00-99	MAINTENANCE WATER TANK WITH TRANSFER PUMPS	EQUIPMENT SUPPLIED BY OEM	1.00 LT	-	-	-	86	5,176	1,292	6,468
	31-31-00-99	DUAL FUEL CAPABILITY	EQUIPMENT SUPPLIED BY OEM INCLUDING BIOFUEL CAPABILITY	5.00 EA	-		-	862	51,759	12,920	64,678
		ENGINE			**782,000**	**75,383,329**		**6,281**	**377,096**	**94,127**	**76,636,552**
		FIRE PROTECTION EQUIPMENT & SYSTEM									
	31-41-00-30	FIRE EXTINGUISHERS ENGINE HALL	DRY POWDER TYPE	27.00 EA	-	-	27,540	47	2,795	698	31,033
	31-41-00-40	6 IN FIRE HYDRANT CAST IRON, CLASS 125		14.00 EA	-	138,259	-	97	5,797	1,447	145,503
	31-41-00-60	ENGINE HALL WET PIPE SPRINKLER SYSTEM	SUBCONTRACT	1.00 LS	360,400	-	-				360,400
	31-41-00-99	FIRE DETECTION SYSTEM	SUBCONTRACT	1.00 LS	272,000	-	-				272,000
	31-41-00-99	FIRE PUMP STATION	SUBCONTRACT, 1X100% DIESEL (2,500 GPM @ 125 PSI), 1x100% ELECTRIC (2,500 GPM @ 125 PSI), 1X100% JOCKEY, PUMPHOUSE	1.00 LS	546,312	-	-				546,312
	31-41-00-99	FIRE/RAW WATER TANK	CAPACITY: APPROX. 250,000 GAL. VERTICAL, INCL STAIRS, LADDERS, MANWAYS, & CATHODIC PROTECTION. CS W/ EPOXY COATING.	1.00 EA	992,800	-	-				992,800
		FIRE PROTECTION EQUIPMENT & SYSTEM			**2,171,512**	**138,259**	**27,540**	**143**	**8,592**	**2,145**	**2,348,048**
		BLACK START GENERATOR									
	31-65-00-99	CAT 700 KW DIESEL GENERATOR	PRICING PROVIDED BY TOROMONT CAT	1.00 LS	-	357,459	-	126	7,591	1,895	366,945
		BLACK START GENERATOR				**357,459**		**126**	**7,591**	**1,895**	**366,945**
		LUBRICATING OIL SYSTEM									
	31-69-00-99	LUBRICATING OIL STORAGE TANK, FRESH OIL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	4,279	1,068	5,347
	31-69-00-99	LUBRICATING OIL SERVICE TANK	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	4,279	1,068	5,347
	31-69-00-99	LUBRICATING OIL TRANSFER PUMP UNIT, MOBILE	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	57	3,451	861	4,312
	31-69-00-99	LUBRICATING OIL TRANSFER PUMP UNIT, STATIONARY	EQUIPMENT SUPPLIED BY OEM	2.00 EA	-	-	-	57	3,451	861	4,312
	31-69-00-99	LUBRICATING OIL STORAGE TANK, USED OIL	EQUIPMENT SUPPLIED BY OEM	1.00 EA	-	-	-	71	4,279	1,068	5,347
		LUBRICATING OIL SYSTEM						**329**	**19,737**	**4,927**	**24,664**
		CHARGE AIR SYSTEM									
	31-71-00-05	DUCTING, CHARGING AIR	EQUIPMENT SUPPLIED BY OEM	272.93 LF	-	-	-	314	18,840	4,703	23,543
	31-71-00-05	DUCT SUPPORTS	EQUIPMENT SUPPLIED BY OEM	10.00 EA	-	-	-	299	17,943	4,479	22,422
	31-71-00-05	CHARGE AIR FILTER	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	14,147	3,531	17,679
	31-71-00-05	CHARGE AIR PREHEATING UNIT	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	14,147	3,531	17,679
	31-71-00-05	CHARGE AIR SILENCER	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	236	14,147	3,531	17,679
		CHARGE AIR SYSTEM						**1,320**	**79,225**	**19,775**	**99,001**
		PUMP									
	31-75-00-99	WELL PUMP	100%@300 GPM & 150 TDH	1.00 EA	-	25,383	-	18	1,104	276	26,762
		PUMP				**25,383**		**18**	**1,104**	**276**	**26,762**
		SCREEN									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		SCREEN									
	31-77-00-05	DEBRIS FILTER - SIEVE	INSTRUMENT AIR PIPING	4.00 EA	-	-	272	14	828	207	1,307
	31-77-00-05	DEBRIS FILTER - SIEVE	DRAIN PIPING, FLOOR DRAINS	5.00 EA	-	-	340	17	1,035	258	1,634
	31-77-00-05	DEBRIS FILTER - SIEVE	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	408	21	1,242	310	1,960
	31-77-00-05	DEBRIS FILTER - SIEVE	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	680	34	2,070	517	3,267
	31-77-00-99	SCREEN - BIRD	INSTRUMENT AIR PIPING	2.00 EA	-	-	204	7	414	103	721
	31-77-00-99	SCREEN - SIEVE	UREA PIPING SYSTEM	4.00 EA	-	-	272	14	828	207	1,307
	31-77-00-99	SCREEN - BIRD	COOLING WATER PIPING SYSTEM	1.00 EA	-	-	102	3	207	52	361
		SCREEN					**2,278**	**110**	**6,625**	**1,654**	**10,557**
		EXHAUST SYSTEM									
	31-81-00-99	EXHAUST GAS SILENCER - VERTICAL	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	293	17,598	4,393	21,991
	31-81-00-99	DUCTING, EXHAUST GAS	EQUIPMENT SUPPLIED BY OEM	593.85 LF	-	-	-	1,366	81,986	20,464	102,450
	31-81-00-99	DUCT SUPPORTS (TOWERS)	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	707	42,442	10,594	53,036
	31-81-00-99	BELLOWS	EQUIPMENT SUPPLIED BY OEM	20.00 EA	-	-	-	713	42,787	10,680	53,467
	31-81-00-99	EXHAUST GAS STACK PIPE	EQUIPMENT SUPPLIED BY OEM	371.16 LF	-	-	-	427	25,621	6,395	32,016
	31-81-00-99	DUCT INSULATION & JACKETING	EQUIPMENT SUPPLIED BY OEM	3,108.53 SF		-	-	1,126	67,577	16,868	84,444
	31-81-00-99	EXHAUST PURGE FAN	EQUIPMENT SUPPLIED BY OEM	5.00 EA		-	-	172	10,352	2,584	12,936
	31-81-00-99	RUPTURE DISCS WITH WEATHER COVERS	EQUIPMENT SUPPLIED BY OEM	5.00 EA		-	-	144	8,626	2,153	10,780
	31-81-00-99	EXHAUST GAS SILENCER - HORIZONTAL	EQUIPMENT SUPPLIED BY OEM	5.00 EA		-	-	293	17,598	4,393	21,991
		EXHAUST SYSTEM						**5,240**	**314,586**	**78,524**	**393,110**
		WATER TREATING									
	31-93-00-99	WELL WATER TREATMENT SYSTEM	ALLOWANCE	1.00 LS	34,000	-	-				34,000
		WATER TREATING			**34,000**						**34,000**
		MECHANICAL EQUIPMENT, TESTING									
	31-98-00-99	NOISE ASSESSMENT	SUBCONTRACT	1.00 LS	50,830	-	-				50,830
		MECHANICAL EQUIPMENT, TESTING			**50,830**						**50,830**
		MECHANICAL EQUIPMENT, MISCELLANEOUS									
	31-99-00-99	TAGGING		1.00 LS	-	-	20,992	181	10,852	2,709	34,552
	31-99-00-99	MECHANICAL EQUIPMENT - HIGH VELOCITY LUBE OIL FLUSH	LUBE OIL PIPING SYSTEM	1.00 LS	54,808	-	-				54,808
	31-99-00-99	MECHANICAL EQUIPMENT -2" HOSE 100LF FOR SKID FILL	COOLING WATER PIPING SYSTEM	1.00 EA	-	-	877	5	276	69	1,222
		MECHANICAL EQUIPMENT, MISCELLANEOUS			**54,808**		**21,869**	**185**	**11,128**	**2,778**	**90,582**
		MECHANICAL EQUIPMENT			**3,194,310**	**76,364,274**	**74,878**	**14,537**	**872,820**	**217,865**	**80,724,147**
		HVAC									
		HVAC, MISCELLANEOUS									
	34-99-00-99	AIR HANDLING UNITS, AIR ROTATION UNITS, AND VIBRO ACOUSTICS	ALLOWANCE	2.00 LS	-	2,004,830		487	31,139	4,635	2,040,603
	34-99-00-99	HEATERS	ALLOWANCE	2.00 LS	-	216,738		104	6,643	989	224,370
	34-99-00-99	DAMPERS	ALLOWANCE	2.00 LS	-	43,348		87	5,536	824	49,707
	34-99-00-99	LOUVERS/GRAVITY RELIEF HOODS	ALLOWANCE	2.00 LS	-	216,738		173	11,072	1,648	229,458
	34-99-00-99	FANS	ALLOWANCE	2.00 LS	-	18,062		139	8,857	1,318	28,237
	34-99-00-99	DUCTWORK	ALLOWANCE	2.00 LS	-	252,861		5,846	373,668	55,614	682,144
	34-99-00-99	DUCTWORK INSULATION	ALLOWANCE	2.00 LS	415,415						415,415
		HVAC, MISCELLANEOUS			**415,415**	**2,752,577**		**6,835**	**436,915**	**65,028**	**3,669,935**
		HVAC			**415,415**	**2,752,577**		**6,835**	**436,915**	**65,028**	**3,669,935**
		PIPING									
		SS 304, ABOVE GROUND, PROCESS AREA									
	35-13-01-06	0.75 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	1,834.09 LF	-	-	45,896	2,130	144,186	166,425	356,507
	35-13-01-10	1 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	611.37 LF	-	-	20,870	780	52,821	60,861	134,552
	35-13-01-22	3 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	126.64 LF	-	-	9,318	237	16,067	5,544	30,929
	35-13-01-38	10 IN DIA, SCH 40S, 2 SS 12'V X 9' H RISERS	FIRE PROTECTION PIPING SYSTEM	91.71 LF	-	-	39,624	336	22,770	7,857	70,251
		SS 304, ABOVE GROUND, PROCESS AREA					**115,707**	**3,484**	**235,844**	**240,688**	**592,239**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-06	0.75 IN DIA, SCH 80	HOT DRAINS IFC	193.89 LF	-	-	2,610	210	14,186	4,895	21,692
	35-13-10-06	0.75 IN DIA, SCH 80	SERVICE AIR PIPING	497.83 LF	-	-	6,703	538	36,424	12,569	55,695
	35-13-10-06	0.75 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	52.41 LF	-	-	706	57	3,834	1,323	5,863
	35-13-10-10	1 IN DIA, SCH 80	HOT DRAINS IFC	89.09 LF	-	-	1,393	104	7,073	2,441	10,907
	35-13-10-10	1 IN DIA, SCH 80	SERVICE AIR PIPING	15.72 LF	-	-	246	18	1,248	431	1,924

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-10	1 IN DIA, SCH 80	LUBE OIL PIPING SYSTEM	34.06 LF	-	-	533	40	2,704	933	4,170
	35-13-10-14	1.5 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	274.24 LF	-	-	6,191	366	24,761	8,544	39,497
	35-13-10-18	2 IN DIA, SCH 80	HOT DRAINS IFC	75.11 LF	-	-	2,411	109	7,366	2,542	12,319
	35-13-10-18	2 IN DIA, SCH 80	SERVICE AIR PIPING	1,220.10 LF	-	-	39,161	1,768	119,660	41,291	200,111
	35-13-10-18	2 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	382.54 LF	-	-	12,278	554	37,517	12,946	62,741
	35-13-10-18	2 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	304.81 LF	-	-	9,783	442	29,894	10,315	49,992
	35-13-10-21	2.5 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	840.19 LF	-	-	29,481	1,207	81,746	28,208	139,435
	35-13-10-25	3 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	488.22 LF	-	-	19,189	752	50,921	17,571	87,682
	35-13-10-29	4 IN DIA, SCH 40	HOT DRAINS IFC	26.20 LF	-	-	1,354	45	3,018	1,042	5,414
	35-13-10-29	4 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	59.39 LF	-	-	3,069	101	6,842	2,361	12,272
	35-13-10-33	6 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	72.49 LF	-	-	5,708	134	9,084	3,135	17,927
	35-13-10-33	6 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	680.36 LF	-	-	53,574	1,259	85,260	29,421	168,255
	35-13-10-33	6 IN DIA, SCH 40	FIRE PROTECTION PIPING SYSTEM	44.54 LF	-	-	3,507	82	5,582	1,926	11,015
	35-13-10-37	8 IN DIA, SCH 40	FIRE PROTECTION PIPING SYSTEM	44.54 LF	-	-	5,101	98	6,657	2,297	14,054
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**202,998**	**7,884**	**533,777**	**184,191**	**920,966**
		SS 304, STRAIGHT RUN									
	35-14-01-18	2 IN DIA, SCH 40S	INSTRUMENT AIR PIPING	305.68 LF	-	-	16,255	309	20,938	21,005	58,198
		SS 304, STRAIGHT RUN					**16,255**	**309**	**20,938**	**21,005**	**58,198**
		CARBON STEEL, STRAIGHT RUN									
	35-14-10-18	2 IN DIA, SCH 80	COOLING WATER PIPING SYSTEM	907.44 LF	-	-	19,869	803	54,386	18,767	93,023
	35-14-10-25	3 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	1,310.07 LF	-	-	31,892	949	64,241	22,168	118,301
	35-14-10-29	4 IN DIA, SCH 40	LUBE OIL PIPING SYSTEM	436.69 LF	-	-	14,551	351	23,793	8,210	46,554
	35-14-10-29	4 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	349.35 LF	-	-	11,641	281	19,035	6,568	37,243
	35-14-10-37	8 IN DIA, SCH 40	COOLING WATER PIPING SYSTEM	786.04 LF	-	-	62,003	850	57,511	19,845	139,359
		CARBON STEEL, STRAIGHT RUN					**139,956**	**3,234**	**218,966**	**75,559**	**434,481**
		HDPE, BURIED									
	35-15-30-10	2 IN DIA, DR 11	POTABLE WATER	698.70 LF	-	-	3,231	361	24,473	8,445	36,148
	35-15-30-18	4 IN DIA, DR 11	SANITARY SEWER PIPING	698.70 LF	-	-	5,511	321	21,754	7,507	34,772
	35-15-30-29	10 IN DIA, DR 9	FIRE PROTECTION PIPING SYSTEM	1,746.75 LF	-	-	96,449	1,968	133,241	45,977	275,667
	35-15-30-57	24 IN DIA, DR 9	STORM SEWER BYPASS PIPING	436.69 LF	-	-	109,277	818	55,404	19,118	183,799
	35-15-30-57	24 IN DIA, DR 9	OUTLET PIPING	69.87 LF	-	-	17,485	131	8,865	3,059	29,408
		HDPE, BURIED					**231,953**	**3,600**	**243,736**	**84,106**	**559,795**
		CHDPE, BURIED									
	35-15-31-01	12 IN	STORM SEWER PIPING	436.69 LF	-	-	7,721	251	16,995	5,864	30,580
	35-15-31-99	24 IN	STORM SEWER PIPING	436.69 LF	-	-	16,629	402	27,192	9,383	53,204
		CHDPE, BURIED					**24,350**	**653**	**44,187**	**15,248**	**83,785**
		CAST IRON, BURIED									
	35-15-37-99	8 IN DIA CAST IRON SOIL PIPE	OILY WATER SEWER SYSTEM	1,746.75 LF	-	-	108,612	1,205	81,576	28,149	218,337
		CAST IRON, BURIED					**108,612**	**1,205**	**81,576**	**28,149**	**218,337**
		PIPE SUPPORTS, HANGERS									
	35-35-00-01	SINGLE ROD SUPPORT W/O BEAM FOR 1 IN AND BELOW DIA PIPE	ALLOWANCE	825.00 EA	-	-	196,350	1,897	128,397	44,306	369,052
	35-35-00-04	SINGLE ROD SUPPORT W/O BEAM FOR 3 IN PIPE	STARTING AIR	14.00 EA	-	-	3,846	48	3,268	1,128	8,242
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE	STARTING AIR	30.00 EA	-	-	9,506	138	9,338	3,222	22,067
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	FUEL GAS SYSTEM	20.97 EA	-	-	5,560	84	5,710	1,970	13,241
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	FUEL GAS SYSTEM	5.24 EA	-	-	1,390	21	1,428	493	3,311
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	CLOSED COOLING WATER	53.00 EA	-	-	14,056	213	14,435	4,981	33,472
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN DETAIL 2	CLOSED COOLING WATER	27.00 EA	-	-	7,160	109	7,354	2,538	17,052
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	LUBE OIL SYSTEM	157.00 EA	-	-	41,636	632	42,760	14,755	99,152
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	LUBE OIL SYSTEM	37.00 EA	-	-	9,812	149	10,077	3,477	23,367
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	SERVICE WATER SYSTEM	26.00 EA	-	-	6,895	105	7,081	2,444	16,420
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	SERVICE WATER SYSTEM	14.00 EA	-	-	3,713	56	3,813	1,316	8,842
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	INSTRUMENT/SERVICE AIR SYSTEM	40.00 EA	-	-	10,608	161	10,894	3,759	25,262
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 2	INSTRUMENT/SERVICE AIR SYSTEM	14.00 EA	-	-	3,713	56	3,813	1,316	8,842
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	SANITARY SYSTEM	10.00 EA	-	-	2,652	40	2,724	940	6,315
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 1-1/2 IN AND 2 IN - DETAIL 1	SERVICE WATER SYSTEM	93.00 EA	-	-	24,664	374	25,329	8,740	58,733
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE - DETAIL 1	FUEL GAS SYSTEM	8.74 EA	-	-	3,232	66	4,487	1,548	9,267
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE - DETAIL 1	SERVICE WATER SYSTEM	39.00 EA	-	-	14,427	296	20,030	6,912	41,368
	35-35-00-28	SINGLE ROD SUPPORT W/ BEAM FOR 3 IN PIPE - DETAIL 2	SERVICE WATER SYSTEM	16.00 EA	-	-	5,919	121	8,217	2,836	16,972

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PIPE SUPPORTS, HANGERS									
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 3	LUBE OIL SYSTEM	26.00 EA	-	-	10,714	227	15,376	5,306	31,397
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 1	INSTRUMENT/SERVICE AIR SYSTEM	93.00 EA	-	-	38,323	812	55,000	18,979	112,303
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 2	INSTRUMENT/SERVICE AIR SYSTEM	29.00 EA	-	-	11,950	253	17,151	5,918	35,019
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE - DETAIL 1	SANITARY SYSTEM	11.00 EA	-	-	4,533	96	6,505	2,245	13,283
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE - DETAIL 4	CLOSED COOLING WATER	105.00 EA	-	-	47,838	1,159	78,439	27,067	153,343
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE - DETAIL 2	CLOSED COOLING WATER	74.00 EA	-	-	33,714	817	55,281	19,076	108,071
		PIPE SUPPORTS, HANGERS					**512,212**	**7,931**	**536,907**	**185,270**	**1,234,389**
		VALVES									
	35-45-00-05	LARGE BORE - 10" POST INDICATOR VALVE	FIRE PROTECTION PIPING SYSTEM	10.00 EA	-	-	49,025	73	4,965	1,713	55,703
	35-45-00-05	LARGE BORE - 4" GATE	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	15,685	24	1,634	564	17,883
	35-45-00-05	LARGE BORE - 3" CHECK, S&L-CHECK00	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	2,300	10	700	242	3,242
	35-45-00-05	LARGE BORE - 3" GLOBE S&L-GLOBE00	LUBE OIL PIPING SYSTEM	16.00 EA	-	-	9,614	28	1,868	644	12,126
	35-45-00-05	LARGE BORE - 3" QUARTER TURN S&L-QTURN00	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	37,512	10	700	242	38,454
	35-45-00-05	LARGE BORE - 4" GLOBE	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	8,667	17	1,167	403	10,237
	35-45-00-05	LARGE BORE - 3" BUTTERFLY	COOLING WATER PIPING SYSTEM	105.00 EA	-	-	77,794	181	12,256	4,229	94,279
	35-45-00-05	8 IN POST INDICATOR VALVE	OILY WATER SEWER SYSTEM	7.00 EA	-	-	16,915	64	4,358	1,504	22,776
	35-45-00-05	LARGE BORE - 3" BALL	STARTING AIR	19.00 EA	-	-	33,668	48	3,253	1,122	38,043
	35-45-00-10	SMALL BORE - 2" BALL	SERVICE AIR PIPING	10.00 EA	-	-	3,502	18	1,219	421	5,142
	35-45-00-10	SMALL BORE - 1" PRV	SERVICE AIR PIPING	6.00 EA	-	-	3,362	14	934	322	4,618
	35-45-00-10	SMALL BORE - 1/2" QUARTER TURN	SERVICE AIR PIPING	10.00 EA	-	-	242	17	1,167	403	1,812
	35-45-00-10	SMALL BORE - 3/4" QUARTER TURN	SERVICE AIR PIPING	18.00 EA	-	-	667	31	2,101	725	3,493
	35-45-00-10	SMALL BORE - 2" BALL	CLASS 600, INSTRUMENT AIR PIPING	3.00 EA	-	-	3,167	5	366	126	3,659
	35-45-00-10	SMALL BORE - 1" GLOBE	CLASS 600, INSTRUMENT AIR PIPING	31.00 EA	-	-	14,732	53	3,618	1,249	19,599
	35-45-00-10	SMALL BORE - 1/2" GLOBE	CLASS 600, INSTRUMENT AIR PIPING	18.00 EA	-	-	5,045	31	2,101	725	7,871
	35-45-00-10	SMALL BORE - 1/2" QUARTER TURN	CLASS 600, INSTRUMENT AIR PIPING	26.00 EA	-	-	13,403	45	3,035	1,047	17,485
	35-45-00-10	SMALL BORE - 2" CHECK (2OIA-V0021)	CLASS 600, INSTRUMENT AIR PIPING	5.00 EA	-	-	5,034	9	584	201	5,819
	35-45-00-10	SMALL BORE - 2" BALL	LUBE OIL PIPING SYSTEM	38.00 EA	-	-	40,068	69	4,682	1,616	46,366
	35-45-00-10	SMALL BORE - 1 1/2" GLOBE, S&L-GLOBE00	LUBE OIL PIPING SYSTEM	6.00 EA	-	-	1,208	10	700	242	2,150
	35-45-00-10	SMALL BORE - 2" BALL	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	3,502	17	1,167	403	5,072
	35-45-00-10	SMALL BORE - 2" QUARTER TURN (20WM-V0004) DIAPHRAM OPERATED	COOLING WATER PIPING SYSTEM	10.00 EA	-	-	6,637	17	1,167	403	8,207
	35-45-00-99	VALVE - 3" GLOBE	CLASS 600, INSTRUMENT AIR PIPING	10.00 EA	-	-	89,632	17	1,167	403	91,202
		VALVES					**441,380**	**811**	**54,910**	**18,948**	**515,238**
		MISCELLANEOUS									
	35-99-00-99	12 IN AREA DRAIN	FOUNDATIONS - OIL WATER SEPARATOR	2.00 EA	-	-	3,801	12	794	274	4,868
	35-99-00-99	PIPING, MISCELLANEOUS - 1" AUTOMATED DRAIN TRAP	INSTRUMENT AIR PIPING	2.00 EA	-	-	3,037	5	311	107	3,456
	35-99-00-99	PIPING, MISCELLANEOUS - 10" THRUST BLOCKS	FIRE PROTECTION PIPING SYSTEM	14.00 LS	-	-	10,405	20	1,387	479	12,270
	35-99-00-99	PIPING, MISCELLANEOUS - 4" FLOOR DRAIN	DRAIN PIPING, FLOOR DRAINS	5.00 EA	-	-	624	17	1,167	403	2,194
	35-99-00-99	PIPING, MISCELLANEOUS - 4" CLEAN OUT	DRAIN PIPING, FLOOR DRAINS	2.00 EA	-	-	795	5	311	107	1,213
	35-99-00-99	PIPING, MISCELLANEOUS - 12" 90 DEG ELBOW	DRAIN PIPING, FLOOR DRAINS	2.00 EA	-	-	1,563	4	241	83	1,887
	35-99-00-99	PIPING, MISCELLANEOUS - 12" 45 DEG ELBOW	DRAIN PIPING, FLOOR DRAINS	3.00 EA	-	-	1,947	5	356	123	2,425
	35-99-00-99	PIPING, MISCELLANEOUS - P TRAP	DRAIN PIPING, FLOOR DRAINS	2.00 EA	-	-	186	5	311	107	604
	35-99-00-99	PIPING, MISCELLANEOUS - 3" TRUCK UNLOADING CONNECTOR	LUBE OIL PIPING SYSTEM	2.00 EA	-	-	507	9	623	215	1,344
	35-99-00-99	PIPING, MISCELLANEOUS - BREATHER VENT (20LO-M0001 6" TEDECO MODEL M1067EMFV OR EQUIVALENT	LUBE OIL PIPING SYSTEM	2.00 EA	-	-	1,098	7	467	161	1,726
	35-99-00-99	PIPING, MISCELLANEOUS - 10" THRUST BLOCKS	FIRE PROTECTION PIPING SYSTEM	8.00 LS	-	-	5,946	12	792	273	7,012
		MISCELLANEOUS					**29,907**	**100**	**6,761**	**2,333**	**39,000**
		PIPING					**1,823,328**	**29,211**	**1,977,602**	**855,497**	**4,656,427**
		INSULATION									
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-99	LARGE BORE PIPING	LUBE OIL/UREA PUMP HOUSE PRE-ENGINEERED BUILDINGS	4,587.84 LF	-	-	245,403	4,660	257,122	47,999	550,524
	36-17-03-99	SMALL BORE PIPING	LUBE OIL/UREA PUMP HOUSE PRE-ENGINEERED BUILDINGS	4,323.21 LF	-	-	114,003	2,556	141,058	26,332	281,393
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**359,406**	**7,216**	**398,180**	**74,331**	**831,917**
		INSULATION, MISCELLANEOUS									
	36-99-00-99	EXHAUST DUCT INSULATION		2,375.94 SF	132,660	-					132,660
	36-99-00-99	6 IN ROOF INSULATION AND 3 IN WALL INSULATION	LUBE OIL/UREA PUMP HOUSE PRE-ENGINEERED BUILDINGS	1,257.95 SF	-	-	1,304				1,304
		INSULATION, MISCELLANEOUS			**132,660**		**1,304**				**133,965**
		INSULATION			**132,660**		**360,711**	**7,216**	**398,180**	**74,331**	**965,882**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		ELECTRICAL EQUIPMENT									
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION		1.00 LS	-	-	175,168	154	10,947	3,132	189,246
		CATHODIC PROTECTION					**175,168**	**154**	**10,947**	**3,132**	**189,246**
		COMMUNICATION SYSTEM									
	41-17-00-29	TELEPHONE - TERMINAL BOX	COMMUNICATION	20.00 EA	-	-	78,200	536	33,949	10,746	122,895
	41-17-00-51	HANDSET/SPEAKER AMPLIFIER WITH HANDSET, PRESSBAR AND MAGNETIC HOOKSWITCH, CLASS 1 DIV 2, GAI-TRONICS	COMMUNICATION	47.00 EA	-	-	42,187	270	19,140	5,476	66,803
	41-17-00-53	HORN, GAI-TRONIC, WEATHER PROOF	COMMUNICATION	5.00 EA	-	-	1,394	11	814	233	2,441
	41-17-00-54	SPEAKER AMPLIFIER, INDOOR WITH ENCLOSURE, CLASS I DIV 2, GAI-TRONICS	COMMUNICATION	7.00 EA	-	-	3,570	16	1,140	326	5,036
	41-17-00-55	SPEAKER AMPLIFIER, WEATHERPROOF WITH ALUMINUM ENCLOSURE, CLASS I DIV 2, GAI-TRONICS	COMMUNICATION	7.00 EA	-	-	5,426	20	1,425	408	7,260
		COMMUNICATION SYSTEM					**130,778**	**854**	**56,470**	**17,189**	**204,436**
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	PIGTAILS	1,135.39 LF	-	-	10,979	37	2,590	741	14,310
	41-31-00-08	#500 KCMIL CU BARE STRANDED GROUND WIRE	GROUND GRID	26,201.29 LF	-	-	356,333	1,416	100,326	28,702	485,361
	41-31-00-16	EXOTHERMIC WELD, FENCE GROUNDING CONNECTION	UNDERGROUND ELECTRICAL	208.00 EA	-	-	4,243	478	33,882	9,693	47,819
	41-31-00-16	EXOTHERMIC WELD, GATE GROUNDING CONNECTION	UNDERGROUND ELECTRICAL	110.00 EA	-	-	2,244	253	17,919	5,126	25,289
	41-31-00-18	COPPER CLAD GROUND ROD, 15' LONG, 3/4 " DIA.	UNDERGROUND ELECTRICAL	172.00 EA	-	-	35,088	395	28,018	8,016	71,122
	41-31-00-19	CADWELD		1,079.00 EA	-	-	29,349	620	43,941	12,571	85,861
	41-31-00-49	CONNECTION - EQUIPMENTCONNECTOR	UNDERGROUND ELECTRICAL	495.00 EA	-	-	23,562	398	28,222	8,074	59,858
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 35"4/0 GROUND TAIL	UNDERGROUND ELECTRICAL	492.00 EA	-	-	50,184	1,018	72,131	20,635	142,950
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 15' #4 GROUND TAIL	UNDERGROUND ELECTRICAL	71.00 EA	-	-	1,448	82	5,783	1,654	8,886
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 1-1/*2" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	612.00 EA	-	-	5,410	211	14,954	4,278	24,642
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 2" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	3,975.00 EA	-	-	59,466	1,371	97,127	27,786	184,380
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 3" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	917.00 EA	-	-	32,113	632	44,813	12,820	89,746
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - 5" BELOW GRADE GRC WITH ELBOWS AND FLANGES	UNDERGROUND ELECTRICAL	917.00 EA	-	-	65,786	843	59,750	17,094	142,630
	41-31-00-99	ELECTRICAL EQUIPMENT, GROUNDING - ENCASEMENT FOR BELOW GRADE GRC	UNDERGROUND ELECTRICAL	9,669.00 EA	-	-	233,410	3,334	236,257	67,589	537,256
	41-31-00-99	TESTING	TEST & DOCUMENTATION	1.00 LT	-	-		25	1,779	509	2,288
		ELECTRICAL EQUIPMENT, GROUNDING					**909,615**	**11,113**	**787,492**	**225,288**	**1,922,396**
		HEAT TRACING									
	41-33-00-02	3/4 IN PIPE HEAT TRACING - ALLOWANCE	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	524.03 LF	-	-	13,127	470	33,300	9,527	55,954
	41-33-00-09	6 IN PIPE HEAT TRACING - ALLOWANCE	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	1,004.39 LF	-	-	47,699	1,305	92,464	26,452	166,616
		HEAT TRACING					**60,827**	**1,775**	**125,764**	**35,979**	**222,569**
		LIGHTNING PROTECTION									
	41-35-00-01	GROUND CONDUCTOR - #4/0 BARE CONDUCTOR	PERIMETER LIGHTNING GROUND	3,144.15 LF	-	-	30,403	101	6,407	2,028	38,837
	41-35-00-99	LIGHTNING PROTECTION		1.00 LS	-	-	73,781	60	4,269	1,221	79,271
		LIGHTNING PROTECTION					**104,183**	**161**	**10,676**	**3,249**	**118,109**
		LIGHTING ACCESSORY (FIXTURE)									
	41-37-00-19	FLOURESCENT - BLDG GENERAL LIGHTING, WIRE & CONDUITS FOR MAINT/ CONTROL RM	LIGHTING, ALLOWANCE	7,075.99 SF	-	-	55,335	813	51,485	16,297	123,117
	41-37-00-59	OUTDOOR INCL. POLE - POLE MOUNTED FIXTURES	LIGHTING	11.00 EA	-	-	68,816	506	32,014	10,134	110,963
		LIGHTING ACCESSORY (FIXTURE)					**124,151**	**1,319**	**83,499**	**26,431**	**234,081**
		MOTOR CONTROL CENTER (MCC), COMPLETE									
	41-45-00-99	MOTOR CONTROL CENTER (MCC), COMPLETE - BOP	ASSUMED: 800A, 480V, 5 VER. SEC. & ARC FLASH RESISTANT TYPE	3.00 EA	-	385,560		193	12,223	3,869	401,653
	41-45-00-99	MOTOR CONTROL CENTER (MCC), COMPLETE - OEM	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-		322	20,372	6,449	26,821
		MOTOR CONTROL CENTER (MCC), COMPLETE				**385,560**		**515**	**32,596**	**10,318**	**428,474**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	A.C. DISTRIBUTION - 240V, 100A 4X PANEL		4.00 EA	-	-	16,685	14	873	276	17,834

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	A.C. DISTRIBUTION - 480V PANEL BOARD		4.00 EA	-	-	34,158	14	873	276	35,307
	41-47-00-09	A.C. DISTRIBUTION - 150A 208/120V LIGHTING & RECEPTACLE	LIGHTING	4.00 EA	-	-	33,501	18	1,164	369	35,034
	41-47-00-09	2000A, 13.8KV, 3 PHASE	INSTALL NEW DISCONNECT SWITCH BY GSU TRANSFORMER IN NEMA 4X ENCLSURE INCLUDING SUPPORTING HDWR (ALLOWANCE)	2.00 LT	-	65,688		55	3,479	226	69,393
		PANEL: CONTROL, DISTRIBUTION, & RELAY				**65,688**	**84,343**	**101**	**6,390**	**1,147**	**157,568**
		POWER TRANSFORMER									
	41-51-00-99	40 KVA, 480V/277V POWER TRANSFORMER		1.00 EA	-	7,898		55	3,479	226	11,603
	41-51-00-99	70 KVA, 480V/277V POWER TRANSFORMER		1.00 EA	-	14,217		74	4,657	1,474	20,347
	41-51-00-99	TESTING AND DOCUMENTATION		1.00 LT	-			172	12,217	3,495	15,712
	41-51-00-99	69/15 KV, 60 MVA, GSU	INCLUDING ALLOWANCES FOR FREIGHT AND LOAD TAP CHANGER	2.00 EA		10,800,000		2,989	189,172	59,881	11,049,053
		POWER TRANSFORMER				**10,822,115**		**3,290**	**209,525**	**65,075**	**11,096,716**
		SWITCHGEAR, COMPLETE									
	41-55-00-99	TEST, BREAKER CURRENT ADJUSTMENT, CALIBRATION	TEST & DOCUMENTATIONS	1.00 LS	-			51	3,247	210	3,458
		SWITCHGEAR, COMPLETE						**51**	**3,247**	**210**	**3,458**
		WIRING DEVICE									
	41-57-00-09	RECEPTACLE - 120V RECEPTACLE & SWITCH	LIGHTING	114.00 EA	-	-	23,256	262	16,589	5,251	45,096
	41-57-00-29	WELDING RECEPTACLE - 60A, 480V		14.00 EA	-	-	13,328	32	2,037	645	16,010
	41-57-00-99	WIRING DEVICE - BLOCK HEATER OUTLETS	LIGHTING	9.00 EA	-	-	6,120	52	3,274	1,036	10,431
		WIRING DEVICE					**42,704**	**346**	**21,900**	**6,932**	**71,537**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	600 V ELECTRICAL EQUIPMENT UPGRADE FROM 480 V	ALLOWANCE	1.00 LS	-	121,475	56,873	268	16,991	5,378	200,717
		ELECTRICAL EQUIPMENT, MISCELLANEOUS				**121,475**	**56,873**	**268**	**16,991**	**5,378**	**200,717**
		ELECTRICAL EQUIPMENT				**11,394,838**	**1,688,642**	**19,949**	**1,365,496**	**400,329**	**14,849,305**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY, GALVANIZED STEEL									
	42-13-47-06	12 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		1,746.75 LF	-	-	77,135	2,229	157,559	3,850	238,544
	42-13-47-07	18 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		1,746.75 LF	-	-	90,011	2,591	183,109	4,474	277,594
	42-13-47-10	36 IN WIDE SOLID BOTTOM TYPE INCLUDING SUPPORTS AND FITTINGS		4,366.88 LF	-	-	346,360	10,543	745,210	18,208	1,109,778
		CABLE TRAY, GALVANIZED STEEL					**513,506**	**15,363**	**1,085,878**	**26,532**	**1,625,916**
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	2" DROP-OFF CONDUIT TO 13.8 KV SIDE OF 1500KVA XFMR	3.00 EA	-	-	332	6	402	10	744
	42-15-23-22	4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	BETWEEN GSU XFMR & 2000A DISCONNECT SW ENCLOSURE	3.00 EA	-	-	1,627	9	609	15	2,251
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**1,959**	**14**	**1,011**	**25**	**2,995**
		CONDUIT, PVC									
	42-15-33-19	4 IN DIA, SCH 40 INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	(2) CONDUIT FROM PULL BOX TO DUCT BANK FOR GSU XFMR MAIN FEEDER & CONTROL CABLE (15FT x 2)	262.01 LF	-	-	3,296	30	2,150	53	5,499
		CONDUIT, PVC					**3,296**	**30**	**2,150**	**53**	**5,499**
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	LIGHTING	7,511.04 LF	-	-	55,774	1,675	118,410	2,893	177,077
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	COMMUNICATION	273.38 LF	-	-	2,030	61	4,310	105	6,445
	42-15-37-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	LIGHTING	873.38 LF	-	-	9,360	240	16,962	414	26,737
	42-15-37-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	2" DROP-OFF CONDUIT FROM CABLE TRAY TO 13.4KV SIDE OF 1500KVA XFMR	43.67 LF	-	-	984	18	1,249	31	2,264
	42-15-37-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	POWER & CONTROL - (2) CONDUIT FROM CABLE TRAY TO PULL BOXEX (25FT x 2)	174.68 LF	-	-	11,082	162	11,455	280	22,817
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	5" DROP-OFF CONDUIT FROM CABLE TRAY TO 480V SIDE OF 1500KVA XFMR (10FT x 3 CONDUIT)	87.34 LF	-	-	10,144	113	7,999	195	18,338
		CONDUIT, RGS					**89,374**	**2,269**	**160,385**	**3,919**	**253,677**
		CONDUIT BOX									
	42-17-00-39	PULL BOX	FOR GSU XFMR 15KV MAIN FEEDER CABLE RUN (32" W x 32" L x 20" D IN NEMA4X INCLUDING, (2) 4" HOLES, MYERS HUB, SUPPORT WALL MTG HDWR)	3.00 EA	-	-	4,488	41	2,925	71	7,484

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONDUIT BOX									
	42-17-00-39	PULL BOX	FOR GSU XFMR CONTROL/COMMUNICATION CABLE (24" W x 22" L x 12" D IN NEMA4X INCLUDING, (2) 4" HOLES, MYERS HUB, SUPPORT WALL MTG HDWR)	2.00 EA	-	-	1,768	18	1,300	32	3,100
	42-17-00-99	HOLES & VARIOUS CABLE GRIP CONNECTORS	INSTALL ON (2) 15KV & (24) 480V SWGR ENCLOSURE	24.00 EA	-	-	2,448	41	2,925	71	5,444
		CONDUIT BOX					**8,704**	**101**	**7,149**	**175**	**16,028**
		DUCT BANK									
	42-18-00-99	DUCT BANK - 3X3X3 HANDHOLE	UNDERGROUND ELECTRICAL	6.00 EA	-	-	39,168	103	7,312	179	46,658
	42-18-00-99	CONCRETE DUCT BANK	20" W x 12" H CONCRETE ENCASEMENT + (2) 4" PVC, EXCAVATION, BACKFILL & DISPOSAL	87.34 LF	-	-	6,334	150	10,575	258	17,168
	42-18-00-99	UNDERGOUND DEEP SCAN SURVEY	SERVICE BY SUBCONTRACTOR	218.34 LF	8,537	-					8,537
		DUCT BANK			**8,537**		**45,502**	**253**	**17,887**	**437**	**72,363**
		RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS									
	42-99-00-99	ADDITIONAL CONDUIT AND BOXES PER BOM		1.00 LS	-	-	5,438	71	5,027	123	10,588
		RACEWAY, CABLE TRAY, & CONDUIT, MISCELLANEOUS					**5,438**	**71**	**5,027**	**123**	**10,588**
		RACEWAY, CABLE TRAY & CONDUIT			**8,537**		**667,779**	**18,103**	**1,279,488**	**31,262**	**1,987,066**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-04	300V #16 1 TW PR TYPE E SHIELDED THERMOCOUPLE XLPE CPE	COMMUNICATION	2,305.71 LF	-	-	11,634	34	2,442	699	14,774
	43-10-00-23	#24 4 TW PR CU CATEGORY 5e PLENUM RATED JACKET		12,576.62 LF	-	-	9,071	246	17,417	4,983	31,470
	43-10-00-23	#24 4 TW PR CU CATEGORY 5e PLENUM RATED JACKET - INSTALL ONLY		262.01 LF	-	-		5	363	104	467
	43-10-00-80	TERMINATION - FIBER OPTIC		367.00 EA	-	-	3,743	316	22,419	6,414	32,576
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		4,404.00 EA	-	-	7,187	253	17,935	5,131	30,253
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 4 PR SHIELDED		1,048.05 LF	-	-	1,735	18	1,281	366	3,382
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 12 PR SHIELDED 300V		1,991.30 LF	-	-	7,633	69	4,883	1,397	13,913
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 2 PR SPOS		16,978.44 LF	-	-	23,057	390	27,666	7,915	58,637
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 2 PR SPOS		14,672.72 LF	-	-	12,657	337	23,909	6,840	43,406
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 4PR SPOS		733.64 LF	-	-	2,210	17	1,195	342	3,748
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 8PR SPOS		1,886.49 LF	-	-	8,592	2,234	158,302	45,288	212,181
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #16 8 PR SPOS , MATERAL ONLY		3,668.18 LF	-	-	16,706	0	30	9	16,744
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 8 PR SPOS		1,467.27 LF	-	-	6,371	34	2,391	684	9,446
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 8PR SPOS, MATERIA ONLY		3,248.96 LF	-	-	14,107	0	27	8	14,142
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - 2 STRAND 50/125 FO		1,781.69 LF	-	-	2,898	61	4,355	1,246	8,499
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - 2 STRAND 50/125 FO INSTALL ONLY		5,449.87 LF	-	-		188	13,321	3,811	17,131
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 4 PR SHLD, MATERIAL ONLY		3,668.18 LF	-	-	6,071	0	30	9	6,110
	43-10-00-98	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE - #20 12PR SHIELDED 300 V, MATERIA ONLY		2,724.93 LF	-	-	10,445	0	22	6	10,473
	43-10-00-99	CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - AND WIRE TAP		105.00 EA	-	-	1,428	60	4,276	1,223	6,927
	43-10-00-99	TEST AND DOCUMENTATION	.05 MH PER TERMINATION	4,877.00 EA	-	-		280	19,861	5,682	25,543
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**145,544**	**4,546**	**322,123**	**92,154**	**559,821**
		600V CABLE & TERMINATION									
	43-20-00-02	600V #12 2/C CU SHIELDED XLPE LSZH, MATERIAL RUN		2,724.93 LF	-	-	3,595				3,595
	43-20-00-02	600V #12 2/C CU SHIELDED XLPE LSZH		6,288.31 LF	-	-	8,296	116	8,196	2,345	18,837
	43-20-00-03	600V #12 3/C CU SHIELDED XLPE LSZH	LIGHTING	16,768.83 LF	-	-	28,051	366	25,958	7,426	61,436
	43-20-00-03	600V #12 3/C CU SHIELDED XLPE LSZH		5,240.26 LF	-	-	8,766	114	8,112	2,321	19,199
	43-20-00-05	600V #12 12/C CU SHIELDED XLPE LSZH		5,554.67 LF	-	-	33,768	294	20,817	5,955	60,540
	43-20-00-07	600V #10 2/C CU XLPE LSZH		1,048.05 LF	-	-	2,095	20	1,451	415	3,962
	43-20-00-07	600V #10 2/C CU XLPE LSZH		3,458.57 LF	-	-	6,914	68	4,790	1,370	13,074
	43-20-00-08	600V #10 3/C CU XLPE LSZH	LIGHTING	5,240.26 LF	-	-	13,327	121	8,539	2,443	24,309
	43-20-00-10	600V #10 4/C CU XLPE LSZH		15,720.77 LF	-	-	53,237	434	30,738	8,794	92,769
	43-20-00-10	600V #10 4/C CU XLPE LSZH		1,886.49 LF	-	-	6,388	52	3,689	1,055	11,132

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		600V CABLE & TERMINATION									
	43-20-00-10	600V #10 4/C CU XLPE LSZH		4,192.21 LF	-	-	14,196	116	8,197	2,345	24,738
	43-20-00-14	600V #8 3/C W/G CU EPR TS-CPE		7,250.77 LF	-	-	36,585	283	20,085	5,746	62,415
	43-20-00-18	600V #6 3/C W/G CU EPR TS-CPE		3,144.15 LF	-	-	27,538	170	12,039	3,444	43,021
	43-20-00-26	600V #2 3/C W/G CU EPR TS-CPE		5,240.26 LF	-	-	86,305	386	27,322	7,816	121,444
	43-20-00-28	600V #1/0 1/C CU XLPE LSZH		2,096.10 LF	-	-	8,837	63	4,440	1,270	14,547
	43-20-00-32	600V #2/0 1/C CU EPR TS-CPE		524.03 LF	-	-	2,751	17	1,238	354	4,343
	43-20-00-44	600V #350 KCMIL 3-1/C CU TRIPLEXED		2,620.13 LF	-	-	144,637	331	23,480	6,717	174,835
	43-20-00-45	600V #500 KCMIL 1/C CU		3,668.18 LF	-	-	66,400	253	17,931	5,130	89,460
	43-20-00-47	600V #750 KCMIL 1/C CU EPR TS-CPE	1/C#750 WIRE RUNS TROUGH CABLE TRAY FROM XFMR TO 480V SWGR (4 x 3= 12 x 50FT=600FT) x 2 LINEUPS	2,096.10 LF	-	-	211,893	181	12,807	3,664	228,364
	43-20-00-98	600V CABLE - #12 4/C		209.61 LF	-	-	498	6	427	122	1,047
	43-20-00-98	600V CABLE - #10 2/C W/GND		15,720.77 LF	-	-	36,245	2,169	153,691	43,968	233,904
	43-20-00-98	600V CABLE - #14 2/C		7,860.39 LF	-	-	9,451	181	12,808	3,664	25,923
	43-20-00-98	600V CABLE - #14 2/C SHLD		7,650.77 LF	-	-	7,141	176	12,467	3,567	23,174
	43-20-00-98	600V CABLE - #16 2/C		384.29 LF	-	-	495	9	626	179	1,300
	43-20-00-98	600V CABLE - #16 2/C SHLD		6,288.31 LF	-	-	6,403	145	10,247	2,931	19,581
	43-20-00-98	600V CABLE - #14 3/C		2,096.10 LF	-	-	3,469	48	3,416	977	7,862
	43-20-00-98	600V CABLE - #16 3/C		524.03 LF	-	-	756	12	854	244	1,854
	43-20-00-98	600V CABLE - #14 4/C		2,096.10 LF	-	-	4,121	72	5,123	1,466	10,710
	43-20-00-98	600V CABLE - #14 4/C, MATERIAL RUN		2,305.71 LF	-	-	4,533	0	19	5	4,557
	43-20-00-98	600V CABLE - #14 4/C SHLD		12,576.62 LF	-	-	14,232	434	30,740	8,794	53,766
	43-20-00-98	600V CABLE - #16 4/C		1,048.05 LF	-	-	1,972	36	2,562	733	5,266
	43-20-00-98	600V CABLE - #16 7/C		4,401.82 LF	-	-	12,016	152	10,759	3,078	25,853
	43-20-00-98	600V CABLE - #16 12/C		1,467.27 LF	-	-	9,650	67	4,781	1,368	15,799
	43-20-00-98	600V CABLE - #16 12/C MATERIA RUN		3,353.76 LF	-	-	15,369	0	27	8	15,405
	43-20-00-99	600V TERMINATION -		5,242.00 EA	-	-	5,347	1,506	106,738	30,536	142,621
	43-20-00-99	TEST AND DOCUMENTATION	.15 MH PER TERMINATION	5,242.00 EA	-	-		904	64,043	18,322	82,364
		600V CABLE & TERMINATION					**895,277**	**9,302**	**659,156**	**188,573**	**1,743,006**
		2000V VFD CABLE & TERMINATION									
	43-30-00-01	2000V #10 3/C W/3G CU SHIELDED, VFD CABLE		7,397.50 LF	-	-	40,700	374	26,518	7,586	74,804
	43-30-00-02	2000V #8 3/C W/3G CU SHIELDED, VFD CABLE		524.03 LF	-	-	3,550	30	2,135	611	6,295
	43-30-00-05	2000V #2 3/C W/3G CU SHIELDED, VFD CABLE		1,109.19 LF	-	-	14,669	105	7,410	2,120	24,198
	43-30-00-07	2000V #2/0 3/C W/3G CU SHIELDED, VFD CABLE		6,349.45 LF	-	-	136,326	847	60,005	17,167	213,498
	43-30-00-08	2000V #4/0 3/C W/3G CU SHIELDED, VFD CABLE		1,109.19 LF	-	-	32,569	191	13,555	3,878	50,002
	43-30-00-84	TERMINATION - 2000 V		218.00 EA	-	-	2,742	125	8,878	2,540	14,160
	43-30-00-99	TEST AND DOCUMENTATION	.3 MH PER TERMINATION	218.00 EA	-	-		75	5,327	1,524	6,851
		2000V VFD CABLE & TERMINATION					**230,556**	**1,747**	**123,827**	**35,425**	**389,808**
		15KV CABLE & TERMINATION									
	43-50-00-04	15KV #2/0 3-1/C CU TRIPLEXED	FOR MAIN FEEDER TO 1500KVA XFMR FROM 15KV SWGR, (50FT CABLE TRAY + 10FT TERM.) X 2	104.80 LF	-	-	1,283	11	751	215	2,249
	43-50-00-04	15KV #4/0 3-1/C CU TRIPLEXED	FOR (2) MAIN FEEDER TO GSU XFMR (55FT DUCT+ 40FT CABLE TRAY +10FT TERM.)	174.68 LF	-	-	2,138	24	1,722	493	4,353
	43-50-00-10	15KV #500 KCMIL 1/C CU		18,402.04 LF	-	-	416,696	2,560	181,402	51,896	649,994
	43-50-00-89	TERMINATION - COMPRESSION LUG, #2/0, 2 HOLE, COPPER	INCLUDING WIRE TAG AT EACH TEMINATION @ 1500KVA XFMR & 15KV SWGR	9.00 EA	-	-	220	13	916	262	1,399
	43-50-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER	INCLUDING WIRE TAG AT EACH TEMINATION @ SWGR, OUTDOOR DIS. SW, GSU XFMR	11.00 EA	-	-	269	21	1,478	423	2,170
	43-50-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		94.08 EA	-	-	4,862	357	25,287	7,234	37,383
	43-50-00-99	15KV TEST AND DOCUMENTATION	.5 MANHOUR PER TERMINATION	114.24 EA	-	-		66	4,652	1,331	5,983
		15KV CABLE & TERMINATION					**425,468**	**3,051**	**216,209**	**61,854**	**703,531**
		CABLE, MISCELLANEOUS									
	43-99-00-99	ADDITIONAL CABLE AND FITTING PER BOM		1.00 LS	-	-	10,657	279	19,781	5,659	36,097
		CABLE, MISCELLANEOUS					**10,657**	**279**	**19,781**	**5,659**	**36,097**
		CABLE					**1,707,502**	**18,926**	**1,341,095**	**383,665**	**3,432,263**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-99	PLANT CONTROL SYSTEM INCLUDING UPS	FURNISHED WITH OEM EQUIPMENT	1.00 LS	-	-		222	16,166	1,405	17,571
		CONTROL SYSTEM						**222**	**16,166**	**1,405**	**17,571**
		INSTRUMENT									

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		INSTRUMENT									
	44-21-00-32	FLOW ELEMENT, 20WM-FE-0001	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	4,413	41	2,925	71	7,409
	44-21-00-37	FLOW TRANSMITTER, 20WM-FT-0001	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	18,911	62	4,522	393	23,825
	44-21-00-62	PRESSURE INDICATOR PI (20SAPI0015)	SERVICE AIR PIPING	5.00 EA	-	-	350	6	419	36	805
	44-21-00-62	PRESSURE INDICATOR, 22WC-PI-0002	COOLING WATER PIPING SYSTEM	1.00 EA	-	-	434	2	167	15	616
	44-21-00-62	PRESSURE INDICATOR, 22WC-PI-0005	COOLING WATER PIPING SYSTEM	2.00 EA	-	-	869	5	335	29	1,233
	44-21-00-62	PRESSURE INDICATOR, 23WC-PI-0002	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,908	21	1,507	131	5,546
	44-21-00-62	PRESSURE INDICATOR, 23WC-PI-0005	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	3,908	21	1,507	131	5,546
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-0001 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-0003 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-0006 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 22WC-TEW-004 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0001 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0003 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0004 (2)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
	44-21-00-96	THERMOWELL (INDICATOR), 23WC-TEW-0006 (3)	COOLING WATER PIPING SYSTEM	9.00 EA	-	-	2,206	21	1,466	419	4,092
		INSTRUMENT					**50,443**	**323**	**23,111**	**4,162**	**77,715**
		CONTROL & INSTRUMENTATION					**50,443**	**545**	**39,277**	**5,567**	**95,287**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	START-UP CRAFT SUPPORT	ELECTRICIANS	1.00 LS	-	-		803	56,923	-	56,923
	61-15-00-99	START-UP CRAFT SUPPORT	PIPE FITTERS	1.00 LS	-	-		803	54,384	-	54,384
	61-15-00-99	START-UP CRAFT SUPPORT	MILLWRIGHTS	1.00 LS	-	-		703	46,258	-	46,258
	61-15-00-99	START-UP CRAFT SUPPORT	BOILERMAKERS	1.00 LS	-	-		301	19,825	-	19,825
	61-15-00-99	START-UP CRAFT SUPPORT	I&C TECHNICIANS	1.00 LS	-	-		803	58,521	-	58,521
	61-15-00-99	START-UP CRAFT SUPPORT	HIGH VOLTAGE RELAY TECHICIANS	1.00 LS	-	-		602	38,137	-	38,137
		CRAFT PERSONNEL						**4,017**	**274,047**		**274,047**
		CONSTRUCTION INDIRECT						**4,017**	**274,047**		**274,047**
		PROJECT INDIRECT									
		PROJECT INDIRECT									
	71-99-00-99	SITE GEOTECHNICAL		1.00 LS	54,400	-				-	54,400
	71-99-00-99	SITE TOPOGRAPHIC SURVEY		1.00 LS	88,400	-				-	88,400
	71-99-00-99	INDEPENDANT CQA EARTHWORK TESTING CONTRACTOR		1.00 LS	48,960	-				-	48,960
		PROJECT INDIRECT			**191,760**						**191,760**
		PROJECT INDIRECT			**191,760**						**191,760**
		1 BASE			**12,096,627**	**94,089,407**	**9,486,200**	**171,483**	**10,577,080**	**2,985,370**	**129,234,683**
BIO		**BIODIESEL SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	322.76 CY	-	-		72	3,260	1,604	4,864
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	9.88 CY	-	-		3	115	56	171
		EXCAVATION						**75**	**3,375**	**1,660**	**5,035**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.75 CY	-	-		1	55	27	82
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-		0	18	9	27
		DISPOSAL						**2**	**73**	**36**	**109**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	24.21 CY	-	-	1,053	5	244	120	1,418
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	5.96 CY	-	-	259	1	60	29	349
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	280.80 CY	-	-	12,220	48	2,182	1,067	15,469
	21-20-00-12	SAND BEDDING	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	16.68 CY	-	-	386	3	146	71	603

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL					**13,919**	**58**	**2,632**	**1,288**	**17,839**
		POND									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	3,904	18	839	98	4,842
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	199.36 SY	-	-	1,627	6			1,627
		POND					**5,531**	**24**	**839**	**98**	**6,468**
		CIVIL WORK					**19,450**	**159**	**6,920**	**3,082**	**29,451**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	17.21 CY	-	-	3,863	49	2,365	802	7,030
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	3.92 CY	-	-	880	11	539	183	1,602
		CONCRETE					**4,743**	**61**	**2,904**	**985**	**8,632**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	172.07 LB	-	-	702	10	566	23	1,291
		EMBEDMENT					**702**	**10**	**566**	**23**	**1,291**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	557.48 SF	-	-	1,403	128	7,104	1,316	9,822
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	212.35 SF	-	-	534	68	3,788	702	5,024
		FORMWORK					**1,937**	**197**	**10,892**	**2,017**	**14,846**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	22 FT DIA BIO-DIESEL DAY TANK RING FOUNDATION	3.69 TN	-	-	5,627	86	4,608	1,209	11,443
		REINFORCING					**5,627**	**86**	**4,608**	**1,209**	**11,443**
		CONCRETE					**13,009**	**353**	**18,970**	**4,233**	**36,212**
		MECHANICAL EQUIPMENT									
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, 304L STAINLESS STEEL, AWWA D100	22 FT DIA. X 18 FT TALL, 50,000 GAL - BIO-DIESEL DAY TANK	1.00 EA	976,527		-				976,527
		TANK			**976,527**						**976,527**
		MECHANICAL EQUIPMENT			**976,527**						**976,527**
		INSULATION									
		EQUIPMENT									
	36-15-00-99	INSULATION OF NEW 22 FT DIA. X 18 FT TALL, 50,000 GAL - BIO-DIESEL DAY TANK		1,625.36 SF	101,462	-					101,462
		EQUIPMENT			**101,462**						**101,462**
		INSULATION			**101,462**						**101,462**
		ELECTRICAL EQUIPMENT									
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	TANK IMMERSION HEATER	BIO-DIESEL DAY TANK	2.00 EA	-	-	22,848	46	2,910	921	26,680
	41-99-00-09	TANK RTD	BIO-DIESEL DAY TANK	2.00 EA	-	-	5,649	18	1,164	369	7,182
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**28,497**	**64**	**4,074**	**1,290**	**33,862**
		ELECTRICAL EQUIPMENT					**28,497**	**64**	**4,074**	**1,290**	**33,862**
		BIO BIODIESEL SYSTEM			**1,077,989**		**60,956**	**576**	**29,965**	**8,605**	**1,177,514**
CEMS		**CONTINUOUS EMISSIIONS MONITORING SYSTEM**									
		CIVIL WORK									
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	ADDITIONAL CT SKIDS/EQUIPMENT	33.74 CY	-	-		6	262	128	390
		EXCAVATION						**6**	**262**	**128**	**390**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	ADDITIONAL CT SKIDS/EQUIPMENT	6.13 CY	-	-	267	1	48	23	337
		BACKFILL					**267**	**1**	**48**	**23**	**337**
		CIVIL WORK					**267**	**7**	**310**	**151**	**728**
		CONCRETE									
		CONCRETE									
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	18.12 CY	-	-	4,066	26	1,245	422	5,733
	22-13-00-20	MUD MAT, 1500 PSI	ADDITIONAL CT SKIDS/EQUIPMENT	3.06 CY	-	-	395	2	84	29	508
		CONCRETE					**4,461**	**28**	**1,329**	**451**	**6,241**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	ADDITIONAL CT SKIDS/EQUIPMENT	121.53 LB	-	-	496	7	400	16	912
		EMBEDMENT					**496**	**7**	**400**	**16**	**912**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	ADDITIONAL CT SKIDS/EQUIPMENT	186.30 SF	-	-	469	43	2,374	440	3,282
		FORMWORK					**469**	**43**	**2,374**	**440**	**3,282**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	ADDITIONAL CT SKIDS/EQUIPMENT	1.26 TN	-	-	1,912	29	1,565	411	3,888
		REINFORCING					**1,912**	**29**	**1,565**	**411**	**3,888**
		CONCRETE					**7,338**	**107**	**5,668**	**1,317**	**14,323**
		RACEWAY, CABLE TRAY & CONDUIT									
		CONDUIT, RGS									
	42-15-37-02	3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		600.00 LF	-	-	4,455	134	9,459	231	14,145
		CONDUIT, RGS					**4,455**	**134**	**9,459**	**231**	**14,145**
		RACEWAY, CABLE TRAY & CONDUIT					**4,455**	**134**	**9,459**	**231**	**14,145**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-18	600V #14 7/C CU XLPE LSZH		400.00 LF	-	-	1,088	12	847	242	2,178
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**1,088**	**12**	**847**	**242**	**2,178**
		600V CABLE & TERMINATION									
	43-20-00-14	600V #8 3/C W/G CU EPR TS-CPE		400.00 LF	-	-	2,018	16	1,108	317	3,443
		600V CABLE & TERMINATION					**2,018**	**16**	**1,108**	**317**	**3,443**
		CABLE					**3,106**	**28**	**1,955**	**559**	**5,621**
		CONTROL & INSTRUMENTATION									
		MONITORING EQUIPMENT									
	44-25-00-01	CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) - NOX MONITORING SYSTEM	FURNISHED WITH OEM EQUIPMENT	5.00 LS	-	2,250,000		402	29,307	2,547	2,281,854
		MONITORING EQUIPMENT				**2,250,000**		**402**	**29,307**	**2,547**	**2,281,854**
		CONTROL & INSTRUMENTATION				**2,250,000**		**402**	**29,307**	**2,547**	**2,281,854**
		CEMS CONTINUOUS EMISSIIONS MONITORING SYSTEM				**2,250,000**	**15,166**	**677**	**46,699**	**4,806**	**2,316,671**
FUEL OIL		**FUEL OIL SYSTEM**									
		CIVIL WORK									
		STRIP & STOCKPILE TOPSOIL									
	21-14-00-15	STRIP 6" DEEP, 300 FT HAUL	ACCESS ROAD, UNLOADING AREA AND TANK AREA	3.45 AC	-	-		63	3,169	7,702	10,870
		STRIP & STOCKPILE TOPSOIL						**63**	**3,169**	**7,702**	**10,870**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		EXCAVATION									
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	55 FT DIA TANK RING FOUNDATION	800.18 CY	-	-		179	8,082	3,976	12,058
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	107.07 CY	-	-		24	1,081	532	1,613
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	76.05 CY	-	-		17	768	378	1,146
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	TRUCK UNLOADING PAD 8" THICK	26.21 CY	-	-		7	305	149	455
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	24.70 CY	-	-		6	288	141	429
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE		750.47 CY	-	-		129	5,831	2,851	8,681
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	TRUCK UNLOADING PUMP SKID FOUNDATION	81.05 CY	-	-		14	630	308	938
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	FIRE PROTECTION SKID FOUNDATION	48.03 CY	-	-		8	373	182	556
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	322.76 CY	-	-		72	3,260	1,604	4,864
	21-17-00-02	FOUNDATION EXCAVATION, COMMON EARTH USING 1 CY BACKHOE	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	9.88 CY	-	-		3	115	56	171
	21-17-00-06	MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	IMPORTED FILL MATERIAL FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	1,793.11 CY	-	-	53,622	134	6,686	16,252	76,560
	21-17-00-06	MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	IMPORTED FILL MATERIAL FOR 22 FT DIA BIO-DIESEL DAY TANK BERM	1,793.11 CY	-	-	53,622	134	6,686	16,252	76,560
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FIRE WATER UNDERGROUND	3,151.68 CY	-	-		235	10,611	5,188	15,799
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	POTABLE WATER	324.36 CY	-	-		24	1,092	534	1,626
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL TRUCK UNLOADING	252.90 CY	-	-		19	851	416	1,268
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL PUMP DISCHARGE	687.55 CY	-	-		51	2,315	1,132	3,447
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	FUEL OIL RETURN PIPING FROM TURBINES	880.07 CY	-	-		66	2,963	1,449	4,412
	21-17-00-11	TRENCH EXCAVATION 6FT TO 10 FT DEEP, COMMON EARTH USING 0.75 CY EXCAVATOR	OILY WATER DRAINAGE	479.97 CY	-	-		36	1,616	790	2,406
	21-17-00-12	TRENCH EXCAVATION 6FT TO 10FT DEEP, DENSE HARD CLAY USING 0.75 CY EXCAVATOR	DUCT BANK	1,547.29 CY	-	-		133	6,011	2,939	8,950
	21-17-00-16	EXCAVATION 4 FT TO 10 FT DEEP	OILY-WATER AND SANITARY DRAINAGE STRUCTURE	171.11 CY	-	-		29	1,329	650	1,979
		EXCAVATION					**107,243**	**1,322**	**60,895**	**55,779**	**223,917**
		DISPOSAL									
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	55 FT DIA TANK RING FOUNDATION	44.01 CY	-	-		3	137	67	204
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE WATER UNDERGROUND	772.44 CY	-	-		53	2,400	1,174	3,574
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	POTABLE WATER	47.33 CY	-	-		3	147	72	219
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL TRUCK UNLOADING	43.39 CY	-	-		3	135	66	201
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL PUMP DISCHARGE	135.25 CY	-	-		9	420	206	626
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FUEL OIL RETURN PIPING FROM TURBINES	173.13 CY	-	-		12	538	263	801
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	9.81 CY	-	-		1	46	22	68
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	OILY WATER DRAINAGE	69.68 CY	-	-		5	217	106	322
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	DUCT BANK	202.51 CY	-	-		14	629	308	937
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	TRUCK UNLOADING PAD 8" THICK	5.00 CY	-	-		1	31	15	46
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	89.06 CY	-	-		6	277	135	412
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	65.04 CY	-	-		4	202	99	301
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	TRUCK UNLOADING PUMP SKID FOUNDATION	8.01 CY	-	-		1	50	24	74
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	FIRE PROTECTION SKID FOUNDATION	4.00 CY	-	-		1	25	12	37
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	17.75 CY	-	-		1	55	27	82
	21-19-00-09	DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	3.92 CY	-	-		0	18	9	27
		DISPOSAL						**118**	**5,327**	**2,605**	**7,932**
		BACKFILL									
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	55 FT DIA TANK RING FOUNDATION	60.01 CY	-	-	2,612	13	606	298	3,516
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	18.01 CY	-	-	784	5	210	89	1,083
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	11.01 CY	-	-	479	3	128	55	662
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	TRUCK UNLOADING PAD 8" THICK	3.83 CY	-	-	167	1	60	29	255
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 50 FT DIA TANK BERM	14.89 CY	-	-	648	3	150	74	872
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	TRUCK UNLOADING PUMP SKID FOUNDATION	7.00 CY	-	-	305	2	109	53	467
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	FIRE PROTECTION SKID FOUNDATION	5.00 CY	-	-	218	2	78	38	333
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	24.21 CY	-	-	1,053	5	244	120	1,418
	21-20-00-01	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	EMBEDDED HDPE CONCRETE ANCHOR FOR 20 FT DIA L.S. DIESEL DAY TANK BERM	5.32 CY	-	-	232	1	54	26	312

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		BACKFILL									
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL	OILY WATER SEPARATOR	20.11 CY	-	-	875	3	156	76	1,108
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	55 FT DIA TANK RING FOUNDATION	696.15 CY	-	-	30,297	120	5,409	2,644	38,350
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	TRUCK UNLOADING PUMP SKID FOUNDATION	66.04 CY	-	-	2,874	11	513	251	3,638
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	FIRE PROTECTION SKID FOUNDATION	39.02 CY	-	-	1,698	9	394	193	2,285
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X2 X FT 1.85 FT	87.05 CY	-	-	3,789	15	676	331	4,796
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	PLATFORM FOUNDATIONS (4) 4 FT X 4 FT X 2 FT	62.04 CY	-	-	2,700	11	482	236	3,418
	21-20-00-02	FOUNDATION BACKFILL, SELECT STRUCTURAL FILL - CRUSHED LIMESTONE	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	280.80 CY	-	-	12,220	48	2,182	1,067	15,469
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FIRE WATER UNDERGROUND	2,379.25 CY	-	-		273	12,324	6,025	18,349
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	POTABLE WATER	277.03 CY	-	-		32	1,435	702	2,136
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL TRUCK UNLOADING	209.52 CY	-	-		24	1,085	531	1,616
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL PUMP DISCHARGE	552.26 CY	-	-		63	2,860	1,399	4,259
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DEMIN WATER PUMP DISCHARGE	552.30 CY	-	-		63	2,861	1,399	4,259
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	FUEL OIL RETURN PIPING FROM TURBINES	706.94 CY	-	-		81	3,662	1,790	5,452
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	OILY WATER DRAINAGE	410.29 CY	-	-		47	2,125	1,039	3,164
	21-20-00-11	TRENCH BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	DUCT BANK	1,344.78 CY	-	-		154	6,965	3,406	10,371
	21-20-00-12	SAND BEDDING	55 FT DIA TANK RING FOUNDATION	41.34 CY	-	-	956	8	362	177	1,495
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FIRE WATER UNDERGROUND	710.61 CY	-	-	16,429	106	4,785	2,339	23,553
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	POTABLE WATER	46.97 CY	-	-	1,086	9	411	201	1,698
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL TRUCK UNLOADING	42.38 CY	-	-	980	8	371	181	1,532
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL PUMP DISCHARGE	129.57 CY	-	-	2,996	19	872	427	4,295
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	DEMIN WATER PUMP DISCHARGE	129.57 CY	-	-	2,996	19	872	427	4,295
	21-20-00-12	TRENCH BACKFILL, SAND BEDDING	FUEL OIL RETURN PIPING FROM TURBINES	165.85 CY	-	-	3,834	25	1,117	546	5,497
	21-20-00-12	SAND BEDDING	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	16.68 CY	-	-	386	3	146	71	603
	21-20-00-16	BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	OILY-WATER AND SANITARY DRAINAGE STRUCTURE	76.05 CY	-	-		13	591	289	880
		BACKFILL					**90,613**	**1,204**	**54,295**	**26,528**	**171,436**
		EQUIPMENT									
	21-37-00-99	UNDERGROUND OIL WATER SEPARATOR 500 GPM WITH 2x250 GPM INTEGRAL PUMPS	OILY WATER SYSTEM	1.00 LS	-	151,286		138	8,281	2,067	161,635
		EQUIPMENT				**151,286**		**138**	**8,281**	**2,067**	**161,635**
		EROSION AND SEDIMENTATION CONTROL									
	21-41-00-60	SILT FENCE		1,999.49 LF	-	-	3,481	161	7,367	860	11,708
		EROSION AND SEDIMENTATION CONTROL					**3,481**	**161**	**7,367**	**860**	**11,708**
		POND									
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	1,244.33 SY	-	-	24,369	114	5,238	612	30,219
	21-55-00-10	60 MIL THICK HDPE SMOOTH LINER	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	199.36 SY	-	-	3,904	18	839	98	4,842
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	1,244.33 SY	-	-	10,153	36			10,153
	21-55-00-69	GEOSYNTHETIC CLAY LINER (GCL)	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	199.36 SY	-	-	1,627	6			1,627
		POND					**40,053**	**174**	**6,077**	**709**	**46,840**
		SURVEY									
	21-67-00-29	SITE SURVEY		1.00 LS	68,000	-				-	68,000
		SURVEY			**68,000**						**68,000**
		CIVIL WORK, MISCELLANEOUS									
	21-99-00-99	STABILIZED CONSTRUCTION ENTRANCE/EXIT	STABILIZED CONSTRUCTION ENTRANCE	1.00 EA	-	-	2,040	23	1,037	507	3,583
		CIVIL WORK, MISCELLANEOUS					**2,040**	**23**	**1,037**	**507**	**3,583**
		CIVIL WORK			**68,000**	**151,286**	**243,430**	**3,204**	**146,448**	**96,756**	**705,921**
		CONCRETE									
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	55 FT DIA TANK RING FOUNDATION	42.68 CY	-	-	9,576	123	5,864	1,988	17,429
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	TRUCK UNLOADING PAD 8" THICK	92.06 CY	-	-	20,658	132	6,325	2,144	29,127

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONCRETE									
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 50 FT DIA TANK BERM	8.76 CY	-	-	1,965	25	1,203	408	3,576
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	17.21 CY	-	-	3,863	49	2,365	802	7,030
	22-13-00-02	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	3.92 CY	-	-	880	11	539	183	1,602
	22-13-00-03	MAT FOUNDATION LESS THAN 5 FT THICK, 4500 PSI	OILY WATER SEPARATOR	25.02 CY	-	-	5,614	36	1,719	583	7,915
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	11.74 CY	-	-	2,634	34	1,613	547	4,794
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	12.47 CY	-	-	2,799	36	1,714	581	5,094
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	6.00 CY	-	-	1,347	17	825	280	2,452
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	3.00 CY	-	-	674	9	413	91	1,178
	22-13-00-05	SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	5.00 CY	-	-	1,123	14	687	152	1,963
	22-13-00-20	MUD MAT, 1500 PSI	OILY WATER SEPARATOR	10.11 CY	-	-	1,306	6	278	94	1,678
	22-13-00-20	FLOWABLE FILL, 1500 PSI	DUCT BANK	202.51 CY	-	-	26,164	116	5,566	1,887	33,616
	22-13-00-70	PIPE THRUST BLOCK, 4500 PSI	FIRE PROTECTION - VALVE SUPPORTS	6.60 EA	-	-	1,481	23	1,366	341	3,189
		CONCRETE					**80,083**	**631**	**30,477**	**10,080**	**120,641**
		EMBEDMENT									
	22-15-00-10	EMBEDMENTS, CARBON STEEL	OILY WATER SEPARATOR	200.04 LB	-	-	816	11	658	27	1,501
	22-15-00-10	EMBEDMENTS, CARBON STEEL	55 FT DIA TANK RING FOUNDATION	426.58 LB	-	-	1,741	25	1,403	57	3,201
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	117.36 LB	-	-	479	13	772	32	1,282
	22-15-00-10	EMBEDMENTS, CARBON STEEL	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	124.69 LB	-	-	509	14	820	34	1,362
	22-15-00-10	EMBEDMENTS, CARBON STEEL	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	60.01 LB	-	-	245	7	395	16	656
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	30.01 LB	-	-	122	3	197	9	329
	22-15-00-10	EMBEDMENTS, CARBON STEEL	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	50.01 LB	-	-	204	6	329	15	548
	22-15-00-10	EMBEDMENTS, CARBON STEEL	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	172.07 LB	-	-	702	10	566	23	1,291
		EMBEDMENT					**4,818**	**90**	**5,140**	**212**	**10,170**
		FORMWORK									
	22-17-00-10	BUILT UP INSTALL & STRIP	OILY WATER SEPARATOR	180.00 SF	-	-	453	41	2,294	425	3,171
	22-17-00-10	BUILT UP INSTALL & STRIP	55 FT DIA TANK RING FOUNDATION	1,382.08 SF	-	-	3,477	318	17,612	3,262	24,350
	22-17-00-10	BUILT UP INSTALL & STRIP	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	144.00 SF	-	-	362	66	3,670	680	4,712
	22-17-00-10	BUILT UP INSTALL & STRIP	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	104.00 SF	-	-	262	31	1,723	319	2,304
	22-17-00-10	BUILT UP INSTALL & STRIP	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	84.00 SF	-	-	211	25	1,392	258	1,861
	22-17-00-10	BUILT UP INSTALL & STRIP	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	147.99 SF	-	-	372	44	2,452	3,759	6,583
	22-17-00-10	BUILT UP INSTALL & STRIP	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	128.00 SF	-	-	322	38	2,120	3,251	5,694
	22-17-00-10	BUILT UP INSTALL & STRIP	TRUCK UNLOADING PAD 8" THICK	166.75 SF	-	-	420	54	2,975	551	3,945
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 55 FT DIA TANK BERM	473.99 SF	-	-	1,193	153	8,456	1,566	11,215
	22-17-00-10	BUILT UP INSTALL & STRIP	DUCT BANK	3,821.35 SF	-	-	9,615	878	48,695	9,018	67,327
	22-17-00-10	BUILT UP INSTALL & STRIP	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	557.48 SF	-	-	1,403	128	7,104	1,316	9,822
	22-17-00-10	BUILT UP INSTALL & STRIP	EMBEDDED HDPE CONCRETE ANCHOR FOR 22 FT DIA L.S. DIESEL DAY TANK BERM	212.35 SF	-	-	534	68	3,788	702	5,024
		FORMWORK					**18,623**	**1,845**	**102,279**	**25,105**	**146,008**
		PRECAST									
	22-23-00-39	PRECAST CONCRETE TRENCH	PRECAST CONCRETE TRENCH (POTABLE WATER) 2 FT X 2 FT INCLUDING GRATING COVER	49.99 LF	-	-	19,706	46	2,296	5,581	27,583
	22-23-00-41	ELECTRICAL PRECAST MANHOLE, 4 FT BY 4 FT BY 6 FT		4.00 EA	-	-	20,500	129	5,805	2,838	29,143
	22-23-00-50	MANHOLE - 3 FT ID BY 4 FT DEEP	OILY WATER SYSTEM	3.00 EA	-	-	5,563	55	2,488	1,216	9,267
	22-23-00-50	PRECAST CONCRETE OUTLET STRUCTURE	OUTLET STRUCTURE 8 FT DIA.	1.00 EA	-	-	1,408	17	777	380	2,565
		PRECAST					**47,177**	**247**	**11,366**	**10,015**	**68,559**
		REINFORCING									
	22-25-00-10	UNCOATED A615 GR60	OILY WATER SEPARATOR	1.70 TN	-	-	2,582	39	2,114	555	5,251
	22-25-00-10	UNCOATED A615 GR60	55 FT DIA TANK RING FOUNDATION	9.16 TN	-	-	13,951	212	11,425	2,997	28,373
	22-25-00-10	UNCOATED A615 GR60	FUEL OIL PUMP SKIDS 6 FT X 12 FT X 2 FT 4 EACH	0.79 TN	-	-	1,196	36	1,958	514	3,668
	22-25-00-10	UNCOATED A615 GR60	FIRE PROTECTION SKID 6 FT X 12 FT X 2 FT	0.40 TN	-	-	611	19	1,000	262	1,874
	22-25-00-10	UNCOATED A615 GR60	TRUCK UNLOADING PUMP SKID 9 FT X 17 FT X 2 FT	0.84 TN	-	-	1,278	39	2,093	549	3,920
	22-25-00-10	UNCOATED A615 GR60	PIPING SUPPORTS - FOUNDATIONS (10) 2 FT X 2 X FT 1.85 FT	0.21 TN	-	-	314	10	514	66	894
	22-25-00-10	UNCOATED A615 GR60	PLATFORM FOUNDATIONS 4 FT X 4 FT X 2 FT, 4 EACH	0.34 TN	-	-	516	16	846	109	1,471
	22-25-00-10	UNCOATED A615 GR60	TRUCK UNLOADING PAD 8" THICK	6.11 TN	-	-	9,310	283	15,248	4,000	28,558
	22-25-00-10	UNCOATED A615 GR60	DUCT BANK	9.00 TN	-	-	13,704	209	11,223	2,944	27,871
	22-25-00-10	UNCOATED A615 GR60	22 FT DIA L.S. DIESEL DAY TANK RING FOUNDATION	3.69 TN	-	-	5,627	86	4,608	1,209	11,443
		REINFORCING					**49,088**	**948**	**51,030**	**13,204**	**113,323**
		CONCRETE					**199,790**	**3,761**	**200,293**	**58,617**	**458,699**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		STEEL									
		ROLLED SHAPE									
	23-25-00-02	LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	0.61 TN	-	-	3,691	17	1,141	612	5,444
	23-25-00-10	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, TWO COAT PAINTED	ALLOWANCE FOR MISC. COMPONENT SUPPORTS	8.00 TN	-	-	37,859	175	11,520	6,182	55,562
	23-25-00-11	MEDIUM WEIGHT MEMBERS, 21 LB/LF TO 40 LB/LF, GALVANIZED	FUEL OIL STORAGE (CONTAINMENT)	5.51 TN	-	-	27,639	121	7,932	4,257	39,827
	23-25-00-99	FABRICATED STEEL INTERNAL TANK IMMERSION HEATER SUPPORTS		11.00 EA	-	-	11,124	379	24,962	13,396	49,483
		ROLLED SHAPE					**80,312**	**692**	**45,555**	**24,448**	**150,315**
		STEEL					**80,312**	**692**	**45,555**	**24,448**	**150,315**
		PAINTING & COATING									
		COATING									
	27-13-00-99	COATING - MISC STEEL		1.00 LS	38,080	-					38,080
		COATING			**38,080**						**38,080**
		PAINTING									
	27-17-00-18	PIPE PAINTING, 4 IN DIA	FIRE WATER ABOVE GROUND	559.86 LF	-	-	2,452	86	5,111	2,211	9,774
	27-17-00-21	PIPE PAINTING, 10 IN DIA	FIRE WATER ABOVE GROUND	187.45 LF	-	-	1,958	75	4,487	1,950	8,395
		PAINTING					**4,410**	**161**	**9,598**	**4,161**	**18,169**
		PAINTING & COATING			**38,080**		**4,410**	**161**	**9,598**	**4,161**	**56,249**
		MECHANICAL EQUIPMENT									
		PUMP									
	31-75-00-99	PUMP AND FILTER - FUEL OIL KIDNEY FILTER SKID	200 GPM PUMP AND FILTRATION	2.00 EA	-	1,512,864	-	92	5,521	1,378	1,519,763
	31-75-00-99	PUMP - FUEL OIL TRUCK UNLOADING SKID (PUMPS, STRAINER, ETC.)	SKID:2 X100%, 100 GPM, 120 FT, 5 HP, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	541,059	-	55	3,313	827	545,198
	31-75-00-99	FUEL OIL FORWARDING PUMP SKID	SKID:2 X 100%, 100GPM, 150 FT, DUPLEX STRAINER ISOLATION AND CHECK VALVES	1.00 EA	-	86,289	-	55	3,313	827	90,429
		PUMP				**2,140,212**		**202**	**12,146**	**3,032**	**2,155,390**
		TANK									
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	45 FT DIA. X 35 FT TALL, 412,500 GAL L.S. DIESEL STORAGE TANK	2.00 EA	2,000,000		-				2,000,000
	31-83-00-99	TANK - F.O. STORAGE TANK, CARBON STEEL, COATED, AWWA D100	22 FT DIA. X 18 FT TALL, 50,000 GAL - L.S. DIESEL DAY TANK	1.00 EA	605,223		-				605,223
	31-83-00-99	TANK COATING	55 FT DIA. X 48 FT TALL, 660,000 GAL L.S. DIESEL STORAGE TANK - INCLUDES ALLOWANCE FOR ADDITIONAL INTERNAL TANK BOTTOM COATING	9,503.54 SF	299,289		-				299,289
	31-83-00-99	TANK COATING	22 FT DIA. X 18 FT TALL, 40,000 GAL - L.S. DIESEL DAY TANK - INCLUDES ALLOWANCE FOR ADDITIONAL INTERNAL TANK BOTTOM COATING	1,445.61 SF	45,526		-				45,526
		TANK			**2,950,038**						**2,950,038**
		MECHANICAL EQUIPMENT			**2,950,038**	**2,140,212**		**202**	**12,146**	**3,032**	**5,105,428**
		PIPING									
		SS 316, ABOVE GROUND, PROCESS AREA									
	35-13-02-18	2 IN DIA, SCH 40S	FALSE START DRAIN	223.94 LF	-	-	27,898	363	24,577	28,409	80,884
	35-13-02-18	2 IN DIA, SCH 40S	MISC. VENTS AND DRAINS	223.94 LF	-	-	27,898	363	24,577	28,409	80,884
	35-13-02-26	4 IN DIA, SCH 40S	FUEL OIL TRUCK UNLOADING	187.45 LF	-	-	25,825	392	26,555	9,163	61,543
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP DISCHARGE	249.94 LF	-	-	55,066	580	39,297	13,560	107,923
	35-13-02-30	6 IN DIA, SCH 40S	FUEL OIL PUMP SUCTION	149.96 LF	-	-	33,040	348	23,578	8,136	64,754
		SS 316, ABOVE GROUND, PROCESS AREA					**169,726**	**2,047**	**138,585**	**87,678**	**395,989**
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-40	10 IN DIA, SCH 40	FIRE WATER ABOVE GROUND	83.98 LF	-	-	20,301	232	15,688	5,413	41,402
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					**20,301**	**232**	**15,688**	**5,413**	**41,402**
		SS 316, BURIED									
	35-15-02-26	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL TRUCK UNLOADING	249.94 LF	-	-	27,125	423	28,636	9,882	65,643
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL PUMP DISCHARGE	1,119.71 LF	-	-	201,315	2,513	170,125	58,705	430,145
	35-15-02-30	4 IN DIA, SCH 40S, WRAPPED, DOUBLE WALL	FUEL OIL RETURN PIPING FROM TURBINES	1,343.66 LF	-	-	241,578	3,016	204,149	70,446	516,174
		SS 316, BURIED					**470,019**	**5,951**	**402,910**	**139,032**	**1,011,962**
		HDPE, BURIED									
	35-15-30-10	2 IN DIA, DR 11	POTABLE WATER	799.80 LF	-	-	3,698	414	28,014	9,667	41,379
	35-15-30-22	6 IN DIA, DR 11	OILY WATER DRAINAGE	895.77 LF	-	-	14,254	618	41,834	14,436	70,523

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		HDPE, BURIED									
	35-15-30-25	8 IN DIA, DR 9	FIRE WATER UNDERGROUND	167.96 LF	-	-	6,441	160	10,851	3,744	21,036
	35-15-30-29	10 IN DIA, DR 9	FIRE WATER UNDERGROUND	1,119.71 LF	-	-	61,826	1,262	85,411	29,473	176,710
		HDPE, BURIED					**86,219**	**2,454**	**166,109**	**57,319**	**309,648**
		CAST IRON, BURIED									
	35-15-37-99	4 IN DIA	OILY-WATER DRAINAGE	223.94 LF	-	-	12,971	72	4,851	1,674	19,496
	35-15-37-99	6 IN DIA	OILY-WATER DRAINAGE	279.93 LF	-	-	27,743	106	7,166	2,473	37,382
		CAST IRON, BURIED					**40,714**	**178**	**12,017**	**4,147**	**56,878**
		PIPE SUPPORTS, HANGERS									
	35-35-00-02	SINGLE ROD SUPPORT W/O BEAM FOR 2 IN DIA PIPE		61.00 EA	-	-	14,518	140	9,494	3,276	27,287
	35-35-00-05	SINGLE ROD SUPPORT W/O BEAM FOR 4 IN PIPE		57.00 EA	-	-	18,062	262	17,742	6,122	41,926
	35-35-00-06	SINGLE ROD SUPPORT W/O BEAM FOR 6 IN PIPE		9.00 EA	-	-	3,244	62	4,202	1,450	8,896
	35-35-00-08	SINGLE ROD SUPPORT W/O BEAM FOR 10 IN PIPE		1.00 EA	-	-	510	9	623	215	1,347
	35-35-00-26	SINGLE ROD SUPPORT W/ BEAM FOR 2 IN PIPE		61.00 EA	-	-	16,177	245	16,614	5,733	38,524
	35-35-00-29	SINGLE ROD SUPPORT W/ BEAM FOR 4 IN PIPE		57.00 EA	-	-	23,489	498	33,710	11,632	68,831
	35-35-00-30	SINGLE ROD SUPPORT W/ BEAM FOR 6 IN PIPE		10.00 EA	-	-	4,556	110	7,470	2,578	14,604
	35-35-00-32	SINGLE ROD SUPPORT W/ BEAM FOR 10 IN PIPE		3.00 EA	-	-	1,860	46	3,128	1,079	6,068
		PIPE SUPPORTS, HANGERS					**82,416**	**1,373**	**92,982**	**32,085**	**207,484**
		VALVES									
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	4.00 EA	-	-	4,202	38	2,552	881	7,636
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	4.00 EA	-	-	4,202	38	2,552	881	7,636
	35-45-00-05	4 IN SS SWING CHECK VALVE, #150	FO	2.00 EA	-	-	2,101	16	1,089	376	3,567
	35-45-00-05	4 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	4.00 EA	-	-	4,202	32	2,179	752	7,133
	35-45-00-05	6 IN SS SPLIT/FLEXIBLE WEDGE GATE VALVE	FO	2.00 EA	-	-	4,903	42	2,817	972	8,692
	35-45-00-06	1 IN RELIEF VALVE		7.00 EA	-	-	3,628	21	1,416	489	5,533
	35-45-00-29	8 IN VALVE, CLASS 125 DI POST INDICATOR GATE VALVE	FIRE PROTECTION	10.00 EA	-	-	56,032	115	7,782	2,685	66,499
	35-45-00-29	8 IN BUTTERFLY VALVE, FUSIBLE LINK LUGGED ENDS		2.00 EA	-	-	27,119	24	1,634	564	29,318
		VALVES					**106,391**	**325**	**22,022**	**7,599**	**136,012**
		STAINLESS STEEL VALVES									
	35-46-00-10	2 IN BALL VALVE, CLASS 600, WELD END		22.00 EA	-	-	12,327	137	9,245	3,190	24,762
	35-46-00-10	2 IN CHECK VALVE, CLASS 600, WELD END		4.00 EA	-	-	2,942	25	1,681	580	5,203
	35-46-00-19	4 IN CHECK VALVE, CLASS 150, WELD END		2.00 EA	-	-	5,043	19	1,276	440	6,759
	35-46-00-20	4 IN GATE VALVE, CLASS 150, WELD END		11.00 EA	-	-	27,274	104	7,019	2,422	36,715
	35-46-00-24	6 IN CHECK VALVE, CLASS 900, WELD END		2.00 EA	-	-	27,063	51	3,473	1,198	31,735
	35-46-00-24	6 IN GATE VALVE, CLASS 150, WELD END		10.00 EA	-	-	44,405	131	8,871	3,061	56,338
	35-46-00-24	6 IN GATE VALVE, CLASS 900, WELD END		11.00 EA	-	-	146,538	282	19,102	6,592	172,232
	35-46-00-24	6 IN GATE VALVE, CLASS 150, MOTOR OPERATED, WELD END		5.00 EA	-	-	73,542	82	5,525	1,906	80,973
	35-46-00-28	8 IN CHECK VALVE, CLASS 150, WELD END		2.00 EA	-	-	15,549	37	2,475	854	18,877
	35-46-00-28	8 IN GATE VALVE, CLASS 150, WELD END		5.00 EA	-	-	35,580	91	6,186	2,135	43,901
	35-46-00-28	8 IN GATE VALVE, CLASS 150,WELD END, ELECTRIC MOTOR OPERATED		2.00 EA	-	-	25,775	45	3,019	1,042	29,836
		STAINLESS STEEL VALVES					**416,038**	**1,003**	**67,872**	**23,421**	**507,331**
		MISCELLANEOUS VALVES									
	35-49-00-99	6 IN DIA POST INDICATOR VALVE WITH 12 IN X 6 IN REDUCER	OILY WATER SYSTEM	4.00 EA	-	-	29,047	55	3,735	1,289	34,071
		MISCELLANEOUS VALVES					**29,047**	**55**	**3,735**	**1,289**	**34,071**
		MISCELLANEOUS									
	35-99-00-99	6 IN FIRE HYDRANT CAST IRON, CLASS 125	FUEL OIL TANK AREA	4.00 EA	-	-	26,335	28	1,868	644	28,847
	35-99-00-99	4 IN RUBBER FUEL OIL HOSE	FUEL OIL TANK AREA	29.52 LF	-	-	1,214	17	1,130	390	2,735
	35-99-00-99	PIPING, 10 IN HDPE PIPE TIE-IN TO EXISTING 10 IN HDPE	TIE-IN TO EXISTING PIPING, INCLUDING EXCAVATION AND BACKFILL	1.00 EA		-	588	57	3,891	1,343	5,821
		MISCELLANEOUS					**28,137**	**102**	**6,889**	**2,377**	**37,403**
		PIPING					**1,449,007**	**13,720**	**928,810**	**360,361**	**2,738,178**
		INSULATION									
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING									
	36-17-03-20	1 IN THICK, 2 IN PIPE		447.88 LF	-	-	5,665	139	7,644	1,427	14,735
	36-17-03-35	1 IN THICK, 4 IN PIPE		993.75 LF	-	-	17,840	393	21,687	4,049	43,576
	36-17-03-41	1.5 IN THICK, 6 IN PIPE		251.94 LF	-	-	6,955	124	6,841	1,277	15,073
	36-17-03-51	1.5 IN THICK, 10 IN PIPE		83.98 LF	-	-	3,563	52	2,893	540	6,996

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		PIPE, MINERAL WOOL W/ALUMINUM JACKETING					**34,023**	**708**	**39,065**	**7,292**	**80,381**
		INSULATION					**34,023**	**708**	**39,065**	**7,292**	**80,381**
		ELECTRICAL EQUIPMENT									
		CATHODIC PROTECTION									
	41-15-00-99	CATHODIC PROTECTION		1.00 EA	76,160	-					76,160
		CATHODIC PROTECTION			**76,160**						**76,160**
		CONTROL & BACKUP POWER									
	41-21-00-99	125V DC, 200A BATTERY CHARGER	ELECTRICAL ROOM	2.00 EA	-	-	81,600	37	2,328	737	84,665
	41-21-00-99	UPS 40 KVA INVERTER	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	68,000	23	1,455	461	69,916
	41-21-00-99	125V DC BATTERIES, 400 AH WITH BATTERY RACK	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	136,000	41	2,619	829	139,448
	41-21-00-99	120VAC, 225A UPS PANEL, 42 CIRCUITS	ELECTRICAL ROOM - DISTRIBUTE UPS POWER	1.00 EA	-	-	3,400	18	1,164	369	4,933
	41-21-00-99	UPS BYPASS TRANSFORMER, 480-120VAC, 30 KVA	ELECTRICAL ROOM - ALTERNATE AC FEED FOR MAINTENANCE	2.00 EA	-	-	20,604	37	2,328	737	23,669
	41-21-00-99	125VDC, 200A DISTRIBUTION PANEL	ELECTRICAL ROOM - BACKUP POWER	1.00 EA	-	-	49,980	18	1,164	369	51,513
	41-21-00-99	UPS REMOTE BYPASS SWITCH	ELECTRICAL ROOM - FOR UPS BYPASS TRANSFORMER	2.00 EA	-	-	13,600	18	1,164	369	15,133
		CONTROL & BACKUP POWER					**373,184**	**193**	**12,223**	**3,869**	**389,277**
		ELECTRICAL EQUIPMENT, GROUNDING									
	41-30-00-16	#500 KCMIL CU BARE STRANDED GROUND WIRE	UNDERGROUND GRID INCLUDING TO BURIED GRID	1,679.57 LF	-	-	26,269	212	15,053	4,306	45,628
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE	PIGTAILS FROM UG GRID TO BLDG STEEL AND EQUIPMENT (20 CABLES)	223.94 LF	-	-	2,165	26	1,873	536	4,575
	41-31-00-06	#4/0 CU BARE STRANDED GROUND WIRE		895.77 LF	-	-	8,662	29	2,043	585	11,290
	41-31-00-16	EXOTHERMIC WELD	#4/0 AWG WIRE, 20 CABLES, 2 WELDS PER CABLE	45.00 EA	-	-	918	103	7,330	2,097	10,345
	41-31-00-16	EXOTHERMIC WELD		9.00 EA	-	-	184	21	1,466	419	2,069
	41-31-00-18	COPPER CLAD GROUND ROD, 20' LONG, 3/4 " DIA.		17.00 EA	-	-	3,468	39	2,769	792	7,029
	41-31-00-18	COPPER CLAD GROUND ROD, 15' LONG, 3/4 " DIA.		4.00 EA	-	-	816	9	652	186	1,654
	41-31-00-69	STRAP, LUG		9.00 EA	-	-	220	11	806	231	1,257
	41-31-00-99	TEST AND DOCUMENTATION		54.00 EA	-	-		9	660	0	660
		ELECTRICAL EQUIPMENT, GROUNDING					**42,702**	**461**	**32,653**	**9,153**	**84,508**
		HEAT TRACING									
	41-33-00-05	2 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	447.88 LF	-	-	13,127	458	32,475	9,291	54,892
	41-33-00-08	4 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	993.75 LF	-	-	33,936	1,120	79,340	22,698	135,974
	41-33-00-09	6 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	251.94 LF	-	-	11,965	327	23,193	6,635	41,793
	41-33-00-10	8 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	251.94 LF	-	-	13,969	368	26,067	7,457	47,493
	41-33-00-11	10 IN PIPE HEAT TRACING	INCLUDING HEAT TRACE CABLE, THERMOSTAT, END LINE RESISTOR, STRAPS, HEAT TRACE SPLICE KIT, BREAKER, CONDUIT, FITTINGS, AND WIRE	74.98 LF	-	-	4,828	122	8,674	2,482	15,984
	41-33-00-30	HEAT TRACING PANEL		5.00 EA	-	-	35,700	138	8,731	2,764	47,195
	41-33-00-99	HEAT TRACE ENGINEERING		1.00 LS	27,200	-					27,200
		HEAT TRACING			**27,200**		**113,525**	**2,533**	**178,481**	**51,326**	**370,532**
		LIGHTNING PROTECTION									
	41-35-00-99	LIGHTNING PROTECTION		1.00 LS	99,008	-					99,008
		LIGHTNING PROTECTION			**99,008**						**99,008**
		EXTERIOR LIGHTING									
	41-38-00-99	LIGHTING - FIXTURES, ACCESSORY	OUTDOOR BUILDING AND AREA LIGHTING	1.00 LS	85,000	-					85,000
		EXTERIOR LIGHTING			**85,000**						**85,000**
		MOTOR CONTROL CENTER (MCC), COMPLETE									
	41-45-00-09	480V, 1500A MOTOR CONTROL CENTER, 7 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER TO BOP LOADS	2.00 EA	-	175,930		207	14,623	357	190,910
		MOTOR CONTROL CENTER (MCC), COMPLETE				**175,930**		**207**	**14,623**	**357**	**190,910**
		PANEL: CONTROL, DISTRIBUTION, & RELAY									
	41-47-00-09	OUTDOOR-RATED NEMA 4 480VAC PANEL, 3-PH, 60HZ 800A COPPER BUS, FULLY RATED, 800A MAIN BRKR, W/ 2 - 350A FEEDER BRKR AND 2 - 50A FEEDER BRKRS		1.00 EA	-	-	35,714	32	2,037	645	38,396
	41-47-00-39	TANK HEATER CONTACTOR		2.00 EA	-	-	62,710	34	2,183	691	65,583
		PANEL: CONTROL, DISTRIBUTION, & RELAY					**98,424**	**67**	**4,220**	**1,336**	**103,980**

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		POWER TRANSFORMER									
	41-51-00-09	30KVA HEAT TRACE TRANSFORMER OUTDOOR RATED NEMA 3R W/ WEATHER SHIELD, 480-120/208VAC, 3-PHASE, 60HZ, COPPER WINDINGS, 150°C RISE WITH 220°C INSULATION		5.00 EA	-	-	116,756	115	7,276	2,303	126,335
	41-51-00-19	25KVA, 3-PHASE, 480-120/240V DRY TYPE TRANSFORMER	ELECTRICAL ROOM - BUILDING POWER AND LIGHTING	2.00 EA	-		16,483	74	4,639	301	21,423
	41-51-00-99	1200/1650 KVA DRY TYPE TRANSFORMER, 4160/480V, PAD MOUNTED		2.00 EA	-	262,907		437	27,648	8,752	299,307
		POWER TRANSFORMER				**262,907**	**133,239**	**625**	**39,563**	**11,356**	**447,065**
		SWITCHGEAR, COMPLETE									
	41-55-00-99	480V, 3200A SWITCHGEAR 4 VERTICAL SECTIONS	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO LV MOTOR AND MCC's	1.00 EA	-	479,808		463	29,336	9,286	518,430
	41-55-00-99	4160V, 2000A SWITCHGEAR 5 VERTICAL SECTIONS MAIN-TIE-MAIN	ELECTRICAL ROOM - DISTRIBUTE POWER FROM TRANSFORMERS TO MV MOTOR LOADS AND TRANSFORMERS	1.00 EA	-	539,784		489	30,966	9,802	580,552
		SWITCHGEAR, COMPLETE				**1,019,592**		**953**	**60,302**	**19,088**	**1,098,982**
		ELECTRICAL EQUIPMENT, MISCELLANEOUS									
	41-99-00-09	IN-LINE DIESEL HEATER	L.S. DIESEL STORAGE TANK	2.00 EA	-	-	217,721	92	5,821	1,842	225,384
	41-99-00-09	DIESEL RTD	L.S. DIESEL STORAGE TANK	2.00 EA	-	-	5,649	18	1,164	369	7,182
		ELECTRICAL EQUIPMENT, MISCELLANEOUS					**223,370**	**110**	**6,985**	**2,211**	**232,566**
		ELECTRICAL EQUIPMENT			**287,368**	**1,458,429**	**984,444**	**5,149**	**349,051**	**98,696**	**3,177,988**
		RACEWAY, CABLE TRAY & CONDUIT									
		CABLE TRAY, ALUMINUM									
	42-13-37-01	12 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		356.91 LF	-	-	12,615	453	32,049	783	45,447
	42-13-37-03	24 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		237.94 LF	-	-	10,983	478	33,818	826	45,627
	42-13-37-05	36 IN WIDE LADDER TYPE INCLUDING SUPPORTS AND FITTINGS		832.79 LF	-	-	45,689	2,014	142,318	3,477	191,484
		CABLE TRAY, ALUMINUM					**69,287**	**2,945**	**208,185**	**5,087**	**282,558**
		CONDUIT, ALUMINUM									
	42-15-13-03	1 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		2,379.39 LF	-	-	19,383	588	41,571	1,016	61,970
	42-15-13-06	2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		3,569.09 LF	-	-	70,382	1,301	91,940	2,246	164,569
	42-15-13-08	3 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		3,569.09 LF	-	-	127,902	2,384	168,509	4,117	300,528
	42-15-13-10	4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,189.70 LF	-	-	67,146	993	70,188	1,715	139,049
	42-15-13-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,189.70 LF	-	-	105,574	1,381	97,644	2,386	205,603
		CONDUIT, ALUMINUM					**390,388**	**6,648**	**469,852**	**11,480**	**871,719**
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
	42-15-23-14	1 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		71.00 EA	-	-	2,696	82	5,768	141	8,605
	42-15-23-18	2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		47.00 EA	-	-	5,204	89	6,300	154	11,658
	42-15-23-20	3 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		24.00 EA	-	-	8,827	55	3,900	95	12,822
	42-15-23-22	4 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		12.00 EA	-	-	6,506	34	2,437	60	9,003
	42-15-23-23	5 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS		12.00 EA	-	-	18,353	38	2,681	66	21,099
		CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**41,586**	**298**	**21,086**	**515**	**63,187**
		CONDUIT, PVC									
	42-15-33-15	3 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	1,343.66 LF	-	-	13,047	125	8,844	216	22,108
	42-15-33-21	5 IN DIA, SCH 40 INCLUDING ELBOWS, AND MISC HARDWARE	DUCT BANK	2,687.31 LF	-	-	47,329	433	30,573	747	78,649
		CONDUIT, PVC					**60,376**	**558**	**39,417**	**963**	**100,757**
		CONDUIT, RGS									
	42-15-37-05	1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		1,343.66 LF	-	-	22,842	439	31,010	758	54,609
	42-15-37-11	5 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE		559.86 LF	-	-	65,024	725	51,273	1,253	117,550
		CONDUIT, RGS					**87,866**	**1,164**	**82,283**	**2,010**	**172,159**
		DUCT BANK									
	42-18-00-01	SPACERS	DUCT BANK	766.00 EA	-	-	3,167	106	7,468	182	10,817

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		DUCT BANK					**3,167**	**106**	**7,468**	**182**	**10,817**
		RACEWAY, CABLE TRAY & CONDUIT					**652,670**	**11,719**	**828,290**	**20,238**	**1,501,198**
		CABLE									
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
	43-10-00-10	600V #16 2 TW PR CU SHIELDED XLPE LSZH		2,379.39 LF	-	-	7,378	63	4,459	1,276	13,112
	43-10-00-11	600V #16 4 TW PR CU SHIELDED XLPE LSZH		3,569.09 LF	-	-	13,882	119	8,432	2,412	24,727
	43-10-00-11	600V #16 8 TW PR CU SHIELDED XLPE LSZH		2,379.39 LF	-	-	15,144	137	9,692	2,773	27,609
	43-10-00-15	600V #14 2/C CU XLPE LSZH		2,379.39 LF	-	-	1,942	52	3,683	1,054	6,679
	43-10-00-17	600V #14 5/C CU XLPE LSZH		3,569.09 LF	-	-	7,621	94	6,688	1,913	16,222
	43-10-00-18	600V #14 7/C CU XLPE LSZH		271.83 LF	-	-	739	8	576	165	1,480
	43-10-00-18	600V #14 7/C CU XLPE LSZH		223.94 LF	-	-	609	7	474	136	1,219
	43-10-00-20	600V #14 12/C CU XLPE LSZH		2,379.39 LF	-	-	9,255	96	6,785	1,941	17,981
	43-10-00-21	600V #14 19/C CU XLPE LSZH		2,379.39 LF	-	-	17,830	142	10,080	2,884	30,794
	43-10-00-22	ETHERNET CAT 6A CABLE 300V		951.76 LF	-	-	2,100	142	10,080	2,884	15,064
	43-10-00-27	2 FIBER PATCH CORDS		5.00 EA	-	-	1,839	6	407	117	2,362
	43-10-00-27	24 FIBERSINGLE MODE OPTICAL FIBER PATCH PANEL		57.00 EA	-	-	1,871	7	464	133	2,468
	43-10-00-29	24 FIBER SINGLE MODE OPTICAL FIBER ARMORED RISER RATED		1,665.57 LF	-	-	8,175	258	18,247	5,220	31,643
	43-10-00-80	TERMINATION - FIBER OPTIC		344.00 EA	-	-	3,509	237	16,811	4,809	25,129
	43-10-00-83	TERMINATION - ETHERNET		10.00 EA	-	-	27	4	285	82	394
	43-10-00-84	TERMINATION - COMPRESSION LUG, #16 AND SMALLER, 1 HOLE, COPPER		1,114.00 EA	-	-	1,818	64	4,537	1,298	7,653
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		1,808.00 EA	-	-	4,180	208	14,726	4,213	23,119
	43-10-00-85	TERMINATION - COMPRESSION LUG, #14, 1 HOLE, COPPER		32.00 EA	-	-	74	4	261	75	409
	43-10-00-99	TEST AND DOCUMENTATION		3,302.00 EA	-	-		190	13,447	3,847	17,294
		CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**97,994**	**1,836**	**130,134**	**37,229**	**265,356**
		600V CABLE & TERMINATION									
	43-20-00-08	600V #10 3/C CU XLPE LSZH		4,758.78 LF	-	-	12,103	153	10,855	3,105	26,063
	43-20-00-21	600V #4 3/C CU EPR TS-CPE		2,379.39 LF	-	-	25,435	148	10,468	2,995	38,897
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		223.94 LF	-	-	2,708	19	1,332	381	4,420
	43-20-00-22	600V #4 3/C W/G CU EPR TS-CPE		671.83 LF	-	-	8,123	56	3,996	1,143	13,261
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		11.20 LF	-	-	208	2	128	37	373
	43-20-00-27	600V #2 4/C W/G CU EPR TS-CPE		11.20 LF	-	-	208	2	128	37	373
	43-20-00-38	600V #4/0 3/C CU		1,189.70 LF	-	-	45,579	133	9,402	2,690	57,670
	43-20-00-45	600V #500 KCMIL 1/C CU		671.83 LF	-	-	12,161	49	3,448	986	16,596
	43-20-00-45	600V #500 KCMIL 1/C CU		335.92 LF	-	-	6,081	24	1,724	493	8,298
	43-20-00-46	600V #500 KCMIL 3-1/C CU TRIPLEXED EPR TS-CPE		2,379.39 LF	-	-	177,687	309	21,904	6,266	205,858
	43-20-00-47	600V #750 KCMIL 1/C CU		8,061.94 LF	-	-	814,971	769	54,514	15,596	885,081
	43-20-00-81	TERMINATION - COMPRESSION LUG, #10, 1 HOLE, COPPER		144.00 EA	-	-	431	41	2,932	839	4,202
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		72.00 EA	-	-	906	41	2,932	839	4,677
	43-20-00-84	TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER		18.00 EA	-	-	226	10	733	210	1,169
	43-20-00-85	TERMINATION - COMPRESSION LUG, #2, 2 HOLE, COPPER		22.00 EA	-	-	329	15	1,075	308	1,712
	43-20-00-89	TERMINATION - COMPRESSION LUG, #4/0, 2 HOLE, COPPER		30.00 EA	-	-	734	38	2,688	769	4,191
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		72.00 EA	-	-	3,721	182	12,901	3,691	20,313
	43-20-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		28.00 EA	-	-	1,447	71	5,017	1,435	7,900
	43-20-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		20.00 EA	-	-	1,686	70	4,936	1,412	8,034
	43-20-00-99	TEST AND DOCUMENTATION		388.00 EA	-	-		67	4,740	1,356	6,096
		600V CABLE & TERMINATION					**1,114,744**	**2,199**	**155,853**	**44,587**	**1,315,184**
		5/8KV CABLE & TERMINATION									
	43-40-00-11	5/8KV #500 KCMIL 3-1/C CU TRIPLEXED		761.41 LF	-	-	59,718	135	9,553	2,733	72,004
	43-40-00-12	5/8KV #750 KCMIL 1/C CU		15,989.51 LF	-	-	439,046	1,783	126,357	36,149	601,551
	43-40-00-92	TERMINATION - COMPRESSION LUG, #500, 2 HOLE, COPPER		22.00 EA	-	-	1,137	83	5,913	1,692	8,742
	43-40-00-93	TERMINATION - COMPRESSION LUG, #750, 2 HOLE, COPPER		46.00 EA	-	-	3,879	240	17,028	4,872	25,779
	43-40-00-99	TEST AND DOCUMENTATION		68.00 EA	-	-		39	2,769	792	3,561
		5/8KV CABLE & TERMINATION					**503,780**	**2,281**	**161,620**	**46,237**	**711,637**
		CABLE					**1,716,518**	**6,317**	**447,607**	**128,053**	**2,292,177**
		CONTROL & INSTRUMENTATION									
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH CONTROLLERS	ELECTRICAL ROOM - DSC MAIN CONTROLLER	1.00 EA		52,530		28	2,010	175	54,714

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CONTROL SYSTEM									
	44-13-00-09	DISTRIBUTED CONTROL SYSTEM (DCS) - CABINET WITH I/O CARDS	ELECTRICAL ROOM - DSC I/O MODULES, ASSUME 250 I/O POINTS PER CABINET,PROGRAMMING INCLUDED WITHIN MANHOURS	2.00 EA		700,400		552	40,193	3,493	744,086
	44-13-00-09	INTERMEDIATE TERMINATION CABINET	ELECTRICAL ROOM - MARSHALLING CABINETS TO WIRE DSC MODULES AND FIELD CABLES	4.00 EA		105,060		74	5,199	127	110,386
		CONTROL SYSTEM				**857,990**		**653**	**47,402**	**3,795**	**909,187**
		FLOW DEVICES									
	44-21-20-27	FLOW METER, DIFFERENTIAL PRESSURE ORIFICE FLOW TYPE, WITH 3 VALVE MANIFOLD, DIRECT MOUNT		2.00 EA	-	-	14,680	27	1,959	170	16,810
		FLOW DEVICES					**14,680**	**27**	**1,959**	**170**	**16,810**
		LEVEL DEVICES									
	44-21-30-06	LEVEL TRANSMITTER, GUIDED WAVE RADAR LIQUID LEVEL TYPE, FLANGE MOUNT		2.00 EA	-	-	12,831	46	3,349	291	16,472
	44-21-30-13	LEVEL GUAGE		2.00 EA	-	-	2,241	34	2,512	218	4,972
		LEVEL DEVICES					**15,073**	**80**	**5,862**	**509**	**21,444**
		PRESSURE DEVICES									
	44-21-40-10	PRESSURE TRANSMITTER, GAUGE TYPE, WITH 2 VALVE MANIFOLD		8.00 EA	-	-	48,804	101	7,369	640	56,813
		PRESSURE DEVICES					**48,804**	**101**	**7,369**	**640**	**56,813**
		CONTROL & INSTRUMENTATION				**857,990**	**78,557**	**861**	**62,592**	**5,115**	**1,004,253**
		CONSTRUCTION INDIRECT									
		CRAFT PERSONNEL									
	61-15-00-99	CRAFT STARTUP SUPPORT		1.00 EA	-	-		2,299	138,023	0	138,023
		CRAFT PERSONNEL						**2,299**	**138,023**	**0**	**138,023**
		CONSTRUCTION INDIRECT						**2,299**	**138,023**	**0**	**138,023**
		FUEL OIL FUEL OIL SYSTEM			**3,343,486**	**4,607,917**	**5,443,160**	**48,793**	**3,207,478**	**806,770**	**17,408,811**
SCR		**SCR SYSTEM**									
		CONCRETE									
		CONCRETE									
	22-13-00-02	CONCRETE FOUNDATION FOR SCR	ALLOWANCE - INCLUDES EXCAVATION, BACKFILL, COMPACTION. FORMWORK, BRACING, MUDMAT, CHAIRS, REINFORCEMENT, AND EMBEDMENTS	227.02 CY	-	-	98,797	1,565	74,869	25,379	199,045
		CONCRETE					**98,797**	**1,565**	**74,869**	**25,379**	**199,045**
		CONCRETE					**98,797**	**1,565**	**74,869**	**25,379**	**199,045**
		MECHANICAL EQUIPMENT									
		ENGINE									
	31-31-00-99	ENGINE/GENERATOR SETS (13.8 KV, 60 HZ) W/ SPRING MOUNTED BASE FRAMES	SCR AT 7% OF ENGINE COST - INSTALLATION COVERED IN NOX CONTROL EQUIPMENT BELOW	5.00 EA	-	5,729,680	-				5,729,680
		ENGINE				**5,729,680**					**5,729,680**
		NOX CONTROL EQUIPMENT									
	31-53-00-99	SCR / CO MODULES	EQUIPMENT SUPPLIED BY OEM	5.00 EA	-	-	-	1,029	61,765	15,417	77,183
	31-53-00-99	INSULATION & JACKETING	EQUIPMENT SUPPLIED BY OEM	6,104.86 SF	-	-	-	2,526	151,673	37,859	189,533
		NOX CONTROL EQUIPMENT						**3,555**	**213,439**	**53,277**	**266,715**
		UREA SYSTEM									
	31-63-00-99	UREA STORAGE TANK	EQUIPMENT SUPPLIED BY OEM	1.00 LS	-	-	-	95	5,720	1,428	7,147
	31-63-00-99	UREA FORWARDING SKID	EQUIPMENT SUPPLIED BY OEM	1.00 LS	-	-	-	70	4,174	1,042	5,216
	31-63-00-99	UREA DOSING SKID	EQUIPMENT SUPPLIED BY OEM	2.00 LS	-	-	-	191	11,439	2,855	14,295
		UREA SYSTEM						**355**	**21,333**	**5,325**	**26,658**
		MECHANICAL EQUIPMENT				**5,729,680**		**3,910**	**234,772**	**58,601**	**6,023,053**
		PIPING									
		CARBON STEEL, ABOVE GROUND, PROCESS AREA									
	35-13-10-18	2 IN DIA, SCH 80	UREA PIPING SYSTEM	83.84 LF	-	-	2,691	121	8,223	2,837	13,751

MARITIME ELECTRIC COMPANY LTD
LOCATION 2
5 X 18 MW RICE ENGINES

Area	Item	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Construction Equipment Cost	Total Cost
		CARBON STEEL, ABOVE GROUND, PROCESS AREA					2,691	121	8,223	2,837	13,751
		VALVES									
	35-45-00-10	SMALL BORE - 2" GLOBE (2OUR-V001)	UREA PIPING SYSTEM	4.00 EA	-	-	6,186	7	467	161	6,814
	35-45-00-10	SMALL BORE - 3/4" GLOBE (2OUR-V005)	UREA PIPING SYSTEM	2.00 EA	-	-	886	3	233	81	1,200
	35-45-00-10	SMALL BORE - 3/8" GLOBE (22UR-V006)	UREA PIPING SYSTEM	2.00 EA	-	-	1,479	3	233	81	1,793
		VALVES					8,551	14	934	322	9,807
		MISCELLANEOUS									
	35-99-00-99	PIPING, MISCELLANEOUS - 2" TRUCK UNLOADING CONNECTOR	UREA PIPING SYSTEM	1.00 EA	-	-	676	3	233	81	990
		MISCELLANEOUS					676	3	233	81	990
		PIPING					11,917	139	9,390	3,240	24,548
		SCR SCR SYSTEM				5,729,680	110,714	5,614	319,030	87,221	6,246,645

EXHIBIT J. BASIS OF ESTIMATE

Basis of Cost Estimate

Cost Estimate Nos.:

36484C – “1X0 SC LM6000 PC SPRINT WITH SYNCH CONDENSER”

36500C – “ADD SYNCH CONDENSER ON EXISTING LM6000”

36501C – “10 MW / 40 MWH BATTERY ENERGY STORAGE SYSTEM”

36503C – “5X0 RICE & BESS GREENFIELD SITE SUBSTATION UPGRADES”

36641C – “FIVE 18 MW RICE ENGINES”

Client Name: Maritime Electric Company, Ltd.
Station: Prince Edward Island, Canada
Project Number: A14782.003
Date: 09/24/2024

Sargent & Lundy

55 East Monroe Street
Chicago, IL 60603-5780

Table of Contents

1. Introduction

This document describes and identifies the basis upon which the cost estimate(s) mentioned herein have been developed by documenting the purpose, scope, methods, parameters, cost estimating methodology, strategy, assumptions, source information and exclusions.

The purpose of the estimate(s) is to provide capital cost information for either project planning, screening/feasibility, budgeting, project alternative evaluations. It is expected that the estimate(s) be used in a manner where the end usage takes into consideration the Estimate's Classification and accuracy of the represented costs.

The cost estimates were developed based primarily on experience on similar projects, conceptual design layout and configuration, and client input. Detailed engineering has not been performed to firm up the project details, and specific site characteristics have not been fully analyzed. We have attempted to assign allowances where necessary to cover issues that are likely to arise but are not clearly quantified at this time

2. General Information

2.1. Estimates:

- Cost Estimate No.
- 36484C – "1X0 SC LM6000 PC With Synch Condenser"
- 36500C – "Add Synch Condenser On Existing LM6000"
- 36501C – "10 MW / 40 MWH Battery Energy Storage System"
- 36503C – "5X0 RICE & BESS Greenfield Site Substation Upgrades"
- 36641C – "Five 18 MW RICE Engines"

Estimates are provided to cover two options. The first utilizes estimates 36484C, 36501C, 36503C, and 36641C resulting in installation of a new LM6000 at a brownfield site on PEI, and a new 5x0 RICE installation with BESS at an alternate site on PEI. The second option utilizes 36500C resulting in installation of synchronous condensing capability on the existing LM6000 at Charlottetown.

2.2. Facility Locations: - Prince Edward Island, Canada

2.3. Facility Type:

- Existing Brownfield Peaker Site (36484C &36500C) on PEI
- Greenfield Site (36501C, 36503C, and 36641C) on PEI

2.4. Capacity Rating:

- Cost Estimate No. 36484C – 1x0 50 MW Combustion Turbine Addition
- Cost Estimate No. 36641C – 5x18 MW RICE

2.5. Unit of Measurement: - S.I.

2.6. Currency: - Canadian Dollars (CAD) at conversion of 1.36 CAD to 1.00 USD

3. Estimate Scope Description

Listed below is a summary level scope (not all inclusive) of facilities included in the estimate(s). See cost estimate(s) for a detailed listing of the work breakdown structure and scope.

3.1. Civil work
3.2. Structural work
3.3. Concrete work
3.4. Mechanical work
3.5. Electrical work
3.6. Instrumentation and controls
3.7. Power Distribution

4. Methodology

These estimates were developed using baseline estimates deemed to be representative of the required scope of facilities and cost and scope-adjusted using client input and cost/quantity factors based on parametric factors.

5. Estimate Classification

Based on the maturity level of the project definition deliverables and the estimating methods used, these estimate can be categorized as Class 4/5 estimate and assigned a probable accuracy range of +/- 30%. Accuracy range is calculated on the total cost estimate after the application of appropriate contingency.

The Association for the Advancement of Cost Engineering (AACE) International has established a classification system for cost estimates listed in the following table.

Source: (AACE International Recommended Practice No. 18R-97)

Estimate Class	**Maturity Level of Project Definition Deliverables** % of complete definition	**End Usage** Typical purpose of estimate	**Methodology** Typical Estimating Method	**Expected Accuracy Range**
Class 5	0% to 2%	Concept screening	Capacity factored, parametric model, judgement, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

This table illustrates typical accuracy ranges that are associated with process industries. AACE RP 104-19 explains accuracy. The +/- value represents typical percentage variation at an 80% confidence interval of actual costs from the cost estimate after application of contingency (typically to achieve a 50% probability of project overrun versus underrun) for given scope. Depending on the technical and project deliverables (and other variables) and risks associated with each estimate, the accuracy range for any estimate is expected to fall into the ranges identified, although extreme risks can lead to wider ranges.

6. Quantity Development

Quantities and scope of facilities to be cost estimated were based on parametrically-factored costs and quantities in the selected base estimates along with client scope input. Detailed engineering has not been performed to firm up the project details, and specific site characteristics have not been fully analyzed. Allowances have been assigned where necessary to cover issues that are likely to arise but are not clearly quantified at this time.

7. Structure and Coding of the Estimate

Standard coding and structure within the estimating system have been used in preparing the estimate. The structure of the estimate follows a predefined format whereas the cost information is organized and presented by grouping costs with similar attributes. The basic presentation of the overall estimate hierarchy follows:

- Direct Costs
- General Conditions Costs
- Project Indirect Costs
- Contingency

Within the direct cost group, the costs are segregated into 5 categories in columnar format in the estimate. The direct cost line items may further be grouped by areas or sub-areas and it is evident on the summary page if this formatting structure is used. The 5 categories are:

1. Subcontract Cost
2. Material Cost
3. Equipment Cost
4. Labor Cost
5. Construction Equipment Cost

A standard coding structure has been used to categorize each direct cost line item within the estimate. A sample of the commonly used codes in the standard coding structure of the estimating system at its highest level of the hierarchy follows. (Any estimate may contain one or more of these codes)

11.00.00	DEMOLITION
21.00.00	CIVIL WORK
22.00.00	CONCRETE
23.00.00	STEEL
24.00.00	ARCHITECTURAL
27.00.00	PAINTING AND COATING
31.00.00	MECHANICAL EQUIPMENT
35.00.00	PIPING
36.00.00	INSULATION

41.00.00 ELECTRICAL EQUIPMENT
42.00.00 RACEWAY, CABLE TRAY & CONDUIT
43.00.00 CABLE
44.00.00 CONTROL & INSTRUMENTATION
51.00.00 SUBSTATION, SWITCHYARD, & TRANSMISSION
91.00.00 SITE OVERHEADS
92.00.00 OTHER CONSTRUCTION INDIRECT COSTS
93.00.00 PROJECT INDIRECT COSTS
94.00.00 CONTINGENCY

8. Direct Costs

Direct field costs represent the permanently installed facilities and include subcontract costs, material costs, process equipment costs, labor costs and construction equipment costs. Each line item in the estimate may have any combination of these cost categories.

All estimated costs have been escalated or re-priced to current 2024 Canadian dollars.

There are 5 direct cost categories that make up the direct costs of the estimate and are discussed as follows.

8.1. Process Equipment Cost Category

Pricing for permanently installed equipment is based on S&L in house data, vendor catalogs, industry publications and other related projects, with exception of the following items for which a budgetary vendor quote was received. Vendor quotes are furnish-only unless otherwise noted.

- Quotes were received for the LM6000 CT, major transformers, and new tanks in revision A (dated September 2023). These quoted costs have been adjusted to current dollars for this revision."

Equipment pricing was reviewed to ensure that the following criteria were addressed and taken into consideration where deemed necessary:

- Allowance for attendance by vendor representatives for technical field assistance
- Freight
- Spare parts

8.2. Material Cost Category

Pricing for permanently installed materials are based on S&L in house data, vendor catalogs, industry publications and other related projects, with exception of the following items for which a budgetary vendor quote was received.

- No quotes solicited for this estimate.

8.3. Labor Cost Category

Development of construction labor cost takes into account the quantity, wage rates, installation hours, labor productivity, labor availability and construction indirect costs. A more detailed description and methodology follows.

8.3.1. Installation Hours

Installation hours represent the labor/man-hours to install an item and collectively all craft hours to install the entire scope of facilities. These include the time of all craft personnel and supervisors and include time spent in inductions, training, toolbox meetings, clean-ups and bus drivers. Sargent & Lundy maintains a database of standard unit installation hours. The database represents standard installation rates for US Gulf Coast Region. Standard unit installation rates were applied to the quantities and equipment in the estimate. The resultant hours were further adjusted for local productivity (described below). Manhours associated with subcontract labor cost are not represented in the estimate.

Equipment setting labor/man-hours were developed using a combination of several techniques. Installation was developed using equipment weights, equipment size, fabrication completeness upon delivery and location congestion.

Both bulk material and equipment installation labor/man-hours may also be based on anyone of the many public domain resources readily available and at our disposal.

8.3.2. Labor Productivity

In evaluating productivity, factors such as jobsite location, type of work and site congestion were considered. A regional labor productivity multiplier of 1.15 is included based on Compass International Global Construction Yearbook. The use of this productivity factor is an approach to compare construction productivity in various locations in the USA to a known basis or benchmark of 1.00 for Texas, Gulf Coast productivity. Productivity multiplier does not include weather related delays. Effectively, this factor increases the installation hours (or decreases productivity) in proportion to the factor and is driven by jurisdictional guidelines set forth in union work and/or individual craftsperson capabilities.

8.3.3. Labor Wage Rates

Labor profile: Prevailing wages for Prince Edward Island, Canada.

Craft labor rates were developed based on input from MECL originally received in 2023 and now escalated at 2% on all craft based on review of escalation of labor per R.S. Means per 2023 and 2024 wage rates for nearby Halifax, Nova Scotia, and Moncton, New Brunswick, Canada. Crew rates are used in the estimate, not the individual craft rates. Construction indirect and general conditions costs are not included in the crew rates. These costs are itemized separately.

8.4. Construction Equipment Cost Category

Construction equipment cost is included on each line item as needed based on the type of activity and construction equipment requirements to perform the work. It includes costs for rental of all construction equipment, fuel, oil and maintenance. Equipment operators are included with direct labor costs.

Depending on the nature of the work, additional cost for construction equipment and operators such as heavy lifting cranes may be required to perform the work activity which would then be included as a separate line item and included in the subcontract cost category. For this project, a supplemental construction equipment cost is not necessary.

8.5. Subcontract Cost Category

Subcontract costs as defined within this estimate are all inclusive costs. It has nothing to do with the contracting strategy or subcontractors. A subcontract cost simply does not include any additional markups such as "General Conditions", "Overheads" or "Other Construction Indirect Costs". Subcontract costs are subject to and included in the EPC Fee, contingency and escalation calculations if applicable. Subcontract costs may or may not have a labor component and as such do not identify associated installation labor/man-hours.

9. Construction General Conditions Costs

The estimate(s) are constructed in such a manner where most of the direct construction costs are determined directly and several direct construction cost accounts are allowances and determined indirectly by taking a percentage of the directly determined costs. These percentages are based on our experience with similar type and size projects. Listed below are the additional costs included unless noted as not included.

9.1. Additional Labor Costs:

- Labor Supervision (additional pay over that of a journeyman)
- Show-up time
- Cost of overtime pay and inefficiency due to extended hours is included, based on working a 50-hour work week (5x10-hour days.)
- Per diem is included at $20 CAD/hr ($200 per workday).

9.2. Site Overheads

- Construction Management (Includes project manager, superintendents, project controls, site clerical)
- Field Office Expenses (trailer rental, furniture, office equipment, computers, site communication, office supplies)
- Material & Quality Control (inspectors, quality assurance personnel)
- Material Handling (Labor cost to receive, unload & properly store material and equipment delivered to the site. Includes materials management. Labor to retrieve materials and equipment from storage and deliver to the worksite.)
- Safety program administration and personnel. (Includes safety manager, personal protective equipment, drug testing kits including lab fees, jobsite orientation materials and materials required to maintain a safe jobsite)
- Temporary Facilities (Includes any temporary structures or utilities required at the job site such as: temporary warehouse, change trailers, site security, temporary electric grid, water consumed during construction, trash hauling fees, sanitary facilities)
- Indirect Craft Labor (Includes tool control, training, welder certification, fire watch, site cleanup, dust control)
- Mobilization/Demobilization to the jobsite
- Legal Expenses/Claims

9.3. Other Construction Costs:

- Small Tools and Consumables
- Scaffolding (includes rental, erection & removal)
- General Liability Insurance (covers premiums likely to be incurred)
- Construction Equipment Mobilization/Demobilization

- Freight on Material
- Freight on Process Equipment – included with equipment cost
- Sales Tax – not included

10. Project Indirect Costs

Listed below are additional project indirect costs included unless noted as not included:

- EPC Engineering Services – included
- EPC Start-up and Commissioning Support – 2% of total project cost (excluding major equipment procured by OWNER)
- Start-Up Spare Parts – 0.3% of the process equipment cost
- EPC G&A Expense – included at 7% of total project cost (excluding major equipment procured by OWNER)
- EPC Risk Fee and Profit – included at 10% of total project cost (excluding major equipment procured by OWNER) – per Clients request.
- Owner’s Engineer – included
- CM and Start-up and Commissioning (3rd party) – not included
- Owners costs – included at 3%
- Warehouse Spares – included as lump sum as follows:
    - 36484C – “1X0 SC LM6000 PC with Synch Condenser” - $1,000,000
    - 36500C – “Add Synch Condenser On Existing LM6000” - $100,000
    - 36501C – “10 MW / 40 MWH Battery Energy Storage System” – not included
    - 36503C – “5X0 RICE & BESS Greenfield Site Substation Upgrades” - $150,000
    - 36641C – “Five 18 MW RICE Engines” - $1,000,000

11. Scope of Work by Owner

The 3% allowance for Owner’s costs is intended to cover the items listed below:

- Owner's Staff - Project management, Construction Management, on-site engineering and services, procurement services
- Per diem/Travel expenses for Owner's Personnel assigned to site
- Site Facilities for Owner's Personnel, Construction Management, and Start-Up & Commissioning (offices/trailers, guard houses, furniture, signage, staff parking, vehicles, access control, computer network/servers, safety equipment, etc.)
- Site Services for Owner's Personnel, Construction Management, and Start-Up & Commissioning (Telephone, electricity, natural gas, potable water, sewage, sanitary, garbage collection, recycled materials/metals collection (may also be collected from contractors, depending on Owner's policy), snow removal, dust control, janitorial services, internet, cable services, reprographics, etc.)
- Construction power source/consumption services. Distribution (transformer, cable, switchboard, etc.) of construction power is included in the direct costs.
- Safety Incentives (any Owner's safety incentive program, over and above contractor's programs)
- Site security guards during construction
- Traffic control facility at the gate (badging, timecard system, etc.)
- Station Operators, I&C Technicians, Relay Technicians, DCS Programmers, Test Equipment
- Lock-out/Tag-Out Program (personnel, procedures, and hardware)
- Plant Staff Training (time for personnel being trained is Owner's cost. Also includes Owner's time for preparation and/or modification of plant operating procedures.)
- Laboratory, workshop, etc. equipment and instruments

- Legal and accounting fees
- Payment and Performance Bonds
- Insurance (example Builder's Risk)
- Project financing
- Permitting (considered to be a project development cost)

12. Contingency

Based on project definition, contingency costs are included in the estimate as separate line items as follows:

- Material Contingency Cost .... Calculated @ 25% of cost
- Process Equipment Contingency Cost .... Calculated @ 20% of cost
- Labor Contingency Cost.. Calculated @ 25% of cost
- Construction Equipment Contingency Cost .... Calculated @ 25% of cost
- Subcontract Contingency Costs............................. Calculated @ 20% of cost
- Indirect Contingency Costs .... Calculated @ 25% of cost

The rates relate to pricing and quantity variation in the specific scope estimated. The contingency does not cover new scope or exclusions outside of what has been estimated, only the variation in the defined scope. The rates do not represent the high range of all costs, nor is it expected that the project will experience all actual costs at the maximum value of their range of variation. The addition of contingency improves the probability of not having a cost overrun. Even with the inclusion of contingency, the estimate is still subject to a cost overrun in accordance with the accuracy range previously defined.

13. Escalation

Escalation is not included. All costs are provided in 2024 CAD.

14. Contracting Approach

The estimate is based on an Engineer – Procure – Construction (EPC) single contract approach. This approach basically has one main contractor, typically a firm with the capability, resources and finances to produce the design, procurement of goods and services and provide construction and construction management services during construction. (Note that the EPC contract approach was also successfully utilized in the MECL 2005 CT3 construction project.)

The EPC contractor is responsible for ensuring the necessary engineered equipment and engineered bulks for the project are procured either directly or indirectly through subcontractors, although there can be exceptions.

Installation is achieved through using many resources including multiple subcontractors. Contractors are responsible for purchasing non-engineered bulk materials. Contractors will apply a markup on the value of non-engineered bulk materials for overhead and profit as mentioned in Section 9.3 above.

The EPC firm is responsible for all warranties for equipment, plant performance, pricing and schedule guarantees. The additional cost (beyond subcontractors G&A and Profit fees) or mainly the value for such warranties and guarantees and financial risks are reflected in the additional “EPC Fee” included in the estimate. Professional engineering, professional construction management & professional startup services are not included in this “EPC Fee” and itemized separately.

15. Notes/Assumptions/Clarifications

15.1. All estimates (excluding 36501C for the BESS) are provided in both "allocated" as well as "unallocated" versions. The unallocated versions show all individual estimate cost details with the General Conditions, Project Indirects, and Contingency costs broken out separately on page 3 of the estimates. The allocated versions are provided as summary-level estimates that incorporate all indirect costs into each line item to provide an estimated total cost for each of the cost groupings as if priced separately by an EPC contractor. (Note that the BESS estimate is based on subcontract costs only, and therefore, the allocated and unallocated versions would be identical.)

15.2. All CTs/engines are installed to operate on low sulfur diesel as the primary fuel with bio-diesel storage provided separately.

15.3. SCRs are included for all CTs and engines. CT SCRs are based on aqueous ammonia, and RICE SCRs on urea.

15.4. The new RICE/BESS facilities buildings are limited to engine halls with bathroom and storage pole-barn construction warehouse.

15.5. Black start capability with a black start diesel generator is provided for the new CT at Charlottetown.

15.6. Black start capability with a black start diesel generator is provided for the RICE facility.

15.7. First fills of diesel and bio-diesel are not included for the CT and RICE facilities.

15.8. Generator foundation modifications for installation of the synchronous condenser capability (estimate 36500C) assumes that the existing foundation will be lengthened and that piles are not required.

15.9. Major equipment will be purchased directly by Owner, and not by EPC. This includes:

15.9.1. Combustion Turbine & SCR (36484C)

15.9.2. CT GSU (36484C)

15.9.3. RICE Engine Package (36641C)

15.9.4. RICE GSU (36641C)

15.9.5. Synchronous Condenser OEM package (36484C and 36500C)

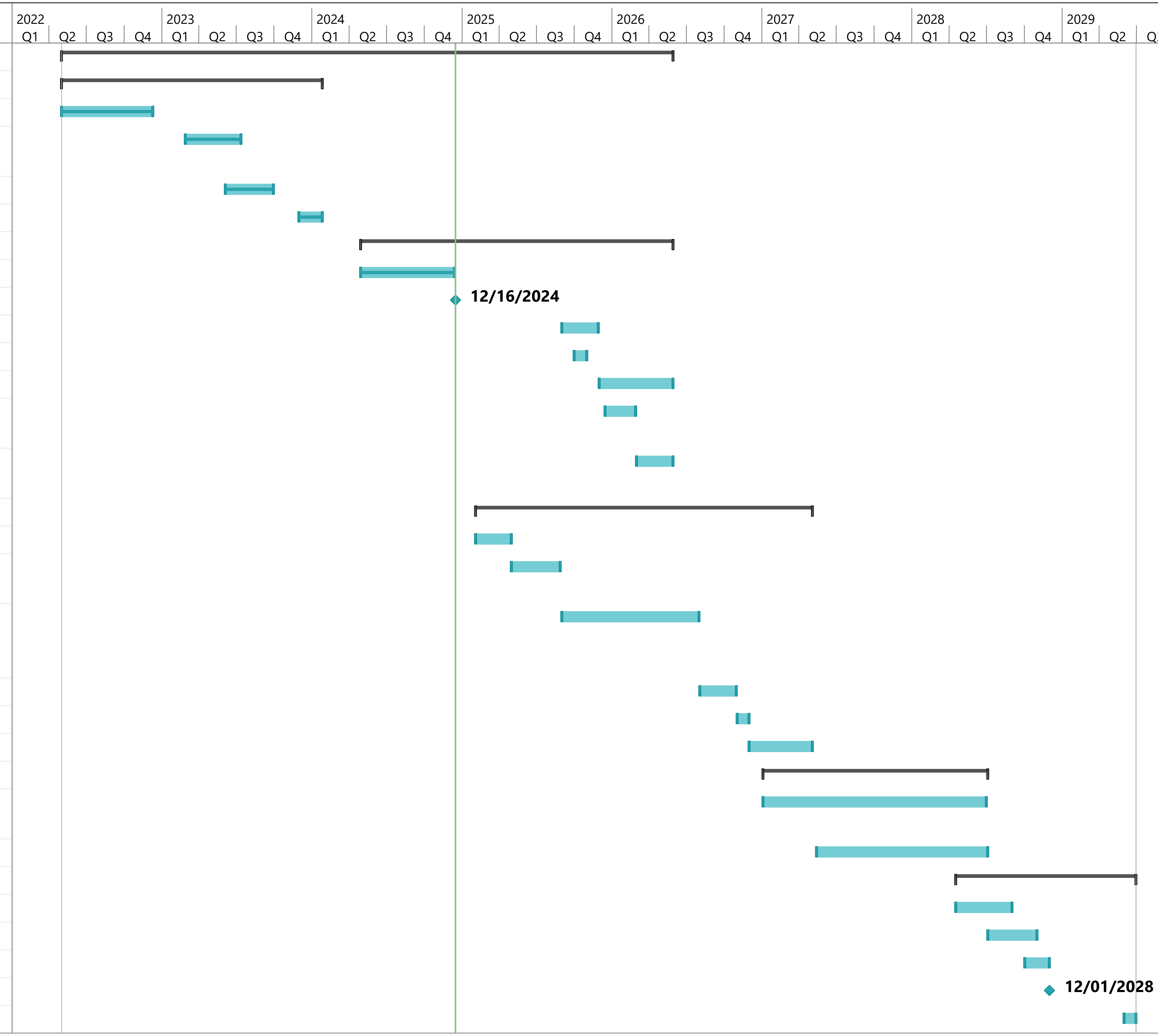
15.9.6. Substation Transformer (36503C)

APPENDIX B

Project Timelines
(Gantt Charts)

BESS - Preliminary Schedule

ID	Task Name	Duration	Start	Finish
1	**Project Development and Procurement**	**1065 days**	**Mon 05/02/22**	**Fri 05/29/26**
2	**Preliminary Studies**	**455 days**	**Mon 05/02/22**	**Fri 01/26/24**
3	Capacity Resource Study	160 days	Mon 05/02/22	Fri 12/09/22
4	Addendum to Capacity Resource Study	98 days	Mon 02/27/23	Wed 07/12/23
5	Initial Project Cost Estimation	85 days	Mon 06/05/23	Fri 09/29/23
6	Cost Estimation Update	41 days	Fri 12/01/23	Fri 01/26/24
7	**Approvals**	**545 days**	**Mon 04/29/24**	**Fri 05/29/26**
8	IRAC Application Development	165 days	Mon 04/29/24	Fri 12/13/24
9	IRAC Application Submission	0 days	Mon 12/16/24	Mon 12/16/24
10	EIA Development	65 days	Mon 09/01/25	Fri 11/28/25
11	EIA Public Consultations	23 days	Wed 10/01/25	Fri 10/31/25
12	EIA Approval	130 days	Mon 12/01/25	Fri 05/29/26
13	Develop Permit and Background Documentation	55 days	Mon 12/15/25	Fri 02/27/26
14	Staff Discussions, Committee Meetings and Approval	65 days	Mon 03/02/26	Fri 05/29/26
15	**Engineering and Vendor Selection**	**586 days**	**Mon 02/03/25**	**Mon 05/03/27**
16	Engineering Consultant Selection	63 days	Mon 02/03/25	Wed 04/30/25
17	Upfront Engineering - Initial Design & Site Selection	85 days	Thu 05/01/25	Wed 08/27/25
18	Upfront Engineering - Detailed Design, Cost Estimating and RFP Development	240 days	Mon 09/01/25	Fri 07/31/26
19	Vendor Pricing	65 days	Mon 08/03/26	Fri 10/30/26
20	Vender Selection	21 days	Mon 11/02/26	Mon 11/30/26
21	Contract Negotiations	110 days	Tue 12/01/26	Mon 05/03/27
22	**Long Lead Delivery Items**	**391 days**	**Mon 01/04/27**	**Mon 07/03/28**
23	Other Major Equipment Delivery Items	390 days	Mon 01/04/27	Sat 07/01/28
24	BESS System Purchase to Delivery	297 days	Fri 05/14/27	Mon 07/03/28
25	**Construction**	**315 days**	**Mon 04/17/28**	**Fri 06/29/29**
26	Site Preparation	99 days	Mon 04/17/28	Thu 08/31/28
27	Equipment Installation	86 days	Tue 07/04/28	Tue 10/31/28
28	Equipment Commissioning	44 days	Mon 10/02/28	Thu 11/30/28
29	BESS Commissioned	0 days	Fri 12/01/28	Fri 12/01/28
30	Sitework Completion	21 days	Fri 06/01/29	Fri 06/29/29

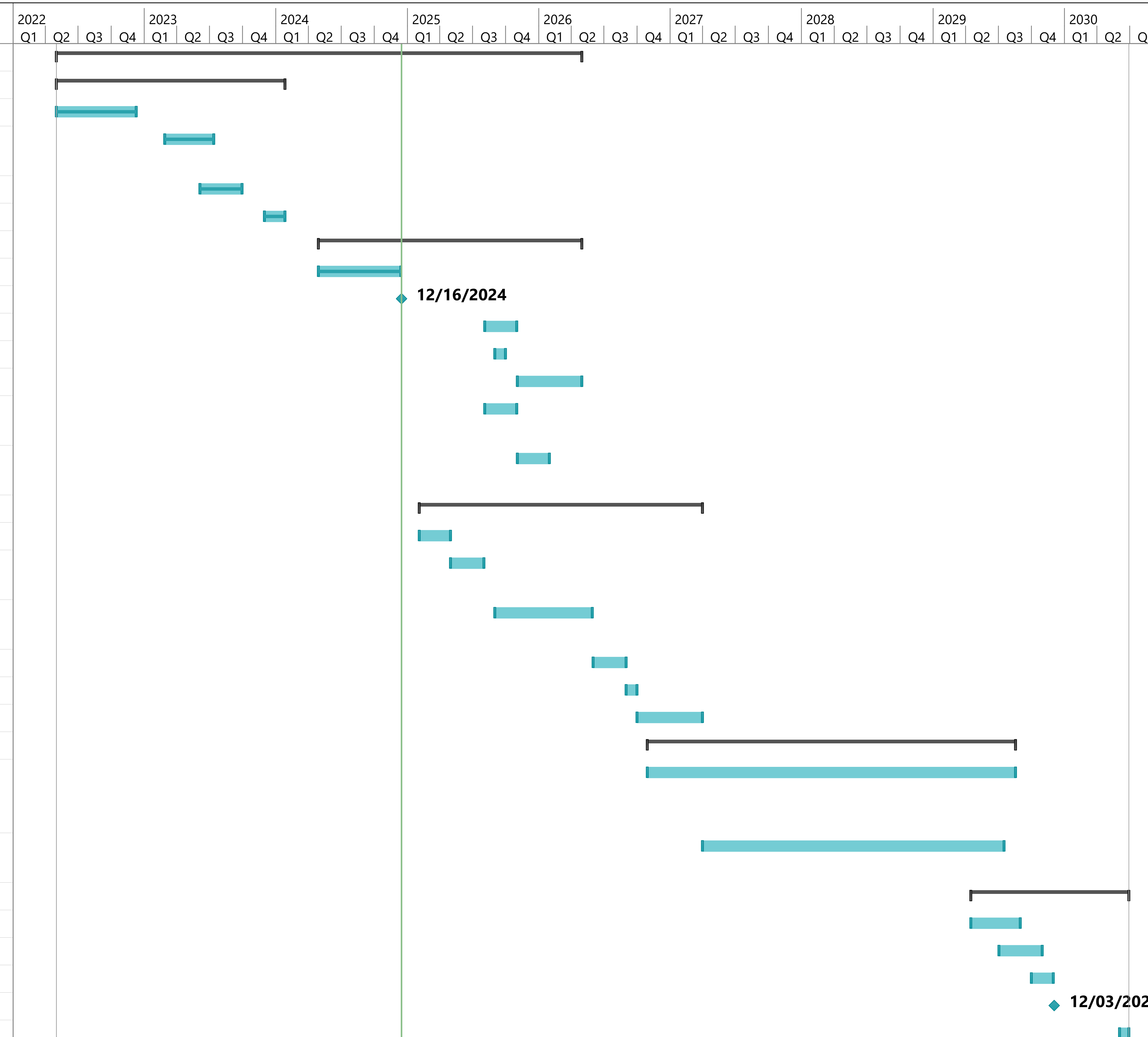


Project: BESS Schedule
Date: Mon 12/16/24

Summary | Project Task | Project Milestone | Task Progress

CT4 - Preliminary Schedule

ID	Task Name	Duration	Start	Finish
1	**Project Development and Procurement**	**1044 days**	**Mon 05/02/22**	**Thu 04/30/26**
2	**Preliminary Studies**	**455 days**	**Mon 05/02/22**	**Fri 01/26/24**
3	Capacity Resource Study	160 days	Mon 05/02/22	Fri 12/09/22
4	Addendum to Capacity Resource Study	98 days	Mon 02/27/23	Wed 07/12/23
5	Initial Project Cost Estimation	85 days	Mon 06/05/23	Fri 09/29/23
6	Cost Estimation Update	41 days	Fri 12/01/23	Fri 01/26/24
7	**Approvals**	**524 days**	**Mon 04/29/24**	**Thu 04/30/26**
8	IRAC Application Development	165 days	Mon 04/29/24	Fri 12/13/24
9	IRAC Application Submission	0 days	Mon 12/16/24	Mon 12/16/24
10	EIA Development	65 days	Mon 08/04/25	Fri 10/31/25
11	EIA Public Consultations	22 days	Mon 09/01/25	Tue 09/30/25
12	EIA Approval	129 days	Mon 11/03/25	Thu 04/30/26
13	City Development Permit and Background Documentation	65 days	Mon 08/04/25	Fri 10/31/25
14	City Staff Discussions, Committee Meetings and Approval	65 days	Mon 11/03/25	Fri 01/30/26
15	**Engineering and Vendor Selection**	**563 days**	**Mon 02/03/25**	**Wed 03/31/27**
16	Engineering Consultant Selection	63 days	Mon 02/03/25	Wed 04/30/25
17	Upfront Engineering - Initial Design & Site Selection	67 days	Thu 05/01/25	Fri 08/01/25
18	Upfront Engineering - Detailed Design, Cost Estimating and RFP Development	195 days	Mon 09/01/25	Fri 05/29/26
19	Vendor Pricing	66 days	Mon 06/01/26	Mon 08/31/26
20	Vender Selection	22 days	Tue 09/01/26	Wed 09/30/26
21	Contract Negotiations	130 days	Thu 10/01/26	Wed 03/31/27
22	**Long Lead Delivery Items**	**731 days**	**Fri 10/30/26**	**Fri 08/17/29**
23	Transformer, Switchgear and other Long Delivery Equipment - Purchase to Delivery	731 days	Fri 10/30/26	Fri 08/17/29
24	Turbine and Generator Purchase to Delivery	598 days	Thu 04/01/27	Mon 07/16/29
25	**Construction**	**315 days**	**Mon 04/16/29**	**Fri 06/28/30**
26	Site Preparation	99 days	Mon 04/16/29	Thu 08/30/29
27	Equipment Installation	86 days	Tue 07/03/29	Tue 10/30/29
28	Equipment Commissioning	45 days	Mon 10/01/29	Fri 11/30/29
29	CT Commissioned	0 days	Mon 12/03/29	Mon 12/03/29
30	Sitework Completion	20 days	Mon 06/03/30	Fri 06/28/30

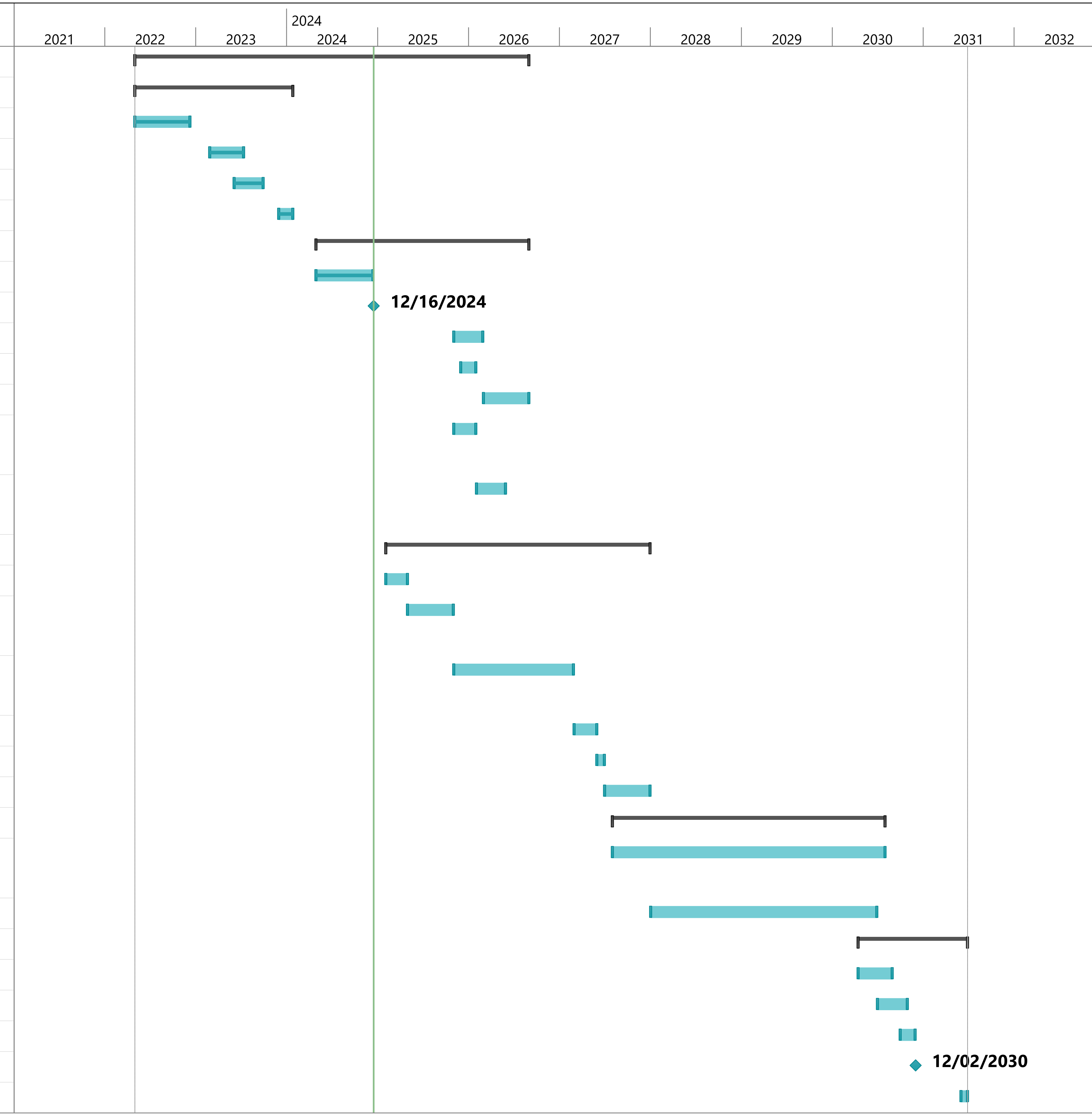


Project: CT4 Schedule
Date: Mon 12/16/24

Summary | Project Task | Project Milestone | Task Progress

RICE Plant - Preliminary Schedule

ID	Task Name	Duration	Start	Finish
1	**Project Development and Procurement**	**1131 days**	**Mon 05/02/22**	**Mon 08/31/26**
2	**Preliminary Studies**	**455 days**	**Mon 05/02/22**	**Fri 01/26/24**
3	Capacity Resource Study	160 days	Mon 05/02/22	Fri 12/09/22
4	Addendum to Capacity Resource Study	98 days	Mon 02/27/23	Wed 07/12/23
5	Initial Project Cost Estimation	85 days	Mon 06/05/23	Fri 09/29/23
6	Cost Estimation Update	41 days	Fri 12/01/23	Fri 01/26/24
7	**Approvals**	**611 days**	**Mon 04/29/24**	**Mon 08/31/26**
8	IRAC Application Development	165 days	Mon 04/29/24	Fri 12/13/24
9	IRAC Application Submission	0 days	Mon 12/16/24	Mon 12/16/24
10	EIA Development	85 days	Mon 11/03/25	Fri 02/27/26
11	EIA Public Consultations	45 days	Mon 12/01/25	Fri 01/30/26
12	EIA Approval	131 days	Mon 03/02/26	Mon 08/31/26
13	Develop Permit and Background Documentation	65 days	Mon 11/03/25	Fri 01/30/26
14	Staff Discussions, Committee Meetings and Approval	85 days	Mon 02/02/26	Fri 05/29/26
15	**Engineering and Vendor Selection**	**759 days**	**Mon 02/03/25**	**Thu 12/30/27**
16	Engineering Consultant Selection	63 days	Mon 02/03/25	Wed 04/30/25
17	Upfront Engineering - Initial Design & Site Selection	132 days	Thu 05/01/25	Fri 10/31/25
18	Upfront Engineering - Detailed Design, Cost Estimating and RFP Development	345 days	Mon 11/03/25	Fri 02/26/27
19	Vendor Pricing	66 days	Mon 03/01/27	Mon 05/31/27
20	Vender Selection	22 days	Tue 06/01/27	Wed 06/30/27
21	Contract Negotiations	130 days	Fri 07/02/27	Thu 12/30/27
22	**Long Lead Delivery Items**	**783 days**	**Mon 08/02/27**	**Wed 07/31/30**
23	Transformer, Switchgear and other Long Delivery Equipment - Purcase to Delivery	783 days	Mon 08/02/27	Wed 07/31/30
24	Engines and Generators - Purchase to Delivery	650 days	Mon 01/03/28	Fri 06/28/30
25	**Construction**	**315 days**	**Mon 04/15/30**	**Fri 06/27/31**
26	Site Preparation	99 days	Mon 04/15/30	Thu 08/29/30
27	Equipment Installation	86 days	Tue 07/02/30	Tue 10/29/30
28	Equipment Commissioning	44 days	Tue 10/01/30	Fri 11/29/30
29	RICE Commissioned	0 days	Mon 12/02/30	Mon 12/02/30
30	Sitework Completion	20 days	Mon 06/02/31	Fri 06/27/31



Project: RICE Schedule
Date: Mon 12/16/24

Summary | Project Task | Project Milestone | Task Progress

APPENDIX C

Sargent and Lundy Capacity Resource Study

February 10, 2023

Island Regulatory and Appeals Commission
PO Box 577
Charlottetown PE C1A 7L1

Dear Commissioners:

As a component of the 2022 Capital Budget, Maritime Electric engaged Sargent & Lundy, a globally recognized engineering consultant with expertise in power systems and energy supply, to undertake a study that examines the Company's energy needs, capacity source options, and the potential impact of each option in terms of emission reductions. The Capacity Resource Study that it recently completed is attached. This submittal letter also serves to highlight Sargent & Lundy's recommendation about the need to improve security of supply, given the developing capacity shortage in the Maritimes due to electrification and the federally mandated closure of all coal fired generation by 2030. The Sargent & Lundy report also notes the role on-Island capacity will play in further development of renewable energy resources on PEI.

As indicated in the Capacity Resource Study, Maritime Electric has both energy and capacity obligations. The energy obligations are associated with providing a continuous supply of electricity to customers, and the capacity obligations are associated with the Interconnection Agreement between Maritime Electric and NB Power. The reliability standards for the Maritimes area are established by the Northeast Power Coordinating Council ("NPCC"), under which NB Power operates and to which Maritime Electric is obliged to meet.

Capacity obligations are necessary to ensure that customer demand for electricity can be met by electrical utilities the vast majority of the time. The North American Reliability Standard, established by the North American Electricity Reliability Corporation ("NERC"), allows for a loss of generating capacity supply totalling one day every ten years. For this reason, electrical utilities are required to have enough capacity to meet their peak load plus 20 per cent, commonly referred to as planning reserve.[1]

For 2023, Maritime Electric has an estimated planning reserve capacity obligation to NB Power of 311 megawatts ("MW"), which it will meet through the resources shown in the table below.

Maritime Electric Capacity Resources for 2023	
Capacity Resource	**Capacity (MW)**
Maritime Electric Combustion Turbines	89
ELCC[a] of On-Island Wind Turbines	21
Point Lepreau Nuclear Generating Station[b]	29
Short-Term Capacity Purchases from NB Power[c]	172
Total	**311**

a. Effective load carrying capacity ("ELCC") of a generator reflects how much the generator is able to contribute toward system resource adequacy (i.e., be counted as a capacity resource).
b. Maritime Electric is entitled to approximately five percent of energy and capacity associated with NB Power's Point Lepreau Nuclear Generating Station through a long-term participation agreement.
c. Short-term capacity purchases currently represent 55 per cent of capacity resources to meet reliability obligations.

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[1] Maritime Electric is under NB Power's control authority and not directly obligated to meet NERC and NPCC planning reserve requirements, but the Company's Interconnection Agreement with NB Power requires it to have enough capacity to meet its firm peak load plus 15 per cent.

Maritime Electric meets it capacity obligations through a combination of owned on-Island generation and short-term contracted capacity purchases. The cost of owned capacity tends to be very stable as it reflects the long-term period for the financial recovery over the life of the asset. The cost of contracted short-term purchased capacity can be highly variable, as it depends upon capacity supply and demand within the region.

In the near term, demand for regional capacity will increase due to a combination of load growth from continued electrification and coal fired generating plant retirements.[2] This is expected to reduce the availability of short-term purchased capacity and increase the price Maritime Electric will have to pay. The Sargent & Lundy report concludes that, as the need for additional capacity in the winter peaking Maritime region becomes more apparent[3] and considering that Maritime Electric has to source and pay for capacity regardless of where it is located, the benefits for adding new capacity as on-Island emergency backup generation are evident.

Security of Supply Issues Addressed with Back-Up Generation
The future tightening of regional capacity resource levels has been identified in recent integrated resource plans in Quebec, Nova Scotia and New Brunswick. Hydro Quebec is now tendering in-province generation projects to address their shortfall by 2026. NB Power's Mactaquac Hydro Generating Station will have reduced output from 2027 to 2030 for its refurbishment program. Both Nova Scotia Power and NB Power have to decommission their coal generating stations by 2030 to meet federal guidelines. This total of 1,701 MW of coal fired generation represents 25 per cent of the Maritime provinces current generating capacity. With electrification growing in the region, supply-side capacity reductions combined with demand-side capacity increases will result in a capacity shortage in the Maritimes. Without new capacity being built in the region, affordability will be a challenge as higher capacity pricing will result from external purchases (i.e., from outside the Maritimes) if the capacity is even available. As such, there is significant risk that there will not be sufficient capacity available to purchase in the Maritime provinces.

Increased Carbon-Free Energy Enabled with Back-Up Generation
The goal for all provinces and utilities to procure carbon-free energy will increase demand for renewable energy sources, especially those with high capacity factors (i.e., not considered intermittent) such as large-scale hydro. These renewable sources (e.g., large-scale hydro) may be purchased on either an interruptible or non-interruptible basis, with interruptible being cheaper. However, the interruptible pricing option is only available to utilities that have sufficient source capacity.[4] In addition, having sufficient source capacity allows a utility to purchase energy from greater distances, increasing available options. On-Island backup-generation will position Maritime Electric as a more attractive customer to suppliers of interruptible renewable energy. It will also allow for increased renewable energy supply from greater distances (i.e., northern Quebec and Labrador) as suppliers will know that the Company can provide for short-term back-up due to supply interruption or the loss of high voltage transmission systems over these greater distances.

.../3

2 Due to the Federal Government requirement that all coal power plants in Canada be retired by 2030, Nova Scotia will lose 1,234 MW, and New Brunswick will lose 467 MW, of current regional operational capacity.
3 The NERC 2022-2023 Winter Reliability Assessment indicates that there is currently sufficient capacity for a typical load in the Maritimes area, but the region will be short on capacity should an extreme event, such as a polar vortex, occur. Texas, which is the only NERC assessment area with a higher capacity shortfall than the Maritimes area in extreme winter conditions, experienced widespread outages, loss of life and significant economic loss as the result of such an event in early 2022.
4 This capacity is required to generate energy during those instances when the energy supply is interrupted by the supplier.

On-Island Back-Up Generation Supports Affordability
Additional on-Island back-up generation supports the affordability of electricity and has the capability to run on renewable fuel sources such as biodiesel, hydrogen, etc.[5] It will provide greater price certainty for a larger portion of the Company's capacity needs at a time when significant challenges and turbulence will be present in the Maritime area capacity market. When negotiating energy supply contracts, additional on-Island back-up generation allows for the purchase of a variety of energy supply products by leveraging the value of the installed back-up capacity. While this on-Island back-up generation resource would not be expected to continually run, the supplier knows that if they have to interrupt contracted energy supply for their own system events, that the customer has the ability to serve their own load. As a market participant and "price taker", this is important to Maritime Electric's customers to achieve the most attractive energy supply cost pricing available.

Further Assessment
In consultation with stakeholders, Maritime Electric intends to further study and determine the best mix and location(s) for the addition of on-Island back-up generation. This will include the development of models to determine the amount of intermittent wind and solar generation that can operate with existing and projected on-Island capacity sources. The installation of additional on-Island back-up generation will provide significant value and protection, and fulfill an integral role in achieving Prince Edward Island's path towards net zero by 2040, Maritime Electric's sustainability goals and the continued affordability of electricity.

In addition, the recent events of the Polar Vortex of February 3-5 have provided significant experience and important statistics that warrant an addendum being developed by Sargent & Lundy. Maritime Electric has requested this be carried out and will submit the addendum when it is completed.

Yours truly,

MARITIME ELECTRIC

Angus S. Orford
Vice President, Corporate Planning
& Energy Supply

ASO01
Enclosure

5 The capacity Resource Study recommends reciprocating internal combustion engines that can run on various fuel sources.

Capacity Resource Study

Evaluation of Various Technology Options for Maritime Electric Company

Prepared for

Maritime Electric Company, Ltd.

Prepared by Sargent & Lundy

Report SL-017203

FINAL

December 9, 2022

Project 14782.001

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Chicago, IL 60603-5780 USA
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Sargent & Lundy

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Sargent & Lundy is one of the longest-standing full-service architect engineering firms in the world. Founded in 1891, the firm is a global leader in power and energy with expertise in grid modernization, renewable energy, energy storage, nuclear power, fossil fuels, carbon capture, and hydrogen. Sargent & Lundy delivers comprehensive project services – from consulting, design, and implementation to construction management, commissioning, and operations/maintenance – with an emphasis on quality and safety. The firm serves public and private sector clients in the power and energy, gas distribution, industrial, and government sectors.

55 East Monroe Street • Chicago, IL 60603-5780 USA • 312-269-2000

VERSION LOG

Version	Issue Date	Sections Modified
FINAL	9 December 2022	Initial Issue

ISSUE SUMMARY AND APPROVAL PAGE

This is to certify that this document has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

Contributors

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Approved by:

9 December 2022

Matthew Thibodeau
Senior Vice President

TABLE OF CONTENTS

FIGURES AND TABLES

APPENDIXES

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition/Clarification
B20, B100	20% or 100% biodiesel fuel blend
BESS	Battery energy storage system
BOP	Balance of Plant
CAD	Canadian dollars
CAES	Compressed air storage system
CO_2e	Carbon dioxide equivalent
CSP	Concentrated solar power
CT	Combustion turbine
DSM	Demand side management
ELCC	Effective load carrying capability
EPA	Energy purchase agreement
EPRI	Electric Power Research Institute
GW	Gigawatt
GWh	Gigawatt hour
IRP	Integrated resource plan
ISP	Integrated system plan
kW	Kilowatt
kWh	Kilowatt hour
Li-Ion	Lithium ion
LMP	Locational marginal price
LNG	Liquified natural gas
MECL	Maritime Electric Company, Limited
MW	Megawatt
MWh	Megawatt hour
NBEM	New Brunswick Energy Marketing
NPCC	Northeast Power Coordinating Council
PEI	Prince Edward Island
PV	Photovoltaic
RICE	Reciprocating internal combustion engines
S&L	Sargent & Lundy
SAT	Single axis tracking
SMR	Small modular reactors
TWh	Terawatt hour
USD	United States dollars
U.S. EIA	United States Energy Information Administration

EXECUTIVE SUMMARY

Sargent & Lundy (S&L) was engaged by Maritime Electric Company (Maritime Electric or MECL) in mid-2022 to develop this Capacity Resource Study for the purposes of evaluating a variety of different electricity capacity resource technologies, developing cost estimates, and recommending technologies well suited to help Maritime Electric cost-effectively achieve its most critical goals and needs.

From the perspective of this Capacity Resource Study, Maritime Electric's key goals and needs that are the focus of the resource selection process are summarized as follows:

1) **Meeting Both Energy and Capacity Obligations:** Maritime Electric must meet both a) energy obligations and b) regional capacity obligations.

   Energy obligations are those associated with Maritime Electric meeting the system's electrical load continuously throughout the day. For example, if system load (i.e., demand) is 200 MW at a certain point during the day, Maritime Electric might be able to meet this load with 70 MW generated from the on-island wind farms and 130 MW from electricity imported from the mainland. As system load and wind generation changes throughout the day and over the course of the year, the amount of electricity purchased from the mainland, or occasionally generated by on-island generators, changes with time.

   Capacity obligations are the share of reserved capacity that electric utilities must have, such that the Northeast Power Coordinating Council (NPCC) reliability standards for the Maritimes Area (which consists of Prince Edward Island [PEI], New Brunswick, Nova Scotia, and northern Maine) are met. The NPCC capacity standards are established to help maintain a stable and reliable electrical system. Load serving entities, such as Maritime Electric, are required to contribute to meeting the standards set by NPCC by having a sufficient amount of reserved capacity.

   For reference, the types of resources that Maritime Electric can utilize to meet its capacity obligations are listed below. Maritime Electric can either own these resources on-island, or Maritime Electric can purchase the capacity from power plants (or energy storage facilities) located on PEI or off-island via an agreement.

   - **Demand Response / Demand Side Programs**: Demand response programs (also known as demand side management or DSM) incentivize customers to shift/reduce electrical usage during certain times. The net result of these programs is that they help the utility better balance supply and demand. For the purposes of capacity planning, demand response is considered a dispatchable resource and can be counted towards meeting capacity obligations due to the fact that it helps utilities reduce peak demand.

- **Energy Storage**: Energy storage systems are effective sources of capacity that Maritime Electric could utilize to meet its capacity obligations. Energy storage systems are considered dispatchable resources.
- **Dispatchable Generators**: A dispatchable generator is one where the operator has control over when the unit is on/off and at what MW output level the generator is operating at. Some examples of common dispatchable generator technologies include engines and combustion turbines. Dispatchable generators are well suited to help Maritime Electric meet its regional capacity obligations.
- **Non-Dispatchable Generators**: These generators are those where the operator only has partial control over generator operation. For example, the MW output level of the wind farms on PEI are dependent on the wind speed, which can vary over the course of the day. Per industry requirements, Maritime Electric can only count a portion of a non-dispatchable generator's nameplate capacity towards meeting its regional capacity obligations (e.g., Maritime Electric is only able to count less than 25% of the total wind nameplate capacity – additional information is provided in Section 2.2.1 and Appendix C). The reason for this is that when electric utilities calculate capacity contributions, they are required to account for both the resource's intermittency and timing of when the resource generates with respect to when system load is highest. Thus, while non-dispatchable generators are well suited to help Maritime Electric meet its energy obligations (thus reducing overall carbon emissions), they are not well suited to help Maritime Electric meet its regional capacity obligations.

One of the benefits of having a higher amount of capacity installed on PEI, versus purchased from mainland power plants, is that it helps to insulate Maritime Electric's customers from a likely future regional capacity shortage in northeastern Canada as a result of increasing regional demand, the retirement of all Canadian coal power plants by 2030, and a lack of adequate regional transmission infrastructure. For reference, the following table illustrates Maritime Electric's historical and estimated future capacity obligations, including the share of capacity met with on-island and mainland resources. Since the mid-2010's, the share of Maritime Electric's on-island capacity has fallen significantly due to on-island power plant retirements and increasing system load.

Table ES-1 — Capacity Obligation and Resource Outlook

Resource	2015-2019 Average	2020	2021	2022	2023	2024
MECL's Capacity Obligation (MW)	**261**	**284**	**302**	**306**	**311**	**316**
Total MECL Capacity (MW)	**276**	**287**	**302**	**306** *(est.)*	**311** *(est.)*	**316** *(est.)*
Total On-Island Capacity (%)[1]	59.4%	51.6%	49.1%	37.0%	36.4%	35.8%
Total Off-Island Capacity, i.e., Purchased from Mainland (%)	40.6%	48.4%	50.9%	63.0%	63.6%	64.2%

Notes/Sources:

1) The above on-island capacity accounts for the appropriate conversion of nameplate capacity to effective capacity (i.e., including the effective load carrying capability of the generator, or ELCC) for non-dispatchable generators (such as the wind power plants), per industry requirements. Further discussion is provided in Section 2.2.1 and Appendix C.

2) **Improving Maritime Electric's Ability to Serve Load if PEI is Electrically Disconnected from the Mainland:** A scenario where PEI is electrically disconnected from the mainland is considered an emergency scenario, and has historical precedence (since 2004, there have been nine times when PEI was either fully or partially disconnected from the mainland). During this emergency situation, on-island resources alone would have to be used to meet load and stabilize the electrical system. If PEI is fully disconnected, Maritime Electric would currently be forced to implement rolling blackouts due to the fact that there is not enough on-island generation to meet the full electrical system load. Given that the amount of on-island capacity has fallen over the last decade due to retirements, future rolling blackouts are likely to be more severe than they have been for PEI in the past. This leaves Maritime Electric's customers exposed to significant financial and health/safety risks.

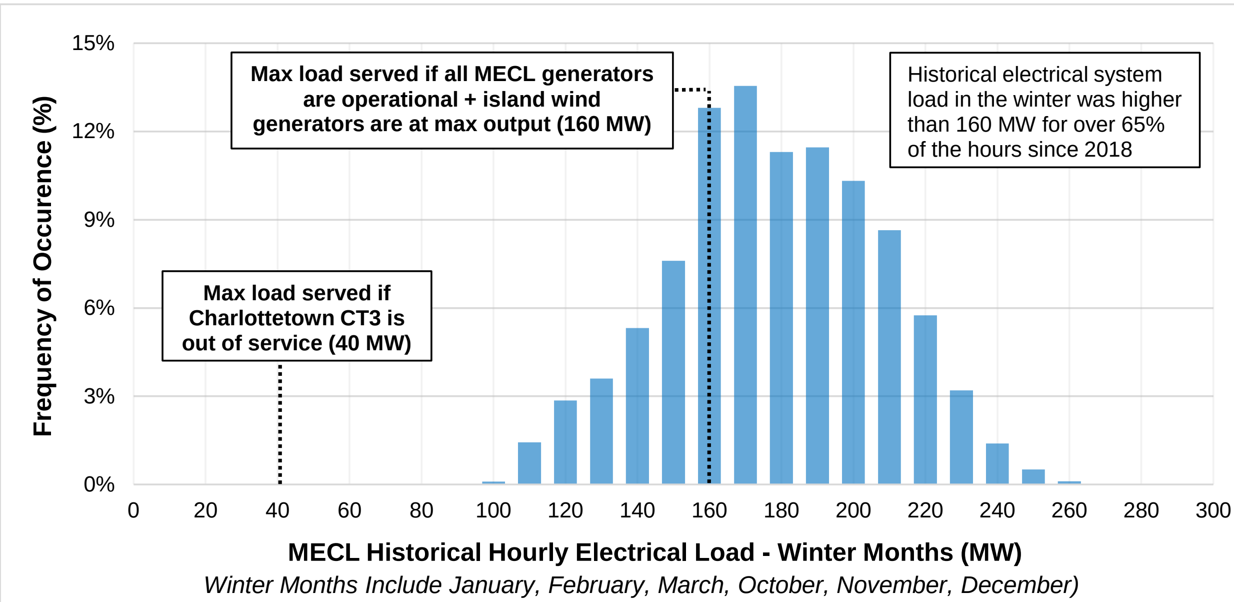
   An important point to note is that during a disconnection from the mainland, only a small portion of the on-island wind generation could be used to meet load. This is due to the fact that there is not enough dispatchable generation capacity installed on-island to be able to fully balance the generation intermittency from the large number of on-island wind generators. Without curtailment of a portion of the wind generation, there is a substantial risk of overwhelming the on-island dispatchable generators and throwing system supply and demand out of balance, which could lead to the collapse of the electrical system. At best, it is estimated that currently a maximum of 37% of all the wind generation on PEI[1] can be utilized during a full disconnection of PEI from the mainland, depending on wind conditions. This value falls to 0% in the event the largest on-island generator (Charlottetown CT3) is out of service.

[1] This is based on energy from all wind generation located on-island, which includes facilities supplying both on- and off-island customers.

The following figure shows a comparison of the historic Maritime Electric winter load to the amount of load that could be served during a disconnection of PEI from the mainland. The figure presents the distribution of historic hourly winter load (January through March and October through December) from the years 2018 through 2021. As an example, the figure illustrates that system load was approximately 190 MW for just under 12% of the hours in winter months between 2018 through 2021. During this time period, the average system load was 173 MW. Overlaid on the figure are how much load Maritime Electric will be able to serve during a disconnection of PEI from the mainland if 1) all of its dispatchable generators are available and 2) if Charlottetown CT3 is out of service. The figure illustrates that the historic system electrical load in the winter is typically far higher than the amount of electricity (in megawatts) that could be provided during a disconnection of PEI from the mainland.

Figure ES-1 — Historical System Winter Load Histogram (2018-2021)

Comparison to the Amount of Load MECL Could Serve During a Disconnection of PEI from the Mainland



For reference, both new dispatchable generators and / or energy storage could help Maritime Electric better manage situations where PEI is disconnected from the mainland. The amount that energy storage resources could help depends on a number of variables, including the charge level of the storage resource at the moment the disconnection occurs, the length of the disconnection, and whether / how much the PEI wind power plants are generating electricity during the disconnection. Due to these variables, there is significant uncertainty surrounding how beneficial energy storage resources would be during a disconnection of PEI from the mainland.

3) **Achieve Sustainability Targets:** Maritime Electric has established a greenhouse gas emissions reduction target to reduce emissions by 55% by 2030 (from 2019 levels). At present, Maritime Electric serves system load with a number of different resources; however, the majority of the energy it uses to serve load is purchased from the mainland, from New Brunswick Energy Marketing (NBEM). Energy supplied by NBEM is generated with many different resources, including renewable generators (e.g., the hydroelectric Mactaquac Generating Station) and also generators that create carbon emissions.

   A breakdown of Maritime Electric's historical generation and carbon emissions by source is provided in the following table. For reference, the energy purchased from NBEM provides a number of additional services beyond simply meeting load. Given PEI's large fleet of wind generators and the fact that wind power plants are intermittent resources, other resources that can balance the generation from the wind farms are needed. The generators that provide the balancing energy to Maritime Electric are located on the mainland and their energy is purchased through NBEM. NBEM also provides Maritime Electric additional ancillary services that help to maintain the stability of the PEI electrical system.

Table ES-2 — Historical Generation and Carbon Emissions by Source

Source	Average Historical Generation (GWh, 2019-2021)[1]	% of Total	Historical Carbon Emissions (Tonnes CO_2e)[2]	% of Total
MECL Diesel Generators	1.2[3]	0.1%	1,233	0.5%
Customer-Owned Generation (i.e., net-metered solar)	3.9	0.3%	0	0%
PEI Wind Farms	295.3	21.0%	0	0%
Point Lepreau Nuclear Generating Station	210.0	14.9%	0	0%
Purchases from NBEM	898.1	63.7%	253,389	99.5%
Total	1,408.5[3]	100.0%	254,622	100.0%

Notes/Sources:

1) Historical generation data provided by Maritime Electric.
2) Carbon emissions rates for Maritime Electric are taken from the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf).
3) The average historical net generation of Maritime Electric's generators is -0.5 GWh, due to the fact that these units are primarily on standby (and to be kept on standby the generators must draw a small amount of electricity from the grid). In addition, between 2019 and 2021 the Charlottetown oil-fired generators used an average of 3.3 GWh per year while being retired from service. Shown in the above table is the generation of the diesel generators, not including the relatively small amount of electricity they used from the system. The total system generation would average 1,403.5 GWh if both the net generation from the diesel generators and the electricity used by the Charlottetown oil-fired generators was considered.

Capacity Resources Considered

Technologies in this study were ultimately selected based upon three different selection steps: a primary, secondary, and final screening. As part of this process, S&L developed cost estimates (2022 Canadian dollars) of the different technologies, considering the unique economic- / location-related specifics of PEI. Much of S&L's work is in either designing or providing project oversight through the development, construction, and operation of different generation and energy storage projects. We maintain detailed internal cost databases of project data. As a result, the cost estimates developed for this study are based on actual cost data for recent projects that are either being built or are operating.

The list of technologies initially considered for this study is provided below:

- Wind power, both onshore and offshore
- Solar power, both photovoltaic (PV) utility and rooftop scale, and concentrating solar power (CSP)
- Battery energy storage systems (BESS), lithium-ion, other storage technologies
- Reciprocating internal combustion engine (RICE), operating both on traditional and renewable fuels
- Combustion turbines (CT), aeroderivative models, operating both on traditional and renewable fuels
- Biomass power plant, operating on different types of biomass
- Nuclear power plant, small modular reactor (SMR)
- Tidal power plant or wave power plant
- Geothermal power plant
- Fuel cells

Final Resource Portfolio Selection

The final shortlisted resources are listed in the following table, along with their per kW costs and notes pertaining to their ability to help meet Maritime Electric's most critical goals/needs.

Table ES-3 — Comparison of Final Shortlisted Resources

Resource	Estimated Overnight Capital Cost ($CAD/kW)	Contributions to Energy and Capacity Obligations	Contributions When PEI is Disconnected from Mainland	Contributions to Sustainability Targets
Onshore Wind Power	$2,126 / kW	*Energy:* Excellent, but intermittent. High expected power plant capacity factor. *Capacity:* Poor, low ELCC	Unreliable resource – Can provide energy during a disconnection, but generation is intermittent. Generation intermittency/variability needs to be balanced by another resource.	Excellent – Renewable generator, very strong wind resource on PEI
Utility-Scale Solar PV	$2,389 / kW	*Energy:* Good, but intermittent. Average expected power plant capacity factor. *Capacity:* Poor, low ELCC	Unreliable resource – Can provide energy during a disconnection, but generation is intermittent. Generation intermittency/variability needs to be balanced by another resource.	Good – Renewable generator, but just average solar resource on PEI
Rooftop Solar PV	$3,131 / kW	Similar to utility-scale solar PV.	Similar to utility-scale solar PV	Similar to utility-scale solar PV
Lithium-Ion BESS	*50 MW, 1-hr* $959 / kW ($959 / kWh) *50 MW, 2-hr* $1,565 / kW ($782 / kWh) *50 MW, 4-hr* $2,670 / kW ($668 / kWh)	*Energy:* Limited – BESS can time-shift previously generated electricity. Also, there are rarely times currently or expected in the intermediate future when there is/will be excess wind + nuclear generation above system load that could be time-shifted to other hours. *Capacity:* Excellent resource for meeting capacity obligations	Uncertain / depends on event – A BESS' ability to contribute to the system (both serving load and providing renewable/load balancing) during a disconnection is dependent on the BESS state of charge when the event occurs, the length of the event, and the operation/output of the wind farms. These variables are either partially or completely out of Maritime Electric's control. At best, a BESS could significantly support the system, at worst, it would not be able to provide support.	Limited – There are rarely times currently or expected in the intermediate future when there is/will be excess wind + nuclear generation above system load that could be time-shifted to other hours. As such, BESS would not appreciably improve Maritime Electric's ability to achieve its sustainability targets. BESS' contributions will increase as more renewable generation is added to the island.
Reciprocating Engines	*Diesel* $2,257 / kW *Biodiesel* $2,556 / kW	*Energy:* Limited – RICE would likely serve as a backup generator and would be rarely utilized to meet energy obligations; however, it could generate electricity if needed. *Capacity:* Excellent resource for meeting capacity obligations	Excellent – As a dispatchable generator with quick start and ramping capabilities, RICE power plants are ideal to help Maritime Electric support the system in a disconnection scenario. Due to its operational flexibility, a RICE power plant could both serve load and provide renewable/load balancing.	Limited – Since a RICE power plant would be primarily a backup facility, the impact to total Maritime Electric emissions would be small. Also, depending on the fuel utilized (diesel vs. biodiesel), RICE could have either a small negative or small positive impact from a carbon emissions perspective.
Combustion Turbines	*Diesel* $2,486 / kW *Biodiesel* $2,643 / kW	Similar to RICE (see above)	Similar to RICE (see above)	Similar to RICE (see above)

From the final shortlisted resources, various potential portfolios were developed for consideration and final recommendation. The final portfolios considered are listed below:

- Portfolio A: BESS (lithium-ion) + onshore wind + solar PV (utility-scale and rooftop)
- Portfolio B: BESS (lithium-ion) + RICE + onshore wind + solar PV (utility-scale and rooftop)
- Portfolio C: BESS (lithium-ion) + CTs + onshore wind + solar PV (utility-scale and rooftop)
- Portfolio D: RICE/CTs + onshore wind + solar PV (utility-scale and rooftop)

Note that each of the above portfolios also assume the continued implementation and growth of the PEI DSM program. The portfolios were evaluated based on a number of criteria, including cost, Maritime Electric's most critical goals/needs, and other important considerations. As highlighted above, Maritime Electric's most critical needs are 1) meeting its energy and capacity obligations, 2) serving system load at all times, including during situations when PEI is electrically disconnected from the mainland, and 3) achieving sustainability targets.

The recommended portfolio was Portfolio D, with RICE recommended over CTs. The reasoning is as provided as follows.

The combination of RICE, onshore wind, and solar PV would provide Maritime Electric with carbon-free generation to help meet both its energy obligations and sustainability targets (via the wind and solar PV), along with capacity to meet its regional capacity obligations (via the RICE). The wind and solar PV would reduce the amount of energy needed to be purchased from NBEM. In addition, the combination of this additional energy from the wind and solar PV projects, combined with the capacity from the RICE, will help to provide a buffer against potential future regional market price volatility in energy and capacity.

Because a RICE power plant would primarily serve as a backup generator, the fact that a RICE generates carbon emissions will not substantially impact Maritime Electric's ability to meet sustainability targets, but it could create a stranded asset problem for Maritime Electric if the government of Canada begins enforcing stricter rules on allowable fuels for power generation. One distinct advantage of RICE is that it can operate on fuels the government of Canada considers to be renewable, such as biodiesel. A RICE can operate on biodiesel, with only minimal modifications required to the balance of plant equipment/storage. The lifecycle carbon emissions of biodiesel are much lower than that of traditional diesel. The fact that RICE can operate on renewable fuels helps Maritime Electric avoid the risk that a new RICE power plant would become a stranded asset in the future if fuel regulations change.

A RICE power plant would also significantly help Maritime Electric during a disconnection from the mainland. The addition of RICE to PEI would provide Maritime Electric more dependable dispatchable capacity to both serve load and also to balance the wind generation intermittency during a disconnection, which would in turn allow Maritime Electric to utilize more of PEI's wind capacity without risking an imbalance of generation and load. For reference, while a BESS project could help support the system during a disconnection from the mainland in many of the same ways, the level of support it can provide depends on the BESS' state of charge when the disconnection occurs, generation from on-island wind/solar PV, and the length of the disconnection, which are all unknowns. As a result, a BESS is not a reliable resource to support the electrical system during a disconnection of PEI from the mainland.

We estimate that a minimum of 85 MW of dispatchable capacity needs to be added to the system to be able to bring the ratio of total dispatchable capacity versus winter peak load back in line with historical levels (see Section 2.2.4 for additional discussion). Without this level of additional capacity, it is highly likely that future rolling blackouts (that might occur as a result of a disconnection of PEI from the mainland) will be much more severe than those that have occurred in the past. This capacity should be installed as soon as possible. Additional capacity beyond 85 MW will be required to replace the retirement of the Borden Generating Station generators, expected near 2030.

The following tables provide the forecasted capacity, energy, and emissions sources for Portfolio D. The new reciprocating engines in the table below are assumed to be online by 2025 and operated on biodiesel.

Table ES-4 — Estimated Portfolio D Capacity Sources

Portfolio D	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Capacity Obligation (MW):										
MECL Peak Load (Net of DSM)	284	289	293	299	305	311	317	323	329	335
Less Interruptible Load	14	14	14	14	14	14	14	14	14	14
Plus 15 % Planning Reserve	41	41	42	43	44	45	45	46	47	48
Total MECL Capacity Obligation (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**
A) MECL Capacity Resources (MW):										
Borden Generating Station (CTs)	40	40	40	40	40	40	40	0	0	0
Charlottetown CT3	49	49	49	49	49	49	49	49	49	49
Point Lepreau Nuclear	29	29	29	29	29	29	29	29	29	29
Short Term Capacity Purchases (NBEM)	172	174	94	97	104	111	118	125	132	139
New Reciprocating Engines (Biodiesel)	0	0	85	85	85	85	85	125	125	125
Subtotal (MW)	*290*	*292*	*297*	*300*	*307*	*314*	*321*	*328*	*335*	*342*
B) Wind Power (MW):										
MECL Purchasd Nameplate Capacity	92	122	122	162	162	162	162	162	162	162
ELCC as % of Purchased	23%	20%	20%	17%	17%	17%	17%	17%	17%	17%
ELCC (MW)	*21*	*24*	*24*	*28*	*28*	*28*	*28*	*28*	*28*	*28*
C) Solar PV Power (MW):										
Rooftop Solar	15	15	15	15	15	15	15	15	15	15
Utility Scale	0	0	20	30	40	50	60	60	60	60
ELCC as % of Purchased	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ELCC (MW)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total MECL Capacity (A+B+C) (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**

Table ES-5 — Estimated Portfolio D Energy Sources

Portfolio D	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Energy Obligation (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**
MECL Energy Supply (GWh):										
Borden Generating Station (CTs)	1.1	1.1	0.6	0.6	0.6	0.6	0.6	0	0	0
Charlottetown CT3	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Point Lepreau Nuclear	210	210	210	210	210	210	210	210	210	210
Energy Purchases (NBEM)	968	879	865	719	729	738	747	774	800	827
New Reciprocating Engines (Biodiesel)	0	0	1.2	1.2	1.2	1.2	1.2	1.8	1.8	1.8
Wind Power	295	406	406	557	557	557	557	557	557	557
Rooftop Solar PV	20	20	20	20	20	20	20	20	20	20
Utility Scale Solar PV	0	0	35	52	70	87	105	105	105	105
Total Energy (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**

Table ES-6 — Estimated Portfolio D Emissions Sources

Portfolio D	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Emissions (kilo-Tonnes CO_2e)										
Borden Generating Station (CTs)	1.2	1.2	0.6	0.6	0.6	0.6	0.6	0	0	0
Charlottetown CT3	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Point Lepreau Nuclear	0	0	0	0	0	0	0	0	0	0
Energy Purchases (NBEM)	273	248	244	203	206	208	211	218	226	233
New Reciprocating Engines (Biodiesel)	0	0	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.6
Wind Power	0	0	0	0	0	0	0	0	0	0
Rooftop Solar PV	0	0	0	0	0	0	0	0	0	0
Utility Scale Solar PV	0	0	0	0	0	0	0	0	0	0
Total Emissions (kilo-Tonnes CO_2e)	**276**	**251**	**246**	**205**	**207**	**210**	**213**	**220**	**227**	**235**

Notes

1) Carbon emissions rates related to purchases from NBEM are based on 2019, 2020, and 2021 data compiled by Maritime Electric and contained in the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf). Note the NBEM emissions rate (on a tonnes CO_2e per GWh basis) used to calculate carbon emissions is kept consistent for all the years shown in the table above; however, this rate is expected to fall with time as mainland utilities pursue various decarbonization strategies.
2) Biodiesel emissions assume B100 fuel is used and are calculated assuming the lifecycle emissions (from the production of the B100 fuel through combustion) are 70% less than traditional diesel fuel. The actual lifecycle emissions may vary based on a number of factors, including fuel composition, production method, etc. Note that the Canadian government considers biodiesel as a renewable fuel.

The reason BESS was not included in the recommended portfolio was primarily because of two reasons. First, a BESS solution is not as effective as the other shortlisted technologies at helping Maritime Electric meet its most critical needs. For reference, Maritime Electric's most critical needs are defined as 1) meeting its energy and capacity obligations, 2) serving system load at all times, including during situations when PEI is electrically disconnected from the mainland, and 3) achieving sustainability targets. Additionally, a BESS solution is a higher cost option than the other shortlisted technologies.

It is important to note that a BESS solution could offer some additional advantages for Maritime Electric beyond its most critical needs, such as allowing Maritime Electric to pursue an energy arbitrage strategy (if they wished to participate in an energy marketplace in the future), providing various ancillary services and other system electrical support, and helping to manage times when there is excess wind generation (which does not occur frequently today, but will occur more frequently in the future as more onshore wind is integrated onto PEI). If it were determined that a BESS solution should be pursued, we recommend Maritime Electric pursue, potentially in coordination with interested PEI stakeholders, development of a demonstration 4-hour BESS project. As a demonstration project, Maritime Electric and PEI would be better able to assess which functions/use cases future BESS projects might be utilized for to maximize the benefit for PEI and Maritime Electric's customers.

1. INTRODUCTION

Sargent & Lundy (S&L) was engaged by Maritime Electric (or MECL) in mid-2022 to develop this capacity resource study for the purposes of evaluating a variety of different capacity resource technologies, developing detailed cost estimates, and recommending the technologies best suited to helping Maritime Electric achieve its most critical goals/needs.

At a high level, this report was developed through detailed reviews and analysis of Maritime Electric's planning documents, reviews of planning documents/information from the other major utilities and planning organizations in the Maritimes region, our experience with and understanding of the technical characteristics of the different capacity resources, and our experience preparing detailed cost estimates for various capacity resource technologies.

This report is structured as follows:

- **Resource Planning Considerations** – This section of the report highlights the key planning considerations that factor prominently in the analysis of the different capacity resource options considered and ultimately drive the final resource recommendations.
- **Carbon Emissions Planning** – This section augments the previous section with a specific focus on how Maritime Electric can most effectively achieve its carbon reduction/sustainability targets. This section discusses some of the challenges associated with portfolio decarbonization, along with potential ways those challenges can be addressed.
- **Capacity Resource Comparison** – This section of the report introduces the different capacity resources considered as part of this analysis. For each resource, a summary of the resource's key technical characteristics and applicability to Prince Edward Island (PEI) / Maritime Electric's portfolio are discussed.
- **Capacity Resource Analysis** – In this section, both a preliminary and secondary screening of the different resources is performed to narrow the technologies down to those that are best suited to meeting Maritime Electric's most immediate needs/goals.
- **Capacity Resource Recommendations** – The final section of this report compares various portfolios that combine the different short-listed technologies, ultimately recommending a final portfolio.

This report is meant not only to provide a recommendation of a portfolio of technologies for Maritime Electric, but also to serve as a guide to the reader on the unique considerations that drive the final resource recommendations. In addition to the main sections of the report, a number of appendices are also included that provide supporting information.

The following subsection provides a brief introduction to S&L.

1.1. SARGENT & LUNDY INTRODUCTION

S&L is one of the oldest and most experienced full-service architect-engineering firms in the world. Founded in 1891, the firm is a global leader in power and energy with expertise in: all forms of electric power generation; resource planning; power transmission and distribution; grid modernization; energy storage; fuel infrastructure; energy consulting; decarbonization; hydrogen; carbon capture; oil and gas infrastructure; and physical and cyber-security. S&L's power generation experience includes wind, solar, natural gas- and diesel-fired, nuclear power, coal-fired; biomass-fired, oil-fired power plants, among others. We are frequently asked to perform analyses, much like this one for Maritime Electric, to help utilities plan for the future, focusing on the best ways to cost-effectively achieve decarbonization goals, improve system reliability, and maximize value for customers and stakeholders.

From the perspective of generation and energy storage cost and performance estimates, S&L is one of the most recognized firms in the energy industry. Our work frequently consists of either designing or providing project oversight through the development / operation of generation and energy storage projects. S&L maintains detailed cost databases of these projects, which helps inform our cost estimates such that they are based on actual cost data for recent projects that are either being built or are operating. Due to our knowledge of generation and energy storage costs, we helped develop the U.S. Energy Information Administration's (EIA) cost and performance benchmarking database, which consists of 25 different power generation and energy storage technology cases. In addition, we have been performing similar scopes of work for numerous other utilities and for the Electric Power Research Institute (EPRI) for many years.

More information about S&L can be found on our website, at sargentlundy.com.

2. RESOURCE PLANNING CONSIDERATIONS

This section details the key planning considerations that guide the analysis of the different capacity resource technologies evaluated later in the report. Important background information on the various considerations is provided as necessary.

2.1. MARITIME ELECTRIC'S ENERGY AND CAPACITY OBLIGATIONS

Maritime Electric must not only meet the hourly electricity demand for their customers, but it must also have a sufficient amount of generation capacity (either owned by Maritime Electric or purchased from resources on PEI or on the mainland) to meet regional reliability requirements of the electrical system. The two requirements are discussed further below:

2.1.1. Energy Obligations

Energy obligations are those that are associated with real-time system electrical demand. Maritime Electric's energy obligations vary on a continuous basis throughout the day, based on customer electricity usage. Maritime Electric has historically served this load with energy generated by three different sources:

1. A total of 29 MW of continuous baseload energy purchased from the Point Lepreau Nuclear Generating Station (located on the mainland in New Brunswick);
2. Energy purchased from wind farms located on PEI. Generation from the wind farms varies hourly based on wind speed;
3. Energy purchased from the mainland through an energy purchase agreement (EPA) with New Brunswick Energy Marketing (NBEM). The amount of energy purchased from NBEM varies continuously depending on the system load and real-time electricity generation from PEI's wind farms;

These three resources have historically combined to meet over 99% of Maritime Electric's load (with the remainder supplied by Maritime Electric's on-island backup generation). In addition, these resources are mostly carbon-free. In fact, 86% of the energy that Maritime Electric provides to its customers (as of 2021) is generated with resources that do not emit carbon[2].

Maritime Electric's system load, both in terms of system peak and energy, has increased virtually every year since 2010. The following table illustrates both historical and forecasted load. For reference, there has been over a 25% load increase (in GWh) between 2010 and 2021.

[2]Taken from page 23 of the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf)

Table 2-1 — Historical and Forecasted Annual Energy and Peak Load

Year	2015-2019 *(avg.)*	2020	2021	2022 *(est.)*	2023 *(est.)*	2024 *(est.)*
MECL Energy (GWh)	1,318	1,392	1,433	1,477	1,495	1,517
December Peak Load (MW)	239	257	276	280	284	289

The increasing load correlates with the steady population growth PEI has seen over the most recent decades. In 2011, the PEI Statistics Bureau reported that PEI had just over 140 thousand residents[3], which grew to 154 thousand residents by 2021[4]. This corresponds to a 10% growth in island population between 2011 and 2021. Maritime Electric has also noted a continuous shifting towards electric heating on the island, which is expected to continue moving forward over the near to intermediate term. This shift helps to explain the fact that electricity consumption growth on the island has outpaced population growth on the island over the most recent decade.

Moving forward, we would expect system load to continue to increase due to a combination of continued population growth (which is forecasted to increase steadily moving forward based on estimates by the PEI Statistics Bureau), a continued transition of island residents to electric heating, and some adoption of electric vehicles. There are some considerations that will help to offset system load growth, including increasing demand side resources / policies, energy efficiency improvements, increasing resident-owned generation such as solar panels on homes (which provides energy but does not reduce peak system load), etc. However, based on our review of the current / forecasted impact of the demand side management (DSM) program, we do not expect the DSM program will be able to fully offset the expected increase in load as a result of the island population growth and the continued transition of residents to electric heating.

2.1.2. Capacity Obligations

Capacity obligations are associated with ensuring there is enough generation capacity installed in the region to maintain system resource adequacy[5]. The capacity requirements for the entire Maritimes Area, which includes PEI, New Brunswick, Nova Scotia, and northern Maine, are established by the Northeast Power Coordinating Council (NPCC).

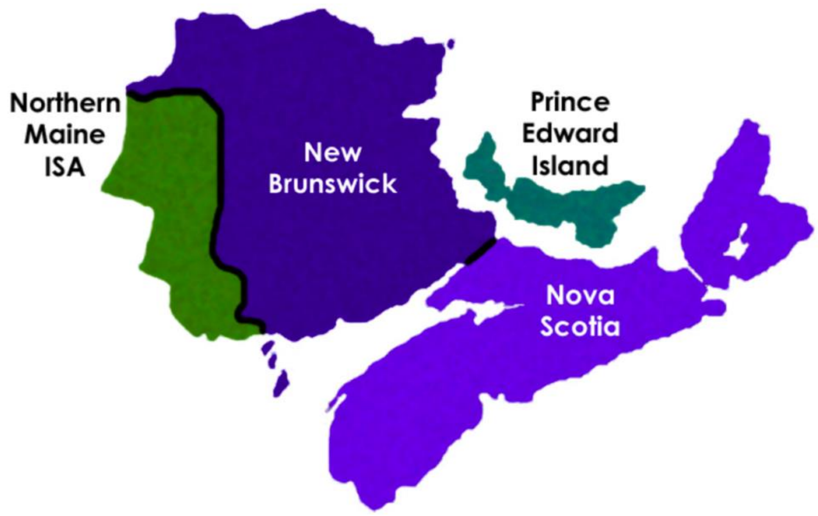
As one of the utilities serving electrical load in the Maritimes Area, Maritime Electric coordinates with the other utilities in the Maritimes Area to ensure the regional capacity requirements established by NPCC are

[3] http://www.gov.pe.ca/photos/original/2011Census.pdf
[4] https://www.princeedwardisland.ca/sites/default/files/publications/2021_census_reports.pdf
[5] Resource adequacy refers specifically to the provision that the region has a sufficient number of generating resources installed to meet both system load and generating reserve requirements. The amount of generation installed in the region needs to be high enough to cover for the periodic maintenance of generators and the probability that some generators will be out of service due to forced outages (i.e., broken down)

met. Under the terms of its Interconnection Agreement with New Brunswick Power, Maritime Electric is required to be able to carry sufficient generating capacity to meet its firm peak hourly load, plus a 15% planning reserve margin. Additionally, a single capacity resource cannot account for more than 30% of Maritime Electric's capacity contributions.[6]

The following figure illustrates the Maritimes Area.

Figure 2-1 — Maritimes Area Region for Capacity Planning[7]



It is important to note the distinct differences between Maritime Electric's energy and capacity requirements. While related, energy and capacity are also distinctly different. Resources that Maritime Electric uses to meet their regional capacity obligations do not have to be the same resources that they use to meet energy obligations. For example, Maritime Electric's diesel and oil-fired generators typically account for less than 1% of annual energy generation, but they have accounted for over 40% of the capacity Maritime Electric counts toward their regional capacity sharing obligations. If Maritime Electric cannot meet its capacity obligations fully using on-island resources, it must meet them by purchasing capacity from generators elsewhere (i.e., the mainland). In 2021, Maritime Electric purchased approximately 50% of its required capacity from power plants in New Brunswick (this includes purchases from Point Lepreau). The following table compares the resources that Maritime Electric used to meet their energy and capacity obligations in 2021.

[6] These are contractual requirements per the 1977 interconnection agreement between Maritime Electric and New Brunswick Power that were established to regulate the amount that Maritime Electric / PEI contribute to the overall Maritimes Area regional capacity requirements

[7] Source: *NPCC 2021 Maritimes Area Interim Review of Resource Adequacy*

Table 2-2 — Comparison of MECL Energy and Capacity Obligations for 2021

Obligation / Resource	Energy Obligations (i.e., Load MECL Must Serve)		Capacity Obligations (i.e., to Meet Requirements Established by NPCC)	
	Energy (GWh)	% of Total	Capacity (MW)	% of Total
MECL's Obligation	1,433	-	302	-
Maritime Electric Diesel Generators	2.2	0.15%	127[1]	42%
PEI Wind Farms	280.6	19.6%	21[2]	7%
PEI Solar	5.7	0.40%	0[2]	0%
Point Lepreau Nuclear Generating Station	197.7	13.8%	29	10%
Purchases from NBEM / New Brunswick	946.8	66.1%	125	41%

Notes/Sources:

1) Due to the retirement of the Charlottetown oil-fired generators, this value falls from 127 MW to 89 MW in 2022, resulting in capacity purchases from New Brunswick increasing from 41% to 54% of the total resources Maritime Electric utilizes to meet capacity obligations.
2) The capacity values of the wind and solar generators account for the appropriate conversion of nameplate capacity to effective capacity (i.e., including the effective load carrying capability of the generator, or ELCC), which is a required conversion Maritime Electric must perform. Further discussion is provided in Section 2.2.1 and Appendix C.

In the table above, it is important to note the small amount of capacity that Maritime Electric is able to count from the PEI wind farms and solar installations towards their regional capacity obligations (21 MW and 0 MW, respectively), especially considering there are 92.5 MW of wind generation contracted with Maritime Electric. The reason for this is because the capacity contributions of these resources is calculated using a methodology that appropriately reduces their capacity value to account for both the resource's intermittency and when the resource generates with respect to when system load is highest. This calculation methodology is an industry requirement that Maritime Electric must follow. This concept/methodology is discussed in additional detail in Appendix C.

2.1.2.1. Meeting Capacity Obligations in the Future

The recent retirement of Maritime Electric's Charlottetown oil-fired generators has resulted in a significant drop in generation capacity located on PEI. As a result, in order for Maritime Electric to meet its regional capacity obligations, it has had to purchase additional capacity from New Brunswick to replace the retired capacity of the Charlottetown generators. Table 2-3 provides Maritime Electric's historical and forecasted capacity obligations, in addition to the resources that Maritime Electric has/will use to meet those obligations. It is important to note that the capacity obligations increase each year as a result of increasing island peak hourly load (Maritime Electric's load and peak load forecast is discussed further in Section 2.1.1). For reference, the capacity obligations also account for the forecasted increasing contributions from the DSM program on PEI. As can be observed in the table, the share of Maritime Electric's capacity obligations that it can meet with on-island generators falls from near 60% (between 2015 and 2019) to just above 35% following the retirement of the Charlottetown generators and the continued increase in system peak load.

Table 2-3 — Capacity Obligation and Resource Outlook

Resource	2015-2019 Average	2020	2021	2022	2023	2024
MECL's Capacity Obligation (MW)	**261**	**284**	**302**	**306**	**311**	**316**
MECL Diesel / Oil Generators[1]	143	127	127	89	89	89
PEI Wind Farms[2]	21	21	21	24	24	24
Point Lepreau Nuclear	29	29	29	29	29	29
Purchases from New Brunswick	83	110	125	164 (est.)	169 (est.)	174 (est.)
Total (MW)	**276**	**287**	**302**	**306** (est.)	**311** (est.)	**316** (est.)
Total On-Island (%)	59.4%	51.6%	49.1%	37.0%	36.4%	35.8%
Total Off-Island (%)	40.6%	48.4%	50.9%	63.0%	63.6%	64.2%

Notes:

1) The reductions from 143 MW to 127 MW in 2020 and from 127 MW to 89 MW in 2022 is a result of the retirement of the Charlottetown oil-fired generators.
2) The capacity values of the wind generators account for the appropriate conversion of nameplate capacity to effective capacity (i.e., ELCC), which is a required conversion Maritime Electric must perform. Further discussion is provided in Section 2.2.1 and Appendix C. The effective capacity of the solar generators is 0 MW; thus, they are not included in the above table.

Purchasing higher amounts of capacity from New Brunswick, or other locations, results in increased capacity market price exposure for Maritime Electric. In the event that the price of generation capacity rises, Maritime Electric's customers will be more negatively impacted by the price increase. As discussed in Section 2.4.1, the mandated retirement of coal power plants throughout Canada by 2030 will result in less available capacity in the region. With less available capacity in the region (combined with the other factors discussed in Section 2.4), we expect that the market price for capacity will rise in the future.

In addition, less on-island generation capacity translates to a higher risk for Maritime Electric's customers in the event that PEI is electrically disconnected from the mainland. During a disconnection, Maritime Electric can only serve load with the generators installed on-island. In addition, only a portion of the on-island wind generation can be used during a disconnection from the mainland due to the fact that there are not enough other on-island generators available to fully balance the wind generation (without proper balancing of the wind generation, the electrical system can collapse). As a result, any disconnection from the mainland will result in Maritime Electric not having enough generation to fully meet load and it will be forced to shed load (i.e., not fully serve all customer demand) and implement rolling blackouts. The severity of the rolling blackouts will increase with lower amounts of generation capacity installed on the island. For Maritime Electric, this risk is of significant concern given that the potential consequences of Maritime Electric not being able to serve customer load during a serious weather event are potentially catastrophic. This scenario is discussed in further detail in Section 2.2.

2.1.2.2. Potential Capacity Resources

There are many different types of technologies that provide capacity to an electrical system. In general, the technologies best suited to providing capacity to the system are those that are dispatchable, meaning the system operator has complete control over when the technology provides electricity to the system. A further discussion of the different sources of capacity that Maritime Electric could integrate and their effectiveness at helping meet Maritime Electric's regional capacity obligations are summarized below:

- **Demand Response / Demand Side Programs**: Demand response programs (DSM) incentivize customers to shift/reduce electrical usage during critical times. The net result of these programs is that they help the utility better balance supply and demand. Demand response is considered a dispatchable resource and can be counted towards meeting capacity obligations due to the fact that it helps utilities reduce peak demand.
- **Energy Storage**: Energy storage systems are a good source of capacity that Maritime Electric could utilize to meet its obligations. Energy storage systems are considered dispatchable resources. It would need to be formally quantified how much of the energy storage nameplate capacity Maritime Electric would be able to count towards its capacity obligations; however, we expect this value to be near the storage project's nameplate capacity.
- **Dispatchable Generators**: A dispatchable generator is one where the operator has control over when the unit is on/off and at what MW output level the generator is operating at. Some examples of common dispatchable generator technologies include engines and combustion turbines. Dispatchable generators are well suited to help Maritime Electric meet its regional capacity obligations.
- **Non-Dispatchable Generators**: These generators are those where the operator only has partial control over generator operation. For example, the MW output level of the wind farms on PEI are dependent on the wind speed, which can vary over the course of the day. Per industry requirements, Maritime Electric can only count a small portion of a non-dispatchable generator's nameplate capacity towards meeting its regional capacity obligations (e.g., Maritime Electric is only able to count less than 25% of the total wind nameplate capacity – additional information is provided in Section 2.2.1 and Appendix C); thus, while non-dispatchable generators are well suited to help Maritime Electric meet its energy obligations, they are not well suited to help Maritime Electric meet its regional capacity obligations.

2.2. DISCONNECTION FROM MAINLAND

An important planning consideration for Maritime Electric is a situation where PEI is electrically disconnected from the mainland. A disconnection from the mainland has the potential to have serious consequences for PEI, especially if the outage were to take place during an extreme weather event. Since PEI has seen a significant transition towards electric heating in homes, a disconnection and subsequent loss of power during extreme cold would leave many residents without heat, which could result in significant property damage (i.e., from frozen plumbing) or even loss of life. For reference, the extended power outages during winter 2021 in Texas, resulted in 246 deaths[8] and nearly $200 billion dollars (USD) in property damage[9]. While the cause of the devastation in Texas was weather-driven, it was also a consequence of lack of system preparedness for a low probability, but high severity event.

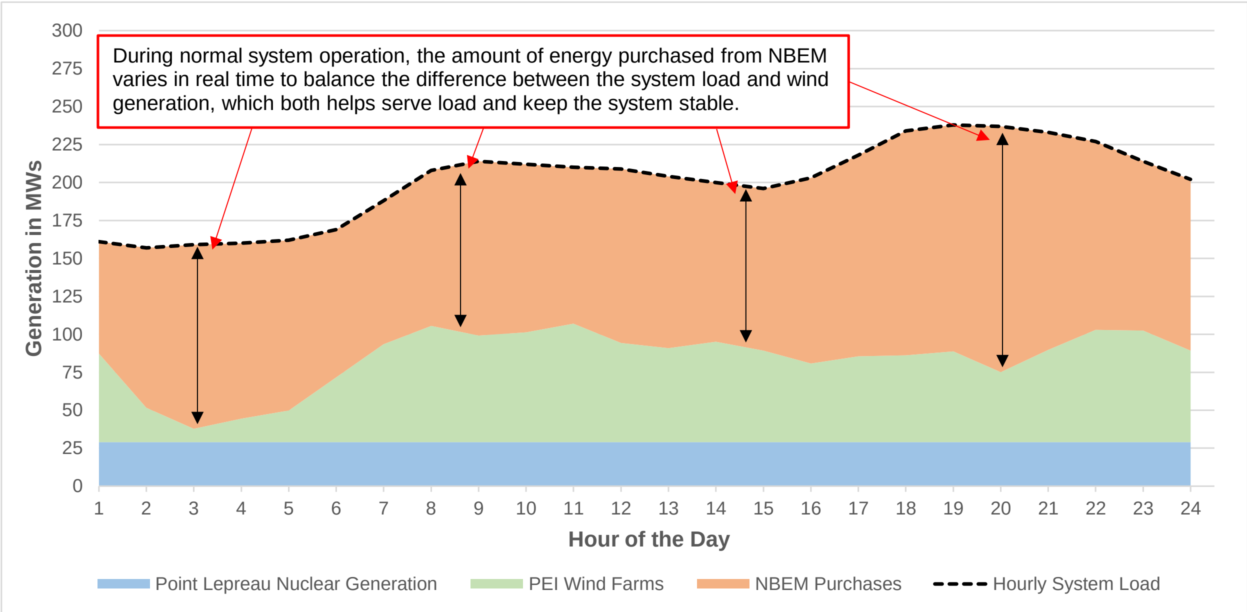
In the event that PEI is electrically disconnected from the mainland in the winter, there is not enough on-island generation installed to meet system load, which would result in Maritime Electric having to implement rolling blackouts.[10] The reason for this is twofold. First, the total capacity of Maritime Electric's on-island dispatchable generators has recently fallen due to the retirement of the Charlottetown oil-fired generators. Historically, Maritime Electric's dispatchable capacity (127 MW) has been approximately 50% of peak load; however, this number (89 MW) is now only just above 30% of peak load. Second, only a fraction of the island's wind capacity can be utilized in a scenario where PEI is disconnected from the mainland, as is discussed in the following paragraph. Table 2-7 in Section 2.2.4 provides an annual comparison of the amount of dispatchable capacity Maritime Electric has available versus system peak load.

2.2.1. Wind Capacity During Disconnection of PEI from Mainland

Both when PEI is connected to the mainland and in a scenario where it is disconnected, properly managing island load and the variable generation of the wind farms on PEI is critical, due to the fact that an imbalance of electricity supply and demand can result in a system collapse. When connected to the mainland, the load/wind balancing requirements of the PEI electrical system are provided by mainland generators and purchased through the agreement with NBEM. An example illustrating the load/wind balancing support the NBEM energy provides is shown in Figure 2-2, which illustrates a typical winter day for Maritime Electric. As can be seen in the figure, nuclear generation is fixed for each hour of the day, but the wind generation varies based on the wind speed. The NBEM energy purchases vary throughout the day and make up the difference between the system load and the wind plus nuclear energy.

[8] https://www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246/amp/
[9] https://www.austintexas.gov/sites/default/files/files/HSEM/2021-Winter-Storm-Uri-AAR-Findings-Report.pdf
[10] Maritime Electric 2020 Integrated System Plan, page 41 and 42

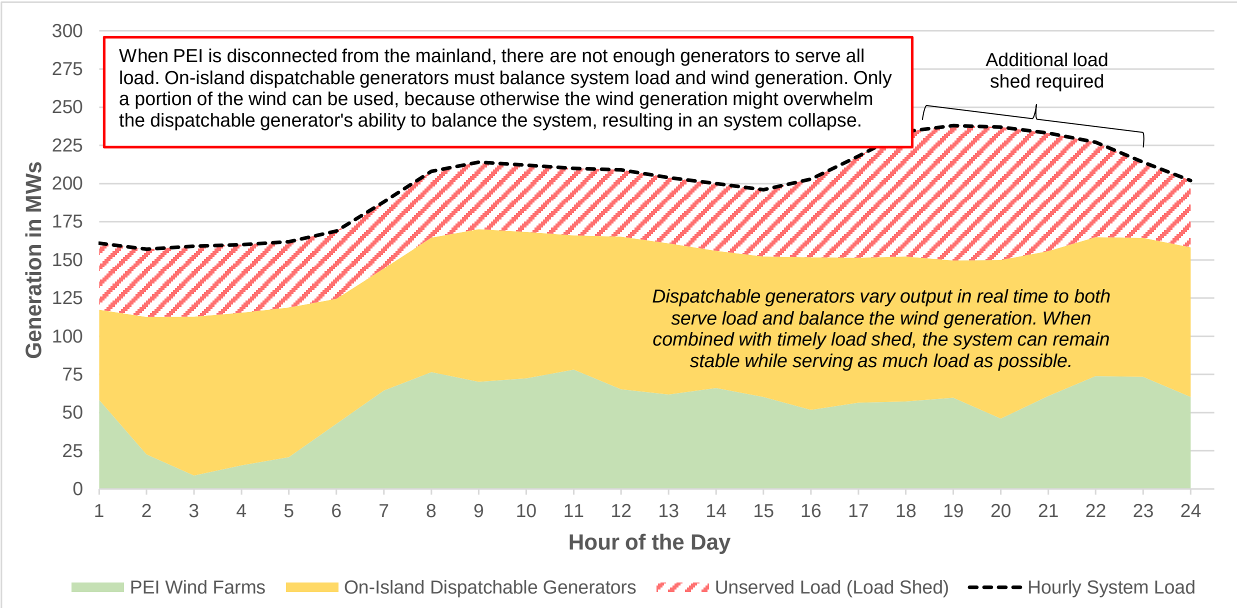
Figure 2-2 — Typical Winter Day System Dispatch



If PEI were disconnected from the mainland, these balancing requirements would need to be met by on-island generators. To balance the wind generation and system load, the dispatchable generators on PEI would need to vary output on a continuous basis to offset the peaks and valleys of the wind generation and load. Given there is a significant amount of wind capacity installed on PEI relative to the amount of on-island dispatchable capacity, only a fraction of the wind generation could be utilized when PEI is disconnected from the mainland without risking overwhelming the capabilities of the dispatchable generators on the island, leading to an electricity supply/demand imbalance and subsequent potential PEI electrical system collapse.

The following figure provides an example illustration of system dispatch in the event of a disconnection from the mainland. It is important to note that the balance between the amount of load that can be served and the amount of load that must be shed is critical during this event. To maintain this balance, Maritime Electric has to not only properly balance out the generation from the wind, but also intentionally cut power to customers on a rolling basis to not overwhelm the on-island generator's capabilities (see Section 2.2.2 for additional details on rolling blackouts).

Figure 2-3 — Winter Day System Dispatch When PEI is Disconnected



It is also important to note that during very high wind speeds (for example, during a major storm), the wind turbines must be stopped to avoid damage. In this event, much more load shed can be expected.

Maritime Electric estimates that a maximum of roughly 37% (71 MW) of all the total installed island wind nameplate capacity on PEI[11] could be dispatched if PEI were disconnected from the mainland without risking overwhelming the balancing capabilities of the dispatchable generators. Actual wind dispatch would depend on wind conditions, wind farm ability to respond to system operator directives, and contractual arrangements. In the event that the Charlottetown CT3 was also lost, the island would have an extreme shortfall in dispatchable generation that could be used for energy balancing; thus, an estimated 0% of the on-island wind generation could be utilized without risking system collapse. To illustrate this important concept, the following table was developed based on input from Maritime Electric. In the table, three different scenarios are illustrated:

- **Scenario A**: Wind generation on PEI is available and generating electricity continuously. In this scenario, the amount of wind shown in the table is the estimated maximum amount that the on-island dispatchable generators can handle without jeopardizing system stability.
- **Scenario B**: This scenario assumes that the Charlottetown CT3 is in outage. This scenario is shown to illustrate the importance of the wind balancing contributions of the on-island dispatchable resources. The loss of CT3 during an event where PEI is disconnected from the mainland would result in a significant reduction in the amount of dispatchable capacity that could be used to balance

[11] This is based on energy from all wind generation located on-island, which includes facilities supplying both on- and off-island customers.

the intermittent generation from the wind. As a result, Maritime Electric estimates that no wind generation could be utilized without risking the destabilization and potential failure of the electrical system. Load shed is expected to be much higher than Scenario A in this scenario.

- **Scenario C**: In this scenario, the wind generation is not available, due to the wind not blowing, wind speeds that are too high for operation of the wind turbines, transmission failure, or other similar reason. Load shed is expected to be much higher than Scenario A in this scenario.

The amount of load that the system can meet in all three scenarios is much lower than the peak winter load (approximately 280 MW), indicating that rolling blackouts will likely occur if PEI is disconnected from the mainland. It is important to note that the dispatchable capacity in the summer would be lower than what is shown in the table due to temperature deratings of the dispatchable generators (the estimated total capacity available in Scenario A would reduce from 160 MW to approximately 140 MW).

Table 2-4 — Capacity Available to Serve Load When PEI is Disconnected

Peak system load in the winter is approximately 280 MW

Generating Resource	Winter Nameplate Capacity (MW)	Scenario A: Wind Generation Available (MW)	Scenario B: CT3 in Outage (MW)	Scenario C: No Wind Generation (MW)
Charlottetown CT3	49	49	Unavailable	49
Borden CT1	15	15	15	15
Borden CT2	25	25	25	25
PEI Wind Farms	191	Up to 71	0	Unavailable
Total Capacity	**280**	**Up to 160**	**40**	**89**

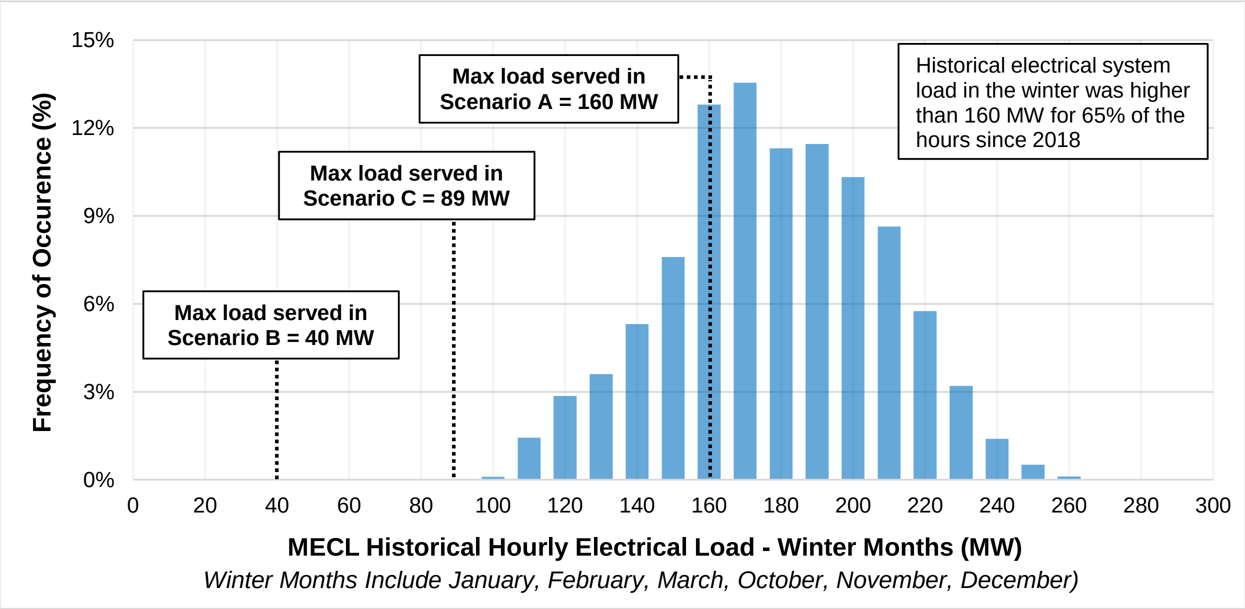
Notes:

1) The values in the above table are an estimation based on our review of the system and our discussions with Maritime Electric. Further detailed study is required to more accurately determine the amount of electricity that can be supplied, both in the current system and in the system after this report's recommendations are incorporated.

The following figure is included to illustrate how the above generation levels compare to historical system electrical demand (load) in the winter months (January through March and October through December). The figure presents the distribution of hourly electrical load based on historical data from the years 2018 through 2021. As an example, the figure illustrates that system load was approximately 190 MW for just under 12% of the hours in winter months between 2018 through 2021. During this time period, the average system load was 173 MW. Overlaid on the figure are the three different generation levels from Scenario A, B, and C in the table above. The figure illustrates the historic system electrical load far exceeded the amount of megawatts that could have been served in Scenarios A, B, and C during a disconnection of PEI from the mainland. Even the generation level of Scenario A, which is the highest of the three scenarios, generally falls short of historical hourly electrical demand.

Figure 2-4 — Historical System Winter Load Histogram (2018-2021)

Comparison to the Amount of Load MECL Could Serve During a Disconnection of PEI from the Mainland



2.2.2. Rolling Blackouts

In the event that PEI is electrically disconnected from the mainland, Maritime Electric would likely be forced to implement rolling blackouts due to the fact that there will not be enough generation to meet the full electrical system load. In a rolling blackout, different parts of the electrical grid are energized on a rotating basis, while others are without power. A rolling blackout reduces total system load such that served electrical demand does not exceed supply (a mismatch could lead to system collapse). In addition, the burden of the generation shortfall is shared such that no one area of the grid is without power for more than a set length of time.

The following table illustrates an example of how a rotating blackout might work. In this example, total system generation is assumed to equal 75 MW for each hour. The example also assumes that Areas A, B, C, and D make up an electrical system, with each area having a load of 25 MW. Since the total combined load of Areas A, B, C, and D is equal to 100 MW (4 x 25 MW), but generation is only equal to 75 MW, only three areas can be served at one time. The area without electricity is rotated each hour.

Table 2-5 — Example Rotating Blackout Schedule

Resource	Areas with Electricity	Area without Electricity
Hour 1	Areas A, B, C	Area D
Hour 2	Areas B, C, D	Area A
Hour 3	Areas A, C, D	Area B
Hour 4	Areas A, B, D	Area C
Hour 5	Areas A, B, C	Area D
Hour 6	Areas B, C, D	Area A

It is important to note that rolling blackouts become more severe if there is less generation available to dispatch. During a rolling blackout, this would translate to longer time periods where areas of the grid would have to go without power, which is a significant risk to customer safety. With the recent retirement of the Charlottetown oil-fired generators, Maritime Electric has less on-island dispatchable generation that it can dispatch during a rolling blackout. In addition, several of the island's dispatchable generators are approaching end of life and will have to be considered for retirement in the near future; for example, Maritime Electric's two Borden combustion turbines are 50 years old and some of the Summerside reciprocating engines are over 60 years old.

2.2.3. Historical Frequency of Mainland Disconnections

There have been a number of times in recent history where PEI was either completely disconnected from the mainland, or some portion of the electrical connection to the mainland was lost, resulting in emergency generation and load shed (emergency blackouts) to prevent total system failure.

- Complete disconnection from mainland: 4 events since 2004, of varying duration. The most recent event took place on November 29, 2018 and lasted approximately 8 hours.
- Partial disconnection from mainland, resulting in emergency generation / load shed: 5 events dating back to 2008. The most recent was on January 22, 2018.

More broadly, between 2019 and 2021, the on-island combustion turbines operated on 130 occasions, of which 42 of those occasions prevented either interruptible load having to be shed or wider system rolling blackouts. All remaining operation of the on-island combustion turbines were either to provide emergency energy to Nova Scotia Power / New Brunswick Power, perform required monthly test runs of the combustion turbines, or various transmission-related reasons. A breakdown of the reasons the combustion turbines were operated between 2019 and 2021 is provided in the following table.

Table 2-6 — Historical Reasons for Combustion Turbine Operation, 2019 – 2021

Resource	Number of Instances	Total MWh
Unit Testing	62	552
NB Power "Hold-to-Schedule"	52	2,106
Emergency Energy Supply to Others	10	569
On-Island Transmission Related	5	167
Curtailment by NB Power	1	91

Of the 130 occasions the combustion turbines had to operate, a common reason is due to "hold to schedule" events, which are discussed further below.

2.2.3.1. Hold to Schedule Events

There have been numerous events where on-island backup generation was operated to prevent interruptible load from being shed, or even rolling blackouts. Many of these events are categorized as "hold to schedule" events and occur when Maritime Electric is unable to import the full amount of electricity from the mainland needed to completely meet system load.

The most common reason for a "hold to schedule" event is when there is a sudden shortfall in island wind generation compared to what the wind generation was forecasted to be. Maritime Electric must tell NBEM how much electricity it plans to import from the mainland ahead of time. In order to determine the amount of electricity it needs to purchase and import, Maritime Electric must first use a forecast of island wind generation to determine how much electricity the PEI wind generators should be able to contribute over the course of the day to meeting system load. After accounting for the forecasted wind generation, Maritime Electric then forecasts how much electricity it needs to purchase from New Brunswick to serve any remaining load that will not be able to be fully met by the expected wind generation. Once Maritime Electric tells New Brunswick Power how much electricity it plans to purchase and import, any remaining unpurchased electricity available at the intertie between PEI and New Brunswick is often purchased by Nova Scotia Power. In the event the wind generation on PEI falls short of its forecast, Maritime Electric will be short on electricity to fully meet load and has to request additional electricity in real time from New Brunswick to make up for the shortfall. If there still is transmission capacity available, Maritime Electric can purchase and import the associated electricity to meet system load; however, if the electricity has already been previously purchased by Nova Scotia Power, or is unavailable for some other reason, Maritime Electric is required to "hold to [its original] schedule", and as a result must start its backup generators to make up for the shortfall in wind generation and meet system load.

Hold to schedule events are typically short in duration (i.e., an hour), but occur with relative frequency, primarily due to the difficulty of forecasting wind generation with complete accuracy all of the time.

2.2.4. Recommended Generation Capacity During Rolling Blackouts

While any instance that rolling blackouts occur is a serious emergency event, the severity of rolling blackouts can vary based on how much on-island generation capacity is available to be dispatched. Historically (through the mid- to late-2010's), Maritime Electric has had an amount of on-island dispatchable generation capacity (between its oil-fired and diesel-fired generators) equal to at least 50% of winter peak load (winter is the season where load is highest on PEI). Maritime Electric has been able to successfully navigate previous potential rolling blackout scenarios with this amount of dispatchable capacity; however, we note that Maritime Electric and PEI have also been fortunate in that the previous instances PEI has been disconnected from the mainland have been resolved within hours. Future events (i.e., large storms, hurricanes, etc.) that might damage key interconnection equipment could result in PEI being disconnected from the mainland for much longer periods of time.

With the recent retirement of the Charlottetown oil-fired generators, Maritime Electric has significantly less dispatchable generation capacity located on PEI that it can utilize to meet system load in the event that PEI is disconnected from the mainland. The retirement of the oil-fired generators has resulted in the amount of on-island dispatchable capacity falling from over 50% to approximately 30% of winter peak load (which includes the peak load reductions provided by DSM). This is shown in the following table.

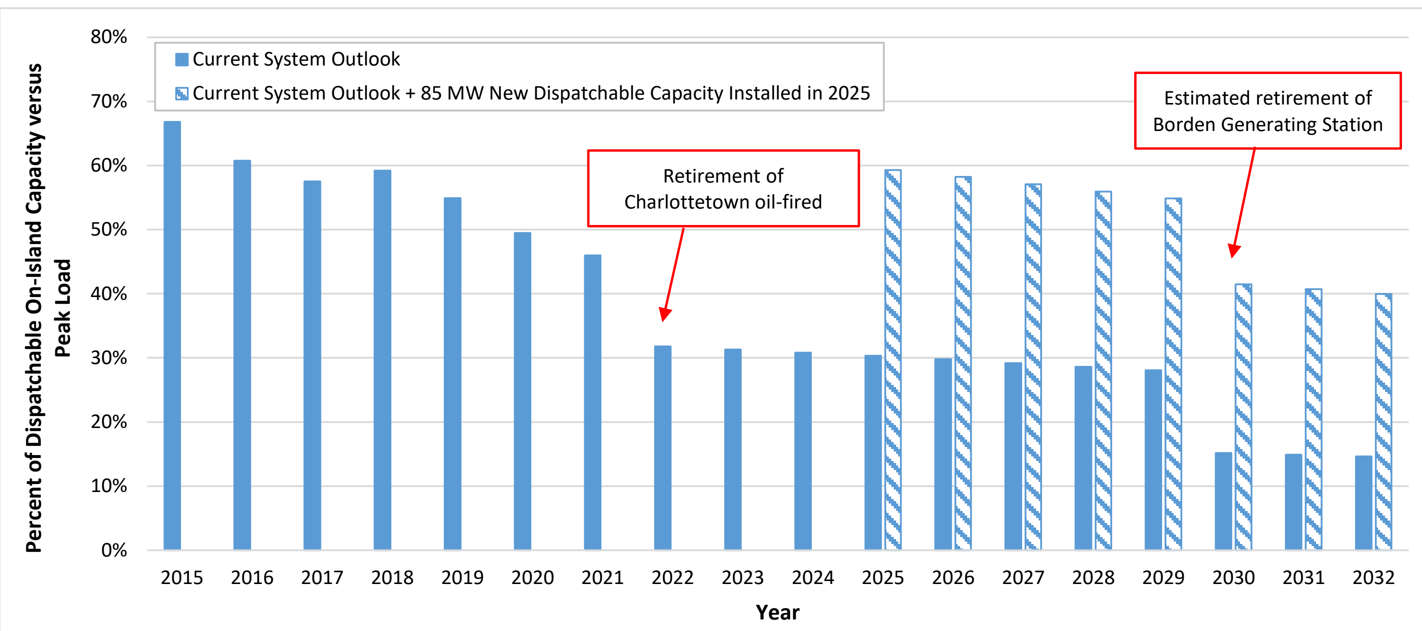
Table 2-7 — Outlook of Dispatchable On-Island Capacity vs. Peak Load

	Year *(2023 – 2032 are Forecasted Years)*													
	Average 2015-2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
MECL Peak Load (MW) (Net of DSM)	239	257	276	280	284	289	293	299	305	311	317	323	329	335
Charlottetown Thermal Plant (MW)	54	38	38	0	0	0	0	0	0	0	0	0	0	0
Borden Generating Station (MW)	40	40	40	40	40	40	40	40	40	40	40	0	0	0
Charlottetown CT3 (MW)	49	49	49	49	49	49	49	49	49	49	49	49	49	49
Total (MW)	**143**	**127**	**127**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**49**	**49**	**49**
Ratio of Dispatchable On-Island Capacity to Peak Load (%)	**60%**	**49%**	**46%**	**32%**	**31%**	**31%**	**30%**	**30%**	**29%**	**29%**	**28%**	**15%**	**15%**	**15%**

As compared to the mid- to late-2010's, the current low amount of dispatchable on-island capacity (per peak load level) poses a significant risk to Maritime Electric's customers in the event of a disconnection from the mainland, as it will likely lead to more severe rolling blackouts than would have occurred in the past. There is not a consistent energy industry standard that identifies exactly what rolling blackout severity level is acceptable versus unacceptable; thus, it is difficult to identify the exact amount of dispatchable capacity Maritime Electric should have installed on PEI to manage the unique situations where PEI is electrically disconnected from the mainland. As such, our recommendation for how much dispatchable capacity Maritime Electric should have installed on PEI is based on the consideration that Maritime Electric was successfully able to navigate previous potential rolling blackout scenarios. During those previous scenarios, there was an amount of dispatchable capacity on PEI greater than or equal to (≥) 50% of peak load.

Accounting for the anticipated continued load growth on PEI, and also considering the continued growth of DSM on the island, approximately 85 MW of additional dispatchable capacity is required to bring the current ratio of dispatchable capacity to peak load back in line with the 50% historical threshold. Note that even with this amount of additional dispatchable capacity, there would likely still be a need for rolling blackouts to be implemented if PEI were disconnected from the mainland. The following figure illustrates the ratio of dispatchable on-island generation capacity versus peak load both historically and forecasted through 2032. A second set of data points are included on the figure to illustrate how the ratio of dispatchable capacity versus peak load increases if 85 MW of additional dispatchable capacity are added on PEI in 2025. Note that current estimates for the retirement of the Borden Generating Station (40 MW) is approximately 2030. Additional capacity, beyond the 85 MW assumed in 2025, would have to be added to the system in 2030 to replace Borden's retired 40 MW capacity to maintain a 50% ratio of capacity to peak load. The following figure does not add any additional capacity to replace Borden; however, it does illustrate the impact of Borden's retirement in terms of the capacity to peak load ratio.

Figure 2-5 — Outlook of Dispatchable On-Island Capacity vs. Peak Load



2.2.5. Battery Energy Storage During System Disconnection

Given the interest in and growth of BESS in electrical systems over the last decade, we have provided the following subsection to explain some of the capabilities and shortcomings of BESS in a situation where PEI were electrically disconnected from the mainland.

A key challenge if PEI's system is disconnected from the mainland grid is that there will likely not be enough generation to meet all system load. As a resource, BESS cannot generate energy, it can only transfer energy from one period of time to another; however, BESS can provide some portion of the system balancing needs (i.e., absorb excess wind generation or inject energy when wind generation is low). By meeting some portion of the island's balancing needs, BESS could allow PEI to utilize a larger amount of the on-island wind generating capacity in the event of an electrical disconnection to the mainland. For example, if wind generation was high one moment, the BESS could absorb some of the excess wind generation, which would allow the dispatchable generators on the island to operate at a more continuous MW level. Without the BESS, those dispatchable generators would otherwise have to lower output to make room for the high wind generation.

It is important to note that the ability for BESS to help meet the island's balancing needs is limited by the BESS state of charge at that point in time. The limitations would be that during low wind production periods, the battery would have to be sufficiently charged to be able to inject the necessary balancing energy, while in contrast, during high wind production periods, the BESS would need sufficient headroom to be able to absorb the excess wind energy. If the BESS were empty / fully charged when wind production was low / high (respectively), the BESS could not help balance the system at that moment. Since the BESS state of charge during a disconnection from the mainland is a function of 1) its state of charge when the mainland disconnection occurred 2) the output of the wind generators during the disconnection, and 3) the length of time it takes for PEI to be re-connected to the mainland, it is difficult to accurately forecast how much system balancing benefit BESS could provide PEI during a disconnection from the mainland.

For planning purposes, a worst-case scenario for PEI during a situation where the island was disconnected from the mainland would be a scenario where there was no wind generation, due to the wind not blowing, the wind blowing too strongly to operate the wind turbines, a transmission failure, or some other similar reason. In this scenario, the benefit of a BESS would be limited to the amount of energy it has stored (i.e., its state of charge) when the island was disconnected from the mainland, the BESS MW capacity, and the BESS duration (i.e., 2-hour, 4-hour, etc.). If this disconnection lasted for a significant period of time (e.g., as long as or longer than the 8-hour disconnection PEI experienced in 2018), the BESS would not be able to help the system for the full duration of the time PEI was disconnected from the mainland. In this situation, the BESS' energy reserves would be drained and there would be no way to recharge the BESS until a mainland connection was restored.

2.3. RENEWABLE AND SUSTAINABILITY TARGETS

Sustainability and reducing carbon emissions are two of Maritime Electric's most important goals. At present, 86% of the electricity that Maritime Electric delivers to its customers is generated using carbon-free resources. In 2021, Maritime Electric received the Sustainable Electricity Leader designation from Electricity Canada. Moving forward, Maritime Electric has established a greenhouse gas emissions reduction target to reduce emissions by 55% by 2030 (from 2019 levels). A detailed discussion regarding our recommended methods for how Maritime Electric can achieve this emissions reduction target is provided in Section 3.3. In addition, Section 3 provides a general overview of carbon emissions planning considerations related to Maritime Electric's portfolio.

2.4. REGIONAL GENERATION PLANNING CONSIDERATIONS

Given that PEI purchases a significant amount of both energy (over 75%) and generation capacity (over 60%) from its neighbours, it is important to consider the generation plans of PEI's neighbours when assessing what types of / how many resource additions PEI will require moving forward. As such, S&L reviewed planning documents from New Brunswick Power, Nova Scotia Power, and Hydro Québec.

2.4.1. Coal Power Plant Retirements

The government of Canada has committed to phasing out conventional coal-fired power plants by 2030. This commitment will have a significant impact on the generation portfolios of both New Brunswick and Nova Scotia. At present, coal generation accounts for the following amounts of capacity in these provinces:

- New Brunswick: 467 MW, or 12.3% of the province's total generating capacity
- Nova Scotia: 1,234 MW, or 41.2% of the provinces total generating capacity

Both the New Brunswick Power and Nova Scotia Power Integrated Resource Plans (IRPs) postulate scenarios where their coal generation is retired in 2030. In both IRPs, the scenarios that retire coal in 2030 require substantial modifications to each utility's overall generation portfolio.

- ***New Brunswick Power:*** At the time the 2020 New Brunswick IRP was written, New Brunswick Power considered the continued operation of the 467 MW Belledune Coal Power plant until 2040 via an equivalency agreement with the government to be the most cost-effective and likely plan for the future. Since the publication of the IRP, the government has mandated that the coal power plant must retire by 2030. The IRP did explicitly consider a scenario where coal is retired by 2030 and noted that electricity imports and renewable energy / storage are not feasible solutions to replacing the retired coal capacity from Belledune. Instead, the IRP postulated potentially building a new natural gas power plant or small modular nuclear reactors to replace the coal capacity. At present, it is uncertain how New Brunswick will replace the retired coal capacity.

- ***Nova Scotia Power:*** Given coal generation makes up a significant percentage of Nova Scotia Power's total generation capacity (41.2%), the retirement of coal generation in Nova Scotia by 2030 necessitates substantial changes to Nova Scotia's generation portfolio. The Nova Scotia IRP considers that the retired coal generation will be replaced with a combination of new natural gas power plants, wind and solar farms, demand response, imported capacity, and energy storage. From an energy perspective, the Nova Scotia IRP estimates that wind generation and imported energy will be primarily how generation from coal is replaced in the future. Additionally, given Nova Scotia will have an increased reliance on imported capacity and energy following the retirement of coal generation in 2030, the top item noted in the IRP's action plan is the development of a regional integration / interconnection strategy to better connect Nova Scotia electrically to the rest of the Canadian provinces and the North American mainland.

- ***Hydro Québec:*** The impact on Hydro Québec due to the retirement of coal generation in Canada by 2030 will be primarily demand-based. Hydro Québec operates a sizable fleet of hydroelectric power plants, with a total hydroelectric capacity of 36,700 MW. The retirement of coal generation in the region is likely to result in an increased demand for capacity and energy from Hydro Québec's power plants. In addition, the United States has been an important consumer of Hydro Québec's hydroelectric generation. Sales of electricity from Hydro Québec to the United States averaged approximately 25 TWh in 2021, which is 30% higher than a decade ago[12]. As the United States works towards meeting its own decarbonization goals, demand from the United States for Hydro Québec's generation is likely to increase. In fact, Hydro Québec recently signed major long-term power purchase agreements with both Massachusetts and New York, each for approximately 10 TWh annually[13]. Finally, Québec's own electricity demand is expected to grow substantially over the next decade. Hydro Québec estimates that their system load will grow by 20 TWh between 2019 and 2029 (a 12% regional load increase). To meet these challenges, Hydro Québec is implementing a robust energy efficiency policy and also has a long-term plan to install another 5,000 MW of renewable generating capacity, consisting primarily of both hydroelectric (2,000 MW installed by 2035) and wind generation (3,000 MW installed by 2026).

From the perspective of PEI, the retirement of coal in Canada by 2030 will result in significant changes to the generation portfolios of PEI's immediate neighbours. While PEI's neighbours are planning on developing new capacity, the level of investment and mobilization needed to replace the retired coal capacity is significant considering that the retirement deadline for the coal power plants is less than a decade away. In addition, there is a forecasted increase in energy and capacity demand from Nova Scotia

[12]https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/statistics/electricity-trade-summary/index.html
[13] https://www.hydroquebec.com/data/documents-donnees/pdf/strategic-plan.pdf?v=2022-03-24

and the northeastern United States. All of this is likely to result in more competition for regional energy and capacity if the development of new generating resources and the implementation of regional energy efficiency programs cannot keep pace with demand growth. An increase in demand without similar corresponding increase in supply has the potential to result in higher costs for Maritime Electric's customers.

2.4.2. Mactaquac Generating Station Life Extension Project

Given that Maritime Electric imports a substantial amount of both system capacity and energy from New Brunswick, S&L reviewed the New Brunswick Power Corporation's 2020 IRP to determine whether any planned changes occurring in New Brunswick with respect to generation might impact Maritime Electric's ability to import electricity and capacity into PEI. One important consideration is the Mactaquac Generating Station life extension project.

The Mactaquac Generating Station is a 668 MW hydroelectric power plant that provides a significant amount of renewable generation to New Brunswick and the surrounding areas, including PEI. This power plant is one of the most important in the region due to both its large size and dispatchability, in addition to the fact that it is a zero-carbon emitting generator. For reference, the Mactaquac Generating Station accounts for just under 18% of New Brunswick Power Corporation's 3,790 MW generating capacity.

Related to the Mactaquac Generating Station, The New Brunswick Power Corporation notes that "since the 1980s, concrete portions of the station have been affected by a chemical reaction called an alkali-aggregate reaction. This reaction causes concrete to swell and crack. This results in significant annual maintenance and repairs. Without additional capital improvements, the station is expected to reach the end of its service life in 2030." As a result, the New Brunswick Power Corporation has recommended a life extension project for the power plant to make necessary repairs and improvements, ultimately allowing the power plant's life to extend to 2068. As of the writing of the New Brunswick Power Corporation's 2020 IRP, this project is expected to start in 2027 and end in 2033. During the project, the output of the power plant will be limited. The life extension project would be a significant capital expense and would require substantial engineering expertise. Estimates for project costs are varied but appear to be in the CAD $3 billion range or higher.

Given the scale of this project and the importance of the power plant to the region, S&L is of the opinion that there is some uncertainty regarding whether New Brunswick will be able to or willing to sell Maritime Electric enough generator capacity and energy to fully meet Maritime Electric's obligations. The timely progress and success of the life extension project is important for PEI given how reliant PEI is on capacity and energy from New Brunswick. In the event that the Mactaquac Generating Station life extension project experiences schedule delays or there are deratings beyond what is planned, New Brunswick will have less capacity and energy available to sell to neighbours; thus, it would be more difficult for Maritime Electric to secure sufficient capacity and energy at a reasonable price from New Brunswick.

2.4.3. Regional Transmission Improvements

From an electrical perspective, the increased demand for zero-carbon electricity in the region, including the northeastern United States, will require significant regional transmission upgrades to transport the electricity longer distances. One such proposed large scale project is the Atlantic Loop Project, which would create a transmission loop through eastern Canada so that zero carbon energy could be transported to the Maritime Provinces from Quebec and Labrador. A diagram of the proposed project is included below.

Figure 2-6 — Proposed Atlantic Loop Project Diagram[14]

Given the size of the project, different levels of Canadian governments involved, and sizable investment required, a final decision on whether the project will be fully implemented has not been made. As a result, there is uncertainty surrounding whether the transmission system will be able to accommodate the increased clean energy imports and exports between Canadian provinces (and between Canada and the United States) in the future. For PEI, this results in another layer of uncertainty surrounding the potential challenge of securing sufficient energy and capacity from the mainland in the future. This challenge is compounded from the fact that there will likely be an increase in demand for imported capacity and energy as coal is retired in Canada by 2030.

[14] Clean power Roadmap for Atlantic Canada, https://www.nrcan.gc.ca/sites/nrcan/files/energy/images/publications/2022/A%20CLEAN%20POWER%20ROADMAP%20FOR%20ATLANTIC%20CANADA-ACC.pdf

2.5. ENERGY CONTRACTS

Currently, Maritime Electric purchases over 60% of the energy it needs to serve system load through a contract (energy purchase agreement, or EPA) with NBEM. The EPA with NBEM is a comprehensive and complex agreement, but in general is based around the framework that the energy Maritime Electric purchases from NBEM follows a fixed rate structure. This agreement offers Maritime Electric a number of important benefits.

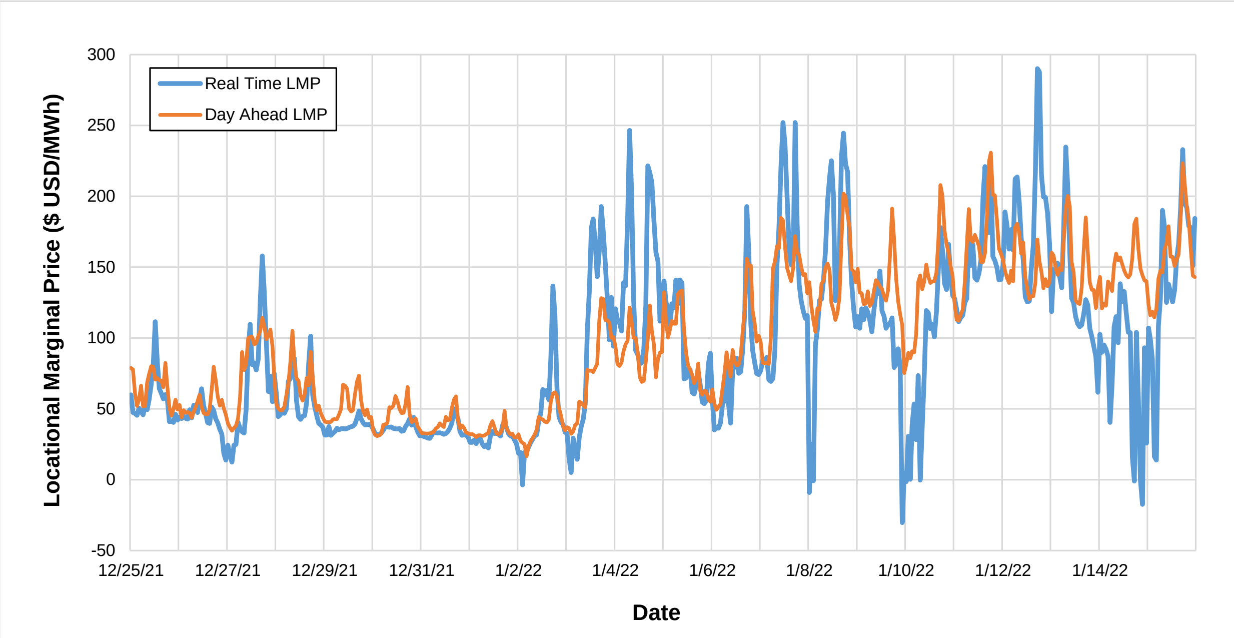
The contract provides some level of price volatility insulation for Maritime Electric's customers, especially when compared to an alternative where Maritime Electric instead purchased energy that varies in price on an hourly basis, as is the case in an energy marketplace. A large amount of generation supplied to Maritime Electric from NBEM is generated by New Brunswick Power, which has both a diverse generation portfolio and has a current surplus of generation capacity. As such, New Brunswick Power is able to provide their customers some level of price hedging against market forces that would otherwise increase the cost of power generation. Through the EPA with NBEM, Maritime Electric is also able to partially benefit from New Brunswick Power's generation portfolio's ability to hedge against market forces.

If Maritime Electric were instead part of an energy marketplace like nearby ISO-New England, Maritime Electric's customers would be directly exposed to power prices that vary on a real-time basis. At times, this may be beneficial for customers due to low power prices; however, at other times power prices could be very high. A utility like New Brunswick Power, which has excess generation capacity, is able to reduce/avoid purchases from a marketplace when prices are high because New Brunswick Power instead could dispatch their own power plants to generate electricity at less cost than purchasing it from the high-priced marketplace. However, Maritime Electric has a shortage of generation capacity installed on-island relative to its peak load. As a result, Maritime Electric would still be forced to buy significant amounts of energy from a marketplace during high-priced periods even if Maritime Electric dispatched their own generators during these times.

The following figure illustrates a recent period of energy price volatility in ISO-New England. Figure 2-7 shows hourly locational marginal prices (LMPs) for electricity (in USD $/MWh), for both day-ahead prices and real-time prices, between the end of December 2021 through the beginning of January 2022. Prices are taken from the node that represents the tie between ISO-New England and New Brunswick. As can be seen in the figure, prices both increased and became much more volatile in the beginning of January 2022 due to a combination of cold weather, high electrical demand, and the high price of natural gas (both gaseous and liquified). While infrequent, prices in energy marketplaces can reach levels much higher than those shown in the graph. For example, during the polar vortex event in Texas in 2021 prices touched USD $9,000/MWh, which was equal to the price cap set by ERCOT, the Texas grid operator.

Figure 2-7 — ISO-New England Locational Marginal Prices (USD)[15]

At the ISO-New England Tie to New Brunswick, December 2021 to January 2022



While the existing EPA with NBEM does not fully insulate Maritime Electric from macro-market forces that impact the cost of electricity production, it does provide significantly more price certainty than if Maritime Electric met its energy obligations through a marketplace, which is reflected in Maritime Electric's rates.

2.5.1. Energy Storage Arbitrage

Electricity price arbitrage is a use-case for BESS that has seen significant growth in popularity. Energy arbitrage is an economic use-case for BESS that is accomplished by buying energy from a marketplace when energy costs are low and storing the energy until energy costs are high. Once prices are high, the energy is re-injected (sold) into the electricity system. The difference between the purchase price and injection price is profit for the utility, net the efficiency losses of the storage system.

The potential for installing a BESS on PEI and utilizing it for arbitrage is discussed in detail in the recently released report, *Prince Edward Island Resource Planning and Maritime Electric Capital Expenditures, Alternatives to MECL Integrated System Plans and Impact on MECL Capital Expenditures*, developed by Synapse Energy Economics. A requirement in order to engage in an energy arbitrage trading strategy is participation in an energy marketplace (e.g., ISO-New England). At present, Maritime Electric does not currently trade energy in an energy marketplace. Maritime Electric could decide to join an energy

[15] Source: ISO-New England LMP pricing information, https://www.iso-ne.com/isoexpress/web/reports/pricing/-/tree/lmp-by-node

marketplace in the future; however, this would amount to a change in Maritime Electric’s corporate strategy and would require additional investigation to weigh the various pros/cons and coordinate with Maritime Electric’s stakeholders/oversight entities. Given that Maritime Electric has a shortage of on-island generation capacity relative to its peak load (described further in the previous section), it is not recommended that Maritime Electric join an energy marketplace in lieu of an agreement with NBEM or similar organization (i.e., exclusively purchase energy through a marketplace instead of through a contract with an entity like NBEM) as this would force Maritime Electric’s to meet a significant portion of its energy needs via a marketplace, exposing its customers to much higher energy price volatility.

3. CARBON EMISSIONS PLANNING

This section provides an overview of PEI's electrical system from a carbon emissions perspective, comparisons of PEI to its neighbours, and a discussion of how PEI might reduce carbon emissions moving forward. The goal of this section is to provide the reader a firm understanding of both where Maritime Electric's electrical system is today with respect to carbon production and the most effective changes/policies Maritime Electric/PEI can implement to reduce carbon production in the future.

3.1. MARITIME ELECTRIC SYSTEM OPERATION

As discussed in Section 2.1, Maritime Electric has historically met the energy needs of its customers on PEI with energy purchased from the Point Lepreau Nuclear Generating Station, energy purchased from the wind farms located on PEI, and energy purchased from the agreement with NBEM. Between 2019 and 2021, these three resources combined to provide over 99% of the energy Maritime Electric utilized to meet system load. Solar energy and energy generated by Maritime Electric's diesel generators provided the remaining generation. It is important to note that the energy purchased through NBEM has historically helped Maritime Electric not only meet load, but also provide critical load- and renewable- balancing support, and frequency / voltage support needed for system electrical stability. The ability for Maritime Electric to purchase the exact amount of energy it needs in real time from NBEM allows Maritime Electric to balance the variable generation from PEI's wind farms. This in turn has allowed PEI to integrate an increasing amount of wind generation on the island.

3.1.1. Load and Renewable Balancing Resources

As more wind and solar energy is installed on PEI, resources that provide load- and renewable-balancing support will become more important for Maritime Electric because higher amounts of installed wind and solar capacity will result in an increase in the magnitude of generation from the wind and solar farms. For example, currently a total of 92.5 MW of wind capacity is contracted with Maritime Electric. A very windy hour could result in 92.5 MW of generation from the wind farms. If the wind then calmed, a large portion of that wind generation will disappear. By contrast, if another 70 MW of wind capacity was contracted with Maritime Electric, a windy hour could result in 162.5 MW of wind generation. If the wind calmed in this scenario, the drop in total wind generation would be greater than in the current system with only 92.5 MW of wind generation. As a result, more balancing resources will be needed to manage these larger swings in generation.

There are many different types of resources that can provide load- and renewable-balancing support for Maritime Electric. Currently, purchases from NBEM are the primary resource that provide this support. Other options that can provide this support in electrical systems are fast-ramping engines / combustion turbines and BESS. At present, Maritime Electric's diesel generators are capable of providing load- and renewable-balancing support to the system, but Maritime Electric rarely utilizes these generators for that purpose due to the fact that they are more expensive to dispatch and produce more carbon emissions (on a per kWh basis) than purchasing energy from NBEM. New engines / combustion turbines could utilize renewable fuels (i.e., biodiesel), which would be an improvement from a carbon emissions perspective; however, purchases from NBEM would still likely be a more cost-effective option than utilizing new engines/combustion turbines.

BESS is also a resource than can be utilized to provide load- and renewable-balancing support to electrical systems. The challenge with utilizing BESS to serve this need on PEI is that there are efficiency losses when charging/discharging a BESS resource, typically on the order of 10% to 15% for lithium-ion batteries. These efficiency losses are significantly higher than the 1.7% transmission losses associated with importing energy from the mainland. The only times a BESS resource could charge in a way that would benefit the system from a carbon emissions perspective would be during hours when the total wind plus nuclear generation exceeds system load. During those hours, the excess generation that would otherwise have to be sold back to the mainland could be stored in the BESS and used at a later time.

To illustrate system operation with and without a BESS, during times when high wind output would result in excess total generation (total generation greater than system load), the following example shown in Table 3-1 was developed. In the example, two scenarios are presented – one without a BESS resource and one with a BESS resource. In both scenarios, two consecutive hours are illustrated. Wind generation for both scenarios is high during hour 1 (190 MW), then falls for hour 2 (100 MW). Nuclear generation from Point Lepreau is consistent at 29 MW for both hours. In both scenarios, during hour 1 there is excess generation equal to 19 MW due to high wind farm output (system load is only 200 MW for hour 1, while total generation is 219 MW). In the scenario without the BESS, the excess 19 MW has to be sold back to the mainland, but in the scenario with the BESS, the excess 19 MW is used to charge the BESS for re-injection back into the system in the second hour. During the second hour, the battery can only inject 16.2 MW of energy back into the system because the battery is only 85% efficient (19 MW x 85% = 16.2 MW).

As can be observed in the example, the scenario with the BESS resource is able to increase the total amount of carbon free MWh utilized by PEI from 329 MWh to 345.2 MWh, while reducing the amount of MWh that have to be purchased from NBEM from 71 MWh to 54.9 MWh. By reducing the amount of MWh purchased from NBEM, the battery is able to help Maritime Electric reduce its carbon emissions.

Table 3-1 — Example A: Comparison of Battery Operation

Battery only charges when there is excess wind + nuclear generation

	Wind + Nuclear Generation Exceeds Load in Hour 0 No BESS is Installed		Wind + Nuclear Generation Exceeds Load in Hour 0 BESS Installed and Charges from Wind	
	Hour 1	Hour 2	Hour 1	Hour 2
System Load (MW)	**200**	**200**	**200**	**200**
Imported Nuclear Generation (MW)	29	29	29	29
Wind Generation (MW)	190	100	190	100
BESS Charge (-) / Discharge (+) (MW)	-	-	-19	16.2
Imports from NBEM (MW)	0	71	0	54.9
Total Generation + Imports (MW)	**219**	**200**	**200**	**200**
Excess generation sold back to mainland (MW)	19	0	0	0
Wind + Nuclear + BESS That Stays on PEI (i.e., Carbon Free MWs Not Sold Back to Mainland)	**200**	**129**	**200**	**145.2**
Sum of Hour 1 + Hour 2 (MWh)	**329**		**345.2**	
Total MWh Imports from NBEM (Hour 0 + Hour 1) (i.e., Non Carbon Free MWs)	**0**	**71**	**0**	**54.9**
Sum of Hour 1 + Hour 2 (MWh)	**71**		**54.9**	

Currently, total wind plus nuclear generation on PEI very rarely exceeds system load; thus, the BESS would rarely be able to charge as is shown in the above example. The number of times when wind generation plus nuclear generation exceeds system load will increase as more wind generation is installed on PEI. In an effort to quantify how effective BESS would be able to help contribute to systemwide carbon emissions reductions, an hourly calculation of system generation and emissions with and without BESS was developed for various amounts of wind generation. The calculation methodology and results are presented in Section 3.2.1 and generally finds that the benefit (in terms of both carbon emissions reductions and carbon emissions reductions per dollar invested) a BESS resource could provide is modest.

If instead the BESS resource was allowed to charge from the wind generation during hours where the wind plus nuclear generation was less than system load (as it is for most hours in the current system), the round-trip efficiency losses of the BESS would result in less overall wind generation being utilized on the island than if the BESS was not used at all. This in turn would require more purchases from NBEM, and higher carbon emissions for the island.

To better illustrate this, the previous example was recreated assuming the wind generation equals 100 MW for both hours 1 and 2. In the example, system operation for the scenario without a BESS resource is identical for both hours due to the fact that both the wind generation and nuclear generation are consistent. In the scenario with the BESS, the BESS charges 19 MW during hour 1, then discharges 16.2 MW during hour 2 – consistent with the previous example. As can be seen in the example that follows, when the BESS resource charges during times when there is not excess generation (e.g., when wind plus nuclear generation is less than system load), total purchases from NBEM increase from 142 MWh to 154.9 MW, indicating that it is actually worse for Maritime Electric from a carbon emissions perspective than if the BESS did not operate / if there was no BESS installed. The reason for this is that the round-trip efficiency losses of the BESS result in some carbon-free generation being lost when the BESS charges/discharges.

Table 3-2 — Example B: Comparison of Battery Operation

Battery charges when there is not excess wind + nuclear generation

	Wind + Nuclear Generation is Less than Load in both Hour 0 and Hour 1 No BESS is Installed		Wind + Nuclear Generation is Less than Load in both Hour 0 and Hour 1 BESS Installed and Charges from Wind	
	Hour 1	**Hour 2**	**Hour 1**	**Hour 2**
System Load (MW)	**200**	**200**	**200**	**200**
Imported Nuclear Generation (MW)	29	29	29	29
Wind Generation (MW)	100	100	100	100
BESS Charge (-) / Discharge (+) (MW)	-	-	-19	16.2
Imports from NBEM (MW)	71	71	90	54.9
Total Generation + Imports (MW)	**200**	**200**	**200**	**200**
Excess generation sold back to mainland (MW)	0	0	0	0
Wind + Nuclear + BESS That Stays on PEI (i.e., Carbon Free MWs Not Sold Back to Mainland)	**129**	**129**	**110**	**145.2**
Sum of Hour 1 + Hour 2 (MWh)	**258**		**255.2**	
Total MWh Imports from NBEM (Hour 0 + Hour 1) (i.e., Non Carbon Free MWs)	**71**	**71**	**100**	**54.9**
Sum of Hour 1 + Hour 2 (MWh)	**142**		**154.9**	

3.2. CARBON EMISSIONS FOR MARITIME ELECTRIC

Of the three main resources that Maritime Electric has historically utilized to meet system load, energy purchased from both Point Lepreau and the wind farms on PEI do not generate carbon emissions. Energy purchased through NBEM is generated from a variety of different types of power plants located throughout New Brunswick, Nova Scotia, Québec, and the United States. As a result, a portion of the energy purchased through NBEM is generated from power plants that release carbon emissions.

For reference, historical generation in GWh and carbon emissions in tonnes CO2e for Maritime Electric between 2019 and 2021 is provided in Table 3-3.

Table 3-3 — Maritime Electric Historical Generation and Emissions by Source

Source	Average Historical Generation (2019-2021)[1]	% of Total	Historical Carbon Emissions (Tonnes CO_2e)[2]	% of Total
MECL Diesel Generators	1.2[3]	0.1%	1,233	0.5%
Customer-Owned Generation (i.e., net-metered solar)	3.9	0.3%	0	0%
PEI Wind Farms	295.3	21.0%	0	0%
Point Lepreau Nuclear Generating Station	210.0	14.9%	0	0%
Purchases from NBEM	898.1	63.7%	253,389	99.5%
Total	1,408.5[3]	100.0%	254,622	100.0%

Notes/Sources:

1) Historical generation data provided by Maritime Electric.
2) Carbon emissions rates for Maritime Electric are taken from the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf).
3) The average historical net generation of Maritime Electric's generators is -0.5 GWh, due to the fact that these units are primarily on standby (and to be kept on standby the generators must draw a small amount of electricity from the grid). In addition, between 2019 and 2021 the Charlottetown oil-fired generators used an average of 3.3 GWh per year while being retired from service. Shown in the above table is the generation of the diesel generators, not including the electricity they used from the system. The total system generation would average 1,403.5 GWh if both the net generation from the diesel generators and the electricity used from the Charlottetown oil-fired generators was considered.

It should be noted that a significant portion of the energy purchased from NBEM is from non-carbon emitting sources. In fact, 86% of the electricity Maritime Electric delivered to its customers (as of 2021) was generated using non-carbon emitting sources[16].

For comparison, Table 3-4 is included to illustrate carbon emissions rates for a variety of different northeast Canadian utilities and other planning regions. From a carbon emissions perspective, Hydro Québec and Newfoundland and Labrador Hydro are the regional leaders in terms of low carbon emission energy production. The vast majority of the electricity these utilities deliver to their customers is generated with in-province hydroelectric power plants, which do not generate carbon emissions. New Brunswick Power has a diverse portfolio of many different types of generators, including those that generate carbon emissions (e.g., the Belledune and Coleson Cove generating stations) and those that are carbon free (e.g., Mactaquac hydro and the Point Lepreau nuclear power plant), while Nova Scotia Power has a number of operating coal-fired power plants, which tend to generate carbon emissions at a higher rate than other power generation technology.

The emissions rates for Nova Scotia Power and New Brunswick Power are set to be reduced in the coming years as a result of the Canadian government's mandated retirement of coal power plants by 2030. This

[16] Taken from page 23 of the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf)

would result in Maritime Electric's carbon emissions falling if it were to continue its energy purchase agreement with NBEM.

Table 3-4 — Historical Carbon Emissions Rates for Various Utilities/Locations

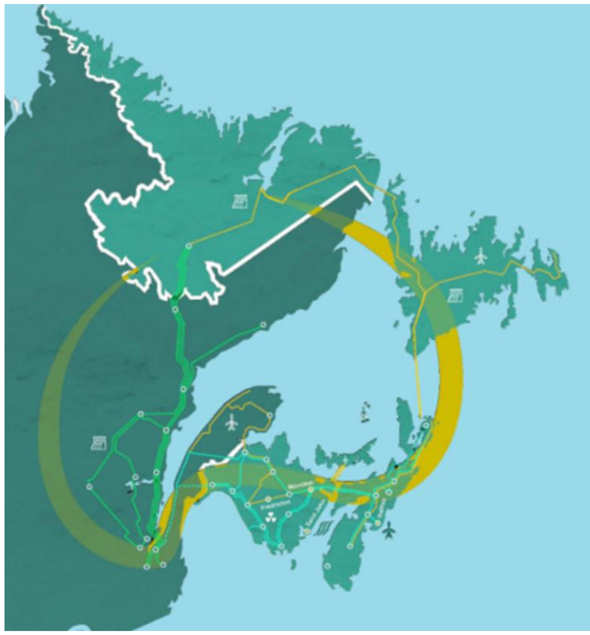
Utility	2019-2021 Average Carbon Emission Rates (kg/kWh)
Maritime Electric[1]	0.195
Nova Scotia Power[2]	0.621
New Brunswick Power[3]	0.295
Hydro Québec[4]	0.001
Newfoundland and Labrador Hydro[5]	0.026
ISO-New England[6]	0.250
All of Canada[7]	0.110
All of United States[8]	0.386

Notes/Sources:

1) Carbon emissions rates for Maritime Electric are taken from the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf) and are all inclusive of electricity produced by Maritime Electric's generators, imported electricity, vehicle emissions, building heating, and other related items.
2) Carbon emissions for Nova Scotia are taken from Nova Scotia Power's emission reporting database (https://www.nspower.ca/cleanandgreen/air-emissions-reporting) and are inclusive of electricity produced by Nova Scotia Power's generators and imported electricity.
3) Carbon emissions for New Brunswick are taken from the Canada Energy Regulator database (https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-new-brunswick.html). Emissions rates are based on 2019 and 2020 data as data for 2021 is not provided.
4) Carbon emissions rates for Hydro Quebec are taken from the following source: https://www.hydroquebec.com/data/developpement-durable/pdf/d-5647-affiche-co2-2021-an-vf.pdf
5) Carbon emissions rates for Newfoundland and Labrador Hydro are taken from the Canada Energy Regulator database (https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-new-brunswick.html). Emissions rates are based on 2019 and 2020 data as data for 2021 is not provided.
6) Carbon emissions rates for ISO-New England are taken from the 2020 ISO-New England Electric Generator Air Emissions Report (https://www.iso-ne.com/static-assets/documents/2022/05/2020_air_emissions_report.pdf)
7) Carbon emissions rates for Canada are taken from the Canada Energy Regulator database for 2020 (https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html#:~:text=The%20greenhouse%20gas%20intensity%20of,%2FkWh%20(Figure%208).)
8) Carbon emissions rates for the United States are taken from the U.S. Energy Information Agency website for 2020 (https://www.eia.gov/tools/faqs/faq.php?id=74&t=11#:~:text=In%202020%2C%20total%20U.S.%20electricity,CO2%20emissions%20per%20kWh).

It is important to note that while Hydro Québec and Newfoundland and Labrador Hydro have a significant amount of carbon free generating capacity, there currently is a lack of electricity transmission infrastructure in place to support a large-scale increase in energy exports from these utilities throughout the region. In the event that regional transmission infrastructure is expanded, Maritime utilities would likely benefit from long term clean energy contracts with Hydro Québec and/or Newfoundland and Labrador Hydro. Currently Québec and New Brunswick are exploring adding additional transmission capacity between the provinces. In addition, the proposed Atlantic Loop Project would create a transmission loop through eastern Canada so that zero carbon energy could be transported through the region. A diagram of the proposed project is included in Figure 2-6 and duplicated below.

Figure 3-1 — Proposed Atlantic Loop Project Diagram[17]



Given the size of the project, different levels of Canadian governments involved, and sizable investment required, a final decision on whether the project will be fully implemented has not been made. As a result, the transmission system cannot currently accommodate a substantial increase in energy imports and exports between Canadian provinces.

It is also important to note that there is a strong likelihood that any future purchases from Hydro Québec and/or Newfoundland and Labrador Hydro that Maritime Electric might be able to secure would be for energy only, and potentially on an interruptible basis. As such, Maritime Electric would need to find alternative means to meet its regional capacity obligations, either through generation capacity installed on PEI or purchased from the mainland.

3.2.1. Carbon Emissions Improvement From Battery Energy Storage

In order to help quantify how much the addition of battery energy storage on PEI could be able to help reduce Maritime Electric's carbon emissions, an hourly calculation of system generation and emissions was developed. The calculation estimated emissions for a variety of different scenarios. The scenarios considered include three different levels of island wind generation:

[17] Clean power Roadmap for Atlantic Canada, https://www.nrcan.gc.ca/sites/nrcan/files/energy/images/publications/2022/A%20CLEAN%20POWER%20ROADMAP%20FOR%20ATLANTIC%20CANADA-ACC.pdf

1. Current system installed wind capacity, for a total system nameplate capacity equal to 92.5 MW, current system (2022) load
2. Additional 70 MW of wind capacity, for a total system nameplate capacity equal to 162.5 MW, expected 2025 system load
3. Additional 120 MW of wind capacity (in addition to Scenario 1), for a total system nameplate capacity equal to 212.5 MW, expected 2025 system load

The wind capacity in Scenario 1 represents the current system, while the wind capacity in Scenario 2 represents the likely amount of installed wind that will be under contract with Maritime Electric in the near future (potentially by 2025). Scenario 3 represents a more aggressive wind development plan and is included for comparison purposes and future planning. Both Scenarios 2 and 3 consider an estimated hourly load forecast for 2025, while Scenario 1 considers the current hourly system load.

For each of the scenarios, different BESS installation cases are considered. Our estimate of the capital costs associated with the BESS systems is also provided, based on our detailed capital cost buildups detailed in Appendix A.

a) No BESS is added to PEI
b) A single 50 MW, 2-hour BESS (100 MWh storage) is added to PEI (CAD $78 Million)
c) A single 50 MW, 4-hour BESS (200 MWh storage) is added to PEI (CAD $134 Million)
d) A single 50 MW, 8-hour BESS (400 MWh storage) is added to PEI (CAD $244 Million)

Calculations are based on the assumption that the addition of BESS to the island would allow Maritime Electric to better manage the generation from the wind power plants installed on PEI. Currently, during times when the wind generation causes total system generation to exceed system load, Maritime Electric is forced to sell excess PEI wind energy to the mainland. At present, the frequency at which this occurs is very low; however, it would likely occur at a higher rate in the future as more wind power plants are installed on PEI. The addition of BESS could store some, or all, of the excess wind generation for re-injection at a later time. Maritime Electric could then reduce the amount of energy it needs to purchase from the mainland by instead using the re-injected wind energy from the BESS. Since the energy from the mainland is generated using some carbon-emitting power plants, the addition of BESS would help Maritime Electric reduce carbon emissions.

The model developed to investigate carbon emissions performs calculations on an hourly basis, then presents the results on an annual basis. Calculations are based on historical Maritime Electric hourly system load and generation data from the last four years. The BESS is modeled such that it charges off wind energy that otherwise would have to be sold back to the mainland due to energy oversupply. The modeled BESS then injects this energy back into system after total system generation falls below system load. The energy the BESS injects back into the system displaces energy that would otherwise have to be imported from New Brunswick or generated by Maritime Electric's diesel-fired generators. In addition, the model conservatively assumes the BESS is able to further reduce the amount that the diesel-fired Maritime Electric generators operate by 100% (this assumption is conservatively high as the addition of BESS cannot completely eliminate the need for the island's diesel-fired generation). The modeled BESS is assumed to have an 85% round trip efficiency. At a high level, the calculation provides a simplified look in the potential benefits of BESS from a carbon reduction perspective versus the capital investment of the BESS.

The results of the analysis are provided in Table 3-5. The data reported includes the following variables:

- **Gross wind generation (MWh)**: This variable is the estimated total amount of on-island wind generation that is purchased by Maritime Electric annually. It includes both the wind generation that Maritime Electric is able to sell to their customers, in addition to generation that might have to be sold by Maritime Electric to the mainland as a result of generation oversupply during some subset of hours in the year.
- **Wind generation sold to MECL customers (MWh)**: This is the annual PEI wind generation that is sold to the Maritime Electric customers. The addition of BESS helps to increase this variable because the BESS is able to absorb some portion of the energy that would otherwise have to be sold to the mainland (due to periods where there is energy oversupply) and inject it back into the system at a later time.
- **Percent of PEI wind generation purchased by MECL that is sold to MECL customers (%)**: This is the ratio of the two previous variables.
- **Total generation carbon emissions, all electricity delivered to MECL customers (tonnes CO_2e)**: This variable tracks the estimated amount of carbon emissions associated with the electricity that Maritime Electric sells to their customers. This variable includes estimated carbon emissions associated with electricity purchased from mainland power plants (via NBEM), based on NBEM's most recent carbon emissions rates (tonnes CO_2e vs GWh produced).
- **Carbon emissions ratio for all electricity delivered to MECL customers (kg/kWh)**: The carbon emissions ratio is the amount of carbon emissions per kWh. This variable is useful to track carbon emissions rates from one location to another, such as to the locations in Table 3-4.
- **Percent of electricity sold to MECL customers that is carbon free (%)**: This variable tracks the percentage of MWhs that Maritime Electric sells to their customers that are generated with carbon free resources.

The results of the analysis indicate that with the amount of wind generation installed on PEI currently, there are very few times when high wind generation results in there being an oversupply of electricity generation on the island. As a result, with the amount of wind capacity installed on PEI today, a BESS system is not needed to shift excess wind generation to other times.

As more wind is installed on the island, there are more times when there will be an oversupply of electricity generation. As a result, BESS becomes more beneficial; however, the benefit is fairly modest. For example, an addition of a 50 MW, 4-hour BESS to the scenario with 70 MW of additional wind (162.5 MW of wind capacity total) yields a reduction in overall carbon emissions of just 1.2% (from 219,074 to 216,350 tonnes CO_2e) from the scenario without BESS. Considering the level of investment required for a 50 MW, 4-hour BESS system (estimated at CAD $134 million), we consider the associated reduction in overall carbon emissions from BESS to be a low value for PEI on a dollars-invested per carbon reduction perspective. The cost per carbon reduction is calculated equal to CAD $49 thousand per tonne CO_2e reduction for the BESS system. By comparison, the addition of 70 MW of wind generation on the island is estimated to reduce future carbon emissions by 14% (from 254,622 to 219,074 tonnes CO_2e) without considering BESS. This reduction in carbon emissions is over 10x higher than that resulting from the addition of the 4-hour BESS alone. Furthermore, we estimate that the cost of adding 70 MW of additional onshore wind generation would be similar to cost of adding a 50 MW, 4-hour BESS; however, on a dollars-invested per carbon reduction perspective, wind would be considerably less expensive. The cost per carbon reduction is calculated equal to CAD $4 thousand per tonne CO_2e reduction for the onshore wind. Detailed cost comparisons of the various technologies considered in this report are provided in Appendix A.

There are a significant number of times when high wind generation results in an oversupply of overall electricity generation on the island in the scenario where 120 MW of additional wind is operational (212.5 MW of wind capacity total). BESS provides the highest benefit in terms of improving overall carbon emissions in this wind capacity scenario; however, the benefit is still fairly small, especially for the smaller-sized BESS cases. A key takeaway from this scenario is that PEI and Maritime Electric should have a plan on how to manage excess electricity generation as higher amounts of wind are installed on the island. S&L did not investigate alternative approaches to managing this generation beyond BESS; however, one alternative approach would be to address this contractually, whether with the wind generators, PEI's neighbours, or other parties, in such a way that provides more flexibility for the island and maximizes value for customers. This is discussed more in Section 3.3.

Table 3-5 — Estimated Portfolio Carbon Emissions with New Battery Storage

Parameter	No BESS	50 MW, 2-hr BESS (100 MWh)	50 MW, 4-hr BESS (200 MWh)	50 MW, 8-hr BESS (400 MWh)
Estimated BESS Capital Cost ($ CAD)	**-**	**$78 M**	**$134 M**	**$244 M**
Current system installed wind capacity (92.5 MW), current system load				
Gross wind generation (MWh)	295,552	295,552	295,552	295,552
Wind generation sold to MECL customers (MWh)	295,267	295,384	295,405	295,448
Percent of PEI wind generation puchased by MECL that is sold to MECL customers (%)	99.90%	99.94%	99.95%	99.96%
Total generation carbon emissions, all electricity delivered to MECL customers (tonnes CO_2e)	254,622	254,588	254,583	254,571
Carbon emissions ratio for all electricity delivered to MECL customers (kg/kWh)	0.181	0.181	0.181	0.181
Percent of electricity sold to MECL customers that is carbon free (%)	85.7%	85.7%	85.7%	85.7%
Current system installed wind capacity + 70 MW new wind capacity (162.5 MW), estimated 2025 load				
Gross wind generation (MWh)	571,475	571,475	571,475	571,475
Wind generation sold to MECL customers (MWh)	557,461	563,319	566,034	567,928
Percent of PEI wind generation puchased by MECL that is sold to MECL customers (%)	97.55%	98.57%	99.05%	99.38%
Total generation carbon emissions, all electricity delivered to MECL customers (tonnes CO_2e)	219,074	217,116	216,350	215,816
Carbon emissions ratio for all electricity delivered to MECL customers (kg/kWh)	0.141	0.139	0.139	0.139
Percent of electricity sold to MECL customers that is carbon free (%)	88.9%	89.0%	89.0%	89.0%
Current system installed wind capacity + 120 MW new wind capacity (212.5 MW), estimated 2025 load				
Gross wind generation (MWh)	768,564	768,564	768,564	768,564
Wind generation sold to MECL customers (MWh)	694,799	707,178	715,646	727,100
Percent of PEI wind generation puchased by MECL that is sold to MECL customers (%)	90.40%	92.01%	93.11%	94.61%
Total generation carbon emissions, all electricity delivered to MECL customers (tonnes CO_2e)	180,327	176,529	174,140	170,909
Carbon emissions ratio for all electricity delivered to MECL customers (kg/kWh)	0.116	0.113	0.112	0.110
Percent of electricity sold to MECL customers that is carbon free (%)	90.8%	91.0%	91.1%	91.3%

3.3. EFFECTIVELY REDUCING CARBON EMISSIONS

Maritime Electric's 2022 Sustainability Report presents a goal of reducing greenhouse emissions by 55% by 2030. Achieving this goal will require Maritime Electric to implement substantial changes to how it serves load. This section discusses the most effective methods Maritime Electric and PEI can pursue to help reduce carbon emissions.

- **Integration of additional wind generation on PEI**: Frequent and strong winds are one of PEI's best resources from a power generation perspective. The capacity factors of the most recently developed wind farms on PEI frequently see levels approaching 50% or higher, which is among the highest in the energy industry for land-based wind generation. PEI has already integrated a significant amount of wind generation on the island (through development by the PEI Energy Corporation); however, the further development of wind generation on PEI would be one of the most effective ways Maritime Electric could achieve their greenhouse gas reduction goals by 2030. For reference, Maritime Electric is anticipating an additional 70 MW of wind generation being developed on PEI through the PEI Energy Corporation, operational in near future.

  One challenge that Maritime Electric will have to address as more wind generation is developed on PEI is how best to manage times when there may be excess wind generation beyond system load. Currently, this occurs very infrequently, but it will occur with more frequent regularity as higher levels of wind capacity are integrated. As illustrated in the previous sections, the addition of BESS onto PEI would only be able to marginally improve the system from the perspective of managing excess wind generation and improving carbon emissions for Maritime Electric. As a result, BESS is not recommended to address this challenge. Instead, Maritime Electric may be required to address this challenge contractually, whether with the wind generators, PEI's neighbours, or other parties.

  Specifically, Maritime Electric might pursue contracts that allow more flexibility, favorable terms, and/or alternative financial arrangements to better address the higher likelihood of curtailment of the island wind power plants. For example, Maritime Electric could pursue payment structures with a price per MWh that varies by hour/season, with the price for the hours with the highest likelihood of curtailment being lowest. Maritime Electric might also explore including a fixed per MW price structure (either in addition to or replacing the per MWh price structure), which would help to fix the payments for the wind generation per month, while also sharing some of the cost burden of curtailment with the wind project owner (since the wind project owner would have to forecast project curtailment in order to properly determine its best per MW price). Alternatively, Maritime Electric might be able to set up an agreement with a mainland offtaker, like New Brunswick Power or Nova Scotia Power, to buy any excess wind generation for a fee.

  In addition, as more wind generation is integrated onto PEI, the importance of load- and renewable-balancing resources increases. At present, energy purchased through NBEM is used to meet Maritime Electric's system balancing needs. With more integrated wind generation, there will be larger swings in totaled (summed) hourly generation from the wind farms. If load- and renewable-balancing needs were continued to be met with energy purchased from NBEM, the larger swings in hourly generation from PEI's wind would be more costly for mainland generators to balance. These costs would ultimately be passed contractually onto Maritime Electric and their customers.

While wind generation is a great source of carbon free energy, it is not a good source of generation capacity due to its intermittent nature (see Appendix C). As a result, even with a large number of on-island wind power plants, Maritime Electric will need to meet their required capacity obligations using other resources, whether installed on the island or purchased from the mainland. This is discussed in detail in Section 2.1.

Finally, the continued integration of wind generation will necessitate transmission upgrades on PEI, especially in the western portion of the island where there is considerable wind energy interest but a lack of the necessary transmission facilities to transport the energy. Without these upgrades, it will not be possible for large amounts of additional wind generation to be added to the system.

- **Further implementation of demand-side management**: A low-cost and effective solution that would help to reduce PEI's carbon emissions is a prudent DSM program. DSM focuses on reducing energy consumption using a variety of methods, including integrating modern technologies (e.g., smart meters, push communications, etc.), influencing customer behavior (e.g., through time-of-use electricity rates, education, etc.), and by improving system efficiency. Currently, PEI's DSM plan is managed by the efficiencyPEI. The successful growth and adoption of PEI's DSM plan will help to partially offset the expected energy consumption growth in PEI resulting from both population increase and the PEI residents' continued transition away from oil-fired heating to electrical heating in homes. Any reductions in energy consumption from DSM would equate to fewer MWh purchased from the mainland, which would result in both carbon emission reductions and cost savings for Maritime Electric's customers.
- **Integration of additional solar generation on PEI**: The addition of solar generation onto PEI will help to reduce carbon emissions on the island. In addition, solar PV is among the lower cost generation technologies available today. Given PEI's solar resource is much lower than PEI's wind resource (the expected capacity factor for new wind farm on PEI is near 45%, while the expected capacity factor for a new solar PV power plant on PEI is approximately 20% - see Appendix D for detailed calculations), the priority should be to develop additional wind generation on PEI. However, additional solar PV can provide carbon-free energy diversity to Maritime Electric's generation portfolio at a relatively low cost; thus, should be part of the solutions Maritime Electric can utilize to reduce carbon emissions moving forward[18].

  Similar to wind generation, solar PV generation is a good source of carbon free energy, but it is not a good source of generation capacity due to its intermittent nature. Given this, Maritime Electric will still need to meet their regulatory capacity obligations using other resources, whether installed on the island or purchased from the mainland. This is discussed in detail in Section 2.1.

Two additional considerations that are likely to help Maritime Electric reduce carbon emissions are included below. While Maritime Electric does not have direct control over the implementation of these items, their implementation/progress is likely to benefit Maritime Electric and PEI.

- **The retirement of coal generation in Canada by 2030**: While Maritime Electric does not own any coal power plants, some portion of the energy it purchases through the NBEM EPA is generated from coal power plants. As a result, the retirement of coal throughout Canada by 2030, along with

[18] Net metering small-scale renewable energy installations such as rooftop solar can cause cross-subsidization issues where non-solar customers are in effect subsidizing the system costs of solar customers.

the further decarbonization of the power sector in Canada, will benefit Maritime Electric from a carbon emissions perspective as it continues to purchase energy from the mainland.

- **Expansion of regional transmission capacity**: As discussed previously, Hydro Québec and Newfoundland and Labrador Hydro have a significant amount of carbon free hydroelectric generating capacity and future generating capability; however, there currently is a lack of electricity transmission infrastructure in place to support a large-scale increase in energy exports from these utilities throughout the region. If regional transmission infrastructure is expanded, Maritime utilities would be able to benefit from long term clean energy contracts with Hydro Québec and/or Newfoundland and Labrador Hydro. It is important to note that there is a strong likelihood that any future purchases from Hydro Québec and/or Newfoundland and Labrador Hydro that Maritime Electric might be able to secure would be for energy only, and potentially on an interruptible basis. As such, Maritime Electric would need to find alternative means to meet its regional capacity obligations, either through generation capacity installed on PEI or purchased from the mainland.

4. CAPACITY RESOURCE COMPARISON

4.1. TECHNOLOGIES CONSIDERED

This section compares a number of different capacity resource technologies based on initial input from both Maritime Electric and S&L. The list of technologies considered is provided below:

- Wind power, both onshore and offshore
- Solar power, both photovoltaic (PV) utility and rooftop scale, and concentrating solar power (CSP)
- Battery energy storage systems (BESS), lithium-ion, other storage technologies
- Reciprocating internal combustion engine (RICE), operating both on traditional and renewable fuels
- Combustion turbines (CT), aeroderivative models, operating both on traditional and renewable fuels
- Biomass power plant, operating on different types of biomass
- Nuclear power plant, small modular reactor (SMR)
- Tidal stream power plant or wave power plant
- Geothermal power plant
- Fuel cells

The following subsections provide an overview of the different technologies listed above, including considerations specific to PEI.

4.1.1. Wind Power

Wind energy is produced from wind turning the blades of a turbine which in turn spins a generator, creating electricity. Wind energy is a renewable source of power that releases no carbon emissions. The amount of power generated is dependent on the real-time wind speed; thus, generation from wind power plants is variable.

Wind turbines can be placed either onshore or offshore. Offshore wind generally provides higher, more consistent energy outputs than onshore wind because of the typically higher and more consistent wind speeds over bodies of water. However, onshore wind is much less expensive than offshore wind because the construction of offshore wind power plants is more complex and extensive than that of onshore power plants. Construction of offshore wind farms is more challenging as boats and special equipment are required. Offshore turbines also typically require more maintenance than those onshore due to various environmental factors, including corrosion facilitated by salt in the ocean.

Consistent and strong wind speeds are one of PEI's best resources from a power generation perspective. New wind farms on PEI could approach a 50% capacity factor on an annual basis, which is among the highest in the energy industry for onshore wind farms. Maritime Electric already has under contract a total of 92.5 MW of wind capacity that it utilizes to serve load, and an additional 70 MW of wind generation is planned. Wind is a clean energy source and its continued development on PEI will be a key part in helping Maritime Electric to achieve its carbon emission reduction goals.

Table 4-1 — Wind Energy Advantages and Disadvantages

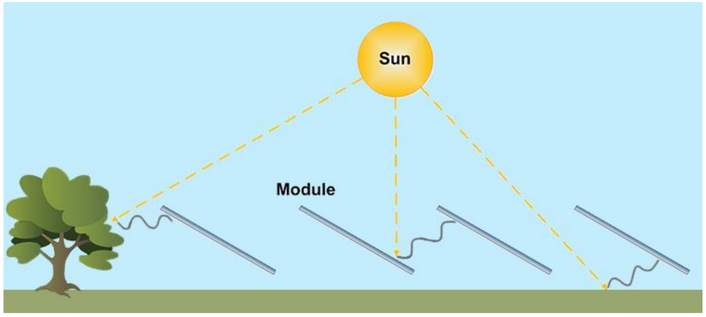
Wind Energy Advantages	Wind Energy Disadvantages
Renewable energy source, no carbon emissions	Intermittent generation profile, not a good source of generation capacity, other resources needed to balance wind generation and load
There are strong and consistent wind speeds on PEI, making the location very suitable for wind generation	Inverter-based resource, at high penetration levels additional planning considerations may be required to maintain electrical stability
Cost effective resource (onshore wind)	High levels of wind integration on PEI will require transmission/system electrical upgrades
Technology has a long and successful service history in the energy industry	Offshore wind is more expensive to construct and maintain

4.1.2. Solar Power

Utility-scale and rooftop solar photovoltaic (PV) both employ solar panels to convert energy from the sun into usable electricity. Energy from the sun is absorbed by PV cells that make up the solar panel. This energy creates electrical charges on the atomic level within the PV cell. These charges create an electric current that is used as electricity. Solar PV is a renewable source of energy. Since the production of electricity from solar PV is based on the energy provided by the sun, electricity production is limited based on the time of day and weather conditions. Solar PV power plants have seen significant growth in popularity over the most recent decades due to their low cost and simplicity.

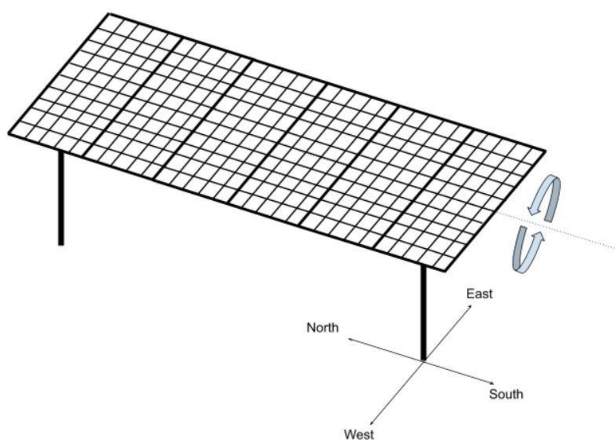
There are different types of PV panels and racking configurations that can impact/improve a solar PV power plant's generation. Solar power plants can utilize monofacial or bifacial solar panels. Monofacial panels are one sided and very common in the energy industry, while bifacial panels have grown in popularity over the most recent years and have the ability to absorb the sun's light on both the front and the reverse side of the panel. Bifacial panels are more expensive than monofacial panels but can help to increase the generation of a solar power plant, especially in locations where the ground reflectivity is high (i.e., light colored ground, snow, etc.). Bifacial panels are typically only used in utility-scale solar power plants, not in small-scale rooftop applications, because they require some ground clearance to maximize the amount of reflected light to the reverse side of the panel. Figure 4-1 provides a simplified illustration of how a bifacial solar PV panel works.

Figure 4-1 — Illustration of Bifacial Solar PV Panel



The two most common racking configurations are fixed-tilt and single-axis tracking. A fixed-tilt racking configuration is simple, in that during construction the panels are initially orientated in such a way that maximizes the amount of solar energy the panels can capture. The panels remain orientated in this position for the lifetime of the project. Fixed tilt configurations are relatively inexpensive and common both for utility-scale projects and in smaller-scale rooftop applications. In a single axis tracking configuration, panels are affixed to a motorized tracker that follows the sun throughout the day on a single axis, keeping the panels always in a position that maximizes the amount of solar energy they are able to absorb. Single-axis tracking helps to increase the amount of solar energy absorbed by the panels over a fixed-tilt configuration, especially during the morning and late afternoon, when the sun is lowest on the horizon. Figure 4-2 is a simple illustration of how a single-axis tracking configuration operates.

Figure 4-2 — Illustration of Single-Axis Tracking PV Configuration



For PEI, solar PV generation is a viable renewable resource that can help Maritime Electric lower carbon emissions. Due to PEI's northern latitude and climate, the potential generation from solar PV installed in PEI will be lower than sites located closer to the equator / in arid climates. S&L developed forecasts of the expected solar generation on PEI using the program PVsyst. PVsyst is a commonly used solar PV design and forecasting program utilized in the energy industry. Four different cases were run:

1. A fixed-tilt racking configuration with monofacial solar panels
2. A fixed-tilt racking configuration with bifacial solar panels
3. A single-axis tracking racking configuration with monofacial solar panels
4. A single-axis tracking racking configuration with bifacial solar panels

Each forecast incorporates PEI-specific solar irradiation and climate data, along with S&L's project assumptions regarding expected project design, module layout, electrical and system losses, etc. The results are developed for 10 MW solar PV power plants and include capacity factor, expected annual generation for the 10 MW power plant, and also the expected annual generation if five 10 MW power plants are installed. Detailed PVsyst reports of the different systems are provided in Appendix D. For comparison to the data in the table below, the newest wind power plants on PEI achieve capacity factors of just under 50%. A new 50 MW wind power plant on PEI might expect to generate over 200,000 MWh annually.

Table 4-2 — Solar PV Forecasts

Configuration	Expected Capacity Factor	Expected Annual Generation, 10 MW Power Plant (MWh)	Expected Annual Generation, 5x10 MW Power Plants (MWh)
Fixed Tit, Monofacial Panels	19.2%	16,840	84,200
Fixed Tit, Bifacial Panels	19.9%	17,440	87,200
Single-Axis Tracking, Monofacial Panels	20.9%	18,290	91,450
Single-Axis Tracking, Bifacial Panels	22.4%	19,590	97,950

For PEI, S&L has modeled a fixed-tilt, bifacial configuration. While it is feasible to build a single-axis tracking configuration on PEI, the island's cold climate could make it more challenging to reliably operate a tracking system due to ice and snow buildup on components. Our recommendation of bifacial panels stems from the fact that bifacial panels tend to work well in locations that see snow accumulation (like PEI), due to the high reflectivity of snow.

Table 4-3 — Solar PV Advantages and Disadvantages

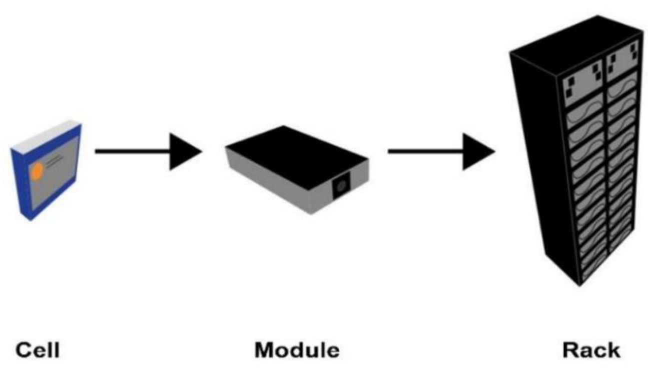
Solar Energy Advantages	Solar Energy Disadvantages
Renewable energy source, no carbon emissions	Intermittent generation profile during the day due to cloud cover, not a good source of generation capacity, other resources needed to balance PV generation and load
Cost effective resource	No generation at night
Technology has a long and successful service history in the energy industry	Inverter-based resource, at high penetration levels additional planning considerations may be required to maintain electrical stability
Different module types and racking configurations can boost the amount of energy generated	Large amounts of land required for a utility-scale solar PV power plant

Another type of power plant that utilizes solar energy to generate electricity is a concentrated solar power (CSP) plant. There are different CSP plant configurations, but one common type of CSP plant captures direct solar radiation by reflecting it to a central receiving tower using mirrors. The reflected solar energy heats the central receiving tower, which contains a high temperature fluid or molten salt that absorbs the energy. The heated liquid is then used to produce steam, which drives a steam turbine to produce electricity. Alternatively, a plant can be designed such that mirrored troughs are used to reflect sunlight into a fluid flowing through a pipe. The heated fluid drives a steam cycle. S&L has worked on a number of different CSP plants across the globe. These types of power plants are best suited for arid climates that receive very high amounts of solar irradiance, for example the Atacama Desert in Chile, various locations in Spain, the southwest United States, etc. Due to its location and climate, PEI is not a suitable location for a CSP plant.

4.1.3. Energy Storage

Energy storage systems store energy generated at one time for use at another time. A battery energy storage system (BESS) consists of many electrochemical batteries that collect energy from the power source and discharge that energy to the grid when it is needed. A BESS can be utilized for numerous different purposes including energy time shifting, providing system capacity, ancillary services, transmission support, renewable and load balancing, and other similar purposes. A BESS can be designed for more than one use case. Lithium-ion BESS is the most common battery type employed in the energy industry due to cost, thermal properties, and life-cycle benefits. A distinct advantage of a BESS project is that it can inject energy into an electrical system virtually instantaneously. A typical lithium-ion BESS arrangement is provided below in Figure 4-3.

Figure 4-3 — Typical BESS Arrangement



A lithium-ion BESS typically has a round trip efficiency of 85-90%, meaning that between 10%-15% of energy entering the battery is lost during the storage process. In addition, a BESS degrades with usage, which results in the need to augment the BESS and add additional batteries to the system in order for the BESS to continue to achieve its originally designed performance levels. BESS projects are not required to perform augmentation; however, an un-augmented BESS project might expect to see performance degradation on the order of 25% to 30% over a 20-year lifespan. The amount of energy stored by a BESS project can vary from project to project based on the size of the battery installed. Like wind and solar PV generators, BESS is an inverter-based resource.

Table 4-4 — Lithium-Ion BESS Advantages and Disadvantages

Lithium-Ion BESS Advantages	Lithium-Ion BESS Disadvantages
Many different potential use cases, including load / renewable shifting, capacity resource, ancillary services, energy arbitrage, etc.	A BESS can only shift electricity from one point in time to another, it cannot generate electricity
Technology has wide adoption in the energy industry	10% to 15% of the energy is lost in the storage process
Energy can be injected instantaneously	A BESS system degrades with usage (and thus must be periodically augmented with additional battery cells in order to maintain consistent performance levels). Alternatively, a BESS can be initially overbuilt to account for performance degradation
A BESS is modular and relatively simple to augment / expand	Inverter-based resource, at high penetration levels additional planning considerations may be required to maintain electrical stability

While there are other types of BESS technologies, lithium-ion BESS is the type that is predominantly utilized in the energy industry. For example, flow batteries are a similar technology to that of lithium-ion batteries but employ a tank of liquid electrolyte to charge and discharge separate from the electrodes. Flow batteries can provide longer storage with little to no degradation as compared to lithium-ion batteries; however, the round-trip efficiency is typically lower than lithium-ion batteries (typically in the 65% to 80% range). Currently, flow battery technology has not been widely adopted for use in the energy industry. For this reason, it is not recommended for Maritime Electric's generation portfolio at this point in time.

Compressed air energy storage (CAES) is another storage technology that has yet to see mainstream adoption in the energy industry but offers promise for the future. In a CAES system, electricity is used to power an air compressor, then air is pumped and pressurized into an underground cavern or tank. When it is needed, the air is released through a turbine to produce electricity. Significant amounts of air can be stored for long periods of time. A drawback of compressed air storage as compared to lithium ion batteries is that a CAES system typically has a lower round trip efficiency. On a utility scale, there are only a handful of CAES systems in service today. There is significant risk associated with being an early adopter of a technology; thus, a CAES system is not recommended for Maritime Electric at this point in time.

4.1.4. Reciprocating Internal Combustion Engine

A reciprocating internal combustion engine (RICE) operates by converting heat and pressure generated by the combustion of fuel into mechanical energy. Energy is derived from a set of pistons, where the fuel is ignited within the piston and the subsequent increase in pressure drives the piston outward. Engines are common in the power industry, in automobiles, and in many other applications. While the acronym "RICE" technically refers to all types of engines, it is commonly used in the energy industry and by electric utilities to refer to large electricity-producing engines. From a fundamental perspective, utility-scale RICE generators are essentially the same as what an individual might find in an automobile, just the size of a utility-scale engine is much bigger and utility-scale engines are used to spin an electrical generator, rather than an automobile's wheels.

In general, RICE generators are a mature technology that offer a combination of modularity and dispatch flexibility. The modular aspect of RICE relates to the fact that individual engines are small in size (typically less than 20 MW); thus, power plants can be economically constructed to meet load demands of virtually any size (i.e., for larger loads, a utility can simply purchase more engines). The flexible nature of engines is related to their ability to start up / shut down and ramp up / down quickly and with little, if any, associated increase in operational costs or performance degradation. Over the last ten years, S&L has seen an uptick in utility interest in RICE power plants due to their modularity, dispatch flexibility, and competitive development and operations costs. Utilities have also found that the flexible dispatch capabilities of RICE power plants complement renewable energy well: an engine's ability to start and ramp quickly can help to offset the variable generation profiles of wind and solar energy. For PEI, an engine would serve virtually exclusively as a backup generator, dispatching only during the times when enough energy could not be procured from the mainland, during emergencies (i.e., disconnections from the mainland), or other similar situations. RICE would serve this purpose well.

There are a number of companies that manufacture engines that would fit the needs of PEI. In addition, modern engines are relatively fuel efficient, with heat rates typically around 8,500 Btu/kWh in a simple cycle configuration. A benefit of RICE is that it can operate on a variety of different fuels, including diesel fuel, natural gas, biodiesel, a mixture of natural gas and hydrogen, and pure hydrogen likely within 3 to 5 years[19]. Some modification to the engine components would be required to convert an engine to operate on very different fuels. For example, modifications would be required to convert an engine that primarily operates on diesel/biodiesel to be able to operate on hydrogen, but in general, the variety of fuels compatible with RICE would help PEI to reduce the risk of having a stranded asset if Canadian regulations changed the allowable fuels that could be used for power generation. For reference, traditional diesel and biodiesel are similar enough in composition that many of the most common RICE units available today can fire either without needing significant modifications (some minor modifications to balance of plant equipment/storage would be required to allow for biodiesel firing).

[19] Per recent discussions with engine original equipment manufacturers that S&L commonly work with

From a carbon emissions perspective, RICE does produce carbon dioxide when burning diesel fuel, natural gas, and biodiesel. Carbon emissions when burning natural gas are significantly lower than when burning diesel fuel. Biodiesel combustion produces lower emissions than typical diesel fuel; however, the lifecycle emissions (considering net emissions from the entire production process of the fuel) of biodiesel are much lower than typical diesel fuel. In fact, the lifecycle emissions are low enough that the government of Canada considers biodiesel as a renewable fuel[20].

Table 4-5 — RICE Advantages and Disadvantages

RICE Advantages	RICE Disadvantages
Mature, dispatchable technology with ability to generate power over long periods of time, so long as fuel is available	Generates carbon emissions (however these can be lowered depending on the fuel used)
Power plants can be built modularly, larger power plants would simply add more engines	In larger applications (i.e., > 200 MW), other thermal technologies can be more cost effective and fuel efficient
Can operate on a variety of different fuels, including fuels classified as renewable	Engines are noisy and require noise attenuation
Flexible generation: ability to start up / shut down and ramp up / down quickly	Requires fuel to operate

4.1.5. Combustion Turbine

Combustion turbines (CT) work similarly to RICE but rather use a turbine instead of a piston to generate electricity. Air is drawn into a compressor, where it is pressurized and fed into the combustion chamber. The fuel mixes with the air and combusts, creating a high-pressure gas that expands and drives a turbine to produce electricity. There are two types of combustion turbines: frame (industrial) and aeroderivative (which share many similarities to the jet engines that power airplanes). In general, the differences between the aeroderivative and frame turbines are weight, size, combustor and turbine design, bearing design (antifriction bearings for aeroderivative turbines and hydrodynamic ones for frame turbines), and the lube oil system. Frame combustion turbines are also field erected and maintained in place, whereas aero-derivative turbine plants are designed for a quick replacement of the entire engine when maintenance is required.

CTs have a representative heat rate of 9,000 to 10,000 BTU/kWh in a simple cycle configuration, which makes them less efficient than RICE. When compared to a RICE, CTs provide a smaller footprint per MW output. CTs can run on various fuel types including diesel fuel, natural gas, biodiesel, a mixture of natural gas and hydrogen, and pure hydrogen likely in the near future (at present there are not yet commercially available CTs that can operate on 100% hydrogen). Because of the combustion process, CTs emit carbon and other greenhouse gases. Alternative fuel sources can help to reduce or eliminate carbon emissions.

[20] https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/alternative-fuels/biofuels/biodiesel/3509

Modifications to the CT components would be required to convert a CT to operate on different fuel types, and in general these modifications would be slightly more extensive than might otherwise be required to convert a RICE unit. For example, while a RICE unit would not require modifications to be able switch from traditional diesel to biodiesel outside of some minor changes to the balance of plant (BOP) and storage systems, a CT would require specialized equipment such as compatible fuel injection nozzles, combustors, etc., to be able to operate on biodiesel (in addition to the changes to the BOP and storage systems that would also be required for a RICE unit). We estimate the cost of the CT equipment modifications would be modest, in the CAD $2.5 to $3.0 million range, for a CT size in the 30 MW range.

CTs are a mature technology with fast startup and ramping capabilities. The technology is used throughout the energy industry for a wide variety of different purposes. Similar to RICE, the flexible dispatch capabilities of CTs complement renewable energy well: CT's ability to start and ramp quickly can help to offset the variable generation profiles of wind and solar energy. For PEI, a CT would serve predominantly as a backup generator, only needed to produce electricity in the event that a sufficient amount of energy cannot be imported from the mainland (which occurs on an infrequent basis throughout the year), during emergencies, or other similar situations.

Table 4-6— Combustion Turbine Advantages and Disadvantages

Combustion Turbine Advantages	Combustion Turbine Disadvantages
Mature, dispatchable technology with ability to generate power over long periods of time, so long as fuel is available	Generates carbon emissions (however these can be lowered depending on the fuel used)
Can operate on a variety of different fuels, including fuels classified as renewable	Requires a separate diesel generator for black start capability
Flexible generation: ability to start up / shut down and ramp up / down quickly	CTs can be noisy for those that are nearby when they are operating, may require noise attenuation
Small land footprint per MW output	Requires fuel to operate

4.1.6. Biomass Burning Power Plant

Biomass power generation facilities rely on the combustion of biomass to generate power. Biomass is fed into the power plant's combustion chamber and burned to produce high-pressure steam. The steam is used to turn a turbine and produce electricity. The type of biomass used to power these generators typically consists of crops, wood, municipal waste, or other organic matter.

Due to the relatively low energy content of solid biomass fuel (e.g., wood typically has approximately 30%-50% of the energy content of commonly used petroleum fuels on a per-mass basis), a significant amount of biomass is required to fuel a power plant. This translates to the power plant requiring very large plots of land to grow the necessary fuel. As an example calculation, a 50 MW biomass power plant operating 70%

of the year (a biomass power plant would likely need to operate as a baseload facility due to its operational inflexibility) would consume approximately 3,990,000 MMBtu of fuel in energy each year (a typical biomass power plant heat rate is 13,000 Btu/kWh). Assuming the fuel is pelletized wood, the energy content of wood varies by wood type, but a value of approximately 17 MMBtu/ton is a reasonable estimate. This equates to approximately 235,000 tons of wood required per year. While trees vary in weight based on their size, if each tree utilized weighed 1 ton, this would equate to 235,000 trees required per year to fuel the biomass power plant. As a rough estimate, assuming a tree farm can support 1,000 trees per acre, the power plant would need to cut down and replant approximately 235 acres of tree farmland per year. Furthermore, since trees take many years/decades to grow and thus could not be re-harvested immediately, trees from different 235-acre plots of land would have to be harvested each year until the original re-planted trees were mature. Ultimately, thousands of acres of land could be needed to grow the required fuel to support the operation of a biomass power plant.

In addition, due to the fundamental design of a biomass power plant as a large water boiler, a biomass power plant is not typically able to start / ramp output quickly relative to other thermal technologies like engines or combustion turbines. Biomass power plants also require a significant amount of staff to operate (as compared to other technologies like RICE or CTs).

Biomass power plants are considered renewable resources by the Canadian government, so long as the rate of consumption of the biomass does not exceed the rate of biomass regeneration. Burning of biomass in a power plant does release carbon dioxide; however, the net lifecycle emissions (which include the carbon dioxide absorbed by the biomass as it grows) are substantially less than that of thermal power plants that consume traditional fossil fuels.

Table 4-7 — Biomass Advantages and Disadvantages

Biomass Advantages	Biomass Disadvantages
Considered a renewable resource as a result of the net lifecycle emissions	Large land requirements required to grow the required biomass fuel
Flexible to run on various biomass types (i.e., trees, crops, etc.)	Combustion byproducts are emitted at the power plant
Dispatchable generator	Power plant is not capable of starting / ramping output as quickly as other generation types, i.e., is a relatively inflexible generator

4.1.7. Small Modular Nuclear Reactors

A significant amount of research into nuclear power has been ongoing over the most recent decades, and the technology that shows significant promise is small modular reactors (SMRs). Recent developments in the engineering of SMRs have broadened the potential applications of nuclear power with increased flexibility, safety, and ease of implementation. Nuclear fission has a legacy of reliable carbon-free power generation, and advanced SMR technology presents an attractive option for utilities interested in strengthening their portfolios with emission-free on-demand generation. These smaller reactors are well suited to be installed individually or in multiple-reactor configurations and distributed in locations where generation is needed, thereby reducing the costs and challenges of long-distance transmission associated with larger centralized installations.

Light water reactor designs generating 300 MW or less are typically considered to be SMRs. A traditional nuclear plant normally consists of one to two reactors, each capable of producing hundreds to more than 1,000 MW. The SMR concept allows a site to design to its demand, offering solutions not traditionally suitable for large nuclear plants, and scalability by allowing the addition of modules as demand grows. More than 70 SMR concepts are currently under development across the world.

As with all nuclear power plants, proper disposal of the used fuel is an important consideration. In addition, development of an SMR power plant would require significant capital investment, permitting/licensing, and time to develop. Given Maritime Electric’s need to have additional capacity operational in the short term, an SMR was not selected as a short-listed technology due to the long amount of time it would take for a new SMR power plant to be operational.

Table 4-8 — Nuclear-SMR Advantages and Disadvantages

Nuclear-SMR Advantages	Nuclear-SMR Disadvantages
Carbon-free energy source	Waste disposal must be managed
SMR power plants can be built modularly	Long lead time for permitting / licensing, design, and construction

4.1.8. Tidal and Wave Power

Tidal and wave energy derive their power from the ocean. Tidal energy is power produced by capturing the surge of the ocean waters during the rise and fall of the tides. There are three types of tidal power: tidal barrage, tidal stream, and tidal lagoon. A tidal barrage employs a large dam with underwater turbines. The barrage gates open as the tide is coming in and shut at high tide, creating a pool behind the barrage. The tidal barrage then functions much like a dam, slowly letting water out through the turbines, generating electricity. A tidal lagoon functions similarly to the barrage with the difference being that the lagoon is manmade by a barrier along the coast. Unlike the barrage, the lagoon would be able to harness power as it is filling and emptying, allowing for more continuous power. Tidal stream power involves the use of underwater turbines. This is similar to wind generation; however, potentially more powerful since water has a much higher density than wind. Wave power generates electricity by harnessing the energy in ocean waves. There are different potential designs; however, many utilize floating pistons that move with the waves, generating electricity. All forms of tidal power and wave power are heavily location dependent. If the location of interest does not have high enough tides, or strong enough waves, the power output would be low. At present, there are only a handful of tidal power facilities in operation today. Similarly, wave power is still primarily a demonstration-stage technology and has not seen energy industry acceptance. From this perspective, there would be a risk for Maritime Electric to deploy either tidal or wave power in that they would be early adopters of the technologies.

Table 4-9 — Tidal and Wave Energy Advantages and Disadvantages

Tidal and Wave Energy Advantages	Tidal and Wave Energy Disadvantages
Clean energy with no carbon emissions	Location dependent on large tidal regions
Harnessing tides / waves effectively has the potential to generate large amounts of electricity	Technologies have little to no industry acceptance – there are only a handful of operating tidal power plants globally and wave power is still in the demonstration phase

4.1.9. Geothermal

Geothermal power is derived from harnessing heat from within the earth. Geothermal power plants are renewable resources. To capture the heat, wells can be drilled into the earth to pipe steam or hot water to the surface. This steam/hot water is then used to power a turbine that generates electricity. Different types of geothermal technologies exist, specifically dry, flash, and binary cycle. The choice of technology is typically dependent on the temperature of the geothermal source. While the fuel source is reliable and the technology has mainstream acceptance in the energy industry, geothermal power plants are highly dependent on location as they require a geothermal heat source to operate. The removal of steam and water from the ground can increase the risk of earthquakes and ground instability in the area. Due to its location and lack of geothermal resource, PEI is not a suitable location for a geothermal power plant.

Table 4-10 — Geothermal Advantages and Disadvantages

Geothermal Advantages	Geothermal Disadvantages
Renewable, clean energy source	Location dependent, requires geothermal resource
Dispatchable power plant with large net capacity	Gases / pollution can be released during drilling
Geothermal resources are long term sources of heat (e.g., as long as the geothermal resource remains hot, electricity can be produced)	Can increase the risk of ground instability in surrounding area

4.1.10. Fuel Cells

Fuel cells use chemical energy in fuels to produce electricity. A voltage difference between the cathode and anode of the cell is created through a chemical reaction between the fuel in the anode and oxygen in the cathode. This reaction generates heat, water, and a free electron. The free electron is then harnessed to generate an electrical current that can be converted into power. With hydrogen as the fuel source (a common fuel for fuel cells), the process is completely carbon free, making it a clean power source. Other fuels can be used to power the cell but will result in the generation of carbon dioxide. Electricity generation through chemistry rather than combustion allows fuel cells to achieve higher efficiencies compared with other power sources.

Currently, fuel cells have not been widely adopted as a source of power generation on a large scale and existing systems in operation are typically small in size. The technology is likely to gain wider acceptance in the future as global decarbonization commitments are pursued; however, the growth and implementation of fuel cells is significantly less than the growth of other renewable technologies, such as wind or solar PV. A challenge for hydrogen fuel cells is that the hydrogen has to be extracted from water via electrolysis or separated from carbon fossil fuels, which requires a significant amount of energy. For application to PEI, S&L considers that fuel cells might be considered for very small scale or demonstration projects on the island (perhaps to provide backup power to commercial or industrial buildings), but fuel cells are not well suited to provide substantial electrical generation capacity for the island.

Table 4-11 — Fuel Cell Advantages and Disadvantages

Fuel Cell Advantages	Fuels Cell Disadvantages
Renewable, clean energy source	Slow energy industry adoption rate
Dispatchable power plant	Projects are generally small in scale (i.e., a couple MWs or much less)
Highly efficient due to chemical generation	For hydrogen fuel cells, hydrogen has to be extracted separately through energy intensive electrolysis process.

4.2. FUELS CONSIDERED

A number of the different capacity resources generate electricity through the combustion of a fuel. Many of these resources are able to operate on a variety of different fuel types. The different fuel types explored for this analysis are listed below:

- Diesel
- Biodiesel
- Biomass
- Natural Gas and Compressed Natural Gas
- Hydrogen

Further discussion of the different fuels considered is provided in the following subsections.

4.2.1. Diesel

Diesel fuel is a commonly used fossil fuel that is produced from crude oil. As a fossil fuel, the burning of diesel fuel in thermal generators (i.e., engines or combustion turbines) releases carbon dioxide into the atmosphere. Ultra-low sulfur diesel fuel is currently used as the main fuel source for Maritime Electric's on-island backup generators. A benefit of diesel fuel is that there is a robust supply chain that makes it relatively easy to purchase. In addition, diesel fuel is easy to store for long periods of time (as opposed to many gaseous fuels like natural gas, hydrogen, etc.).

4.2.2. Biodiesel and Biomass

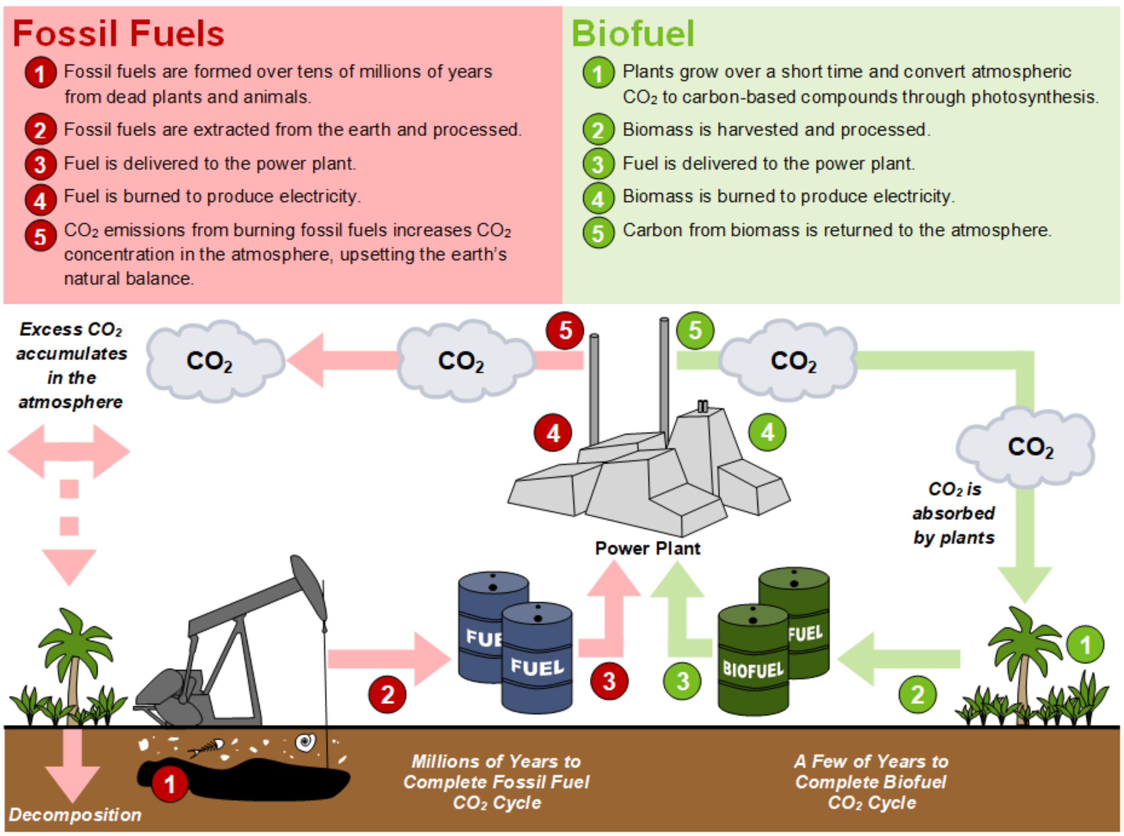
Biodiesel and biomass are both types of biofuel, which are produced from biological materials, rather than extracted from the earth like fossil fuels. Biofuels can be liquid, solid, or gas – biodiesel is a liquid fuel and biomass is a solid fuel. Although the combustion of biofuels releases carbon dioxide, when viewed from a life-cycle perspective, biofuels emit much lower greenhouse gas emissions than fossil fuels and may even result in zero net carbon emissions (discussed further below). Furthermore, biofuel-fired power generation facilities are dispatchable, meaning that they can be used at any time and at full capacity. The most applicable utility-scale applications of biofuels in PEI would be biodiesel and biomass. The government of Canada considers both biodiesel and biomass as renewable fuels[21].

An advantage of burning biofuels instead of fossil fuels is the reduction in life cycle carbon emissions. Life cycle emissions consider additions and reductions of carbon across the full cycle of biofuel production and consumption. Additions include the emissions associated with the combustion of the biofuel for electricity

[21] https://www.nrcan.gc.ca/our-natural-resources/energy-sources-distribution/renewable-energy/about-renewable-energy/7295

generation. Reductions occur as part of the earth's natural cycle associated with plant growth, as biomass growth removes carbon from the atmosphere through photosynthesis. Compared with traditional diesel, pure biodiesel (known as B100) reduces life-cycle carbon emissions by over 70%[22]. A 20% blend of biodiesel with traditional diesel (known as B20) would approximately reduce carbon emissions by 20% of this value, for a net reduction in carbon emissions of approximately 15% over traditional diesel. Solid biomass can also achieve at or close to carbon neutrality as long as the rate of re-planting/growth of the biomass keeps pace with the harvesting and consumption. The following figure provides an illustration of the carbon lifecycle differences between traditional fossil fuels and biofuels, such as biodiesel.

Figure 4-4 — Fossil Fuel vs. Biofuel Carbon Life Cycle



Biodiesel requires some special considerations when storing and utilizing as it can degrade various materials. Special attention must also be given to the fuel in the winter as it can gel if it is allowed to get too cold. Additionally, biodiesel degrades faster than traditional diesel – the typical shelf life for biodiesel that is properly stored is around 6 months.

[22]https://afdc.energy.gov/vehicles/diesels_emissions.html, https://www.anl.gov/argonne-scientific-publications/pub/140803

In this report, the potential use of biodiesel is considered for both reciprocating engines (RICE) and combustion turbines (CTs). Both generators are capable of firing biodiesel, up to a 100% blend (e.g., B100). Many of today's commercially available RICE units are already fully compatible with both traditional diesel and biodiesel firing, without requiring modification to the engine itself; however, some minor modifications would be required to the BOP and storage systems. CTs require some modifications to the various CT components to allow for biodiesel firing, such as compatible fuel injection nozzles, combustors, etc. These modifications are in addition to modifications to the CT BOP and storage systems (similar to what would be required for a RICE power plant). Once these modifications are made, the CT unit is able to burn either traditional diesel or biodiesel. We estimate the cost of the CT equipment modifications would be modest, in the CAD $2.5 million range, for a CT size in the 30 MW range.

Biomass is considered for biomass power plants. The type of biomass used in a power plant can vary from trees (typically wood pellets), grasses, or other sources. Equipment in a biomass power plant would need specialized design depending on the fuel type.

4.2.3. Natural Gas and Compressed Natural Gas

While natural gas is a common fuel utilized in the energy industry that releases much less carbon dioxide when burned than diesel fuel, the significant natural gas delivery infrastructure needed to support power generation (i.e., pipelines from the mainland, liquified natural gas delivery terminals, etc.) are not currently present on PEI. Furthermore, the costs associated with developing this infrastructure are too great to make economic sense for power plants that will be primarily utilized as backup generators. Compressed natural gas can be delivered by truck, but the amount of storage space required to utilize compressed natural gas at Maritime Electric's existing power plants (including required safe standoff distance) is too large for compressed natural gas to be utilized as a fuel source. For these reasons, both natural gas and compressed natural gas were not considered as fuel sources for this analysis.

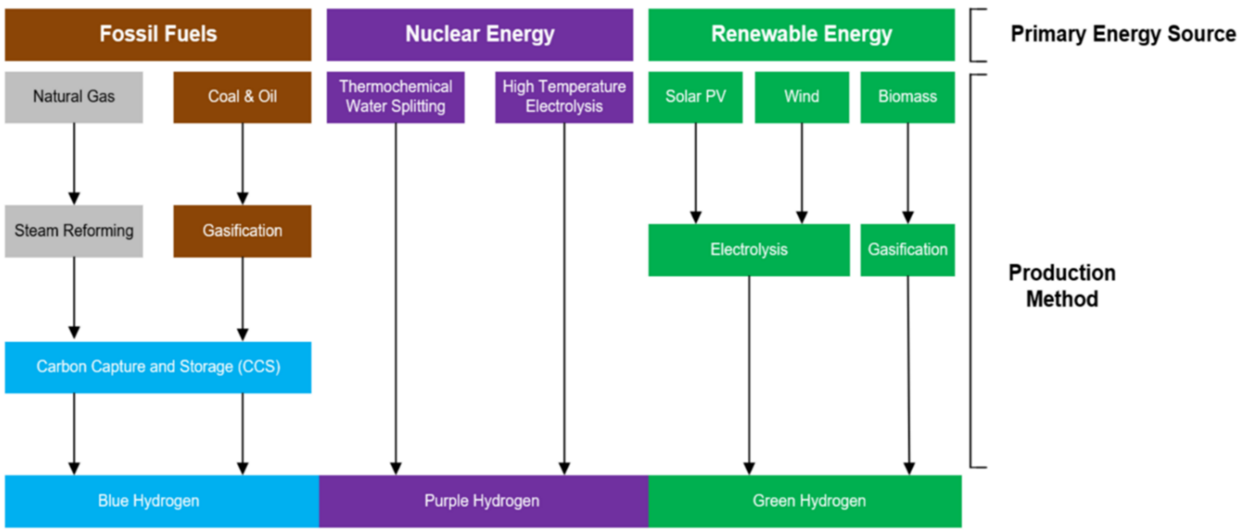
4.2.4. Hydrogen

Hydrogen is not considered as a fuel source for this analysis for a number of different reasons. Currently, there are not any commercially available RICE or CT resources that can operate on 100% hydrogen. The capability for RICE and CT generators to burn 100% hydrogen is estimated to be 5-10 years away based on our discussions with RICE and CT manufacturers. This section provides an overview of considerations associated with hydrogen's use in generators for informational purposes.

Hydrogen is an abundant element that can be stored and combusted to produce energy without carbon emissions. Currently, it has limited use in electricity generation; however, its high energy content per unit of weight and its near-zero emissions make it viable for greater use in the future. Challenges to widespread hydrogen usage include the need to separate elemental hydrogen from the compounds in which it naturally exists and the need for advanced storage and delivery methods. If these challenges can be effectively mitigated, hydrogen will see more significant usage for electricity generation in fuel cell applications or in conventional power plants.

Separation of elemental hydrogen from naturally occurring compounds like water is a process that requires energy. The predominant method for hydrogen production is steam reforming of natural gas, in which natural gas chemically reacts with water and heat to produce hydrogen and carbon dioxide. There are various other production methods, as shown in the following graphic.

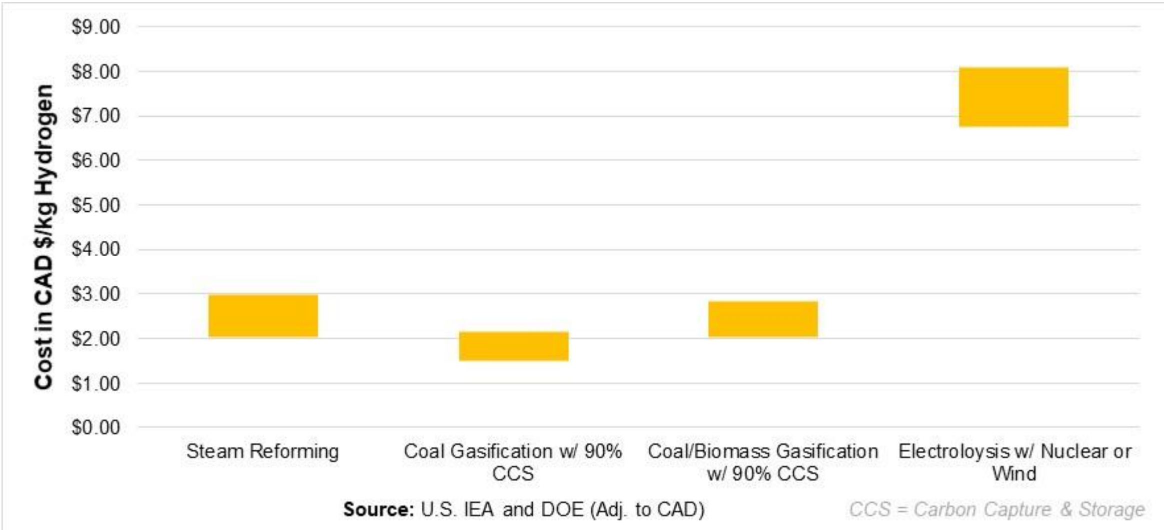
Figure 4-5 — Hydrogen Production Methods



At roughly CAD $1.5 to $3 per kilogram of hydrogen, gasification and steam reforming are currently the most economical ways to produce hydrogen, as illustrated by the following graphic. However, the projected cost of electrolysis is expected to decrease by 50% by 2030, bringing it more in line with the currently predominant and cost-effective methods[23].

[23] PEI has experience with a hydrogen electrolysis project through the Hydrogen Village project that was active in the 2005-2010 timeframe. It was determined at that time that electrolysis of hydrogen using wind power was uneconomic so the technology was not pursued.

Figure 4-6 — Current Cost of Hydrogen Production ($ CAD)



There is significant uncertainty as to the future pricing of hydrogen as a fuel source due to the fact that it is unknown how much both demand and supply might increase. Once elemental hydrogen is produced, it can be used in electricity generation applications in a variety of ways, including direct integration with an existing power plant. Introducing hydrogen as a fuel to an existing power plant requires a transportation and delivery method, which presents unique challenges due to hydrogen's extremely low boiling point temperature. Methods for hydrogen transportation are summarized below:

- **Pipeline**: Transporting gaseous hydrogen via existing pipelines is a low-cost option for delivering large volumes of hydrogen. The high initial capital costs of new pipeline construction constitute a major barrier to expanding hydrogen pipeline delivery infrastructure.
- **Truck – Liquid**: Hydrogen has the lowest boiling point of any element, requiring temperatures below -253°C for liquid phase. As a result, the maximum range for trucking is approximately 4,000 km because over the journey time the cryogenic hydrogen heats up, causing the pressure in the container to rise. Trucking liquid hydrogen is more economical than gaseous hydrogen trucking due to volume contained in truck.
- **Truck – Gas**: This method primarily is used for low / intermittent demand and existing power plant usage (for large generator cooling). Gaseous hydrogen is compressed to pressures of 180 bar (~2,600 psi gauge) or higher. Tube trailers pressure limitations can limit the amount of hydrogen that can be transported. Steel tube trailers are most common.

Once hydrogen is delivered to a site, it can be integrated into a power plant's primary fuel source. Most existing high-pressure transmission pipelines can accept up to 15% hydrogen blending (by volume) with their current material composition. This 15% hydrogen mixture can result in a 5% reduction in carbon dioxide (by mass) in combustion byproducts. Currently, gas turbine and engine manufacturers do not have commercially available generators that can burn 100% hydrogen; however, those are expected to be available within 5 years. OEMs have also indicated that many older, operating combustion turbines can accept some percentage of hydrogen mixed with natural gas.

Hydrogen integration is not without potential challenges and engineering considerations. For example, hydrogen is a smaller molecule than methane (a common fuel source), which means that gaskets and pipeline connections must be checked to eliminate leakage. Integration of hydrogen with an existing power plant can also cause material embrittlement, which can diminish load-bearing capacity and lead to cracking failures below the anticipated yield strength of susceptible materials. Hydrogen embrittlement affects base materials differently – it is problematic for high-strength steel but has no effect on austenitic stainless steel. Therefore, evaluation of welds must be performed prior to the introduction of hydrogen fuel due to welds' varying levels of hardness and yield strength.

Hydrogen usage in power plants also requires additional safety considerations. Hydrogen is the smallest molecule, enabling it to leak out of non-welded systems. It is also a colorless and odorless gas, causing leaks to be more difficult to detect. Furthermore, hydrogen is highly flammable and explosive even in low concentrations, and its temperature increases with pressure drops (in contrast to most other gases) due to the Joule–Thomson effect, increasing the risk of self-ignition during uncontrolled expansion. It therefore requires increased National Fire Protection Association classification and more stringent safety measures, which may require changes to existing electrical equipment and devices.

If Maritime Electric were to install a new generator, we do not recommend hydrogen be pursued as the primary fuel source at this point in time. Currently, engines or CTs that can combust 100% hydrogen are not yet commercially available; therefore, Maritime Electric would have to mix the hydrogen with natural gas. At present, there is not an established natural gas pipeline network on PEI; thus, Maritime Electric would also have to import and store natural gas on the island. Separately, since electricity purchased from NBEM is more economical than energy generated by the on-island CTs and engines, Maritime Electric's generators rarely operate. As a result, an investment into developing hydrogen storage infrastructure and supply chain would likely not result in a significant reduction in Maritime Electric's carbon emissions.

5. CAPACITY RESOURCE ANALYSIS

The different capacity resources considered in this report are analyzed in this section. The analysis first considers a high-level initial screening of the different technologies to rule out technologies that either do not have significant deployment in the energy industry or are clearly not well suited to be developed on PEI. Capacity resource technologies that pass the initial screening are further analyzed from a more in-depth perspective. This in-depth analysis includes a combination of technical, financial, and sustainability considerations. From the financial perspective, S&L has developed cost estimates of the short-listed capacity resource technologies based on our recent experience providing development oversight for projects of the respective technology. Cost estimates have been adjusted to account for PEI-specific considerations, including the island's location, construction labor estimates, taxes, etc.

5.1. INITIAL SCREENING OF TECHNOLOGIES

An initial screening process was performed to assess the high-level viability of the different capacity resource technologies considered in this report. This screening primarily looked at two different criteria:

1) **Significant Energy Industry Deployment**: This criterion is utilized to rule out technologies for which there would be a risk to Maritime Electric for being an early adopter of the technology. As an early adopter of a technology, Maritime Electric would potentially expose their customers to the financial risk associated with technology underperformance, high repair costs, design flaws, delays achieving commercial operation, and other associated items. As such, capacity resource technologies that do not have wide deployment in the energy industry are ruled out in the initial technology screening.

2) **Sufficient Renewable Resource**: This criterion is utilized to rule out renewable technologies for which there is not a sufficient renewable resource in PEI to support electricity generation.

The following table presents the results of the initial screening, including a set of notes regarding the screening decision. In order for the technologies to pass the initial screening, both criteria 1 and 2 must be met. Capacity resource technologies that pass the initial screening are considered as part of a more detailed analysis later in the report.

Table 5-1 — Initial Capacity Resource Technology Screening Results

Technology Type	Significant Energy Industry Deployment?	Sufficient Renewable Resource?	Notes / Other Considerations	Initial Screening Results
Onshore Wind Power	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Offshore Wind Power	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Solar PV (Utility Scale)	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Rooftop Solar PV	Yes	Yes	Widely used technology in energy industry, renewable technology	Selected
Concentrating Solar Power (CSP)	Yes	No	Renewable technology, but PEI's direct normal irradiance levels are not high enough and PEI's climate is not ideal to support a CSP plant	Not Selected
Energy Storage (BESS, Li-Ion)	Yes	Not Applicable	Widely used technology in energy industry	Selected
Energy Storage (BESS, Flow)	No	Not Applicable	Technology has not gained widespread energy industry deployment to date	Not Selected
Energy Storage (Compressed Air)	No	Not Applicable	Only a handful of CAES facilities are in operation around the globe, relatively few are for output greater than 10 MW.	Not Selected
Reciprocating Internal Combustion Engine (RICE)	Yes	Not Applicable	Widely used technology in energy industry, can operate on various fuel types, including renewable-derived fuels	Selected
Combustion Turbine (CT) – Aeroderivative	Yes	Not Applicable	Widely used technology in energy industry, can operate on various fuel types, including renewable-derived fuels	Selected
Biomass Power Plant	Yes	Yes	Widely used technology in energy industry, flexibility to operate on various renewable-derived fuels, renewable technology	Selected
Nuclear - Small Modular Reactor (SMR)	No	Not Applicable	Technology has not yet gained widespread energy industry deployment to date	Not Selected
Tidal Power	No	No	Renewable technology, but only a handful of tidal power stations are in operation around the globe, PEI also lacks a significant tide	Not Selected
Wave Power	No	No	Renewable technology, but technology is in infancy with only a handful of very small-scale projects installed around the globe	Not Selected
Geothermal Power Plant	Yes	No	While widely used in energy industry, the best locations with sufficient heating resource are generally located in western Canada, renewable technology	Not Selected
Fuel Cell	No	Not Applicable	Currently, fuel cells are not yet a technology that has gained significant industry adoption for large power generation applications and existing systems tend to be small in size	Not Selected

5.2. CANDIDATES FOR SECONDARY SCREENING

The capacity resource technologies that passed the initial screening are listed below:

- Onshore wind power
- Offshore wind power
- Solar PV (utility scale)
- Rooftop solar PV
- Energy storage (BESS, Li-Ion)
- Reciprocating internal combustion engine
- Combustion turbine – aeroderivative
- Biomass power plant

The following subsections provide a detailed analysis and cost comparison of the different technologies. In addition, a discussion of how well the different technologies are able to help Maritime Electric cost-effectively meet its most important needs is also provided. These criteria are summarized below and also discussed in Section 2:

1) **Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations:** Maritime Electric must meet both a) energy obligations and b) regional capacity obligations. Energy obligations are those associated with Maritime Electric meeting the system's electrical load every hour of the day. Maritime Electric's capacity obligations are the share of capacity that Maritime Electric must have either installed on-island or purchased from either on PEI or on the mainland such that the NPCC reliability standards for the Maritimes Area (which consists of PEI, New Brunswick, Nova Scotia, and northern Maine) are met.

2) **Resource Contributions When PEI is Electrically Disconnected from Mainland:** A scenario where PEI is electrically disconnected from the mainland is considered an emergency scenario with historical precedence. During this time, assets located on PEI alone must be able to meet load and stabilize the electrical system (electricity to stabilize the system is usually purchased from the mainland).

3) **Resource Contributions Towards Maritime Electric's Sustainability Targets:** Maritime Electric has established a greenhouse gas emissions reduction target to reduce emissions by 55% by 2030 (from 2019 levels). Preference should be given to resources that will help Maritime Electric achieve this target.

5.2.1. Wind Power

5.2.1.1. Onshore Wind Power

As discussed previously, consistent and strong wind speeds are one of PEI's best resources from a power generation perspective. The most recently installed wind farms on PEI approach a 50% capacity factor on an annual basis, which is among the highest in the energy industry for onshore wind farms. S&L developed a cost buildup for a 50 MW onshore wind power plant, which is provided in Appendix A. A summary of the costs is provided in the following table.

Table 5-2 — Onshore Wind Estimated Capital Costs, 50 MW

Cost Parameter	Estimated Cost ($ CAD)
Total Capital Costs	$106,280,000
Total Capital Costs ($/kW)	$2,126

Based on the high wind resource on PEI and the costs for wind power plants in comparison to other technologies, wind power is a cost-effective source of renewable generation for Maritime Electric. A separate cost buildup of operations and maintenance (O&M) costs is provided in Appendix B.

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: Due to PEI's strong wind resource, the continued development of wind power plants on PEI is one of the most effective ways that Maritime Electric can meet its energy obligations in a carbon-free and cost-effective manner. The high capacity factors of the new wind power plants equate to large amounts of energy that are generated, providing carbon-free power to the community and offsetting imports from NBEM.

The intermittent nature of the wind means that wind power plants cannot contribute much towards Maritime Electric's regional capacity obligations. The reason for this is because Maritime Electric is required to calculate the capacity contributions of resources using a methodology that appropriately accounts for both the resource's intermittency and when the resource generates with respect to when system load is highest. The amount of wind capacity that Maritime Electric can count towards their capacity obligations is determined based on the wind power plant's effective load carrying capability (ELCC), which is discussed further in Appendix C. The ELCC for the 92.5 MW of wind generation in Maritime Electric's portfolio today is 23%, meaning that only 21 MW of the 92.5 MW of wind installed count towards Maritime Electric's capacity obligations (92.5 MW x 23% = 21 MW). The ELCC of a resource falls as more of that resource is installed (see Appendix C for further discussion). As a result, if Maritime Electric had another 70 MW of wind generation in their portfolio, for 162.5 MW of wind generation total, the ELCC for the portfolio is estimated to only be 17%. As a result, the resulting amount of wind capacity that Maritime Electric could count towards their capacity obligations would be 28 MW (162.5 MW x 17% = 28 MW), which is only a 7 MW increase in effective capacity over the current portfolio today.

Resource Contributions When PEI is Electrically Disconnected from Mainland: Given their intermittent nature, wind power plants are not a reliable source of electricity during a situation when PEI is electrically disconnected from the mainland. In the event that the wind power plants are generating electricity while PEI is disconnected, the on-island dispatchable generators will need to balance the wind generation so that there is not an over- or under-supply of electricity in the system (without proper balancing, the system can collapse)[24]. Typically, the balancing needs are met by NBEM using mainland-based generation, through the ties of PEI to the mainland. PEI has significantly more wind capacity installed on-island compared to installed dispatchable generating capacity, meaning that only a fraction of the wind capacity can be utilized when PEI is disconnected from the mainland, without risking the wind generation overwhelming the on-island dispatchable generators' balancing capabilities. During a disconnection of PEI, Maritime Electric estimates that only 37% of all the installed on-island wind nameplate capacity on PEI[25] could be utilized when all the on-island dispatchable generators are available. This value falls to 0% in the event the Charlottetown CT3 is unavailable.

Resource Contributions Towards Maritime Electric's Sustainability Targets: Wind energy is a great source of renewable carbon-free energy that would assist Maritime Electric in meeting their sustainability targets. Additional on-island wind generation will provide additional energy for Maritime Electric to serve load, resulting in less energy purchased from the mainland and therefore lower carbon emissions. Maritime Electric already has under contract a total of 92.5 MW of wind capacity that it utilizes to serve load, and an additional 70 MW of wind generation is planned. We estimate that the additional 70 MW of wind generation will decrease carbon emissions by approximately 14% on a tonnes CO_2e basis (see the "No BESS" column of Table 3-5).

[24] When generators are helping to "balance" the system, they must be operated at at less than their maximum output, which allows them to be able to absorb the fluctuations from load or intermittent generation (such as wind or solar) without causing system instability. RICE and CTs can operate as balancing generation as their output is controllable. Wind and solar are not dispatchable generators and thus cannot provide balancing services, since their output is generally not controllable. For reference, energy storage systems can help to balance the system; however, the amount an energy storage system can help balance the system when PEI is disconnected from the mainland may be limited since it depends on the state of charge of the BESS at the moment that disconnection occurs, the length of the disconnection, and whether/how much the wind power plants are generating electricity. This is discussed further in Section 5.2.3.

[25] This is based on energy from all wind generation located on-island, which includes facilities supplying both on- and off-island customers.

5.2.1.2. Offshore Wind Power

Offshore wind power plants generate energy in the same manner as onshore wind power plants, but they utilize larger turbines that are erected in the ocean and can generate more electricity with less intermittency (due to the more consistent winds over the ocean). While offshore wind power plants typically have a higher capacity factor than onshore wind power plants, PEI's onshore wind resource is very strong both in terms of wind speed and frequency. As a result, the expected improvement in capacity factor for offshore turbines near PEI versus PEI's onshore turbines will likely be modest.

From a capital cost perspective, offshore wind power plants are significantly more expensive than onshore wind power plants due to the challenges associated with developing the power plants and their associated infrastructure in the ocean. Based on information we maintain in our internal project databases, we estimate that an offshore wind power plant would cost 3x to 4x more than an onshore wind power plant on a dollar per kW basis ($6,000/kW - $8,000/kW), or potentially more. Additionally, offshore wind power plants are typically hundreds to thousands of MWs in size, which allows them to capture economies of scale cost efficiencies. Given the relatively small amount of generation that Maritime Electric has to serve, an offshore wind power plant likely does not make sense for Maritime Electric's small system.

In summary, given the strong onshore wind resource on PEI and the significantly lower costs associated with onshore wind as compared to offshore wind, an offshore wind power plant is not a recommended resource solution for Maritime Electric.

5.2.2. Solar PV

5.2.2.1. Utility-Scale Solar PV

While PEI's northern latitude and climate are not ideal for solar PV generation, the solar resource on PEI is still high enough to provide a limited amount of energy to the island. As shown in Appendix D of this report, the expected capacity factor for a solar PV power plant on PEI is approximately 19.9% for a bifacial, fixed-tilt configuration. The following table presents our expected costs for 50 MW of solar PV built on PEI (5x10 MW power plants, bifacial, fixed-tilt configuration). The costs are based on our project experience within Canada and the northeastern United States. It is important to note that the costs in the table below are marginally higher than those expected for an onshore wind power plant on PEI with a similar nameplate capacity; however, the expected annual generation produced by the solar PV power plant is less than half of that expected for an onshore wind power plant. A separate cost buildup of O&M costs is provided in Appendix B.

Table 5-3 — Utility Scale Solar PV Estimated Capital Costs, 50 MW (5x10 MW)

Cost Parameter	Estimated Cost ($ CAD)
Total Capital Costs	$119,474,000
Total Capital Costs ($/kW)	$2,389

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: A solar PV power plant would help Maritime Electric meet its energy obligations and purchase less energy from NBEM. While the solar resource on PEI is much lower than the wind resource on PEI, the addition of solar energy to Maritime Electric's generation portfolio would provide diversification since the solar and the wind generation profiles would not be perfectly correlated. In general, a more diverse generation portfolio is beneficial since different resources can complement one another – for example, solar PV can still generate electricity during the day when the wind might not be blowing. However, given the fact that the expected capacity factor of solar PV is much lower than that of an onshore wind power plant for a similar dollar per kW cost point, PEI and Maritime Electric would have to determine if those diversification benefits are high enough to justify investment in solar PV versus simply continuing to invest in more onshore wind power plants, which provide a much higher amount of MWhs generated per dollar invested.

Since the solar PV generates only during the daytime hours, it is unable to supply energy in winter evening periods when Maritime Electric typically reaches its annual peak load. As a result, the ELCC of solar PV is zero, meaning solar PV would not be able to contribute to Maritime Electric's regional capacity obligations.

S&L recommends that continued investment into wind power plants on PEI be pursued as the first priority, with investment into utility-scale solar PV pursued as a close second priority.

Resource Contributions When PEI is Electrically Disconnected from Mainland: Similar to wind, solar PV is limited in the amount of energy that it can contribute in the event of a disconnection of PEI from the mainland. The intermittent nature of the solar generation will require balancing from the on-island dispatchable generators. Additionally, solar PV will not generate energy at night and generation will be reduced when there is cloud cover, further limiting the amount of electricity the resource can provide during a disconnection event. As a result, solar PV power plants are not a reliable resource for Maritime Electric in the event that PEI is disconnected from the mainland.

Resource Contributions Towards Maritime Electric's Sustainability Targets: As a renewable resource, solar PV will support Maritime Electric's efforts towards reducing carbon emissions. Any generation from a solar PV power plant will equate to less energy needed to be purchased from mainland power plants (some of which emit carbon) through the contract with NBEM.

5.2.2.2. Rooftop Solar PV

Small-scale solar PV is typically installed by a customer on the roof of their building (in a small number of cases it is installed as a standalone unit on a customer's property). Customers that install rooftop solar are still connected to the grid, allowing them the ability to buy electricity when their rooftop solar PV production may not be high enough to fully meet their electrical load. Likewise, the connection of the rooftop solar PV system to the grid allows the customer to sell any excess generation back to Maritime Electric. Typically, rooftop solar PV systems are sized to fully offset the home's/business' electrical consumption. The net effect of rooftop solar PV growth on PEI is that it decreases the amount of electricity Maritime Electric needs to provide to their customers, which equates to less electricity purchases from NBEM and thus lower carbon emissions.

S&L has calculated the estimated cost for a 10-kW rooftop solar PV system, including the total cost per kW installed. A summary of those costs is provided in the table below, with a more detailed buildup of costs provided in Appendix A.

Table 5-4 — Rooftop Solar PV Estimated Capital Costs (10 kW)

Cost Parameter	Estimated Cost ($ CAD)
Total Capital Costs (after rebate)	$31,310
Total Capital Costs ($/kW) (after rebate)	$3,131

While less cost effective than utility scale solar PV, rooftop solar PV can be economical for customers, when supported with governmental grants and incentives, from the perspective that it is a long-term investment. Additionally, there are intrinsic benefits for individuals that install rooftop PV systems on their homes/businesses associated with reducing one's carbon footprint.

For much of North America, including PEI, utilities compensate customers that install rooftop solar through a mechanism called net metering. In a net metering arrangement, any electricity that a homeowner / business generates is credited on their electricity bill, often at a fixed electricity rate. If the solar system produces excess electricity beyond the homeowner / business' load, the excess generation is injected back into the electric system and credited on a future electricity bill. There are some drawbacks associated with net metering that are worth noting. First, the value of electricity varies by the time of day, based on system supply and demand. As such, crediting a fixed electricity rate through a net metering program can mis-align 1) the actual value the solar energy provides to the electrical system to 2) what the utility pays the customer for the solar energy. Additionally, electricity rates pay for other services beyond simply the cost to generate the electricity, including costs to maintain/improve the transmission and distribution system, costs for the utility to meet regional capacity obligations, etc. A net metering program can unfairly shift the costs for these services away from customers that have net-metered solar systems onto customers that do not have solar systems. It is generally found that the societal benefits of rooftop solar outweigh these costs; however, it might be beneficial for Maritime Electric to explore if there are alternative payment mechanisms that can be employed to more equitably share the costs associated with rooftop solar.

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: The continued growth of rooftop solar PV on PEI contributes to Maritime Electric's ability to meet energy obligations by reducing system electrical load throughout the daytime. Since rooftop solar PV generation does not occur in the evening (when system load is highest), total system load in the evening is likely to be unchanged. As a result, Maritime Electric's capacity obligations are not likely to fall as more rooftop solar PV is adopted.

Resource Contributions When PEI is Electrically Disconnected from Mainland: With widespread adoption of rooftop solar PV on PEI, the resource could provide a positive systemwide impact during times when PEI is disconnected from the mainland via system load reductions in the daytime. Currently, there is not enough rooftop solar PV installed on PEI to make an appreciable system-wide difference. Additionally, during the night or when there is significant cloud cover, rooftop solar PV will not be able to contribute to the system. Thus, rooftop solar PV is not currently a reliable resource that allows Maritime Electric to better navigate a disconnection to the mainland.

Resource Contributions Towards Maritime Electric's Sustainability Targets: As a renewable resource, rooftop solar PV will support Maritime Electric's efforts towards reducing carbon emissions. Any generation from a rooftop solar PV system will equate to less electricity that Maritime Electric needs to purchase from NBEM.

5.2.3. Lithium-Ion Energy Storage

Lithium-ion energy storage is the most common BESS in the energy industry. BESS is not a generation resource, it is a storage resource that can transfer energy from one time to another; however, many of the use cases for BESS overlap with those of generators. In addition, the unique technical characteristics of BESS allow it to be used in ways many generator types are unable. For example, BESS' ability to inject energy instantaneously makes it well suited to perform energy arbitrage through an energy marketplace (i.e., charging when energy prices are low and discharging when energy prices are high), ancillary services (i.e., voltage support, frequency regulations, etc.), and other similar use cases requiring fast response. This section highlights how BESS can contribute to the three specific use cases that are most critical to Maritime Electric at this point in time.

S&L has provided technical and project developmental guidance to numerous BESS projects. In addition, we have helped run numerous requests for proposals (RFPs) on behalf of utilities for generation and storage projects. As such, we have a detailed cost database of current BESS project pricing. The following table provides our estimate of the capital cost summary for a 50 MW BESS project developed on PEI for three different storage durations: 1 hour, 2 hours, and 4 hours. A more detailed cost buildup of storage costs is provided in Appendix A, including 8 hour and 24 hour duration projects.

Table 5-5 — Lithium-Ion Energy Storage (50 MW) Estimated Capital Costs

BESS Size	Cost Parameter	Estimated Cost ($ CAD)
50 MW, 50 MWh (1-hr storage)	Total Capital Costs	$47,966,000
	Total Capital Costs ($/kW)	$959
	Total Capital Costs ($/kWh)	$959
50 MW, 100 MWh (2-hr storage)	Total Capital Costs	$78,228,000
	Total Capital Costs ($/kW)	$1,565
	Total Capital Costs ($/kWh)	$782
50 MW, 200 MWh (4-hr storage)	Total Capital Costs	$133,523,000
	Total Capital Costs ($/kW)	$2,670
	Total Capital Costs ($/kWh)	$668

It is important to note that while BESS project pricing has fallen continuously over the last decade, prices are still relatively more expensive than some similarly sized generators that can be used for similar use cases, specifically engines and combustion turbines. In recent years, supply chain constraints associated with the demand for electronics and lithium have contributed to BESS prices not being able to achieve full price parity with these generator types.

For comparison, the O&M costs for a new 50 MW, 4-hour, BESS project are estimated to be similar to the O&M costs for an equally-sized new RICE unit that would serve primarily as a backup generator for Maritime Electric (see the end of Appendix B for a detailed 20-year comparison of O&M costs for both BESS and RICE). Considering that a BESS project would likely be utilized more frequently on a day-to-day basis than a backup RICE generator, the BESS O&M costs are considered to be relatively inexpensive. However, due to the performance degradation of batteries with usage, Maritime Electric would have to augment the BESS project (i.e., add more battery cells) multiple times over the project's service life in order to keep the BESS at a consistent performance level. The costs of augmentations are sizable – augmentations are estimated to cost a total of nearly CAD $20 million (2022 $'s) over a 20-year BESS project life (see the table at the end of Appendix B for additional details) for a 50 MW, 4-hour project. It is important to note that a BESS project does not have to be augmented; however, a typical non-augmented project can be expected to degrade approximately 25% to 30% over a 20-year lifespan.

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: A BESS project will have a limited ability to help Maritime Electric meet its energy obligations. This is due to the fact that as a storage resource, a BESS can only store and re-inject already generated electricity. As discussed in detail in Section 3.2.1, in the event that generation from the wind power plants on PEI (and any future solar power plants) plus the nuclear generation from Point Lepreau results in an excess of generation above system load, Maritime Electric has to sell the excess generation to the mainland. During these times, a BESS project would be able to store some or all of this excess generation and re-inject it later, which would help Maritime Electric better meet its energy obligations. Currently, the vast majority of the electricity generated by the wind power plants on PEI is used immediately to serve load – times when there is excess generation are extremely rare. With additional wind and solar projects planned for PEI, specifically the additional 70 MW of wind planned to be online in the coming years, the amount of times when there will be excess generation is likely to increase, but not to forecasted levels that justify a significant investment in BESS. As such, a BESS project is unlikely to appreciably help Maritime Electric meet its energy obligations in the near to intermediate future.

From the perspective of capacity obligations, a significant portion of a BESS' nameplate capacity would be able to be used by Maritime Electric to meet its regional capacity obligations. The exact amount would need to be quantified and would vary based on the technical characteristics of the BESS project, but we expect that it is likely to be similar to the BESS' nameplate capacity. As such, a BESS project is an excellent resource to help Maritime Electric meet its regional capacity obligations if the BESS is used primarily for capacity storage.

Resource Contributions When PEI is Electrically Disconnected from Mainland: During a disconnection event, a BESS could be able to provide some benefit to the island, but the amount is likely to be limited. If PEI is disconnected from the mainland, Maritime Electric does not currently have enough generation to meet system load. As a result, rolling blackouts are expected (discussed further in Section 2.2.2). The addition of BESS to PEI could help Maritime Electric to better balance the wind generation intermittency during a disconnection from the mainland, which would in turn allow Maritime Electric to utilize more of PEI's wind capacity to serve system load. This would likely equate to less severe rolling blackouts.

The level at which BESS would be able to help the system during a disconnection of PEI from the mainland depends on a number of factors, including the state of charge of the BESS at the moment the disconnection occurs, the length of the disconnection, and whether / how much the wind power plants are generating electricity. At best, a BESS system could be very helpful for Maritime Electric during a disconnection from the mainland; however, if the wind power plants are not generating electricity during the time when PEI is disconnected from the mainland, then the amount of support a BESS could provide is limited to both its state of charge and duration. As a result, there is significant uncertainty around how much a BESS project would be able to support the system during a disconnection from the mainland, and thus a BESS project is not considered to be a reliable resource for this specific use case.

Resource Contributions Towards Maritime Electric's Sustainability Targets: In the event that generation from the wind power plants on PEI (and any future solar power plants) plus generation from Point Lepreau results in an excess of generation above system load, Maritime Electric has to sell this excess generation to the mainland. During these times, a BESS project would be able to store some or all of the excess generation and re-inject it on PEI later, which would allow Maritime Electric to purchase less total energy from NBEM and thus reduce carbon emissions. As shown in Section 3.2.1, there is currently not enough wind capacity installed on PEI today, or additional wind capacity planned in the intermediate future (specifically the additional 70 MW of wind planned in the coming years), to result in a large number of times when there will be excess generation above load. As a result, the installation of a BESS is not expected to appreciably improve Maritime Electric's ability to meet sustainability targets in the near future.

As more wind is installed on PEI beyond the 70 MW planned for the coming years, there will be more times when there is excess generation above load. As a result, a BESS would be able to better help Maritime Electric meet sustainability goals; however, at that point in time we recommend that a comparative assessment be performed to assess various carbon-reduction solutions, including a BESS, to determine which solutions would provide the highest carbon-reduction benefits on a per dollar invested perspective.

5.2.4. Reciprocating Internal Combustion Engine

A RICE is a type of dispatchable generator that can provide both energy and capacity. A RICE is a common resource in the energy industry due to its modularity, flexibility (ability to start/stop and ramp quickly), and cost-effectiveness. Additionally, a RICE can operate on a variety of different fuels, including renewable fuels such as biodiesel. While commercially-available RICE offerings cannot yet operate on 100% hydrogen, engine manufacturers expect to have this capability in the coming years. For the purposes of Maritime Electric, the ability for a RICE power plant to operate on renewable fuels would help to reduce the risk that a new RICE power plant might become a stranded asset should the Canadian government introduce stricter policies regarding allowable fuels that can be used for power generation. Maritime Electric would utilize a new RICE power plant primarily for backup and emergency generation.

The following table provides a summary of the expected capital costs for new RICE power plant, specifically one operating on diesel fuel and another operating on biodiesel fuel. A more detailed cost buildup of RICE costs is provided in Appendix A. For reference, two differently designed RICE power plants are not needed to be able to operate on either diesel fuel or biofuel. Engines are very flexible in terms of fuel type; thus, the same power plant could switch from burning diesel fuel to biodiesel fuel without modification. The difference in per kW cost are primarily because the operation of RICE power plant on biodiesel results in some derating in output versus operation on traditional diesel fuel. A separate cost buildup of O&M costs is provided in Appendix B.

Table 5-6 — Reciprocating Internal Combustion Engine Estimated Capital Costs

RICE Unit [1]	Cost Parameter	Estimated Cost ($ CAD)
5 x RICE Units, 53 MW Total, Diesel Fuel	Total Capital Costs	$119,657,000
	Total Capital Costs ($/kW) [2]	$2,257
5 x RICE Units, 46.7 MW Total, Biodiesel Fuel	Total Capital Costs	$119,729,000
	Total Capital Costs ($/kW) [2]	$2,556

Notes

1) Wärtsilä 20V32 engines are assumed as representative engine types. Other manufacturers make similar engines to this model.
2) While the engine type and size are consistent with both diesel and biodiesel fuel, the use of biodiesel results in some derating of engine output versus diesel fuel; thus, the capital costs on a $/kW basis are different.

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: From the perspective of energy obligations, Maritime Electric would use a RICE primarily as a back-up generator and dispatch only when enough electricity could not be procured from the mainland, or during emergencies. As such, it is not expected that a RICE will be utilized to meet Maritime Electric's energy obligations; however, given that a RICE is a dispatchable generator, it could be utilized to meet Maritime Electric's energy obligations if called upon.

A RICE would provide capacity to help Maritime Electric meet its regional capacity obligations. If installed, close to the RICE's nameplate capacity could be utilized to meet Maritime Electric's capacity obligations. A RICE power plant is an excellent source of generating capacity.

Resource Contributions When PEI is Electrically Disconnected from Mainland: A RICE would be a very beneficial resource for Maritime Electric in terms of being able to provide generation to the grid in the event of an electrical disconnection of PEI from the mainland. The addition of a RICE to PEI would provide Maritime Electric more dispatchable capacity to both serve load and also to balance the wind generation intermittency during a disconnection, which would in turn allow Maritime Electric to utilize more of PEI's wind capacity without risking an imbalance of generation and load. As a result, a RICE would reduce the severity of a rolling blackout situation if PEI were disconnected from the mainland.

Resource Contributions Towards Maritime Electric's Sustainability Targets: As primarily a backup generator, an additional RICE would have a small impact on Maritime Electric's overall carbon emissions (this is further illustrated in Table 3-3); however, a RICE does produce carbon emissions when burning fuel.

The amount of carbon emissions the RICE generates is dependent on the type of fuel the RICE burns. Based on PEI's existing fuel delivery infrastructure, the two fuels that are the most realistic for use by Maritime Electric in a RICE are diesel and biodiesel fuel. As a fossil fuel, traditional diesel produces carbon emissions when burned. Biodiesel combustion also produces carbon emissions; however, the lifecycle emissions (considering net emissions from the entire production process of the fuel) of biodiesel are much lower than typical diesel fuel. In fact, the lifecycle emissions are low enough that the government of Canada considers biodiesel a renewable fuel[26].

5.2.5. Combustion Turbine – Aeroderivative

Aeroderivative CTs have many similarities to RICE in terms of the benefits they can provide to an electrical system. CTs are a dispatchable generating resources that are flexible (i.e., they can start/stop and ramp quickly), cost effective, and very common in the energy industry. CTs are also flexible in that they can operate on a variety of different fuels, including both diesel and biodiesel fuels. For the purposes of Maritime Electric, the fuel flexibility of CTs helps to reduce the risk that they might become a stranded asset if the Canadian government introduced stricter restrictions on what fuels could be used in power plants. Unlike RICE, aeroderivative CTs require some minor modifications and associated capital investment to be able operate on biodiesel (estimated at around CAD $2.5 million for a 30 MW CT). Maritime Electric would primarily utilize a CT to provide backup generation and also generation during emergencies.

The following table provides a summary of the expected capital costs for a new aeroderivative CT power plant, specifically ones operating on diesel fuel and another operating on biodiesel fuel. A more detailed cost buildup of CT costs is provided in Appendix A. A separate cost buildup of O&M costs is provided in Appendix B.

Table 5-7 — Combustion Turbine Estimated Capital Costs

RICE Unit	Cost Parameter	Estimated Cost ($ CAD)
2 x Aeroderivative CTs, 58 MW Total, Diesel Fuel	Total Capital Costs	$144,530,000
	Total Capital Costs ($/kW)	$2,486
2 x Aeroderivative CTs, 58 MW Total, Biodiesel Fuel	Total Capital Costs	$153,692,000
	Total Capital Costs ($/kW)	$2,643

Notes

1) General Electric LM2500+ are assumed as representative CT types. Other manufacturers make similar CTs to this model.
2) While the CT type and size are consistent with both diesel and biodiesel fuel, the use of biodiesel necessitates additional capital costs to modify some CT combustion / fuel delivery equipment

[26] https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/alternative-fuels/biofuels/biodiesel/3509

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: An aeroderivative CT power plant would primarily be utilized by Maritime Electric as a backup generator. As a result, a new CT power plant would likely not contribute appreciably towards helping Maritime Electric meet its energy obligations; however, given that it is a dispatchable generator, it could generate energy if called upon.

A CT would help Maritime Electric meet its regional capacity obligations. If installed, close to the CT's nameplate capacity could be utilized to meet Maritime Electric's capacity obligations. A CT power plant is an excellent source of generating capacity.

Resource Contributions When PEI is Electrically Disconnected from Mainland: Similar to a RICE, a CT power plant would be a very beneficial resource for Maritime Electric in terms of being able to provide generation to the grid in the event of an electrical disconnection of PEI from the mainland. The addition of a CT to PEI would provide Maritime Electric more dispatchable capacity to both serve load and also to balance the wind generation intermittency during a disconnection, which would in turn allow Maritime Electric to utilize more of PEI's wind capacity without risking an imbalance of generation and load. As a result, a CT power plant would reduce the severity of a rolling blackout situation if PEI were disconnected from the mainland.

Resource Contributions Towards Maritime Electric's Sustainability Targets: Similar to a RICE power plant, a CT power plant would primarily be utilized to provide system backup generating capacity and support for the system during an emergency. As a result, a CT power plant would have a small impact on Maritime Electric's overall carbon emissions (this is further illustrated in Table 3-3); however, a CT does produce carbon emissions when burning fuel. The amount of carbon emissions generated by a CT power plant is dependent on the type of fuel burned. As a fossil fuel, regular diesel produces carbon emissions when burned. Biodiesel combustion also produces carbon emissions; however, the lifecycle emissions (considering net emissions from the entire production process of the fuel) of biodiesel are much lower than typical diesel fuel (the Canadian government considers biodiesel to be a renewable fuel).

5.2.6. Biomass Power Plant

Biomass power plants are both dispatchable and renewable. Biomass power plants burn biomass fuel to create steam, which drives a steam turbine to produce electricity. Biomass power plants are less flexible than other generating technologies in that a biomass power plant will take longer to start/ramp to different generation levels than a RICE or CT power plant, or BESS project. In addition, biomass power plants are generally more expensive to build than other generating technologies due to the complexity associated with the different systems/equipment (i.e., steam generation, feedwater, steam piping, steam turbine, etc.). Due to its relative inflexibility and high capital cost, it generally makes more sense to operate a biomass power plant as a baseload generator rather than as a backup generator.

An estimate of capital costs to build a 50 MW biomass power plant is provided below. These costs are developed based on our experience with biomass, boilers, steam turbines, and other related equipment.

Table 5-8 — Biomass Power Plant Estimated Capital Costs, 50 MW

Cost Parameter	Estimated Cost ($ CAD)
Total Capital Costs	$292,803,000
Total Capital Costs ($/kW)	$5,856

Resource Contributions Towards Maritime Electric's Energy and Capacity Obligations: A biomass power plant can help Maritime Electric meet both of its energy and capacity obligations. In addition, as a dispatchable generator, Maritime Electric would have control over the dispatch of the power plant. Due to its operational inflexibility, a biomass power plant would likely have to serve as a baseload generator for Maritime Electric. From a cost perspective, while a biomass power plant is also a renewable resource, it is much more expensive than other renewable resources such as onshore wind and solar PV.

Resource Contributions When PEI is Electrically Disconnected from Mainland: As a dispatchable resource, a biomass power plant would be well suited to provide power during an event where PEI is electrically disconnected from the mainland. While a biomass power plant could provide generation, it would be less effective at providing renewable/load balancing support than other generator technologies (i.e., RICE or CTs) or BESS projects. This is due to the fact that a biomass power plant is not as flexible as other technologies in terms of its ability to quickly ramp to different generation levels.

Resource Contributions Towards Maritime Electric's Sustainability Targets: As a renewable generator, a biomass plant would help contribute towards Maritime Electric meeting their sustainability targets. The Canadian government recognizes biomass plants as renewable resources if the complete fuel cycle (i.e., growth of the biomass through combustion in the generators) is carbon net zero. When burned, biomass fuel does emit carbon, but this carbon is considered to be consumed during the process of growing more biomass. One challenge with a biomass power plant is that a significant amount of land would be required to grow the biomass required to fuel the power plant, and to reduce transportation of fuel, having the biomass near the facility is beneficial. An adequate source of biomass on PEI would have to be identified, or a fuel sourcing analysis would be required to see if it can be sourced from the nearby mainland.

5.2.7. Technology Comparison and Final Selection

Based on the analysis in this section, two technologies do not pass the secondary screening: offshore wind and biomass. The following bullets highlight the reasons for these technologies not being selected.

- **Offshore Wind Power Plant**: This resource does not pass the secondary screening for a number of reasons. First, an offshore wind farm off the coast of PEI is only going to be able to achieve a performance level that is incrementally better than an onshore wind farm on PEI. The reason for this is because PEI's onshore wind resource is already very high. Secondly, the cost of offshore wind is an order of magnitude higher than onshore wind. Additionally, offshore wind power plants are typically hundreds to thousands of MWs in size, which allows them to capture economies of scale cost efficiencies. This is much larger than Maritime Electric's needs. Based on these two reasons, offshore wind is not selected to pass the secondary screening.
- **Biomass Power Plant**: This resource does not pass the secondary screening primarily as a result of both its high capital cost and the large land requirements to grow the solid biomass fuel. We estimate that a biomass power plant would cost approximately 2.8 times the cost of a similarly sized onshore wind farm and 2.6 times the cost of a similarly sized RICE power plant on PEI. Those higher costs do not equate to nearly the same level of additional value a biomass power plant would provide in terms of helping Maritime Electric meet its most critical needs. Additionally, the land requirements to grow the required biomass to fuel the power plant are very high. While it is unknown exactly how much land would be required since this would depend on the type of fuel utilized and where it is sourced from, it could easily stretch from 5,000 to 10,000 acres once one accounts for the fact that harvested biomass needs to be replanted and given time to grow (which can take years/decades) before it can be re-harvested again. As a result of both of these reasons, a biomass power plant is not selected to pass the secondary screening .

The remaining technologies pass the secondary screening and move on to the final screening, discussed in the following section. The following table is developed to help compare the various shortlisted technologies. The table combines both the cost of the resource and also the various key attributes of the different evaluated technologies with respect to the three evaluation criterion: 1) the resource's ability to contribute to Maritime Electric's energy and capacity obligations, 2) the resources ability to support the electrical system when PEI is disconnected from mainland, and 3) the resource's ability to help Maritime Electric achieve its sustainability targets. The table is color coded either green or red. Green technologies are those that are selected to pass the secondary screening. Red technologies do not pass the secondary screening.

Table 5-9 — Comparison of Various Shortlisted Resources

Resource	Estimated Overnight Capital Cost ($CAD/kW)	Contributions to Energy and Capacity Obligations	Contributions When PEI is Disconnected from Mainland	Contributions to Sustainability Targets
Onshore Wind Power	$2,126 / kW	*Energy:* Excellent, but intermittent. High expected power plant capacity factor. *Capacity:* Poor, low ELCC	Unreliable resource – Can provide energy during a disconnection, but generation is intermittent. Generation intermittency/variability needs to be balanced by another resource.	Excellent – Renewable generator, very strong wind resource on PEI
Offshore Wind Power	$6,000+ / kW	Similar to onshore wind.	Similar to onshore wind	Similar to onshore wind
Utility-Scale Solar PV	$2,389 / kW	*Energy:* Good, but intermittent. Average expected power plant capacity factor. *Capacity:* Poor, low ELCC	Unreliable resource – Can provide energy during a disconnection, but generation is intermittent. Generation intermittency/variability needs to be balanced by another resource.	Good – Renewable generator, but just average solar resource on PEI
Rooftop Solar PV	$3,131 / kW	Similar to utility-scale solar PV.	Similar to utility-scale solar PV	Similar to utility-scale solar PV
Lithium-Ion BESS	*50 MW, 1-hr* $959 / kW ($959 / kWh) *50 MW, 2-hr* $1,565 / kW ($782 / kWh) *50 MW, 4-hr* $2,670 / kW ($668 / kWh)	*Energy:* Limited – BESS can time-shift previously generated electricity. Also, there are rarely times currently or expected in the intermediate future when there is/will be excess wind + nuclear generation above system load that could be time-shifted to other hours. *Capacity:* Excellent resource	Uncertain / depends on event – A BESS' ability to contribute to the system (both serving load and providing renewable/load balancing) during a disconnection is dependent on the BESS state of charge when the event occurs, the length of the event, and the operation/output of the wind farms. These variables are either partially or completely out of Maritime Electric's control. At best, a BESS could significantly support the system, at worst, it would not be able to provide support.	Limited – There are rarely times currently or expected in the intermediate future when there is/will be excess wind + nuclear generation above system load that could be time-shifted to other hours. As such, BESS would not appreciably improve Maritime Electric's ability to achieve its sustainability targets. BESS' contributions will increase as more renewable generation is added to the island.
Reciprocating Engines	*Diesel* $2,257 / kW *Biodiesel* $2,556 / kW	*Energy:* Limited – RICE would likely serve as a backup generator and would be rarely utilized to meet energy obligations; however, it could generate electricity if needed. *Capacity:* Excellent resource	Excellent – As a dispatchable generator with quick start and ramping capabilities, RICE power plants are ideal to help Maritime Electric support the system in a disconnection scenario. Due to its operational flexibility, a RICE power plant could both serve load and provide renewable/load balancing.	Limited – Since a RICE power plant would be primarily a backup facility, the impact to total Maritime Electric emissions would be small. Also, depending on the fuel utilized (diesel vs. biodiesel), RICE could have either a small negative or small positive impact from a carbon emissions perspective.
Combustion Turbines	*Diesel* $2,486 / kW *Biodiesel* $2,643 / kW	Similar to RICE (see above)	Similar to RICE (see above)	Similar to RICE (see above)
Biomass Power Plant	$5,856 / kW	*Energy:* Excellent (would likely have to serve as a baseload generator though) *Capacity:* Excellent	Good – As a dispatchable generator, a biomass plant would be able to provide electricity to the system during a disconnection. However, due to its operational inflexibility, it is not an ideal resource to provide renewable/load balancing.	Good – While a biomass power is considered renewable, the very large land and deforestation/harvesting requirements needed to fuel the power plant are not ideal.

6. CAPACITY RESOURCE RECOMMENDATIONS

6.1. FINAL TECHNOLOGY SELECTIONS

The following generation / storage technologies passed the secondary screening and are further analyzed in this section for potential recommendation for Maritime Electric.

- Onshore wind generation
- Utility-scale solar PV
- Rooftop solar PV generation
- Energy storage, lithium ion
- Reciprocating engine, with biofuel combustion compatibility
- Combustion turbine, with biofuel combustion compatibility

Given the above technologies each have unique characteristics and would serve different purposes for Maritime Electric, the greatest benefit to the electrical system is likely to be achieved using a combination of the above technologies. As such, different portfolios including the above technologies are defined and assessed in this section. Specifically, the following portfolios are considered:

1. BESS + onshore wind + solar PV (utility-scale and rooftop)
2. BESS + RICE + onshore wind + solar PV (utility-scale and rooftop)
3. BESS + CTs + onshore wind + solar PV (utility-scale and rooftop)
4. RICE or CTs + onshore wind + solar PV (utility-scale and rooftop)

The key considerations when developing these different portfolios are discussed as follows. Note that each of the above portfolios also assume the continued implementation and growth of the PEI DSM program.

6.1.1. Need for Additional Capacity

Additional capacity is needed on PEI. Due to the retirement of the Charlottetown oil-fired generators, Maritime Electric has had to increase the amount of capacity it purchases from the mainland to meet its regional obligations from 40% to over 60%. This leaves Maritime Electric and PEI vulnerable on a number of fronts.

First, it leaves Maritime Electric's customers more exposed to the economic repercussions of a likely capacity shortfall in the Maritimes region due to the retirement of coal throughout Canada by 2030 (as is discussed in further detail in Section 2.4.1). The retirement of coal will necessitate significant changes to the generation portfolios of PEI's immediate neighbours. For reference, coal generation makes up 41% of Nova Scotia's generation portfolio (1,234 MW) and 12% of New Brunswick's portfolio (467 MW). While

PEI's neighbours are planning on developing new capacity to replace their to be retired coal power plants, the level of investment and mobilization needed to replace all of the retired coal capacity is significant considering that the retirement deadline for the coal power plants is less than a decade away. As a result, some of this retired coal capacity will be met with market purchases or purchases from neighbours, as Nova Scotia Power is planning per discussion in their IRP; however, there currently is not enough transmission infrastructure in place for this increase in capacity demand to be met as cost effectively as possible. Separately, there is a forecasted increase in electrical demand in both the Maritimes region and in the northeastern United States over the next decade, which will further increase the capacity obligations of the regional utilities. All of this is likely to result in more competition and thus higher prices for regional capacity if the development of new generating resources and the implementation of regional energy efficiency programs cannot keep pace with demand growth. Any increase in capacity costs for Maritime Electric will be borne by Maritime Electric's customers.

In addition, the lack of capacity leaves Maritime Electric's customers vulnerable in the event of an electrical disconnection of PEI from the mainland. This situation has occurred a number of times in recent history (see Section 2.2.3). In the event that PEI is electrically disconnected from the mainland in the winter (the season where system electrical demand is highest), there is not enough on-island generation installed to meet system load (as is discussed in detail in Section 2.2). As a result, Maritime Electric will be forced to implement rolling blackouts. With additional on-island capacity, the rolling blackouts will either become unnecessary (if enough capacity is added to fully meet load) or the severity of the rolling blackouts will decrease. Given the potential repercussions of blackouts can be life threatening, it is critical Maritime Electric add on-island capacity. As discussed in Section 2.2.4, we estimate that a minimum of 85 MW of dispatchable capacity needs to be added to the system to be able to bring the ratio of total dispatchable capacity versus winter peak load back in line with historical levels. An additional 40 MW will likely be required when the existing Borden generating units have reached end of life and are retired. Without this level of additional capacity, it is highly likely that any future rolling blackouts that result from a disconnection of PEI from the mainland will be much more severe than those that have occurred in the past.

Of the remaining resources that have passed the secondary screening, only BESS, RICE, and CTs are effective sources of capacity. While wind and solar PV are excellent sources of energy, they are poor sources of capacity. From a cost perspective, both RICE and CT's cost less than a 4-hour BESS (4 hours is one of the most common BESS durations in the energy industry). An important additional consideration regarding BESS, is that it would not be as dependable for Maritime Electric as RICE or CTs would be during a disconnection from the mainland. The reason for this is because the level of support a BESS could provide during a disconnection is dependent on a number of external variables, such as the state of charge of the BESS when the disconnection occurs, wind generation during the disconnection, and the length of time before the connection to the mainland can be restored. At best, a BESS system could be very helpful for

Maritime Electric during a disconnection from the mainland; however, at worst (i.e., when the state of charge of the BESS was low when the disconnection occurred and the wind generators were in emergency shutdown), a BESS system would be ineffective at supporting the system.

6.1.2. Meeting Sustainability Targets

Maritime Electric needs to pursue more carbon free generation in order it to meet its sustainability target of reducing greenhouse gas emissions by 55% by 2030 (from 2019 levels). Of the remaining resources that have passed the secondary screening, onshore wind and solar PV (both utility-scale and rooftop) are carbon-free generation sources. Given PEI's excellent onshore wind resource and the relatively low cost to build onshore wind power plants, the continued development of onshore wind should be a main priority for Maritime Electric and PEI. While solar PV will not provide near the same amount of generation for Maritime Electric on a per dollar invested basis as onshore wind, solar PV does have some benefits that make it worth consideration. First, it provides generation diversity to Maritime Electric's portfolio. More specifically, wind and solar generation are not perfectly correlated; thus, the integration of solar PV will help to provide some balance to the island's hourly generation. Additionally, solar PV is relatively low-cost. As a result of these reasons, it is recommended that Maritime Electric and PEI pursue the development of some utility-scale solar PV projects and continue to encourage and support the development of rooftop solar PV on the island.

As discussed earlier (see Section 3.2.1), BESS will have a limited ability to help Maritime Electric meet its sustainability targets. In order for BESS to be able to help Maritime Electric meet its sustainability targets, it would have to be able to charge from a carbon-free resource during a time when that resource's generation could not be used on the island, and discharge that energy back into the system at a later time. At present, there are very rarely times when the generation produced from PEI's carbon-free resources (e.g., the wind farms on PEI) cannot be used immediately to serve load. As more wind generation is installed on PEI, there will be more frequent instances where high amounts of hourly wind generation will result in an oversupply of electricity – a future BESS project could shift this excess electricity to other times. However, the forecasted frequency at which additional wind generation will cause an oversupply of electricity in the future is likely not going to be high enough to fully justify the cost to install a new BESS project.

6.2. PORTFOLIOS CONSIDERED

6.2.1. Portfolio A: BESS + Onshore Wind + Solar PV

The combination of BESS, onshore wind, and solar PV would provide Maritime Electric with carbon-free generation to help meet both its energy obligations and sustainability targets, along with storage to meet its regional capacity obligations. The wind and solar PV would reduce the amount of energy needed to be purchased from NBEM. In addition, the combination of this additional energy from the wind and solar PV projects, combined with the capacity from the BESS, will help to provide a buffer against regional market price volatility in energy and capacity.

A BESS project could offer some additional advantages for Maritime Electric in addition to providing capacity to meet regional obligations. For example, a BESS project could allow Maritime Electric to pursue an energy arbitrage strategy if it wished to participate in an energy marketplace. Additionally, a BESS project could provide various ancillary services and system electrical support for Maritime Electric. While a single BESS project is unlikely to be able to provide all of the different possible functions simultaneously, it can be used for multiple functions. To better assess and quantify the potential benefits a BESS might be able to provide, an approach Maritime Electric could pursue is working with the PEI government to develop a demonstration 4-hour BESS project. As a demonstration project, Maritime Electric and PEI would be better able to assess which functions/use cases future BESS projects might be utilized for to maximize the benefit for PEI and Maritime Electric's customers.

Portfolio A does run into a few challenges when considering an electrical disconnection of PEI from the mainland. Because of their intermittency, onshore wind and solar PV energy are both unreliable resources during a disconnection. If either the onshore wind, solar PV, or both are not operating, no electricity is being generated. While the BESS can support the system, the amount of support it can provide is difficult to forecast since it depends on its state of charge, generation from the wind/solar PV, and the length of the disconnection. If the BESS was unable to provide much support to the system, Maritime Electric would be completely reliant on the few existing dispatchable generators it has on the island (which is the position Maritime Electric is currently in today), which are not sufficient to allow Maritime Electric to avoid severe rolling blackouts.

The following tables provide the forecasted capacity, energy, and emissions sources for this portfolio. Note that the new BESS project marginally increases the amount of wind energy Maritime Electric can utilize to serve load because BESS can capture a portion of the wind generation that would otherwise have to be sold back to the mainland during periods where there is excess total generation beyond load. In addition, while it is difficult to forecast exactly how much a new BESS project would be able to reduce the need for the on-island diesel generators, it is assumed that the BESS reduces on-island diesel generator dispatch by 50%.

Note that the tables assume a 50 MW, 4-hour duration BESS is added to the system, not 85 MW of additional capacity (see Section 2.2.4 for the basis of the 85 MW recommendation). The reason for this is because the 85 MW capacity recommendation is for fully dispatchable capacity that would specifically be able to help Maritime Electric better manage a situation where PEI is electrically disconnected from the mainland. As discussed, a new BESS project might not be dispatchable during a disconnection from the mainland. As such, the capacity of a new BESS project is not considered to be able to fully satisfy the dispatchability requirements associated with the 85 MW capacity recommendation in Section 2.2.4. Instead, this portfolio considers a 50 MW BESS project to minimize portfolio costs.

Table 6-1 — Estimated Portfolio A Capacity Sources

Portfolio A	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Capacity Obligation (MW):										
MECL Peak Load (Net of DSM)	284	289	293	299	305	311	317	323	329	335
Less Interruptible Load	14	14	14	14	14	14	14	14	14	14
Plus 15 % Planning Reserve	41	41	42	43	44	45	45	46	47	48
Total MECL Capacity Obligation (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**
A) MECL Capacity Resources (MW):										
Borden Generating Station (CTs)	40	40	40	40	40	40	40	0	0	0
Charlottetown CT3	49	49	49	49	49	49	49	49	49	49
Point Lepreau Nuclear	29	29	29	29	29	29	29	29	29	29
Short Term Capacity Purchases (NBEM)	172	174	129	132	139	146	153	200	207	214
New BESS	0	0	50	50	50	50	50	50	50	50
Subtotal (MW)	*290*	*292*	*297*	*300*	*307*	*314*	*321*	*328*	*335*	*342*
B) Wind Power (MW):										
MECL Purchasd Nameplate Capacity	92	122	122	162	162	162	162	162	162	162
ELCC as % of Purchased	23%	20%	20%	17%	17%	17%	17%	17%	17%	17%
ELCC (MW)	*21*	*24*	*24*	*28*	*28*	*28*	*28*	*28*	*28*	*28*
C) Solar PV Power (MW):										
Rooftop Solar	15	15	15	15	15	15	15	15	15	15
Utility Scale	0	0	20	30	40	50	60	60	60	60
ELCC as % of Purchased	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ELCC (MW)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total MECL Capacity (A+B+C) (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**

Table 6-2 — Estimated Portfolio A Energy Sources

Portfolio A	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Energy Obligation (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**
MECL Energy Supply (GWh):										
Borden Generating Station (CTs)	1.1	1.1	0.6	0.6	0.6	0.6	0.6	0	0	0
Charlottetown CT3	1.4	1.4	0.7	0.7	0.7	0.7	0.7	1.3	1.3	1.3
Point Lepreau Nuclear	210	210	210	210	210	210	210	210	210	210
Energy Purchases (NBEM)	968	879	863	712	721	731	740	766	793	820
New BESS	0	0	0	0	0	0	0	0	0	0
Wind Power	295	406	408	566	566	566	566	566	566	566
Rooftop Solar PV	20	20	20	20	20	20	20	20	20	20
Utility Scale Solar PV	0	0	35	52	70	87	105	105	105	105
Total Energy (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**

Table 6-3 — Estimated Portfolio A Emissions Sources

Portfolio A	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Emissions (kilo-Tonnes CO_2e)										
Borden Generating Station (CTs)	1.2	1.2	0.6	0.6	0.6	0.6	0.6	0	0	0
Charlottetown CT3	1.4	1.4	0.7	0.7	0.7	0.7	0.7	1.3	1.3	1.3
Point Lepreau Nuclear	0	0	0	0	0	0	0	0	0	0
Energy Purchases (NBEM)	273	248	244	201	204	206	209	216	224	231
New BESS	0	0	0	0	0	0	0	0	0	0
Wind Power	0	0	0	0	0	0	0	0	0	0
Rooftop Solar PV	0	0	0	0	0	0	0	0	0	0
Utility Scale Solar PV	0	0	0	0	0	0	0	0	0	0
Total Emissions (kilo-Tonnes CO_2e)	**276**	**251**	**245**	**202**	**205**	**208**	**210**	**218**	**225**	**233**

Notes

1) Carbon emissions rates related to purchases from NBEM are based on 2019, 2020, and 2021 data compiled by Maritime Electric and contained in the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf). Note the NBEM emissions rate (on a tonnes CO_2e per GWh basis) used to calculate carbon emissions is kept consistent for all the years shown in the table above; however, this rate is expected to fall with time as mainland utilities pursue various decarbonization strategies.

6.2.2. Portfolio B: BESS + RICE + Onshore Wind + Solar PV

A combination of onshore wind, solar PV, BESS and RICE would provide Maritime Electric with much of the same benefits as the previous portfolio, but with a much better ability to navigate an electrical disconnection from the mainland. The onshore wind and solar PV are both carbon-free sources of electricity that would help Maritime Electric both meet its sustainability targets and purchase less energy from NBEM. Both the BESS and RICE would also help Maritime Electric meet their capacity obligations.

The addition of the RICE does add a carbon emission consideration into the portfolio since a RICE power plant generates carbon emissions when it burns fuel. Because a RICE power plant would primarily serve as a backup generator and rarely operate, carbon emissions generated by the RICE power plant will be small and have little impact on Maritime Electric's ability to meet sustainability targets, but it could create a stranded asset problem for Maritime Electric if the government of Canada begins enforcing stricter rules on allowable fuels for power generation. One distinct advantage of a RICE power plant is that it can operate on fuels the government of Canada considers to be renewable, such as biodiesel[27]. The fact that RICE can operate on renewable fuels helps Maritime Electric avoid the risk that a new RICE power plant would become a stranded asset in the future if fuel regulations change.

A RICE power plant would also significantly help Maritime Electric during a disconnection from the mainland. The addition of a RICE power plant to PEI would provide Maritime Electric more dependable dispatchable capacity to both serve load and also to balance the wind generation intermittency during a

[27] RICE power plants are also likely to be able to operate on hydrogen in the coming years, but hydrogen operation would require a significant capital investment for the hydrogen infrastructure. Given a new RICE power plant would primarily be used as a backup generator, the investment in hydrogen infrastructure is likely not worth the investment for Maritime Electric.

disconnection, which would in turn allow Maritime Electric to utilize more of PEI's wind capacity without risking an imbalance of generation and load. While the BESS project could help support the system during a disconnection from the mainland in many of the same ways, the level of support it can provide depends on the BESS' state of charge, generation from the wind/solar PV, and the length of the disconnection, which are all difficult to forecast.

Similar to Portfolio A, a BESS project could offer some additional advantages for Maritime Electric in addition to providing capacity to meet regional obligations, such as allowing Maritime Electric to pursue an energy arbitrage strategy (if it wished to participate in an energy marketplace), providing various ancillary services and system electrical support to the system, among other items. As a demonstration project, Maritime Electric and PEI would be better able to assess which functions/use cases future BESS projects might be utilized for to maximize the benefit for PEI and Maritime Electric's customers.

The following tables provide the forecasted capacity, energy, and emissions sources for this portfolio. The new BESS project marginally increases the amount of wind energy Maritime Electric can utilize to serve load because BESS can capture a portion of the wind generation that would otherwise have to be sold back to the mainland during periods where there is excess generation beyond load. In addition, it is assumed that the new BESS allows Maritime Electric to be able to reduce on-island diesel generator dispatch by 50%.

Similar to Portfolio A, a 50 MW, 4-hour duration BESS is added to the system. In addition, a total of 85 MW of new RICE is added to this portfolio to be consistent with the recommendation in Section 2.2.4. Due to BESS' inability to be fully dispatchable during a disconnection from the mainland, the capacity of a new BESS project is not considered to be able to fully satisfy the dispatchability requirements associated with the 85 MW capacity recommendation in Section 2.2.4.

Table 6-4 — Estimated Portfolio B Capacity Sources

Portfolio B	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Capacity Obligation (MW):										
MECL Peak Load (Net of DSM)	284	289	293	299	305	311	317	323	329	335
Less Interruptible Load	14	14	14	14	14	14	14	14	14	14
Plus 15 % Planning Reserve	41	41	42	43	44	45	45	46	47	48
Total MECL Capacity Obligation (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**
A) MECL Capacity Resources (MW):										
Borden Generating Station (CTs)	40	40	40	40	40	40	40	0	0	0
Charlottetown CT3	49	49	49	49	49	49	49	49	49	49
Point Lepreau Nuclear	29	29	29	29	29	29	29	29	29	29
Short Term Capacity Purchases (NBEM)	172	174	44	47	54	61	68	75	82	89
New BESS	0	0	50	50	50	50	50	50	50	50
New Reciprocating Engines (Biodiesel)	0	0	85	85	85	85	85	125	125	125
Subtotal (MW)	*290*	*292*	*297*	*300*	*307*	*314*	*321*	*328*	*335*	*342*
B) Wind Power (MW):										
MECL Purchasd Nameplate Capacity	92	122	122	162	162	162	162	162	162	162
ELCC as % of Purchased	23%	20%	20%	17%	17%	17%	17%	17%	17%	17%
ELCC (MW)	*21*	*24*	*24*	*28*	*28*	*28*	*28*	*28*	*28*	*28*
C) Solar PV Power (MW):										
Rooftop Solar	15	15	15	15	15	15	15	15	15	15
Utility Scale	0	0	20	30	40	50	60	60	60	60
ELCC as % of Purchased	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ELCC (MW)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total MECL Capacity (A+B+C) (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**

Table 6-5 — Estimated Portfolio B Energy Sources

Portfolio B	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Energy Obligation (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**
MECL Energy Supply (GWh):										
Borden Generating Station (CTs)	1.1	1.1	0.3	0.3	0.3	0.3	0.3	0	0	0
Charlottetown CT3	1.4	1.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Point Lepreau Nuclear	210	210	210	210	210	210	210	210	210	210
Energy Purchases (NBEM)	968	879	863	712	721	731	740	766	793	820
New BESS	0	0	0	0	0	0	0	0	0	0
New Reciprocating Engines (Biodiesel)	0	0	0.6	0.6	0.6	0.6	0.6	0.9	0.9	0.9
Wind Power	295	406	408	566	566	566	566	566	566	566
Rooftop Solar PV	20	20	20	20	20	20	20	20	20	20
Utility Scale Solar PV	0	0	35	52	70	87	105	105	105	105
Total Energy (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**

Table 6-6 — Estimated Portfolio B Emissions Sources

Portfolio B	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Emissions (kilo-Tonnes CO_2e)										
Borden Generating Station (CTs)	1.2	1.2	0.3	0.3	0.3	0.3	0.3	0	0	0
Charlottetown CT3	1.4	1.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Point Lepreau Nuclear	0	0	0	0	0	0	0	0	0	0
Energy Purchases (NBEM)	273	248	244	201	204	206	209	216	224	231
New BESS	0	0	0	0	0	0	0	0	0	0
New Reciprocating Engines (Biodiesel)	0	0	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Wind Power	0	0	0	0	0	0	0	0	0	0
Rooftop Solar PV	0	0	0	0	0	0	0	0	0	0
Utility Scale Solar PV	0	0	0	0	0	0	0	0	0	0
Total Emissions (kilo-Tonnes CO_2e)	**276**	**251**	**244**	**202**	**204**	**207**	**210**	**217**	**224**	**232**

Notes

1) Carbon emissions rates related to purchases from NBEM are based on 2019, 2020, and 2021 data compiled by Maritime Electric and contained in the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf). Note the NBEM emissions rate (on a tonnes CO_2e per GWh basis) used to calculate carbon emissions is kept consistent for all the years shown in the table above; however, this rate is expected to fall with time as mainland utilities pursue various decarbonization strategies.
2) Biodiesel emissions assume B100 fuel is used and are calculated assuming the lifecycle emissions (from the production of the B100 fuel through combustion) are 70% less than traditional diesel fuel. The actual lifecycle emissions may vary based on a number of factors, including fuel composition, production method, etc. Note that the Canadian government considers biodiesel as a renewable fuel.

6.2.3. Portfolio C: BESS + Combustion Turbines + Onshore Wind + Solar PV

This portfolio is very similar to the previous portfolio in that it contains both renewable and dispatchable generation. While the technologies are different, RICE and CTs are very similar in how they would be utilized by Maritime Electric, the type of support they can provide to an electrical system, and the types of fuel they can operate on. As a result, all of the information discussed for the previous portfolio (BESS + RICE + onshore wind + solar PV) is consistent for this portfolio.

There are some small differences between RICE and CTs that are worth mentioning. The first difference is cost. We estimate a slight cost premium to pursue CTs instead of RICE, estimated at between 5% and 10% depending on the fuel type considered (biodiesel versus diesel). Included in this price premium are some equipment modifications that would be required to convert a CT to be able to burn biodiesel. A RICE would not require modification to burn either fuel. Both RICE and CTs would require minor modifications to balance of plant/fuel storage. Finally, CTs burn between 10% and 20% more fuel on a per output basis than RICE (i.e., they are less fuel efficient), depending on the type of fuel. Given the slight cost premium and lower fuel efficiency of CTs versus RICE, we consider a portfolio with RICE to be a better option for Maritime Electric; however, the two technologies have so many similarities that either would be a sound choice.

The following tables provide the forecasted capacity, energy, and emissions sources for this portfolio. The new BESS project marginally increases the amount of wind energy Maritime Electric can utilize to serve load because BESS can capture a portion of the wind generation that would otherwise have to be sold back to the mainland during periods where there is excess generation beyond load. In addition, it is assumed that the new BESS allows Maritime Electric to be able to reduce on-island diesel generator dispatch by 50%.

Similar to Portfolios A and B, a 50 MW, 4-hour duration BESS is added to the system. In addition, a total of 85 MW of new CTs are added to this portfolio to be consistent with the recommendation in Section 2.2.4. Due to BESS' inability to be fully dispatchable during a disconnection from the mainland, the capacity of a new BESS project is not considered to be able to fully satisfy the dispatchability requirements associated with the 85 MW capacity recommendation in Section 2.2.4.

Table 6-7 — Estimated Portfolio C Capacity Sources

Portfolio C	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Capacity Obligation (MW):										
MECL Peak Load (Net of DSM)	284	289	293	299	305	311	317	323	329	335
Less Interruptible Load	14	14	14	14	14	14	14	14	14	14
Plus 15 % Planning Reserve	41	41	42	43	44	45	45	46	47	48
Total MECL Capacity Obligation (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**
A) MECL Capacity Resources (MW):										
Borden Generating Station (CTs)	40	40	40	40	40	40	40	0	0	0
Charlottetown CT3	49	49	49	49	49	49	49	49	49	49
Point Lepreau Nuclear	29	29	29	29	29	29	29	29	29	29
Short Term Capacity Purchases (NBEM)	172	174	44	47	54	61	68	75	82	89
New BESS	0	0	50	50	50	50	50	50	50	50
New CTs (Biodiesel)	0	0	85	85	85	85	85	125	125	125
Subtotal (MW)	*290*	*292*	*297*	*300*	*307*	*314*	*321*	*328*	*335*	*342*
B) Wind Power (MW):										
MECL Purchasd Nameplate Capacity	92	122	122	162	162	162	162	162	162	162
ELCC as % of Purchased	23%	20%	20%	17%	17%	17%	17%	17%	17%	17%
ELCC (MW)	*21*	*24*	*24*	*28*	*28*	*28*	*28*	*28*	*28*	*28*
C) Solar PV Power (MW):										
Rooftop Solar	15	15	15	15	15	15	15	15	15	15
Utility Scale	0	0	20	30	40	50	60	60	60	60
ELCC as % of Purchased	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ELCC (MW)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total MECL Capacity (A+B+C) (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**

Table 6-8 — Estimated Portfolio C Energy Sources

Portfolio C	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Energy Obligation (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**
MECL Energy Supply (GWh):										
Borden Generating Station (CTs)	1.1	1.1	0.3	0.3	0.3	0.3	0.3	0	0	0
Charlottetown CT3	1.4	1.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Point Lepreau Nuclear	210	210	210	210	210	210	210	210	210	210
Energy Purchases (NBEM)	968	879	863	712	721	731	740	766	793	820
New BESS	0	0	0	0	0	0	0	0	0	0
New CTs (Biodiesel)	0	0	0.6	0.6	0.6	0.6	0.6	0.9	0.9	0.9
Wind Power	295	406	408	566	566	566	566	566	566	566
Rooftop Solar PV	20	20	20	20	20	20	20	20	20	20
Utility Scale Solar PV	0	0	35	52	70	87	105	105	105	105
Total Energy (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**

Table 6-9 — Estimated Portfolio C Emissions Sources

Portfolio C	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Emissions (kilo-Tonnes CO_2e)										
Borden Generating Station (CTs)	1.2	1.2	0.3	0.3	0.3	0.3	0.3	0	0	0
Charlottetown CT3	1.4	1.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Point Lepreau Nuclear	0	0	0	0	0	0	0	0	0	0
Energy Purchases (NBEM)	273	248	244	201	204	206	209	216	224	231
New BESS	0	0	0	0	0	0	0	0	0	0
New CTs (Biodiesel)	0	0	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Wind Power	0	0	0	0	0	0	0	0	0	0
Rooftop Solar PV	0	0	0	0	0	0	0	0	0	0
Utility Scale Solar PV	0	0	0	0	0	0	0	0	0	0
Total Emissions (kilo-Tonnes CO_2e)	**276**	**251**	**244**	**202**	**204**	**207**	**210**	**217**	**224**	**232**

Notes

1) Carbon emissions rates related to purchases from NBEM are based on 2019, 2020, and 2021 data compiled by Maritime Electric and contained in the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf). Note the NBEM emissions rate (on a tonnes CO_2e per GWh basis) used to calculate carbon emissions is kept consistent for all the years shown in the table above; however, this rate is expected to fall with time as mainland utilities pursue various decarbonization strategies.
2) Biodiesel emissions assume B100 fuel is used and are calculated assuming the lifecycle emissions (from the production of the B100 fuel through combustion) are 70% less than traditional diesel fuel. The actual lifecycle emissions may vary based on a number of factors, including fuel composition, production method, etc. Note that the Canadian government considers biodiesel as a renewable fuel.

6.2.4. Portfolio D: RICE or Combustion Turbines + Onshore Wind + Solar PV

This portfolio is similar to the previous portfolios but forgoes the inclusion of a battery. Given the similarities between RICE and CTs, this portfolio considers that either technology is pursued, albeit with a cost premium if CTs are pursued since they are slightly more expensive than RICE. The combination of RICE or CTs, onshore wind, and solar PV would provide Maritime Electric with carbon-free generation to help meet both its energy obligations and sustainability targets, along with capacity to meet its regional obligations. The wind and solar PV would reduce the amount of energy needed to be purchased from NBEM. In addition, the combination of this additional energy from the wind and solar PV projects, combined with the capacity from the RICE or CTs, will help to provide a buffer against regional market price volatility in energy and capacity.

The fact that both RICE and CTs can operate on fuels that are considered to be renewable (i.e., biodiesel) also helps Maritime Electric to avoid investing in an asset that might become stranded in the event that the government of Canada changes regulations on allowable fuels for power generation.

Also, as previously discussed, RICE and CT power plants would significantly help Maritime Electric during a disconnection of PEI from the mainland. These generators would provide Maritime Electric more dependable dispatchable capacity to both serve load and also to balance the wind generation intermittency during a disconnection, which would in turn allow Maritime Electric to utilize more of PEI's wind capacity without risking an imbalance of generation and load. This will either help to eliminate or reduce the severity of rolling blackouts if PEI becomes disconnected from the mainland.

The following tables provide the forecasted capacity, energy, and emissions sources for this portfolio. A total of 85 MW of new CTs are added to this portfolio to be consistent with the recommendation in Section 2.2.4.

Table 6-10 — Estimated Portfolio D Capacity Sources

Portfolio D	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Capacity Obligation (MW):										
MECL Peak Load (Net of DSM)	284	289	293	299	305	311	317	323	329	335
Less Interruptible Load	14	14	14	14	14	14	14	14	14	14
Plus 15 % Planning Reserve	41	41	42	43	44	45	45	46	47	48
Total MECL Capacity Obligation (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**
A) MECL Capacity Resources (MW):										
Borden Generating Station (CTs)	40	40	40	40	40	40	40	0	0	0
Charlottetown CT3	49	49	49	49	49	49	49	49	49	49
Point Lepreau Nuclear	29	29	29	29	29	29	29	29	29	29
Short Term Capacity Purchases (NBEM)	172	174	94	97	104	111	118	125	132	139
New Reciprocating Engines (Biodiesel)	0	0	85	85	85	85	85	125	125	125
Subtotal (MW)	*290*	*292*	*297*	*300*	*307*	*314*	*321*	*328*	*335*	*342*
B) Wind Power (MW):										
MECL Purchasd Nameplate Capacity	92	122	122	162	162	162	162	162	162	162
ELCC as % of Purchased	23%	20%	20%	17%	17%	17%	17%	17%	17%	17%
ELCC (MW)	*21*	*24*	*24*	*28*	*28*	*28*	*28*	*28*	*28*	*28*
C) Solar PV Power (MW):										
Rooftop Solar	15	15	15	15	15	15	15	15	15	15
Utility Scale	0	0	20	30	40	50	60	60	60	60
ELCC as % of Purchased	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ELCC (MW)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total MECL Capacity (A+B+C) (MW)	**311**	**316**	**321**	**328**	**335**	**342**	**348**	**355**	**362**	**369**

Table 6-11 — Estimated Portfolio D Energy Sources

Portfolio D	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Energy Obligation (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**
MECL Energy Supply (GWh):										
Borden Generating Station (CTs)	1.1	1.1	0.6	0.6	0.6	0.6	0.6	0	0	0
Charlottetown CT3	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Point Lepreau Nuclear	210	210	210	210	210	210	210	210	210	210
Energy Purchases (NBEM)	968	879	865	719	729	738	747	774	800	827
New Reciprocating Engines (Biodiesel)	0	0	1.2	1.2	1.2	1.2	1.2	1.8	1.8	1.8
Wind Power	295	406	406	557	557	557	557	557	557	557
Rooftop Solar PV	20	20	20	20	20	20	20	20	20	20
Utility Scale Solar PV	0	0	35	52	70	87	105	105	105	105
Total Energy (GWh)	**1,495**	**1,517**	**1,538**	**1,561**	**1,588**	**1,615**	**1,642**	**1,668**	**1,694**	**1,722**

Table 6-12 — Estimated Portfolio D Emissions Sources

Portfolio D	Year									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MECL Emissions (kilo-Tonnes CO_2e)										
Borden Generating Station (CTs)	1.2	1.2	0.6	0.6	0.6	0.6	0.6	0	0	0
Charlottetown CT3	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Point Lepreau Nuclear	0	0	0	0	0	0	0	0	0	0
Energy Purchases (NBEM)	273	248	244	203	206	208	211	218	226	233
New Reciprocating Engines (Biodiesel)	0	0	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.6
Wind Power	0	0	0	0	0	0	0	0	0	0
Rooftop Solar PV	0	0	0	0	0	0	0	0	0	0
Utility Scale Solar PV	0	0	0	0	0	0	0	0	0	0
Total Emissions (kilo-Tonnes CO_2e)	**276**	**251**	**246**	**205**	**207**	**210**	**213**	**220**	**227**	**235**

Notes

1) Carbon emissions rates related to purchases from NBEM are based on 2019, 2020, and 2021 data compiled by Maritime Electric and contained in the 2022 Maritime Electric Sustainability Report (https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf). Note the NBEM emissions rate (on a tonnes CO_2e per GWh basis) used to calculate carbon emissions is kept consistent for all the years shown in the table above; however, this rate is expected to fall with time as mainland utilities pursue various decarbonization strategies.
2) Biodiesel emissions assume B100 fuel is used and are calculated assuming the lifecycle emissions (from the production of the B100 fuel through combustion) are 70% less than traditional diesel fuel. The actual lifecycle emissions may vary based on a number of factors, including fuel composition, production method, etc. Note that the Canadian government considers biodiesel as a renewable fuel.

6.3. FINAL RECOMMENDATION

Based on the above discussions, the following portfolio is recommended for Maritime Electric:

- **Portfolio D**: RICE + Onshore Wind + Solar PV

This portfolio was selected due to its ability to most cost-effectively meet the three most critical needs of Maritime Electric: 1) meeting energy and regional capacity obligations, 2) supporting the system if PEI is disconnected from the mainland, and 3) supporting sustainability targets. For this portfolio, RICE was selected over CTs due to its lower cost and better fuel efficiency.

As discussed in Section 2.2.4, we estimate that a minimum of 85 MW of dispatchable capacity needs to be added to the system to be able to bring the ratio of total dispatchable capacity versus winter peak load back in line with historical levels. Without this level of additional capacity, it is highly likely that future rolling blackouts (that occur as a result of a disconnection of PEI from the mainland) will be much more severe than those that have occurred in the past. The additional capacity should be added to the system as soon as possible.

The reason BESS was not included in the recommended portfolio was primarily because of two reasons. First, a BESS solution is not as effective as the other shortlisted technologies at helping Maritime Electric meet its three most critical needs. Secondly, a BESS solution is a higher cost option than the other shortlisted technologies.

It is important to note that a BESS solution could offer some additional advantages for Maritime Electric beyond its three most critical needs, such as allowing Maritime Electric to pursue an energy arbitrage strategy (if they wished to participate in an energy marketplace in the future), providing various ancillary services and other system electrical support, and helping to manage times when there is excess wind generation (which will occur more frequently as more onshore wind is integrated onto PEI). If it were determined that a BESS solution should be pursued, we recommend Maritime Electric pursue working with the PEI government to develop a demonstration 4-hour BESS project. As a demonstration project, Maritime Electric and PEI would be better able to assess which functions/use cases future BESS projects might be utilized for to maximize the benefit for PEI and Maritime Electric's customers.

APPENDIX A. CAPITAL COST ESTIMATES

This appendix contains generation/storage resource capital cost estimates. All values in Canadian dollars.

Thermal Units – Reciprocating Engines

Technology	**Reciprocating Internal Combustion Engine**	**Reciprocating Internal Combustion Engine**
Unit Type (Representative Manufacturer)	Wartsila 20V32 (5x)	Wartsila 20V32 (5x)
Cycle Type	Simple Cycle	Simple Cycle
Fuel Type	Diesel Fuel	Biodiesel Fuel
Net Plant Output (MW) - Summer (27˚C, 47% RH, 0 m)	53.0	46.9
Net Plant Output (MW) - Winter (-26˚C, 60% RH, 0 m)	53.0	46.9
Net Heat Rate (Btu/kWh) (HHV) (ISO: 15˚C, 60% RH, 0 m)	8,400	8,400
Project Costs		
Owner Furnished Equipment		
Prime Mover	$ 36,148,000	$ 36,148,000
Emission Control (assumed to not be required based on low capacity factors, low sulphur fuels to be used)	$ -	$ -
Sales Tax	$ 5,422,000	$ 5,422,000
Total Owner Furnished Equipment	$ 41,569,000	$ 41,569,000
EPC Costs		
Other Equipment	$ 7,081,000	$ 7,081,000
Diesel/Biodiesel Infrastructure (Fuel Handling and Storage)	$ 2,438,000	$ 2,754,000
Materials	$ 11,830,000	$ 11,830,000
Construction Labour	$ 15,135,000	$ 15,135,000
Other Labour	$ 6,562,000	$ 6,562,000
Sales Tax	$ 2,837,000	$ 2,837,000
EPC Contractor Fee	$ 5,077,000	$ 5,077,000
EPC Contingency	$ 6,996,000	$ 6,996,000
Total EPC Costs	$ 57,955,000	$ 57,955,000
Total Project Costs	$ 99,524,000	$ 99,524,000
Non-EPC Costs		
Project Development	$ 2,897,000	$ 2,897,000
Mobilization and Start-Up	$ 579,000	$ 579,000
Non-Fuel Inventories	$ 290,000	$ 290,000
Owner's Contingency	$ 4,636,000	$ 4,636,000
Electrical Interconnection	$ 2,700,000	$ 2,700,000
Land	$ 2,700,000	$ 2,700,000
Fuel Inventories	$ 5,461,000	$ 5,532,000
Working Capital	$ 869,000	$ 869,000
Subtotal - Non-EPC Costs w/o Financing Fees	$ 20,133,000	$ 20,204,000
	$ -	$ -
Total Non-EPC Costs	$ 20,133,000	$ 20,204,000
Overnight Capital Costs ($)	$ 119,657,000	$ 119,729,000
Overnight Capital Costs ($/kW)	$ 2,257	$ 2,556

(1) Costs based on EPC contracting approach.
(2) Interconnection and land costs are assumed values
(3) Property taxes and insurance costs are not included in the above estimate.

Thermal Units – Combustion Turbines

Technology	**Combustion Turbine - Aeroderivative**	**Combustion Turbine - Aeroderivative**	**Combustion Turbine - Aeroderivative**	**Combustion Turbine - Aeroderivative**	**Combustion Turbine - Aeroderivative**
Unit Type (Representative Manufacturer)	GE LM2500+ Aero (1x)	GE LM2500+ Aero (1x)	GE LM2500+ Aero (2x)	GE LM2500+ Aero (2x)	GE LM2500+ Aero (3x)
Cycle Type	Simple Cycle	Simple Cycle	Simple Cycle	Simple Cycle	Simple Cycle
Fuel Type	Diesel Fuel	Biodiesel Fuel	Diesel Fuel	Biodiesel Fuel	Diesel Fuel
Net Plant Output (MW) - Summer (27˚C, 47% RH, 0 m)	29.1	29.1	58.1	58.1	87.2
Net Plant Output (MW) - Winter (-26˚C, 60% RH, 0 m)	36.3	36.3	72.7	72.7	109.0
Net Heat Rate (Btu/kWh) (HHV) (ISO: 15˚C, 60% RH, 0 m)	9,500	10,000	9,500	10,000	9,500
Project Costs					
Owner Furnished Equipment					
Prime Mover	$ 23,940,000	$ 26,640,000	$ 41,681,000	$ 47,081,000	$ 57,652,000
Emission Control (assumed to not be required based on low capacity factors, low sulphur fuels to be used)	$ -	$ -	$ -	$ -	$ -
Sales Tax	$ 3,591,000	$ 3,996,000	$ 6,252,000	$ 7,062,000	$ 8,648,000
Total Owner Furnished Equipment	$ 27,531,000	$ 30,636,000	$ 47,933,000	$ 54,143,000	$ 66,300,000
EPC Costs					
Other Equipment	$ 7,240,000	$ 7,240,000	$ 12,606,000	$ 12,606,000	$ 17,436,000
Diesel/Biodiesel Infrastructure (Fuel Handling and Storage)	$ 1,584,000	$ 1,787,000	$ 3,166,000	$ 3,576,000	$ 4,749,000
Materials	$ 3,365,000	$ 3,365,000	$ 5,859,000	$ 5,859,000	$ 8,105,000
Construction Labour	$ 15,011,000	$ 15,011,000	$ 26,135,000	$ 26,135,000	$ 36,149,000
Other Labour	$ 3,908,000	$ 3,908,000	$ 6,805,000	$ 6,805,000	$ 9,412,000
Sales Tax	$ 1,591,000	$ 1,591,000	$ 2,770,000	$ 2,770,000	$ 3,831,000
EPC Contractor Fee	$ 3,614,000	$ 3,812,000	$ 6,317,000	$ 6,714,000	$ 8,759,000
EPC Contingency	$ 4,818,000	$ 5,083,000	$ 8,421,000	$ 8,952,000	$ 11,679,000
Total EPC Costs	$ 41,131,000	$ 41,798,000	$ 72,079,000	$ 73,417,000	$ 100,120,000
Total Project Costs	$ 68,662,000	$ 72,434,000	$ 120,012,000	$ 127,560,000	$ 166,420,000
Non-EPC Costs					
Project Development	$ 2,056,000	$ 2,090,000	$ 3,605,000	$ 3,671,000	$ 5,006,000
Mobilization and Start-Up	$ 412,000	$ 419,000	$ 721,000	$ 734,000	$ 1,002,000
Non-Fuel Inventories	$ 205,000	$ 209,000	$ 360,000	$ 367,000	$ 501,000
Owner's Contingency	$ 3,290,000	$ 3,344,000	$ 5,766,000	$ 5,874,000	$ 8,010,000
Electrical Interconnection	$ 2,025,000	$ 2,025,000	$ 3,510,000	$ 3,510,000	$ 4,860,000
Land	$ 2,700,000	$ 2,700,000	$ 2,700,000	$ 2,700,000	$ 2,700,000
Fuel Inventories	$ 3,387,000	$ 4,086,000	$ 6,774,000	$ 8,174,000	$ 10,161,000
Working Capital	$ 617,000	$ 626,000	$ 1,081,000	$ 1,102,000	$ 1,501,000
Subtotal - Non-EPC Costs w/o Financing Fees	$ 14,692,000	$ 15,499,000	$ 24,517,000	$ 26,132,000	$ 33,741,000
	$ -	$ -	$ -	$ -	$ -
Total Non-EPC Costs	$ 14,692,000	$ 15,499,000	$ 24,517,000	$ 26,132,000	$ 33,741,000
Overnight Capital Costs ($)	$ 83,354,000	$ 87,933,000	$ 144,530,000	$ 153,692,000	$ 200,160,000
Overnight Capital Costs ($/kW)	$ 2,867	$ 3,025	$ 2,486	$ 2,643	$ 2,295

(1) Costs based on EPC contracting approach.
(2) Interconnection and land costs are assumed values
(3) Property taxes and insurance costs are not included in the above estimate.

Sargent & Lundy

Battery Energy Storage – Lithium Ion

Technology	**Battery Energy Storage System - Li-Ion (50 MW / 50 MWh, 1 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 100 MWh, 2 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 200 MWh, 4 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 400 MWh, 8 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 1,200 MWh, 24 hours)**
Plant Nameplate Power (MW)	50	50	50	50	50
Storage Duration	1	2	4	8	24
Project Costs					
EPC Costs					
Batteries and Enclosures	$ 18,581,000	$ 37,162,000	$ 74,323,000	$ 148,647,000	$ 445,941,000
PCS and BOP Equipment	$ 5,276,000	$ 6,892,000	$ 8,774,000	$ 12,453,000	$ 24,905,000
BESS Equipment Subtotal	$ 23,857,000	$ 44,054,000	$ 83,098,000	$ 161,100,000	$ 470,846,000
Project Management	$ 2,793,000	$ 3,649,000	$ 4,645,000	$ 6,593,000	$ 13,185,000
Construction & Materials	$ 9,310,000	$ 12,163,000	$ 15,484,000	$ 21,976,000	$ 43,950,000
Sales Tax	$ 3,579,000	$ 6,608,000	$ 12,465,000	$ 24,165,000	$ 70,627,000
EPC Contractor Fee	Included	Included	Included	Included	Included
EPC Contingency	Included	Included	Included	Included	Included
Total EPC Costs	$ 39,539,000	$ 66,474,000	$ 115,692,000	$ 213,834,000	$ 598,608,000
Non-EPC Costs					
Project Development	$ 1,977,000	$ 3,324,000	$ 5,785,000	$ 10,692,000	$ 29,930,000
Mobilization and Start-Up	$ 395,000	$ 665,000	$ 1,157,000	$ 2,138,000	$ 5,986,000
Spare Parts Inventories					
Electrical Interconnection	$ 2,700,000	$ 2,700,000	$ 2,700,000	$ 2,700,000	$ 2,700,000
Land	$ 675,000	$ 675,000	$ 675,000	$ 675,000	$ 675,000
Working Capital	$ 395,000	$ 665,000	$ 1,157,000	$ 2,138,000	$ 5,986,000
Project Contingency	$ 2,284,000	$ 3,725,000	$ 6,358,000	$ 11,609,000	$ 32,194,000
Subtotal - Non-EPC Costs w/o Financing Fees	$ 8,427,000	$ 11,753,000	$ 17,832,000	$ 29,952,000	$ 77,472,000
Total Non-EPC Costs	$ 8,427,000	$ 11,753,000	$ 17,832,000	$ 29,952,000	$ 77,472,000
Overnight Capital Costs ($)	$ 47,966,000	$ 78,228,000	$ 133,523,000	$ 243,786,000	$ 676,079,000
Battery Energy Capital Costs ($/kWh)	$ 959	$ 782	$ 668	$ 609	$ 563
Battery Power Capacity Costs ($/kW)	$ 959	$ 1,565	$ 2,670	$ 4,876	$ 13,522

(1) Costs based on EPC contracting approach.
(2) Interconnection and land costs are assumed values
(3) Property taxes and insurance costs are not

Onshore Wind

Technology	**Wind, On Shore**
Net Plant Output (MW)	50
Estimated Capacity Factor	45%
Estimated MWh per Year	197,100

Project Costs		
Owner Furnished Equipment		
WTG Procurement and Supply	$	52,738,000
Sales Tax	$	7,911,000
Total Owner Furnished Equipment	$	60,649,000
EPC Costs		
Civil / Structural / Architectural Subtotal	$	11,079,000
Turbine Erection	$	4,101,000
Mechanical Subtotal	$	4,101,000
Substation Electrical Equipment	$	2,807,000
Pad Mount Transformers and Collection System	$	9,426,000
Electrical Subtotal	$	12,232,000
Project Indirects	$	945,000
Sales Tax	$	1,835,000
EPC Contractor Fee	$	1,644,000
Total EPC Costs	$	31,837,000
Total Project Costs	$	92,485,000

Non-EPC Costs		
Owners Cost	$	4,605,000
Interconnection	$	2,700,000
Project Contingency	$	6,489,000
Subtotal - Non-EPC Costs w/o Financing Fees	$	13,794,000
Total Non-EPC Costs	$	13,794,000
Overnight Capital Costs	$	106,280,000
Overnight Capital Costs ($/kW)	$	2,126

(1) Costs based on EPC contracting approach.
(2) Interconnection costs are assumed values, land lease costs included in O&M
(3) Property taxes and insurance costs are not included in the above estimate.

Sargent & Lundy

Utility Scale Solar PV

Bifacial, fixed-tilt configuration

Technology	**Utility Scale PV, Fixed Tilt ($50\ MW_{AC}$)**	
Net Plant Output (MW)	50	
Estimated Capacity Factor	19.9%	
Estimated MWh per Year	87,200	
Project Costs		
Owner Furnished Equipment		
Modules	$	42,242,000
Sales Tax	$	6,337,000
Total Owner Furnished Equipment	$	48,578,000
EPC Costs		
Civil / Structural / Architectural Subtotal	$	5,238,000
Racking and Module Installation	$	16,467,000
Mechanical Subtotal	$	21,705,000
Inverters	$	3,910,000
Inverter Installation	$	1,292,000
PV BOP	$	3,930,000
DC/MV Collection, Miscellaneous	$	8,505,000
Substation	$	6,350,000
Electrical Subtotal	$	23,987,000
Project Indirects	$	1,019,000
Sales Tax	$	3,687,000
EPC Contractor Fee	$	2,597,000
Total EPC Costs	$	58,234,000
Total Project Costs	$	106,812,000
Non-EPC Costs		
Owners's Services	$	4,273,000
Interconnection	$	2,700,000
Project Contingency	$	5,689,000
Subtotal - Non-EPC Costs w/o Financing Fees	$	12,662,000
Total Non-EPC Costs	$	12,662,000
Total Capital Costs	$	119,474,000
Total Capital Costs ($/kW)	$	2,389

(1) Costs based on EPC contracting approach.
(2) Interconnection costs are assumed values, land lease costs included in O&M
(3) Property taxes and insurance costs are not included in the above estimate.

Rooftop Solar PV

Technology	**Rooftop Solar, 10 kW, Fixed Tilt**
Net Plant Output (kW)	10
Estimated Capacity Factor	15%
Estimated kWh per Year	13,140

Project Costs

Modules	$ 7,600
Inverters and BOP	$ 11,140
Labor and Overhead	$ 6,250
Permitting	$ 2,870
Up-Front Marketing / Customer Acquisition	$ 6,420
Developer Profit	$ 4,220
Sales Tax	$ 2,810
Total Capital Costs (Pre-Incentives)	$ 41,310
Total Capital Costs ($/kW) (Pre-Incentives)	$ 4,130
Residential Solar Rebate	$ 10,000
	-
Total Capital Costs (After Incentives)	$ 31,310
Total Capital Costs ($/kW) (After Incentives)	$ 3,131

Biomass Power Plant

Technology	**Biomass Plant (50 MW)**
Net Plant Output	50
Heat Rate (Btu/kWh)	13,300

Project Costs		
Owner Equipment and EPC Costs		
Mechanical, Boiler Plant, Including SCR	$	93,686,000
Mechanical, Turbine Plant	$	12,239,000
Mechanical, BOP	$	33,232,000
Mechanical Subtotal	$	139,157,000
Electrical, Main and Aux Power Systems	$	5,855,000
Electrical, BOP and I&C	$	29,176,000
Electrical, Substation and Switchyard	$	8,936,000
Electrical Subtotal	$	43,967,000
Civil / Structural Total	$	34,340,000
Sales Tax	$	9,534,000
Various Project Indirects	$	7,711,000
EPC Contractor Fee	$	9,697,000
EPC Contingency	$	10,873,000
Total Owner Equipment, and EPC Costs	$	255,278,000

Non-EPC Costs		
Owner's Services	$	18,182,000
Interconnection	$	2,700,000
Land	$	2,700,000
Project Contingency	$	13,943,000
Subtotal - Non-EPC Costs w/o Financing Fees	$	37,525,000
Total Non-EPC Costs	$	37,525,000
Overnight Capital Costs ($)		292,803,000
Overnight Capital Costs ($/kW)	$	5,856

(1) Costs based on EPC contracting approach.
(2) Interconnection and land costs are assumed values
(3) Property taxes and insurance costs are not included in the above estimate.

APPENDIX B. O&M COST ESTIMATES

This appendix contains generation/storage resource operations and maintenance cost estimates. All values in Canadian dollars.

Thermal Units – Reciprocating Engines

Technology	**Reciprocating Internal Combustion Engine**	**Reciprocating Internal Combustion Engine**
Unit Type (Representative Manufacturer)	Wartsila 20V32 (5x)	Wartsila 20V32 (5x)
Cycle Type	Simple Cycle	Simple Cycle
Fuel Type	Diesel Fuel	Biodiesel Fuel
Net Plant Output (MW) - Summer (27˚C, 47% RH, 0 m)	53.0	46.9
Net Plant Output (MW) - Winter (-26˚C, 60% RH, 0 m)	53.0	46.9
Net Heat Rate (Btu/kWh) (HHV) (ISO: 15˚C, 60% RH, 0 m)	8,400	8,400
Fixed O&M		
Labor - Routine O&M	$ 315,000	$ 315,000
Maintenance Materials and Services	$ 68,000	$ 68,000
G&A	$ 118,000	$ 118,000
Total Fixed O&M ($)	$ 501,000	$ 501,000
Total Fixed O&M ($/kW-year)	$ 9.45	$ 10.69
Variable O&M		
Annualized Equipment Maintenance	203,078	203,078
VOM (non-fuel)	98,097	98,097
Variable O&M - Hours Based ($/MWh)	$ 64.86	$ 73.38

(1) O&M expenses assume low utilization (1% capacity factor); thus predominately allocate O&M spend on a variable basis.
(2) Given the low utilization, RICE and CT O&M expenses are assumed to be similar.

Thermal Units – Combustion Turbines

Technology	Combustion Turbine - Aeroderivative	Combustion Turbine - Aeroderivative	Combustion Turbine - Aeroderivative	Combustion Turbine - Aeroderivative	Combustion Turbine - Aeroderivative
Unit Type (Representative Manufacturer)	GE LM2500+ Aero (1x)	GE LM2500+ Aero (1x)	GE LM2500+ Aero (2x)	GE LM2500+ Aero (2x)	GE LM2500+ Aero (3x)
Cycle Type	Simple Cycle	Simple Cycle	Simple Cycle	Simple Cycle	Simple Cycle
Fuel Type	Diesel Fuel	Biodiesel Fuel	Diesel Fuel	Biodiesel Fuel	Diesel Fuel
Net Plant Output (MW) - Summer (27˚C, 47% RH, 0 m)	29.1	29.1	58.1	58.1	87.2
Net Plant Output (MW) - Winter (-26˚C, 60% RH, 0 m)	36.3	36.3	72.7	72.7	109.0
Net Heat Rate (Btu/kWh) (HHV) (ISO: 15˚C, 60% RH, 0 m)	9,500	10,000	9,500	10,000	9,500
Fixed O&M					
Labor - Routine O&M	$ 210,000	$ 210,000	$ 315,000	$ 315,000	$ 419,000
Maintenance Materials and Services	$ 37,000	$ 37,000	$ 75,000	$ 75,000	$ 112,000
G&A	$ 65,000	$ 65,000	$ 130,000	$ 130,000	$ 195,000
Total Fixed O&M ($)	$ 275,000	$ 275,000	$ 444,000	$ 444,000	$ 614,000
Total Fixed O&M ($/kW-year)	$ 9.44	$ 9.44	$ 7.64	$ 7.64	$ 7.04
Variable O&M					
Annualized Equipment Maintenance	111,373	111,373	222,747	222,747	334,120
VOM (non-fuel)	53,799	53,799	107,597	107,597	161,396
Variable O&M - Hours Based ($/MWh)	$ 64.86	$ 64.86	$ 64.86	$ 64.86	$ 64.86

(1) O&M expenses assume low utilization (1% capacity factor); thus predominately allocate O&M spend on a variable basis.
(2) Given the low utilization, RICE and CT O&M expenses are assumed to be similar.

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Battery Energy Storage – Lithium Ion

Technology	**Battery Energy Storage System - Li-Ion (50 MW / 50 MWh, 1 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 100 MWh, 2 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 200 MWh, 4 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 400 MWh, 8 hours)**	**Battery Energy Storage System - Li-Ion (50 MW / 1,200 MWh, 24 hours)**
Plant Nameplate Power (MW)	50	50	50	50	50
Storage Duration	1	2	4	8	24
Fixed O&M					
Augmentation Expense (Total Expense, Divided Out Per Year)	$ 346,000	$ 575,000	$ 992,000	$ 1,822,000	$ 5,073,000
O&M Labor	$ 60,000	$ 133,000	$ 322,000	$ 729,000	$ 2,355,000
O&M Production and Parts	$ 7,000	$ 15,000	$ 37,000	$ 83,000	$ 268,000
O&M Fee and G&A	$ 82,000	$ 183,000	$ 443,000	$ 1,002,000	$ 3,238,000
Station Load / Aux Load	$ 8,000	$ 18,000	$ 43,000	$ 97,000	$ 312,000
Miscellaneous Costs	$ 6,000	$ 13,000	$ 32,000	$ 72,000	$ 233,000
Fixed O&M ($/kWh-yr)	$ 3.12	$ 3.49	$ 4.39	$ 4.78	$ 5.14
Fixed O&M ($/kW-yr)	$ 3.12	$ 6.98	$ 17.54	$ 38.22	$ 123.47
Fixed O&M including Augmentation ($/kW-year)	$ 10.03	$ 18.49	$ 37.38	$ 74.66	$ 224.92
Variable O&M					

Included in FOM Above (Assumes 1 Cycle/Day)

(1) Calculations assume 3 augmentations over 20 years, spaced at 5 year intervals.

Onshore Wind

Technology	**Wind, On Shore**
Net Plant Output (MW)	50
Estimated Capacity Factor	45%
Estimated MWh per Year	197,100
Fixed O&M	
WTG Scheduled Maintenance	$ 625,000
WTG Unscheduled Maintenance	$ 601,000
BOP Maintenance	$ 120,000
Labor	$ 421,000
Operations	$ 234,000
Other (includes land lease)	$ 925,000
Total Fixed O&M ($)	$ 2,926,000
Total Fixed O&M ($/kW-year)	$ 59
Variable O&M	
Variable O&M ($/MWh)	$ -

(1) Assumes O&M is performed by an independent service provider
(2) All O&M costs are on a fixed-cost basis

Utility Scale Solar PV

Bifacial, fixed-tilt configuration

Technology	Utility Scale PV, Fixed Tilt ($50\ MW_{AC}$)
Net Plant Output (MW)	50
Estimated Capacity Factor	19.9%
Estimated MWh per Year	87,200
Fixed O&M	
Preventative Maintenance	$ 586,000
Module Cleaning	$ 326,000
Unscheduled Maintenance	$ 51,000
Inverter Maintenance Reserve	$ 182,000
Land Lease	$ 71,000
Total Fixed O&M ($)	$ 1,215,000
Total Fixed O&M ($/kW-year)	$ 24.30
Variable O&M	
Variable O&M ($/MWh)	$ -

**Note: If a 50 MW solar power plant is built as 5 different 10MW individual locations, it will likely utilize central inverters. By contrast, if a larger number of smaller MW locations are developed, it is more likely that string inverters will be utilized. Costs for string vs. central inverters vary slightly on a capital and O&M basis, but differences are unlikely to be significant enough to exclusively drive development decisions over other considerations.*

Biomass Power Plant

Technology	Biomass Plant (50 MW)
Net Plant Output	50
Heat Rate (Btu/kWh)	13,300
Fixed O&M	
Labor (Full Time Equivalents)	
Labor	$ 5,054,000
Materials and Contract Services	$ 2,025,000
Administrative and General	$ 2,430,000
Total Fixed O&M ($)	$ 9,509,000
Total Fixed O&M ($/kW-year)	$ 190
Variable O&M	
Variable O&M - Hours Based ($/MWh)	$ 7.45

The following table presents a 20-year comparison of operational costs for a 50 MW (4-hour duration) BESS to a similar sized RICE project. In order to maintain a consistent BESS performance level, the BESS project is assumed to be augmented every 5 years to counteract the impact of BESS degradation. A BESS project does not have to be augmented; however, a typical non-augmented project can be expected to degrade approximately 25% to 30% over a 20-year lifespan. All values in the table below are presented in 2022 Canadian Dollars.

	20 Year Total (2022 $'s)	Yearly Costs, 2022 $'s																			
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
50 MW / 200 MWh BESS (1 cycle/day)																					
Augmentation Expense (CAD '000)	19,836	0	0	0	0	7,023	0	0	0	0	6,595	0	0	0	0	6,218	0	0	0	0	0
Fixed O&M (CAD '000)																					
O&M Labor	6,448	293	296	299	302	305	308	311	314	317	320	323	327	330	333	336	340	343	346	350	353
O&M Production and Parts	734	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
O&M Fee and G&A	8,867	403	407	411	415	419	424	428	432	436	440	445	449	454	458	462	467	472	476	481	486
Station Load / Aux Load	855	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
Miscellaneous Costs	638	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Total Expenses (CAD '000)	**37,377**	*808*	*815*	*822*	*829*	*7,859*	*843*	*850*	*857*	*865*	*7,467*	*880*	*887*	*895*	*902*	*7,129*	*918*	*926*	*934*	*942*	*950*
Total Expenses (CAD/kW-year)	**37.4**	**16.2**	**16.3**	**16.4**	**16.6**	**157.2**	**16.9**	**17.0**	**17.1**	**17.3**	**149.3**	**17.6**	**17.7**	**17.9**	**18.0**	**142.6**	**18.4**	**18.5**	**18.7**	**18.8**	**19.0**
Total Expenses, O&M Only (CAD '000)	**17,541**	*808*	*815*	*822*	*829*	*836*	*843*	*850*	*857*	*865*	*872*	*880*	*887*	*895*	*902*	*910*	*918*	*926*	*934*	*942*	*950*
Total Expenses, O&M Only (CAD/kW-year)	**17.5**	**16.2**	**16.3**	**16.4**	**16.6**	**16.7**	**16.9**	**17.0**	**17.1**	**17.3**	**17.4**	**17.6**	**17.7**	**17.9**	**18.0**	**18.2**	**18.4**	**18.5**	**18.7**	**18.8**	**19.0**
53 MW RICE (App. 1% Capacity Factor)																					
Fixed O&M (CAD '000)																					
Labor - Routine O&M (1.5 FTE)	6,290	286	289	292	295	298	301	303	306	309	312	316	319	322	325	328	331	335	338	341	345
Maintenance Materials and Services	1,362	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
G&A	2,365	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118
Variable O&M (CAD '000)																					
Annualized Equipment Maintenance	4,062	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203
VOM (non-fuel)	1,962	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
Total Expenses (CAD '000)	**16,042**	*774*	*777*	*779*	*782*	*785*	*788*	*791*	*794*	*797*	*800*	*803*	*806*	*809*	*812*	*816*	*819*	*822*	*825*	*829*	*832*
Fixed O&M (CAD/kW-year)	**9.5**	**14.6**	**14.7**	**14.7**	**14.8**	**14.8**	**14.9**	**14.9**	**15.0**	**15.0**	**15.1**	**15.2**	**15.2**	**15.3**	**15.3**	**15.4**	**15.5**	**15.5**	**15.6**	**15.6**	**15.7**
Variable O&M (CAD/MWh)	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**	**64.9**

Note: All values in CAD and shown in 2022 dollars

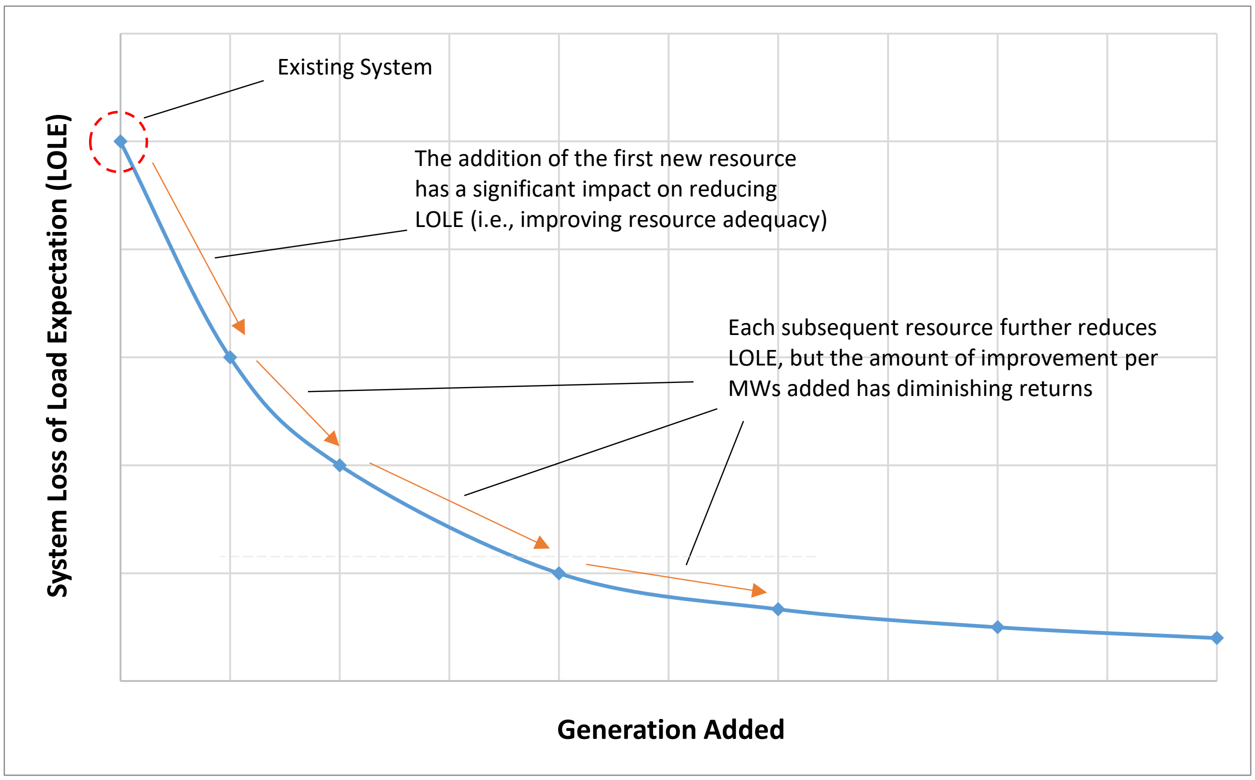
APPENDIX C. EFFECTIVE LOAD CARRYING CAPABILITY INTRODUCTION

The technical characteristics of different generators can result in the generators providing varying levels of contributions towards resource adequacy. To effectively evaluate different technologies and their contributions towards improving system resource adequacy, a concept called the Effective Load Carrying Capability (ELCC) of a generator is used. In simple terms, the ELCC of a generator reflects how much the generator is able to contribute towards system resource adequacy (in the case of Maritime Electric, the “system” is the entire Maritimes Area, including Nova Scotia, New Brunswick, and the northern tip of Maine). As a single measure, the ELCC allows for quick comparison of resource adequacy contributions of different generators. The use of ELCC as a measure to quantify a generator’s contributions towards resource adequacy has increased with the growth in renewable generators, such as solar, wind, and other similar generation technologies, since the variable generation profiles of these generators makes it more of a complex process to quantify the contributions of these generators towards serving system load.

The ELCC of a generator can vary based on a number of variables, including the dispatchability characteristics of the generator. For example, if generation were needed to meet load in the evening, a stand-alone solar power plant would have a lower overall ELCC than a solar power plant paired with an energy storage system. This is due simply to the fact that the stand-alone solar power plant would not be capable of generating much electricity in the evening (since the sun would have nearly set at this time), while the storage system paired to the other solar power plant likely could generate electricity in the evening (provided the storage is sufficiently charged). ELCC will vary from one planning region to another because load and generation characteristics change from region to region.

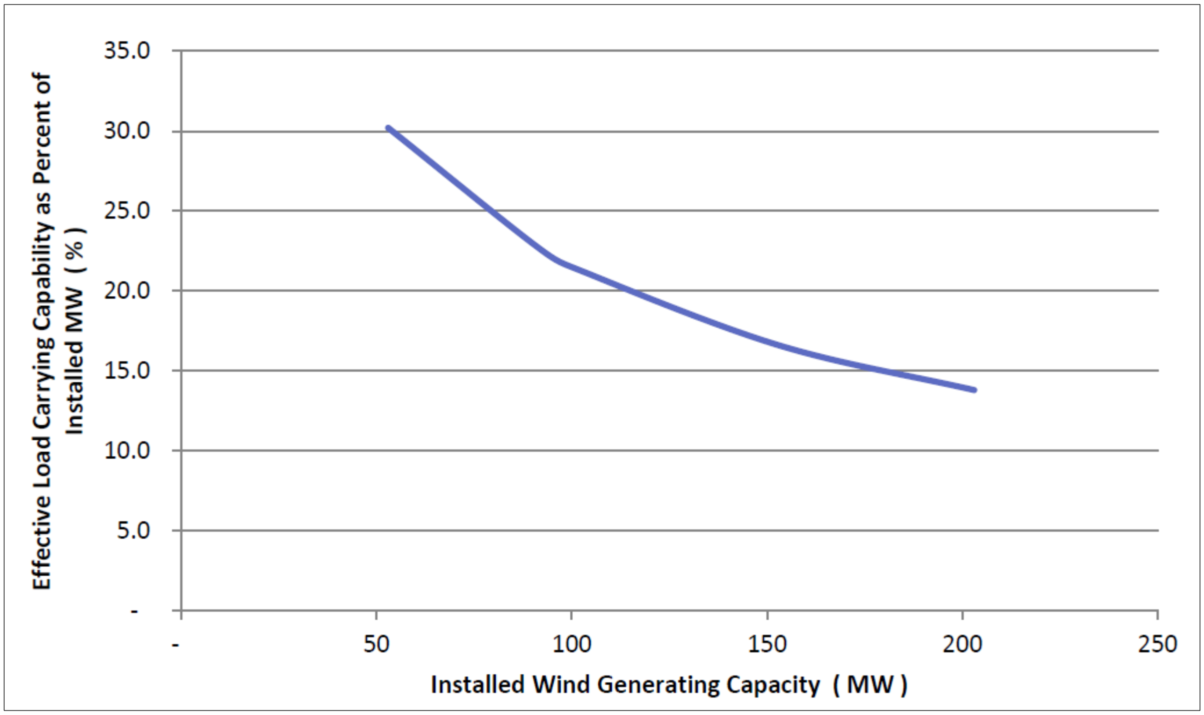
ELCC is typically expressed as a percentage of what could be provided by a “perfect generator”, or a generator that would be available to dispatch every hour of the day, all days of the year. For example, a 100-MW wind generator with an ELCC of 25% would help improve system resource adequacy by an equal amount as a 25 MW perfect generator. An equivalent way to view ELCC is to consider how much system load could be increased with the additional generator such that the system resource adequacy level prior to adding the generator would be equivalent to the resource adequacy level after adding the generator. For example, consider a system with a loss of load expectation (LOLE) or equal to 0.10 days/year. A 100 MW wind power plant is added to the system, resulting in the system LOLE to drop to 0.09 days/year. It was then observed that if load were increased by 25 MW, the system LOLE increased back up to 0.10 days/year. In this case, the ELCC of the wind power plant would be equal to 25% (25 MW load increase / 100 MW wind capacity).

It is important to note that the ELCC is a measure of marginal system impact, or the incremental contribution towards resource adequacy. The state of the electrical system from a resource adequacy perspective at the specific time the new generator is added has an impact on the new generator's ELCC. For example, consider the 100 MW wind power plant described above with an ELCC equal to 25% is added to a system. Then, if a second 100 MW of wind is added to the system, the ELCC of the second 100 MW would be less than 25%. The reason for this is because the contributions of additional similar generators towards improving system resource adequacy have diminishing returns. This is illustrated in the following figure, where each dot to the right of the existing system represents additional generators have been added. In the figure, the ELCC of the first new generator would be higher than subsequent generators of similar technology since the amount of LOLE improvement per MW's added reduces with each subsequent addition.



Given that there are costs associated with adding new generators, it is important for system planners to assess the appropriate balance between the desired system LOLE target and system cost, especially since the benefits associated with additional returns diminishes with each additional MW added.

Maritime Electric has calculated the ELCC of wind generation as function of total wind capacity installed. The following figure is taken from Maritime Electric's 2020 Integrated System Plan and illustrates the ELCC of wind. As can be observed in the figure, each additional MW of installed wind capacity on PEI have smaller contributions to resource adequacy.



APPENDIX D. PVSYST SOLAR OUTPUT REPORTS

Version 7.2.12

PVsyst - Simulation report

Grid-Connected System

Project: PEI - Solar PV Feasibility

Variant: Case 1 - 10 MW - Monofacial - Fixed

Unlimited sheds

System power: 14.50 MWp

Prince Edward Island - Canada

Author

Sargent & Lundy LLC (United States)

Project summary

Geographical Site	Situation		Project settings	
Prince Edward Island	Latitude	46.34 °N	Albedo	0.20
Canada	Longitude	-63.41 °W		
	Altitude	92 m		
	Time zone	UTC-4		

Meteo data
Prince Edward Island
Meteonorm 8.0 (1991-2005), Sat=100% - Synthetic

System summary

Grid-Connected System
Simulation for year no 1

Unlimited sheds

PV Field Orientation
Sheds
tilt 12 °
azimuth 0 °

Near Shadings
Mutual shadings of sheds
Electrical effect

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	25216 units	Nb. of units	13 units
Pnom total	14.50 MWp	Pnom total	10.92 MWac
		Grid power limit	10000 kWac
		Grid lim. Pnom ratio	1.450

Results summary

Produced Energy	17 GWh/year	Specific production	1162 kWh/kWp/year	Perf. Ratio PR	86.98 %
Apparent energy	17774 MVAh				

Table of contents

General parameters

Grid-Connected System | **Unlimited sheds**

PV Field Orientation

Orientation		**Sheds configuration**		**Models used**	
Sheds		Nb. of sheds	200 units	Transposition	Perez
tilt	12 °	Unlimited sheds		Diffuse	Perez, Meteonorm
azimuth	0 °	**Sizes**		Circumsolar	separate
		Sheds spacing	5.58 m		
		Collector width	3.91 m		
		Ground Cov. Ratio (GCR)	70.1 %		
		Shading limit angle			
		Limit profile angle	24.8 °		
		Shadings electrical effect			
		Cell size	15.6 cm		
		Strings in width	3 units		

Horizon		**Near Shadings**	**User's needs**
Average Height	2.5 °	Mutual shadings of sheds	Unlimited load (grid)
		Electrical effect	

Grid injection point

Grid power limitation		**Power factor**	
Active Power	10000 kWac	Cos(phi) (leading)	0.950
Pnom ratio	1.450		

PV Array Characteristics

PV module		**Inverter**	
Manufacturer	Canadian Solar Inc.	Manufacturer	TMEIC
Model	CS7L-575MB-AG 1500V	Model	Solar Ware- PVU-L0840GR
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	575 Wp	Unit Nom. Power	840 kWac
Number of PV modules	25216 units	Number of inverters	13 units
Nominal (STC)	14.50 MWp	Total power	10920 kWac
Modules	788 Strings x 32 In series	Operating voltage	915-1300 V
At operating cond. (50°C)		Pnom ratio (DC:AC)	1.33
Pmpp	13.32 MWp		
U mpp	969 V		
I mpp	13747 A		

Total PV power		**Total inverter power**	
Nominal (STC)	14499 kWp	Total power	10920 kWac
Total	25216 modules	Number of inverters	13 units
Module area	71364 m²	Pnom ratio	1.33

Array losses

Array Soiling Losses

Average loss Fraction 2.5 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
5.0%	7.0%	5.0%	2.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	2.0%	3.0%

Thermal Loss factor		**DC wiring losses**		**LID - Light Induced Degradation**	
Module temperature according to irradiance		Global array res.	1.2 mΩ	Loss Fraction	1.0 %
Uc (const)	29.0 W/m²K	Loss Fraction	1.5 % at STC		
Uv (wind)	0.0 W/m²K/m/s				

Array losses

Module Quality Loss
Loss Fraction -0.4 %

Module mismatch losses
Loss Fraction 0.8 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.5 %/year

Mismatch due to degradation
Imp RMS dispersion 0 %/year
Vmp RMS dispersion 0 %/year

IAM loss factor
Incidence effect (IAM): User defined profile

20°	40°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.990	0.960	0.920	0.840	0.720	0.000

System losses

Auxiliaries loss
Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 630 Vac tri
Loss Fraction 0.04 % at STC

Inverter: Solar Ware- PVU-L0840GR
Wire section (13 Inv.) Copper 13 x 3 x 700 mm²
Average wires length 5 m

MV line up to HV Transfo
MV Voltage 34.5 kV
Average each inverter
Wires Copper 3 x 95 mm²
Length 6300 m
Loss Fraction 0.55 % at STC

HV line up to Injection
HV line voltage 138 kV
Wires Copper 3 x 16 mm²
Length 1135 m
Loss Fraction 0.11 % at STC

AC losses in transformers

MV transfo
Medium voltage 34.5 kV

Operating losses at STC
Nominal power at STC 14277 kVA
Iron loss (24/24 Connexion) 4.76 kW/Inv.
Loss Fraction 0.10 % at STC
Coils equivalent resistance 3 x 0.67 mΩ/inv.
Loss Fraction 0.80 % at STC

HV transfo
Grid voltage 138 kV

Transformer from Datasheets
Nominal power 15000 kVA
Iron loss 7.00 kVA
Loss Fraction 0.05 % of PNom
Copper loss 55.00 kVA
Loss Fraction 0.37 % of PNom

Operating losses at STC
Nominal power at STC 14277 kVA
Iron loss (24/24 Connexion) 7.00 kW
Loss Fraction 0.05 % at STC
Coils equivalent resistance 3 x 291.0 mΩ
Loss Fraction 0.35 % at STC

Horizon definition

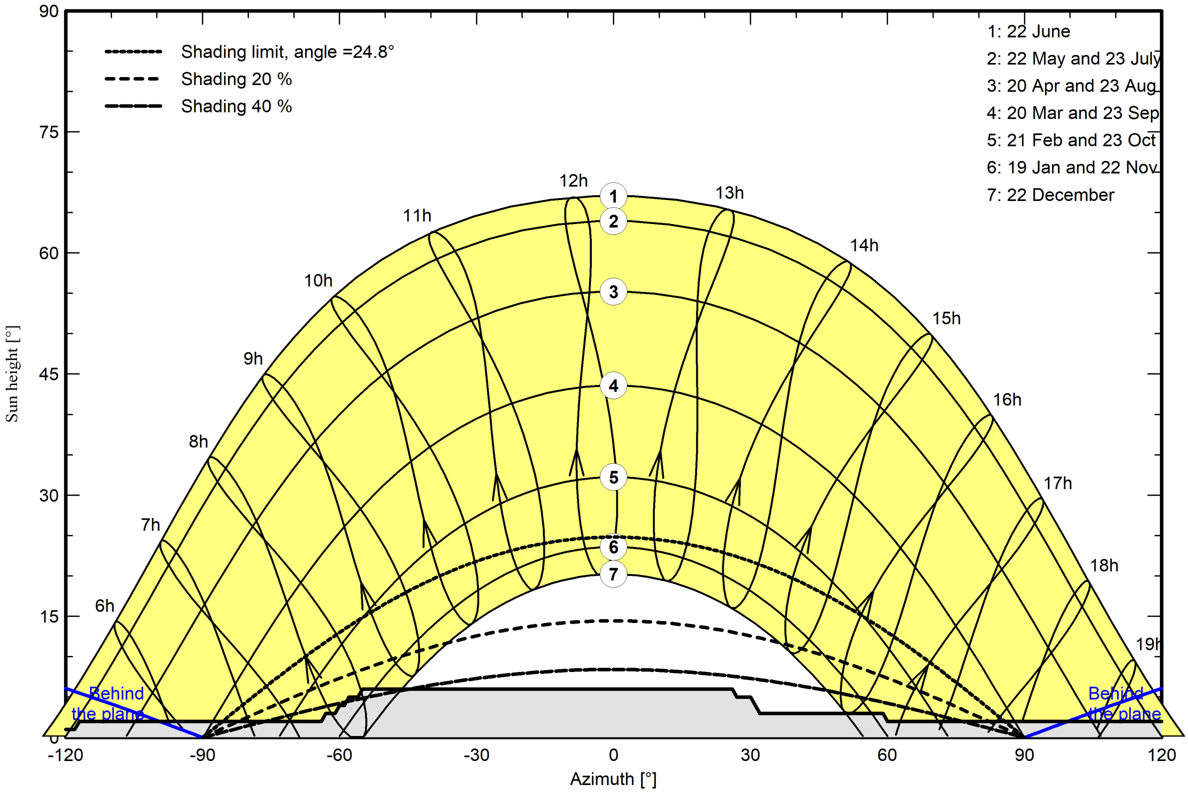
Horizon from Meteonorm web service, lat=46.3396, lon=-63.4083

Average Height	2.5 °	Albedo Factor	0.74
Diffuse Factor	0.98	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-121	-120	-118	-117	-64	-63	-61	-60	-59	-58	-56
Height [°]	0.0	0.0	1.0	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0
Azimuth [°]	-55	26	27	30	32	59	60	123	124	167	168	179
Height [°]	6.0	6.0	5.0	5.0	3.0	3.0	2.0	2.0	1.0	1.0	0.0	0.0

Sun Paths (Height / Azimuth diagram)

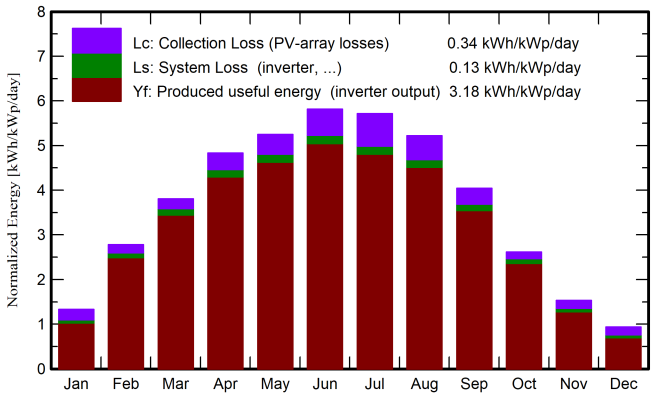


Main results

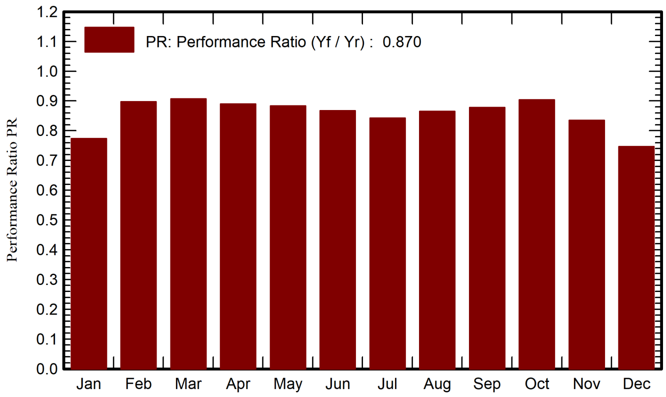
System Production

Produced Energy	17 GWh/year	Specific production	1162 kWh/kWp/year
Apparent energy	17774 MVAh	Performance Ratio PR	86.98 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray GWh	E_Grid GWh	PR ratio
January	32.0	17.71	-6.82	41.2	36.3	0.495	0.462	0.774
February	62.4	27.46	-6.83	77.8	70.7	1.057	1.012	0.897
March	102.7	43.95	-2.70	118.0	110.0	1.614	1.551	0.907
April	134.9	66.05	2.96	145.1	138.7	1.944	1.872	0.890
May	158.1	83.23	9.20	162.7	157.9	2.161	2.082	0.883
June	172.5	85.88	14.37	174.5	169.4	2.276	2.195	0.868
July	173.1	78.95	19.48	177.1	172.2	2.244	2.162	0.842
August	153.2	74.50	19.34	162.0	157.4	2.107	2.030	0.865
September	108.5	45.00	14.94	121.4	118.0	1.607	1.544	0.877
October	68.6	33.10	9.31	81.1	78.5	1.111	1.062	0.904
November	36.7	20.26	3.37	46.0	42.9	0.591	0.557	0.835
December	23.0	15.54	-2.53	28.9	25.3	0.343	0.313	0.746
Year	1225.8	591.64	6.25	1335.7	1277.4	17.550	16.844	0.870

Legends

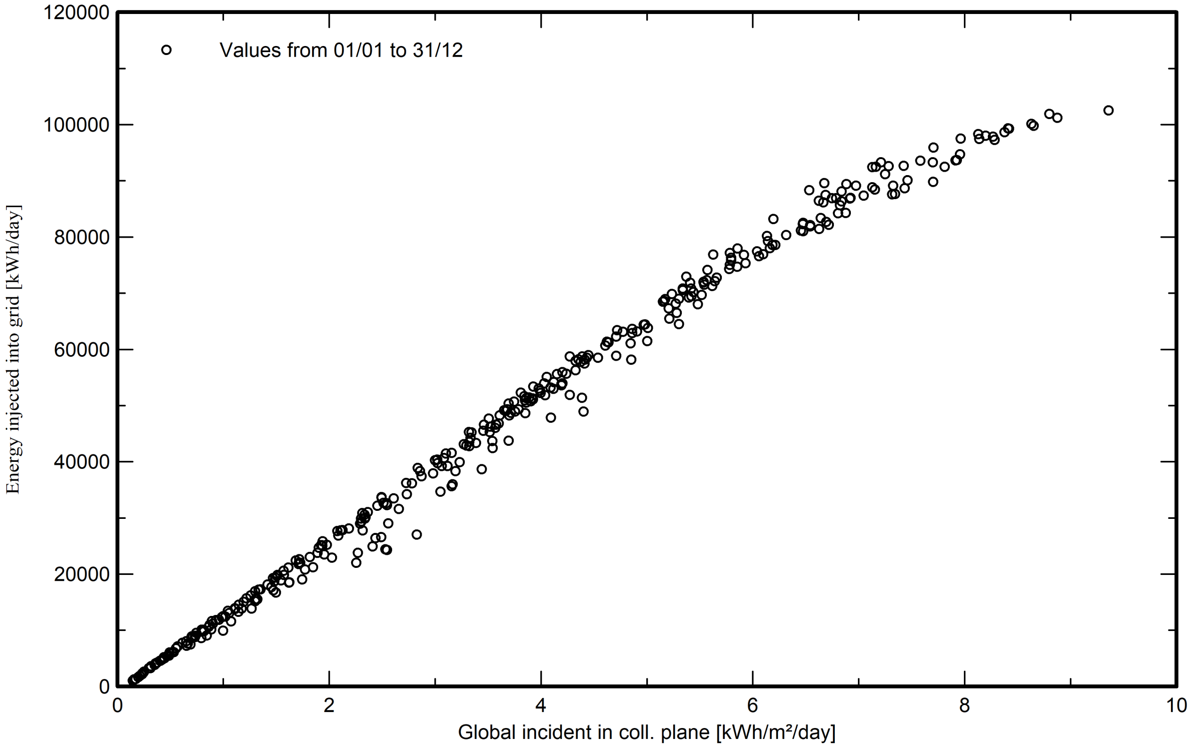
GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

Loss diagram

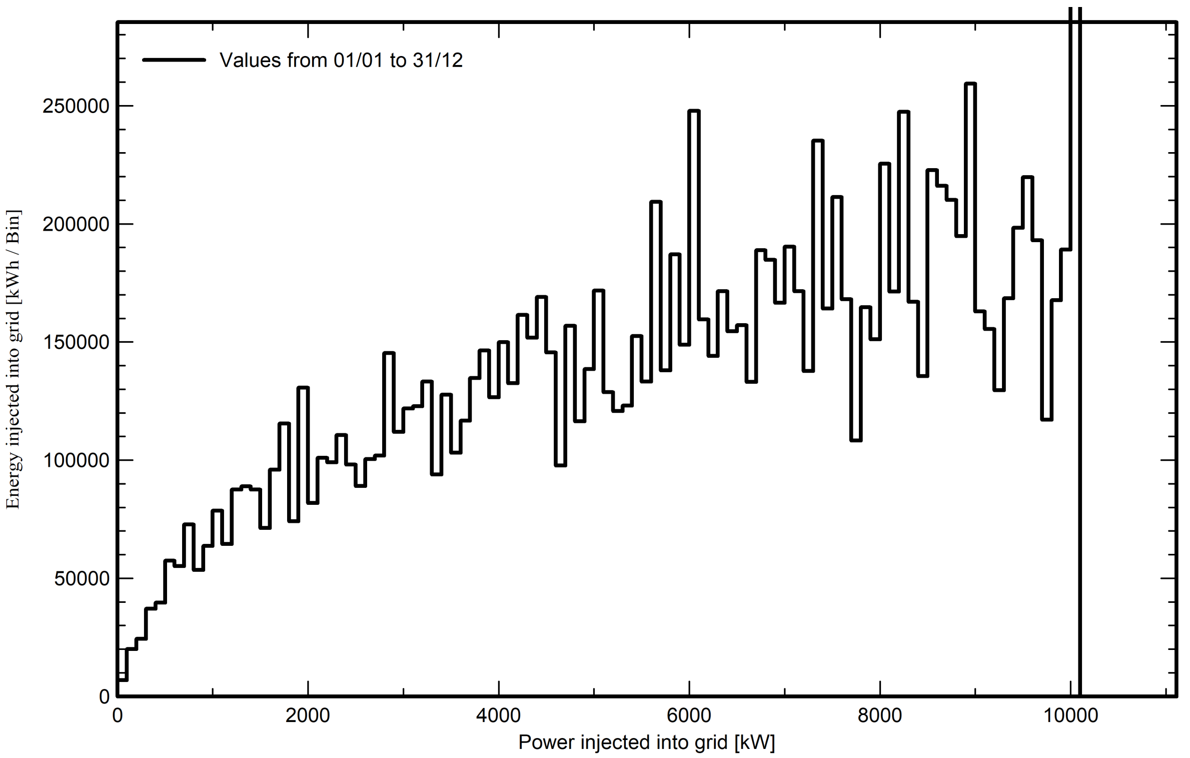
1226 kWh/m²	**Global horizontal irradiation**
+9.0%	**Global incident in coll. plane**
-0.59%	Far Shadings / Horizon
-0.97%	Near Shadings: irradiance loss
-0.81%	IAM factor on global
-2.06%	Soiling loss factor
1277 kWh/m² * 71364 m² coll.	**Effective irradiation on collectors**
efficiency at STC = 20.41%	PV conversion
18.61 GWh	**Array nominal energy (at STC effic.)**
-0.25%	Module Degradation Loss (for year #1)
-0.34%	PV loss due to irradiance level
-0.12%	PV loss due to temperature
-0.78%	Shadings: Electrical Loss , sheds3 strings in width
+0.43%	Module quality loss
-1.00%	LID - Light induced degradation
-0.90%	Mismatch loss, modules and strings
-0.79%	Ohmic wiring loss
17.92 GWh	**Array virtual energy at MPP**
-1.67%	Inverter Loss during operation (efficiency)
-1.02%	Inverter Loss over nominal inv. power
0.00%	Inverter Loss due to max. input current
0.00%	Inverter Loss over nominal inv. voltage
0.00%	Inverter Loss due to power threshold
0.00%	Inverter Loss due to voltage threshold
-0.03%	Night consumption
17.44 GWh	**Available Energy at Inverter Output**
-0.30%	Auxiliaries (fans, other)
-0.02%	AC ohmic loss
-1.14%	Medium voltage transfo loss
-0.26%	MV line ohmic loss
-0.54%	High voltage transfo loss
-0.05%	HV line ohmic loss
-1.12%	Unused energy (grid limitation)
16.84 GWh	**Active Energy injected into grid**
5.67 kVAR	Reactive energy to the grid: Aver. cos(phi) = 0.948
17.77 kVA	**Apparent energy to the grid**

Special graphs

Daily Input/Output diagram



System Output Power Distribution



Version 7.2.12

PVsyst - Simulation report

Grid-Connected System

Project: PEI - Solar PV Feasibility

Variant: Case 2 - 10 MW - Bifacial - Fixed

Unlimited sheds

System power: 14.50 MWp

Prince Edward Island - Canada

Author

Sargent & Lundy LLC (United States)

Project summary

Geographical Site	Situation		Project settings	
Prince Edward Island	Latitude	46.34 °N	Albedo	0.20
Canada	Longitude	-63.41 °W		
	Altitude	92 m		
	Time zone	UTC-4		

Meteo data
Prince Edward Island
Meteonorm 8.0 (1991-2005), Sat=100% - Synthetic

System summary

Grid-Connected System
Simulation for year no 1

Unlimited sheds

PV Field Orientation
Sheds
tilt 12 °
azimuth 0 °

Near Shadings
Mutual shadings of sheds
Electrical effect

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	25216 units	Nb. of units	13 units
Pnom total	14.50 MWp	Pnom total	10.92 MWac
		Grid power limit	10000 kWac
		Grid lim. Pnom ratio	1.450

Results summary

Produced Energy	17 GWh/year	Specific production	1203 kWh/kWp/year	Perf. Ratio PR	90.06 %
Apparent energy	18404 MVAh				

Table of contents

General parameters

Grid-Connected System

Unlimited sheds

PV Field Orientation

Orientation

Sheds	
tilt	12 °
azimuth	0 °

Sheds configuration

Nb. of sheds	200 units
Unlimited sheds	

Sizes

Sheds spacing	5.58 m
Collector width	3.91 m
Ground Cov. Ratio (GCR)	70.1 %

Shading limit angle

Limit profile angle	24.8 °

Shadings electrical effect

Cell size	15.6 cm
Strings in width	3 units

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon
Average Height 2.5 °

Near Shadings
Mutual shadings of sheds
Electrical effect

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation
unlimited sheds

Bifacial model geometry

Sheds spacing	5.58 m
Sheds width	3.91 m
Limit profile angle	24.8 °
GCR	70.1 %
Height above ground	2.00 m

Bifacial model definitions

Ground albedo average	0.34
Bifaciality factor	70 %
Rear shading factor	5.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	4.0 %

Monthly ground albedo values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.50	0.60	0.50	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.40	0.50	0.34

Grid injection point

Grid power limitation

Active Power	10000 kWac
Pnom ratio	1.450

Power factor

Cos(phi) (leading)	0.950

PV Array Characteristics

PV module

Manufacturer	Canadian Solar Inc.
Model	CS7L-575MB-AG 1500V
(Custom parameters definition)	
Unit Nom. Power	575 Wp
Number of PV modules	25216 units
Nominal (STC)	14.50 MWp
Modules	788 Strings x 32 In series
At operating cond. (50°C)	
Pmpp	13.32 MWp
U mpp	969 V
I mpp	13747 A

Inverter

Manufacturer	TMEIC
Model	Solar Ware- PVU-L0840GR
(Custom parameters definition)	
Unit Nom. Power	840 kWac
Number of inverters	13 units
Total power	10920 kWac
Operating voltage	915-1300 V
Pnom ratio (DC:AC)	1.33

PV Array Characteristics

Total PV power

Nominal (STC)	14499 kWp
Total	25216 modules
Module area	71364 m²

Total inverter power

Total power	10920 kWac
Number of inverters	13 units
Pnom ratio	1.33

Array losses

Array Soiling Losses

Average loss Fraction 2.3 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
4.5%	6.0%	4.5%	2.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.5%	2.5%

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 1.2 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation

Loss Fraction 1.0 %

Module Quality Loss

Loss Fraction -0.4 %

Module mismatch losses

Loss Fraction 0.8 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

Module average degradation

Year no 1
Loss factor 0.45 %/year

Mismatch due to degradation

Imp RMS dispersion 0 %/year
Vmp RMS dispersion 0 %/year

IAM loss factor

Incidence effect (IAM): User defined profile

20°	40°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.990	0.960	0.920	0.840	0.720	0.000

System losses

Auxiliaries loss

Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 630 Vac tri
Loss Fraction 0.04 % at STC

Inverter: Solar Ware- PVU-L0840GR

Wire section (13 Inv.) Copper 13 x 3 x 700 mm²
Average wires length 5 m

MV line up to HV Transfo

MV Voltage 34.5 kV
Average each inverter
Wires Copper 3 x 95 mm²
Length 5700 m
Loss Fraction 0.50 % at STC

HV line up to Injection

HV line voltage 138 kV
Wires Copper 3 x 16 mm²
Length 1024 m
Loss Fraction 0.10 % at STC

AC losses in transformers

MV transfo

Medium voltage	34.5 kV
Operating losses at STC	
Nominal power at STC	14277 kVA
Iron loss (24/24 Connexion)	4.76 kW/Inv.
Loss Fraction	0.10 % at STC
Coils equivalent resistance	3 x 0.67 mΩ/inv.
Loss Fraction	0.80 % at STC

HV transfo

Grid voltage 138 kV

Transformer from Datasheets		Operating losses at STC	
Nominal power	15000 kVA	Nominal power at STC	14277 kVA
Iron loss	7.00 kVA	Iron loss (24/24 Connexion)	7.00 kW
Loss Fraction	0.05 % of PNom	Loss Fraction	0.05 % at STC
Copper loss	55.00 kVA	Coils equivalent resistance	3 x 291.0 mΩ
Loss Fraction	0.37 % of PNom	Loss Fraction	0.35 % at STC

Horizon definition

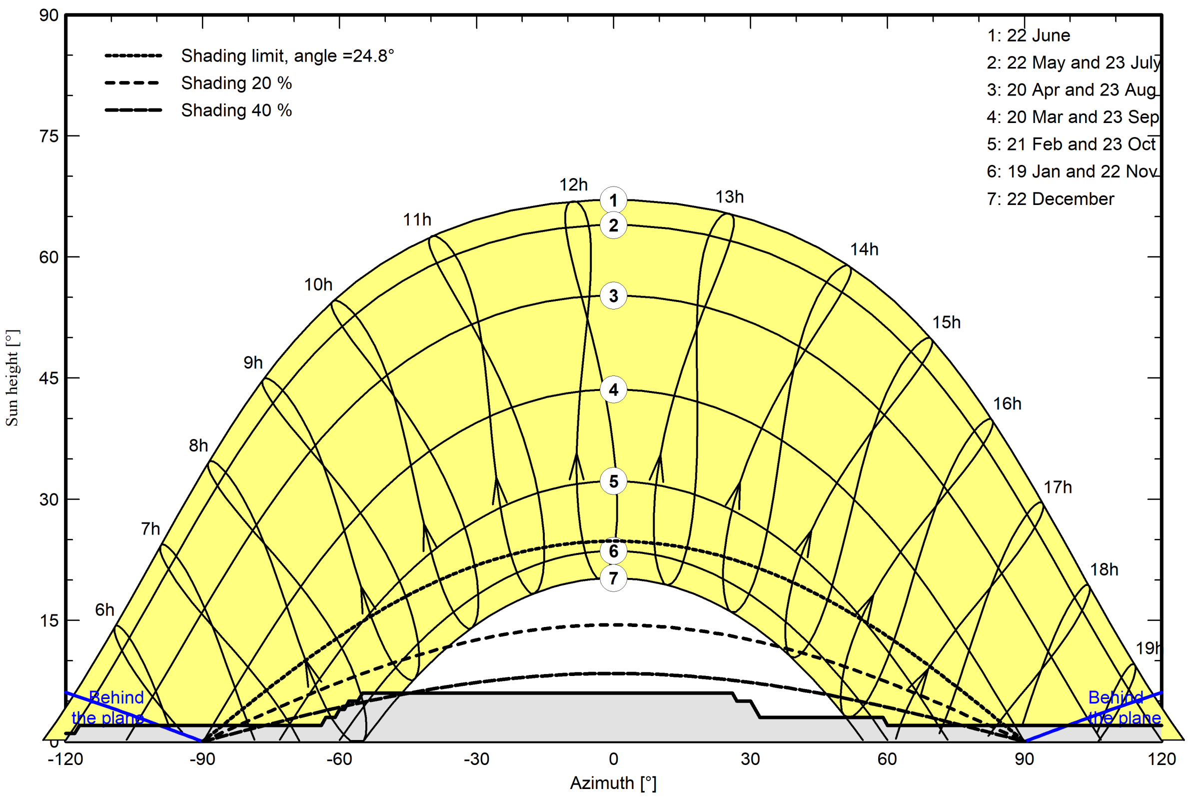
Horizon from Meteonorm web service, lat=46.3396, lon=-63.4083

Average Height	2.5 °	Albedo Factor	0.74
Diffuse Factor	0.98	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-121	-120	-118	-117	-64	-63	-61	-60	-59	-58	-56
Height [°]	0.0	0.0	1.0	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0
Azimuth [°]	-55	26	27	30	32	59	60	123	124	167	168	179
Height [°]	6.0	6.0	5.0	5.0	3.0	3.0	2.0	2.0	1.0	1.0	0.0	0.0

Sun Paths (Height / Azimuth diagram)

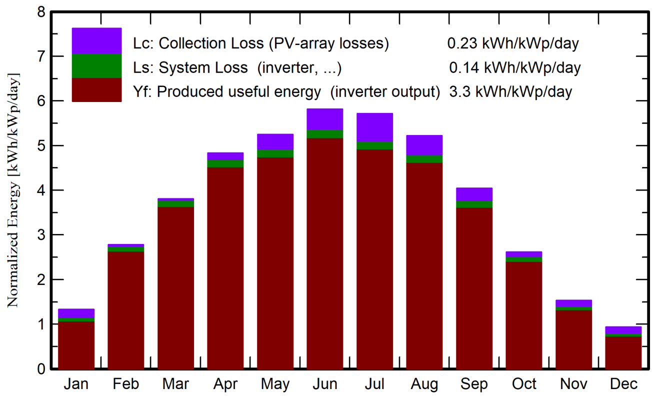


Main results

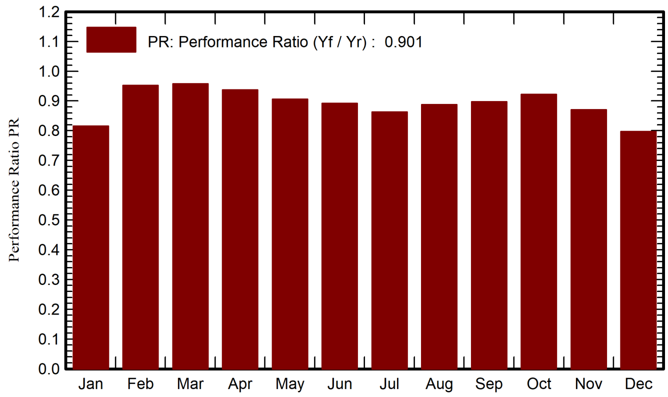
System Production

Produced Energy	17 GWh/year	Specific production	1203 kWh/kWp/year
Apparent energy	18404 MVAh	Performance Ratio PR	90.06 %

Normalized productions (per installed kWp)



Performance Ratio PR



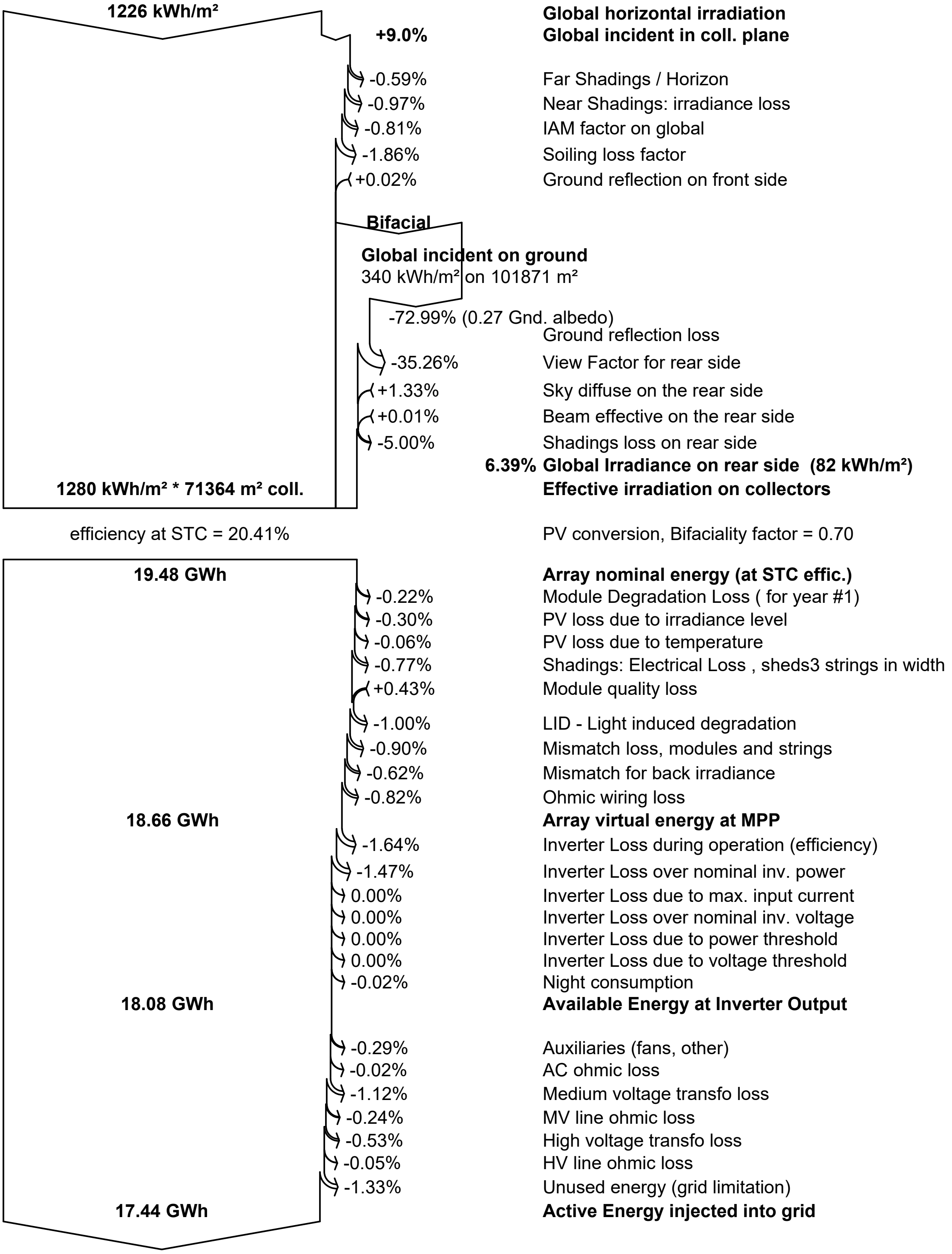
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray GWh	E_Grid GWh	PR ratio
January	32.0	17.71	-6.82	41.2	36.5	0.520	0.487	0.816
February	62.4	27.46	-6.83	77.8	71.5	1.120	1.074	0.952
March	102.7	43.95	-2.70	118.0	110.7	1.704	1.638	0.958
April	134.9	66.05	2.96	145.1	139.5	2.045	1.970	0.937
May	158.1	83.23	9.20	162.7	157.9	2.217	2.137	0.906
June	172.5	85.88	14.37	174.5	169.5	2.339	2.256	0.892
July	173.1	78.95	19.48	177.1	172.2	2.299	2.217	0.863
August	153.2	74.50	19.34	162.0	157.4	2.161	2.084	0.887
September	108.5	45.00	14.94	121.4	118.0	1.643	1.579	0.897
October	68.6	33.10	9.31	81.1	78.5	1.133	1.084	0.922
November	36.7	20.26	3.37	46.0	43.2	0.615	0.580	0.870
December	23.0	15.54	-2.53	28.9	25.4	0.364	0.335	0.797
Year	1225.8	591.63	6.25	1335.7	1280.3	18.159	17.442	0.901

Legends

GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

Loss diagram

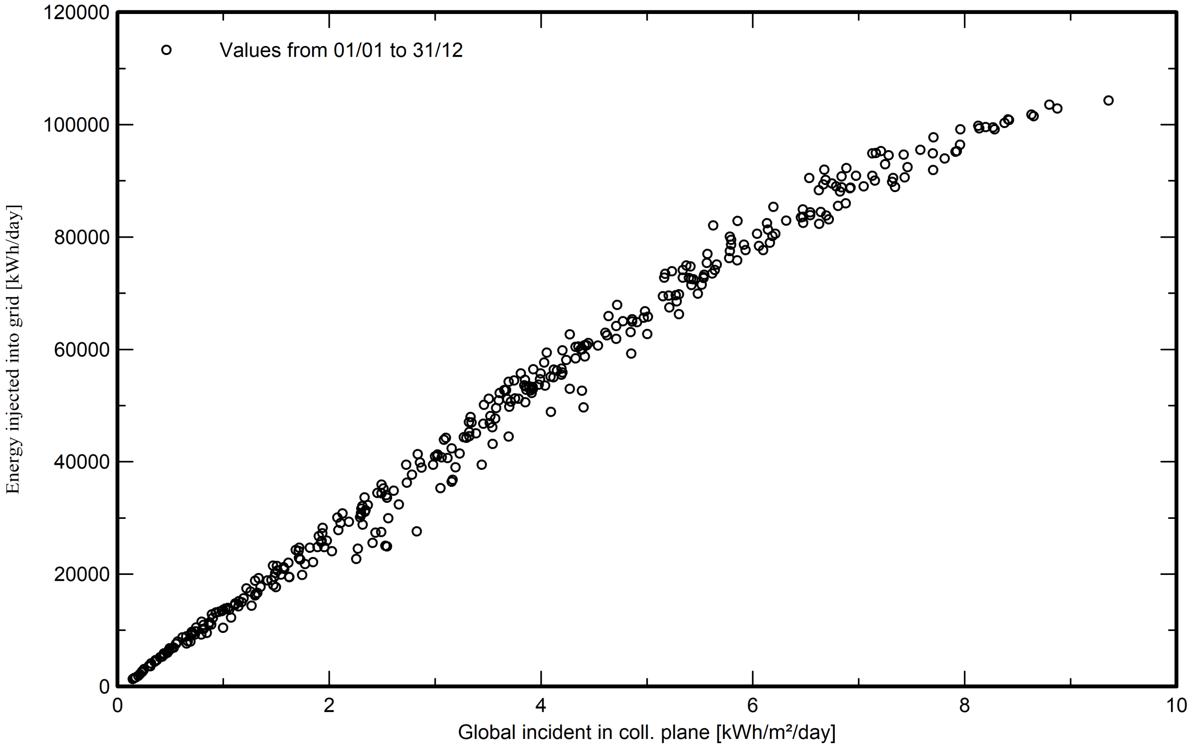


5.87 kVAR — Reactive energy to the grid: Aver. cos(phi) = 0.948

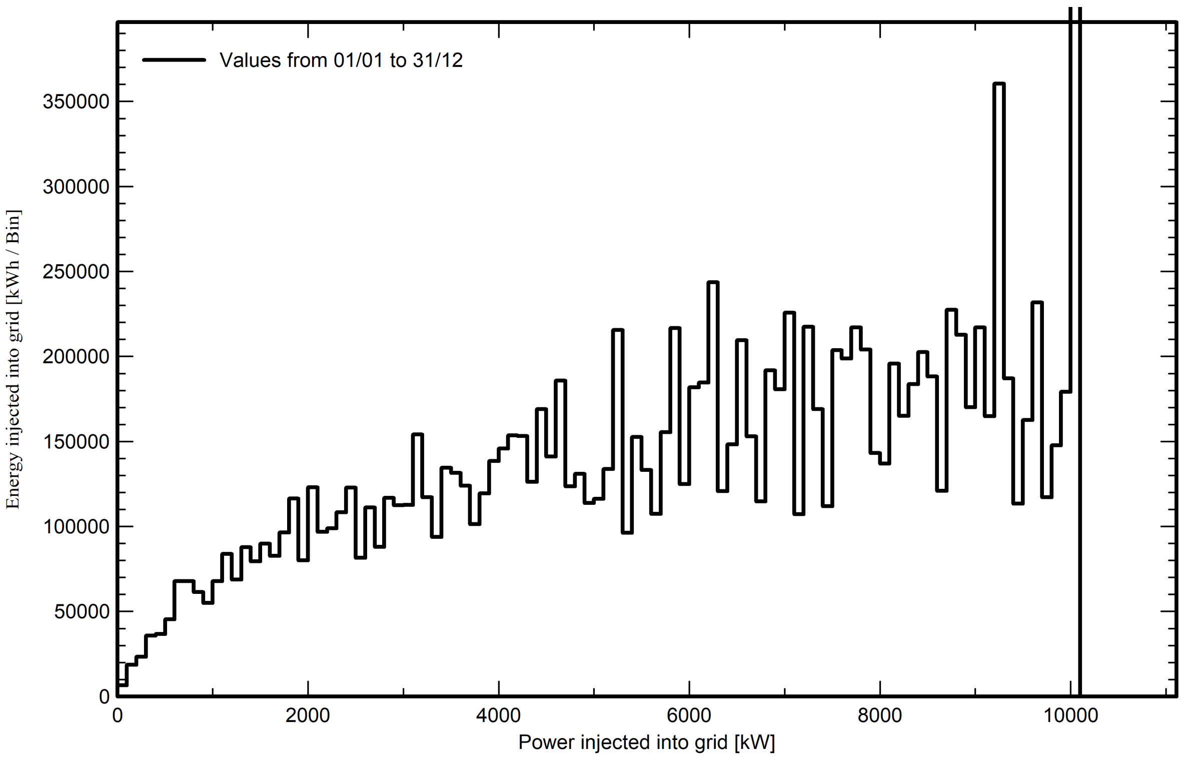
18.40 kVA — **Apparent energy to the grid**

Special graphs

Daily Input/Output diagram



System Output Power Distribution



Version 7.2.12

PVsyst - Simulation report

Grid-Connected System

Project: PEI - Solar PV Feasibility

Variant: Case 3 - 10 MW - Monofacial - SAT

Unlimited Trackers with backtracking

System power: 13.01 MWp

Prince Edward Island - Canada

Author

Sargent & Lundy LLC (United States)

Project summary

Geographical Site		**Situation**		**Project settings**	
Prince Edward Island		Latitude	46.34 °N	Albedo	0.20
Canada		Longitude	-63.41 °W		
		Altitude	92 m		
		Time zone	UTC-4		

Meteo data
Prince Edward Island
Meteonorm 8.0 (1991-2005), Sat=100% - Synthetic

System summary

Grid-Connected System
Simulation for year no 1

Unlimited Trackers with backtracking

PV Field Orientation
Orientation
Tracking horizontal axis

Tracking algorithm
Astronomic calculation
Backtracking activated

Near Shadings
No Shadings

System information

PV Array		**Inverters**	
Nb. of modules	22624 units	Nb. of units	13 units
Pnom total	13.01 MWp	Pnom total	10.92 MWac
		Grid power limit	10000 kWac
		Grid lim. Pnom ratio	1.301

User's needs
Unlimited load (grid)

Results summary

Produced Energy	18 GWh/year	Specific production	1406 kWh/kWp/year	Perf. Ratio PR	88.26 %
Apparent energy	19294 MVAh				

Table of contents

General parameters

Grid-Connected System

Unlimited Trackers with backtracking

PV Field Orientation

Orientation
Tracking horizontal axis

Tracking algorithm
Astronomic calculation
Backtracking activated

Backtracking strategy

Nb. of trackers	200 units
Unlimited trackers	

Sizes

Tracker Spacing	6.21 m
Collector width	2.17 m
Ground Cov. Ratio (GCR)	35.0 %
Phi min / max.	-/+ 52.0 °

Backtracking limit angle

Phi limits	+/- 69.4 °

Shadings electrical effect

Cell size	15.6 cm
Strings in width	3 units

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon

Average Height 2.5 °

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

Grid injection point

Grid power limitation

Active Power	10000 kWac
Pnom ratio	1.301

Power factor

Cos(phi) (leading)	0.950

PV Array Characteristics

PV module

Manufacturer	Canadian Solar Inc.
Model	CS7L-575MB-AG 1500V
(Custom parameters definition)	
Unit Nom. Power	575 Wp
Number of PV modules	22624 units
Nominal (STC)	13.01 MWp
Modules	707 Strings x 32 In series

At operating cond. (50°C)

Pmpp	11.95 MWp
U mpp	969 V
I mpp	12334 A

Inverter

Manufacturer	TMEIC
Model	Solar Ware- PVU-L0840GR
(Custom parameters definition)	
Unit Nom. Power	840 kWac
Number of inverters	13 units
Total power	10920 kWac
Operating voltage	915-1300 V
Pnom ratio (DC:AC)	1.19

Total PV power

Nominal (STC)	13009 kWp
Total	22624 modules
Module area	64029 m²

Total inverter power

Total power	10920 kWac
Number of inverters	13 units
Pnom ratio	1.19

Array losses

Array Soiling Losses
Average loss Fraction 1.4 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2.0%	3.0%	2.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.5%

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 1.3 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation
Loss Fraction 1.0 %

Module Quality Loss
Loss Fraction -0.2 %

Module mismatch losses
Loss Fraction 0.8 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.5 %/year
Mismatch due to degradation
Imp RMS dispersion 0 %/year
Vmp RMS dispersion 0 %/year

IAM loss factor
Incidence effect (IAM): User defined profile

20°	40°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.990	0.960	0.920	0.840	0.720	0.000

System losses

Auxiliaries loss
Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 630 Vac tri
Loss Fraction 0.04 % at STC
Inverter: Solar Ware- PVU-L0840GR
Wire section (13 Inv.) Copper 13 x 3 x 700 mm²
Average wires length 5 m

MV line up to HV Transfo
MV Voltage 34.5 kV
Average each inverter
Wires Copper 3 x 95 mm²
Length 6300 m
Loss Fraction 0.50 % at STC

HV line up to Injection
HV line voltage 138 kV
Wires Copper 3 x 16 mm²
Length 1135 m
Loss Fraction 0.10 % at STC

AC losses in transformers

MV transfo

Medium voltage	34.5 kV
Operating losses at STC	
Nominal power at STC	12813 kVA
Iron loss (24/24 Connexion)	4.27 kW/Inv.
Loss Fraction	0.10 % at STC
Coils equivalent resistance	3 x 0.74 mΩ/inv.
Loss Fraction	0.80 % at STC

HV transfo

Grid voltage 138 kV

Transformer from Datasheets		**Operating losses at STC**	
Nominal power	15000 kVA	Nominal power at STC	12813 kVA
Iron loss	7.00 kVA	Iron loss (24/24 Connexion)	7.00 kW
Loss Fraction	0.05 % of PNom	Loss Fraction	0.05 % at STC
Copper loss	55.00 kVA	Coils equivalent resistance	3 x 291.0 mΩ
Loss Fraction	0.37 % of PNom	Loss Fraction	0.31 % at STC

Horizon definition

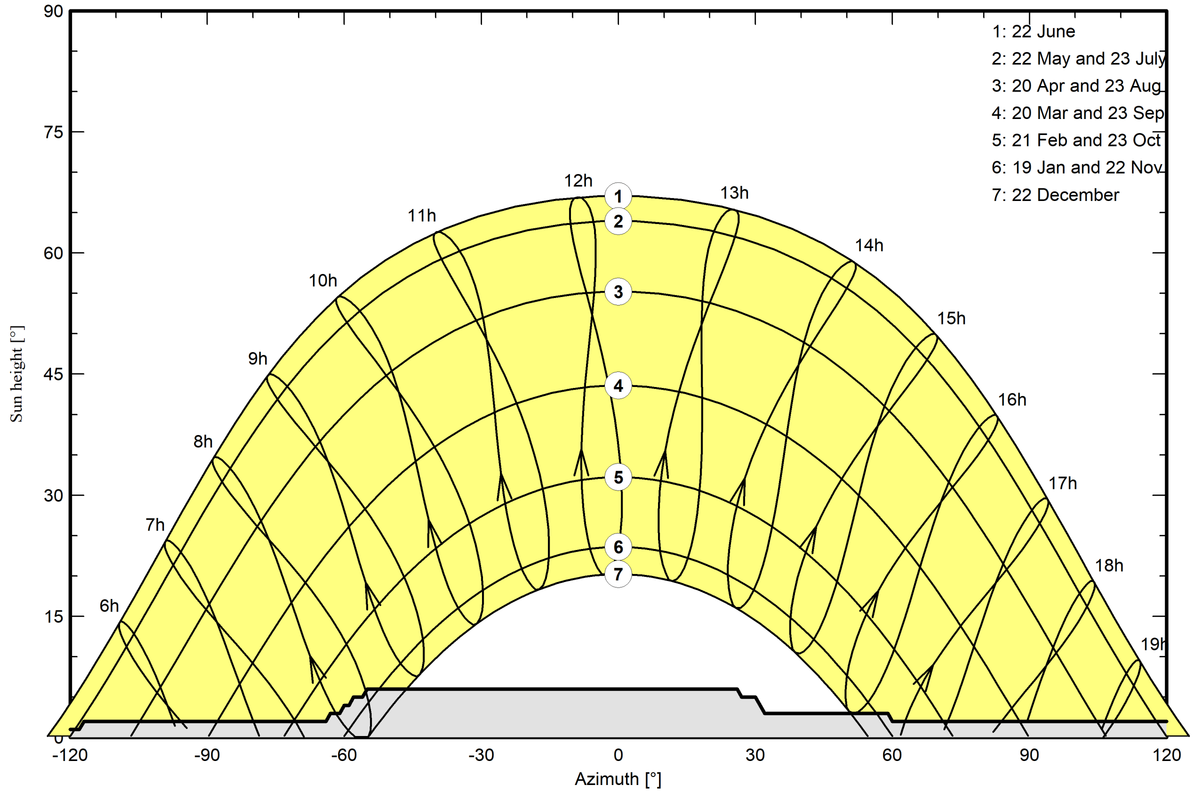
Horizon from Meteonorm web service, lat=46.3396, lon=-63.4083

Average Height	2.5 °	Albedo Factor	0.89
Diffuse Factor	0.97	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-121	-120	-118	-117	-64	-63	-61	-60	-59	-58	-56
Height [°]	0.0	0.0	1.0	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0
Azimuth [°]	-55	26	27	30	32	59	60	123	124	167	168	179
Height [°]	6.0	6.0	5.0	5.0	3.0	3.0	2.0	2.0	1.0	1.0	0.0	0.0

Sun Paths (Height / Azimuth diagram)

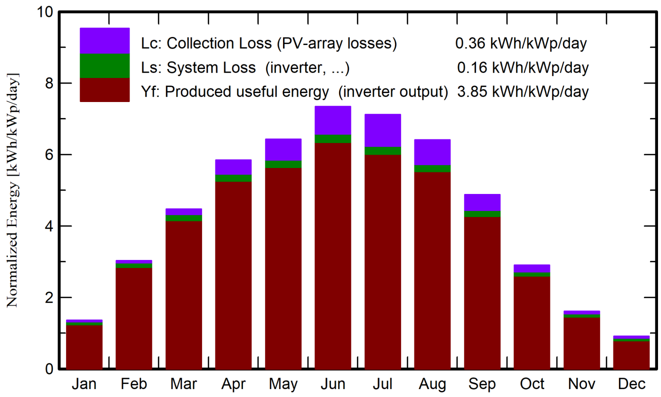


Main results

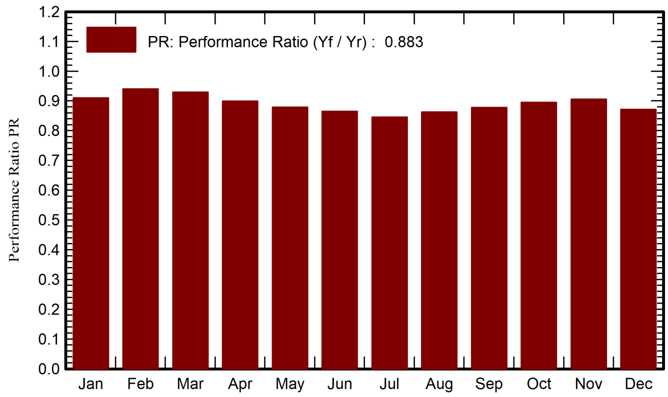
System Production

Produced Energy	18 GWh/year	Specific production	1406 kWh/kWp/year
Apparent energy	19294 MVAh	Performance Ratio PR	88.26 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray GWh	E_Grid GWh	PR ratio
January	32.0	17.71	-6.82	42.2	39.4	0.532	0.499	0.910
February	62.4	27.46	-6.83	84.8	79.9	1.082	1.037	0.941
March	102.7	43.95	-2.70	138.7	132.1	1.744	1.678	0.930
April	134.9	66.05	2.96	175.4	168.5	2.130	2.052	0.900
May	158.1	83.23	9.20	199.1	191.4	2.361	2.276	0.878
June	172.5	85.88	14.37	220.2	211.8	2.567	2.477	0.865
July	173.1	78.95	19.48	220.7	212.5	2.517	2.427	0.845
August	153.2	74.50	19.34	198.7	191.2	2.311	2.230	0.862
September	108.5	45.00	14.94	146.2	140.7	1.736	1.670	0.878
October	68.6	33.10	9.31	90.1	86.2	1.097	1.049	0.895
November	36.7	20.26	3.37	48.4	46.1	0.604	0.570	0.906
December	23.0	15.54	-2.53	28.3	26.3	0.350	0.321	0.871
Year	1225.8	591.63	6.25	1592.7	1526.2	19.030	18.285	0.883

Legends

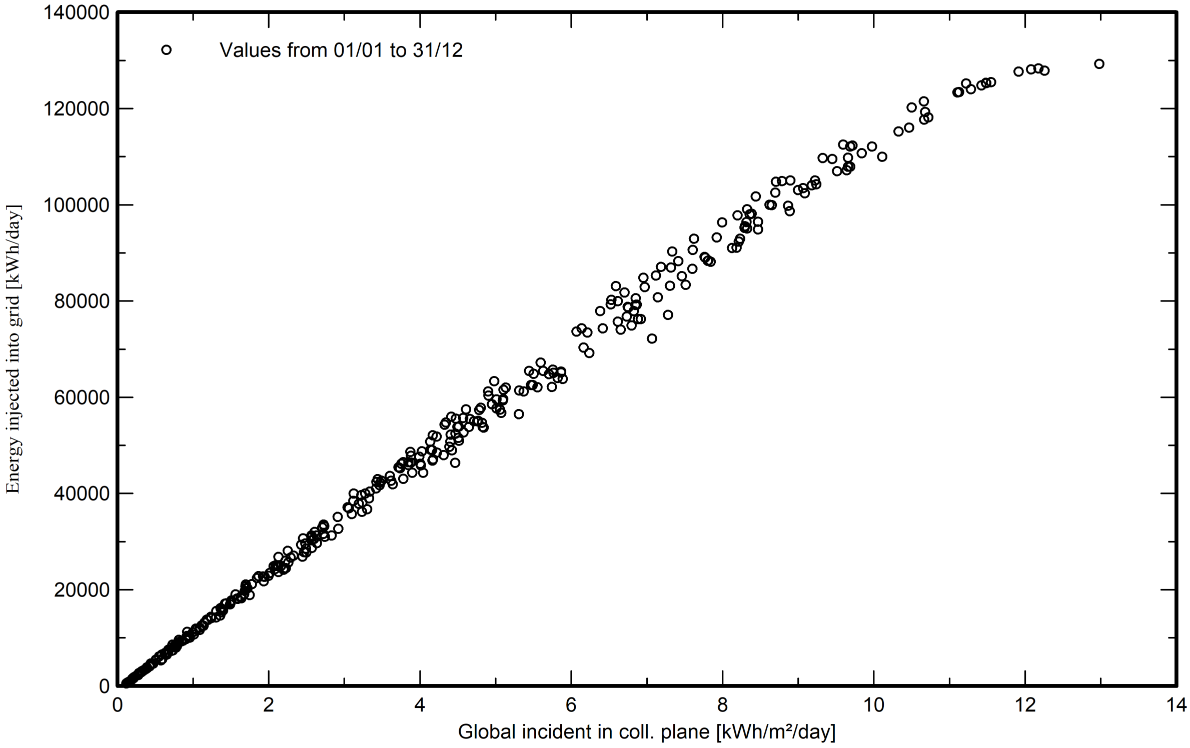
GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

Loss diagram

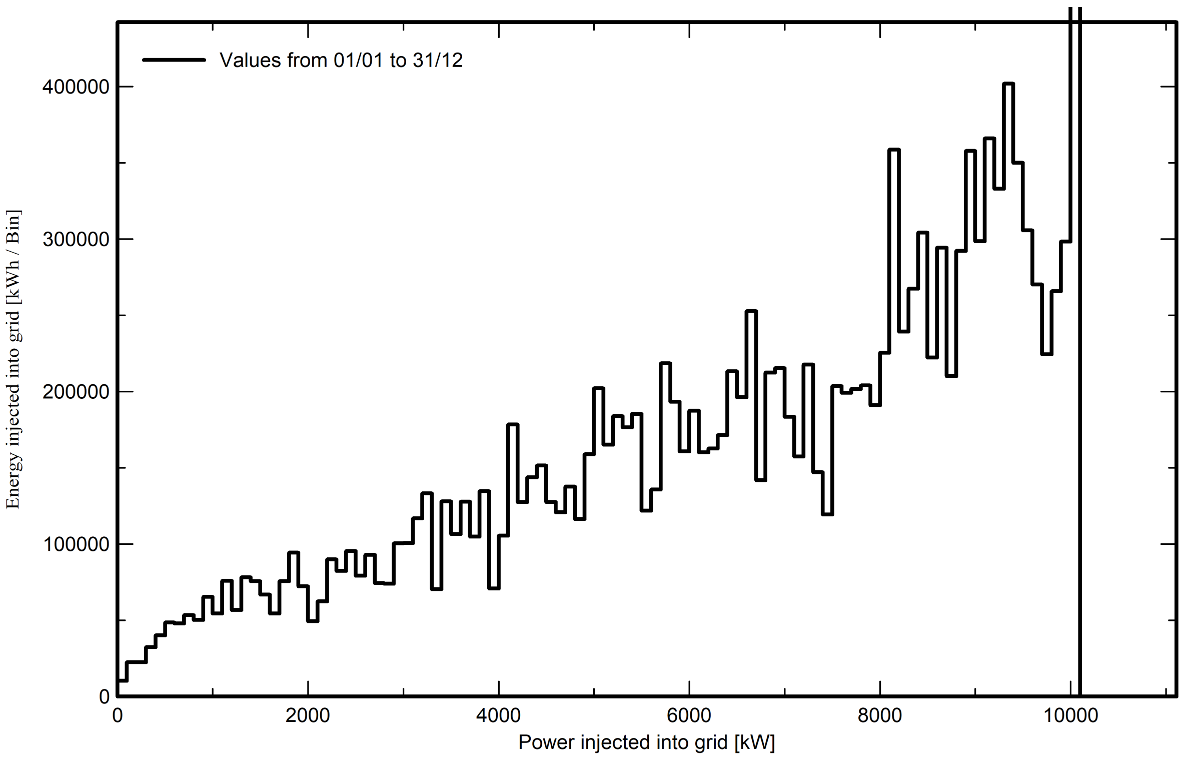
1226 kWh/m²	**Global horizontal irradiation**
+29.9%	**Global incident in coll. plane**
-0.70%	Far Shadings / Horizon
-1.96%	Near Shadings: irradiance loss
-0.34%	IAM factor on global
-1.23%	Soiling loss factor
1526 kWh/m² * 64029 m² coll.	**Effective irradiation on collectors**
efficiency at STC = 20.41%	PV conversion
19.94 GWh	**Array nominal energy (at STC effic.)**
-0.25%	Module Degradation Loss (for year #1)
-0.12%	PV loss due to irradiance level
-0.76%	PV loss due to temperature
0.00%	Shadings: Electrical Loss
+0.20%	Module quality loss
-1.00%	LID - Light induced degradation
-0.90%	Mismatch loss, modules and strings
-0.91%	Ohmic wiring loss
19.21 GWh	**Array virtual energy at MPP**
-1.65%	Inverter Loss during operation (efficiency)
-0.28%	Inverter Loss over nominal inv. power
0.00%	Inverter Loss due to max. input current
0.00%	Inverter Loss over nominal inv. voltage
0.00%	Inverter Loss due to power threshold
0.00%	Inverter Loss due to voltage threshold
-0.02%	Night consumption
18.84 GWh	**Available Energy at Inverter Output**
-0.30%	Auxiliaries (fans, other)
-0.02%	AC ohmic loss
-1.09%	Medium voltage transfo loss
-0.28%	MV line ohmic loss
-0.53%	High voltage transfo loss
-0.06%	HV line ohmic loss
-0.69%	Unused energy (grid limitation)
18.29 GWh	**Active Energy injected into grid**
6.16 kVAR	Reactive energy to the grid: Aver. cos(phi) = 0.948
19.29 kVA	**Apparent energy to the grid**

Special graphs

Daily Input/Output diagram



System Output Power Distribution



Version 7.2.12

PVsyst - Simulation report

Grid-Connected System

Project: PEI - Solar PV Feasibility

Variant: Case 4 - 10 MW - Bifacial - SAT

Unlimited Trackers with backtracking

System power: 13.01 MWp

Prince Edward Island - Canada

Author

Sargent & Lundy LLC (United States)

Project summary

Geographical Site	Situation		Project settings	
Prince Edward Island	Latitude	46.34 °N	Albedo	0.20
Canada	Longitude	-63.41 °W		
	Altitude	92 m		
	Time zone	UTC-4		

Meteo data
Prince Edward Island
Meteonorm 8.0 (1991-2005), Sat=100% - Synthetic

System summary

Grid-Connected System
Simulation for year no 1

Unlimited Trackers with backtracking

PV Field Orientation
Orientation
Tracking horizontal axis

Tracking algorithm
Astronomic calculation
Backtracking activated

Near Shadings
No Shadings

System information

PV Array		Inverters	
Nb. of modules	22624 units	Nb. of units	13 units
Pnom total	13.01 MWp	Pnom total	10.92 MWac
		Grid power limit	10000 kWac
		Grid lim. Pnom ratio	1.301

User's needs
Unlimited load (grid)

Results summary

Produced Energy	20 GWh/year	Specific production	1506 kWh/kWp/year	Perf. Ratio PR	94.58 %
Apparent energy	20673 MVAh				

Table of contents

General parameters

Grid-Connected System — **Unlimited Trackers with backtracking**

PV Field Orientation

Orientation
Tracking horizontal axis

Tracking algorithm
Astronomic calculation
Backtracking activated

Backtracking strategy

Nb. of trackers	200 units
Unlimited trackers	

Sizes

Tracker Spacing	6.21 m
Collector width	2.17 m
Ground Cov. Ratio (GCR)	35.0 %
Phi min / max.	-/+ 52.0 °

Backtracking limit angle

Phi limits	+/- 69.4 °

Shadings electrical effect

Cell size	15.6 cm
Strings in width	3 units

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon
Average Height 2.5 °

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

Bifacial system

Model: 2D Calculation, unlimited trackers

Bifacial model geometry

Tracker Spacing	6.21 m
Tracker width	2.17 m
GCR	35.0 %
Axis height above ground	2.00 m

Bifacial model definitions

Ground albedo average	0.34
Bifaciality factor	70 %
Rear shading factor	2.5 %
Rear mismatch loss	7.5 %
Shed transparent fraction	4.0 %

Monthly ground albedo values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.50	0.60	0.50	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.40	0.50	0.34

Grid injection point

Grid power limitation

Active Power	10000 kWac
Pnom ratio	1.301

Power factor

Cos(phi) (leading)	0.950

PV Array Characteristics

PV module

Manufacturer	Canadian Solar Inc.
Model	CS7L-575MB-AG 1500V
(Custom parameters definition)	
Unit Nom. Power	575 Wp
Number of PV modules	22624 units
Nominal (STC)	13.01 MWp
Modules	707 Strings x 32 In series

PV Array Characteristics

PV module
At operating cond. (50°C)

Pmpp	11.95 MWp
U mpp	969 V
I mpp	12334 A

Inverter

Manufacturer	TMEIC
Model	Solar Ware- PVU-L0840GR
(Custom parameters definition)	
Unit Nom. Power	840 kWac
Number of inverters	13 units
Total power	10920 kWac
Operating voltage	915-1300 V
Pnom ratio (DC:AC)	1.19

Total PV power

Nominal (STC)	13009 kWp
Total	22624 modules
Module area	64029 m²

Total inverter power

Total power	10920 kWac
Number of inverters	13 units
Pnom ratio	1.19

Array losses

Array Soiling Losses
Average loss Fraction 1.3 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1.5%	2.5%	1.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	2.5%

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 1.3 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation
Loss Fraction 1.0 %

Module Quality Loss
Loss Fraction -0.4 %

Module mismatch losses
Loss Fraction 0.8 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.45 %/year

Mismatch due to degradation
Imp RMS dispersion 0 %/year
Vmp RMS dispersion 0 %/year

IAM loss factor
Incidence effect (IAM): User defined profile

20°	40°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.990	0.960	0.920	0.840	0.720	0.000

System losses

Auxiliaries loss
Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage	630 Vac tri
Loss Fraction	0.04 % at STC
Inverter: Solar Ware- PVU-L0840GR	
Wire section (13 Inv.)	Copper 13 x 3 x 700 mm²
Average wires length	5 m

MV line up to HV Transfo

MV Voltage	34.5 kV
Average each inverter	
Wires	Copper 3 x 95 mm²
Length	6350 m
Loss Fraction	0.50 % at STC

HV line up to Injection

HV line voltage	138 kV
Wires	Copper 3 x 16 mm²
Length	1141 m
Loss Fraction	0.10 % at STC

AC losses in transformers

MV transfo

Medium voltage	34.5 kV
Operating losses at STC	
Nominal power at STC	12813 kVA
Iron loss (24/24 Connexion)	4.27 kW/Inv.
Loss Fraction	0.10 % at STC
Coils equivalent resistance	3 x 0.74 mΩ/inv.
Loss Fraction	0.80 % at STC

HV transfo

Grid voltage 138 kV

Transformer from Datasheets

Nominal power	15000 kVA
Iron loss	7.00 kVA
Loss Fraction	0.05 % of PNom
Copper loss	55.00 kVA
Loss Fraction	0.37 % of PNom

Operating losses at STC

Nominal power at STC	12813 kVA
Iron loss (24/24 Connexion)	7.00 kW
Loss Fraction	0.05 % at STC
Coils equivalent resistance	3 x 291.0 mΩ
Loss Fraction	0.31 % at STC

Horizon definition

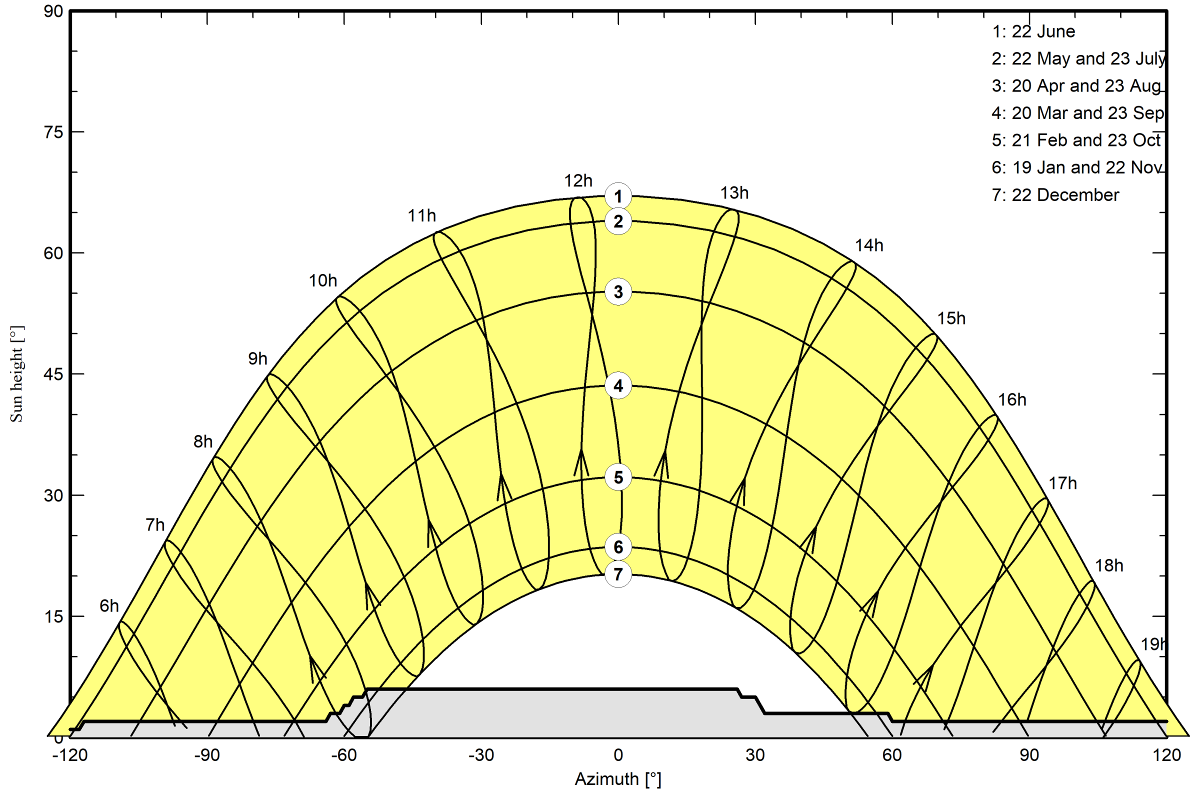
Horizon from Meteonorm web service, lat=46.3396, lon=-63.4083

Average Height	2.5 °	Albedo Factor	0.89
Diffuse Factor	0.97	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-121	-120	-118	-117	-64	-63	-61	-60	-59	-58	-56
Height [°]	0.0	0.0	1.0	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0
Azimuth [°]	-55	26	27	30	32	59	60	123	124	167	168	179
Height [°]	6.0	6.0	5.0	5.0	3.0	3.0	2.0	2.0	1.0	1.0	0.0	0.0

Sun Paths (Height / Azimuth diagram)

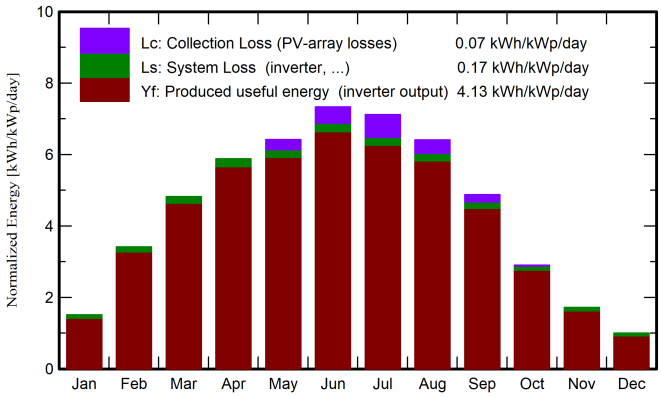


Main results

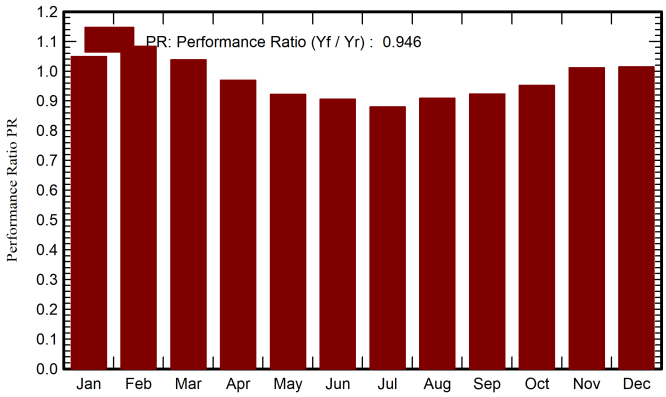
System Production

Produced Energy	20 GWh/year	Specific production	1506 kWh/kWp/year
Apparent energy	20673 MVAh	Performance Ratio PR	94.58 %

Normalized productions (per installed kWp)



Performance Ratio PR



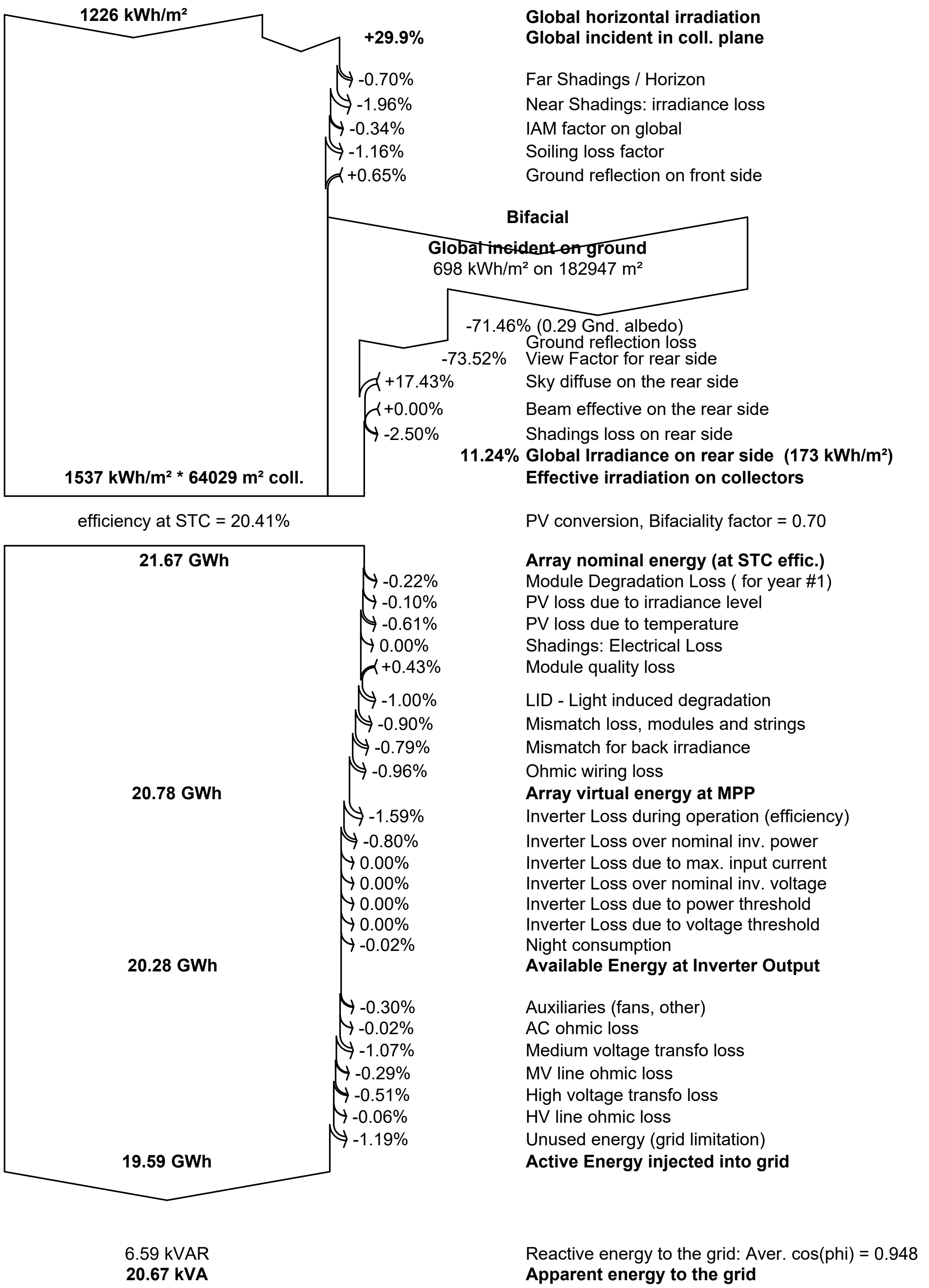
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray GWh	E_Grid GWh	PR ratio
January	32.0	17.71	-6.82	42.2	40.1	0.610	0.575	1.049
February	62.4	27.46	-6.83	84.8	81.4	1.245	1.195	1.084
March	102.7	43.95	-2.70	138.7	134.2	1.946	1.872	1.038
April	134.9	66.05	2.96	175.3	170.0	2.294	2.211	0.969
May	158.1	83.23	9.20	199.1	192.2	2.478	2.389	0.922
June	172.5	85.88	14.37	220.1	212.7	2.688	2.594	0.906
July	173.1	78.95	19.48	220.7	213.4	2.619	2.526	0.880
August	153.2	74.50	19.34	198.7	192.0	2.435	2.349	0.909
September	108.5	45.00	14.94	146.2	141.3	1.825	1.756	0.923
October	68.6	33.10	9.31	90.1	86.7	1.165	1.115	0.952
November	36.7	20.26	3.37	48.4	46.6	0.672	0.637	1.011
December	23.0	15.54	-2.53	28.3	26.4	0.403	0.374	1.015
Year	1225.8	591.63	6.25	1592.5	1537.0	20.380	19.593	0.946

Legends

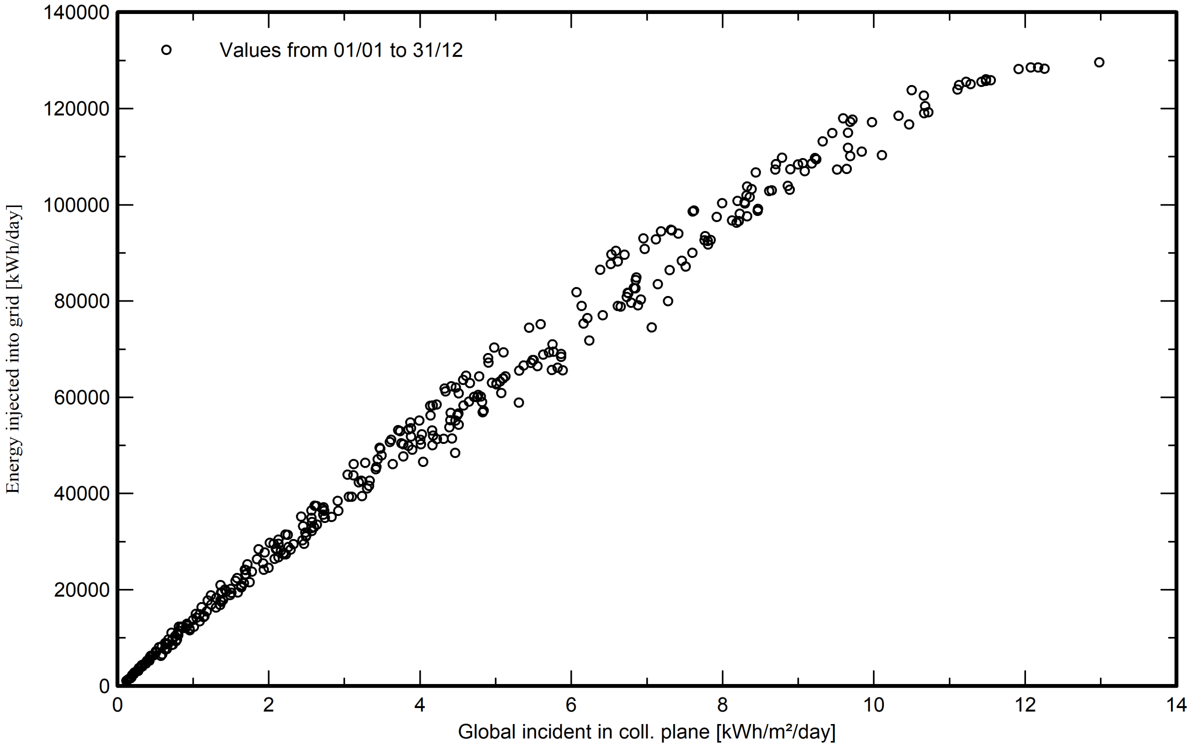
GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

Loss diagram

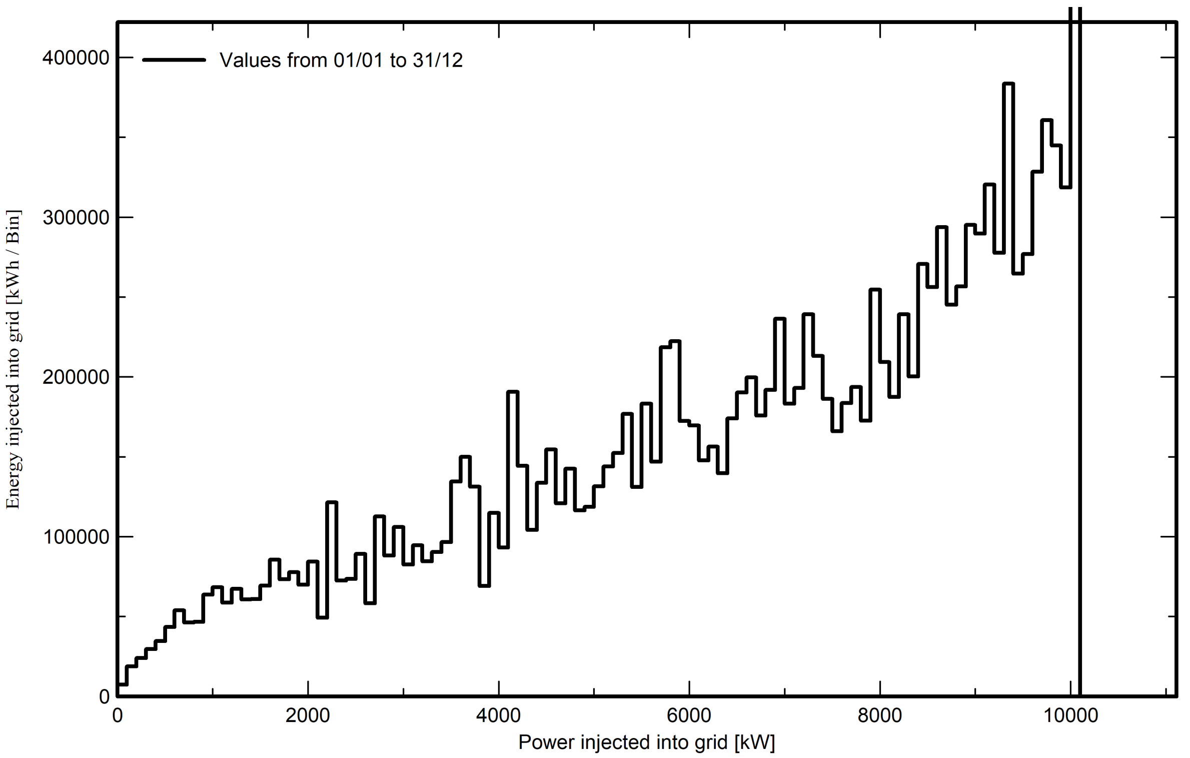


Special graphs

Daily Input/Output diagram



System Output Power Distribution



APPENDIX D

Sargent and Lundy Extreme Weather Event
Capacity Impact
Adddendum to Capacity Resource Study

July 21, 2023

RECEIVED
JUL 2 1 2023
The Island Regulatory and Appeals Commission

Island Regulatory and Appeals Commission
PO Box 577
Charlottetown PE C1A 7L1

Dear Commissioners:

Please find attached the Addendum to the December 2022 Maritime Electric Capacity Resource Study. The Addendum highlights the capacity impact of the February 3 to 5, 2023 extreme weather event. The purpose of the Addendum is to revisit and revise some of the recommendations made in the December 2022 report in light of the polar vortex that occurred in the Maritimes and Quebec.

The event highlighted that i) PEI is more susceptible to mainland electricity import interruptions or curtailments than originally assumed, and ii) Maritime Electric's peak load is higher than previously forecasted during the preparation of the December 2022 report.

Sargent & Lundy is of the opinion that the events that transpired on February 3 to 5, 2023 should serve as an early warning example of the challenges PEI faces with respect to potential electricity disruptions during extreme weather events. Also, regardless of whether global warming is found to increase the rate and/or severity of polar vortex disruptions in the future, extreme cold weather events already occur with sufficient regularity that proper planning of the electrical system is essential, especially when considering the growth of electric heating throughout the Maritimes.

The Addendum also provides previous examples of cold weather events contributing to the failure of electrical systems in Texas and Newfoundland where insufficient generation capacity, combined with both a peak load that surpassed the forecast and untimely system equipment failure, resulted in loss of life, major system disruptions and blackouts.

Fortunately, PEI was able to get through the events of February 3 to 5, 2023 without having to implement load shed due to electricity shortages. However, in many respects, PEI was in the most precarious position of any location within the entire region. This is because PEI does not have enough dispatchable capacity installed on-Island to fully meet peak load and thus required continuous imported electricity from New Brunswick in order to avoid load shed. While the wind generation installed on PEI is an excellent resource from the perspective of lowering carbon emissions, wind generation is not a dispatchable resource in an emergency.

This was evident during the extreme cold event as only 25 per cent of the turbines were operational at the time of peak load and the remainder were in forced or planned outage. PEI was fortunate that ISO New England, Newfoundland and Labrador, and Nova Scotia had small amounts of excess electricity to send to New Brunswick.

.../2

On May 15, 2023, NERC (North American Electric Reliability Corporation) released a Level 3 Essential Actions Alert titled Cold Weather Preparations for Extreme Weather Events III. Level 3 essential actions alert is the highest severity level that NERC issues and this is the first time a Level 3 essential actions alert has ever been issued by NERC. The assessments and recommendations from NERC illustrate that many parts of North America are at risk during extreme cold weather events. Among the locations facing the greatest challenges is Canada's Maritime Provinces region. For PEI, this is an indication that electricity imports from the mainland are not guaranteed during future extreme cold events.

Due to the shortage in dispatchable resources seen during the February 2023 event, Sargent & Lundy revised its previous recommendations to Maritime Electric of installing a minimum of 85 MW of new reciprocating internal combustion engine ("RICE")/combustion turbine ("CT") with biofuel compatibility to a higher range of 125 to 150 MW of the same technology. This recommendation is based on the Maritime Electric record peak load of 359 MW experienced on February 4, 2023. Sargent & Lundy continues to recommend the integration of both onshore wind and solar photo voltaic to help meet Maritime Electric's decarbonization goals but notes that these non-dispatchable resources may not be available to provide reliable generation during an emergency event as was experienced during the February 3-5, 2023. In addition, Sargent and Lundy continues to note that a new battery energy storage system ("BESS") demonstration project could help identify the BESS functions/use cases that offer the maximum benefit for the Island.

Yours truly,

MARITIME ELECTRIC

Angus S. Orford
Vice President, Corporate Planning
& Energy Supply

ASO04
Enclosure

Extreme Weather Event Capacity Impact

Addendum to December 2022 Maritime Electric Capacity Resource Study

Prepared for

Maritime Electric Company, Ltd.

Prepared by Sargent & Lundy

Report SL-017775

Final

July 12, 2023

Project 14782.002

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Sargent & Lundy

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ISSUE SUMMARY AND APPROVAL PAGE

This is to certify that this document has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

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Senior Vice President

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FIGURES AND TABLES

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition/Clarification
BESS	Battery energy storage system
CAD	Canadian dollars
CT	Combustion turbine
EEA	Energy Emergency Alert
ISO	International Organization for Standardization
kW	Kilowatt
kWh	Kilowatt hour
LIL	Labrador Island Link
Maritime Electric	Maritime Electric Company, Limited
MECL	Maritime Electric Company, Limited
MW	Megawatt
MWh	Megawatt hour
NERC	North American Electric Reliability Corporation
PEI	Prince Edward Island
RICE	Reciprocating internal combustion engines
S&L	Sargent & Lundy
WEICAN	Wind Energy Institute of Canada

EXECUTIVE SUMMARY

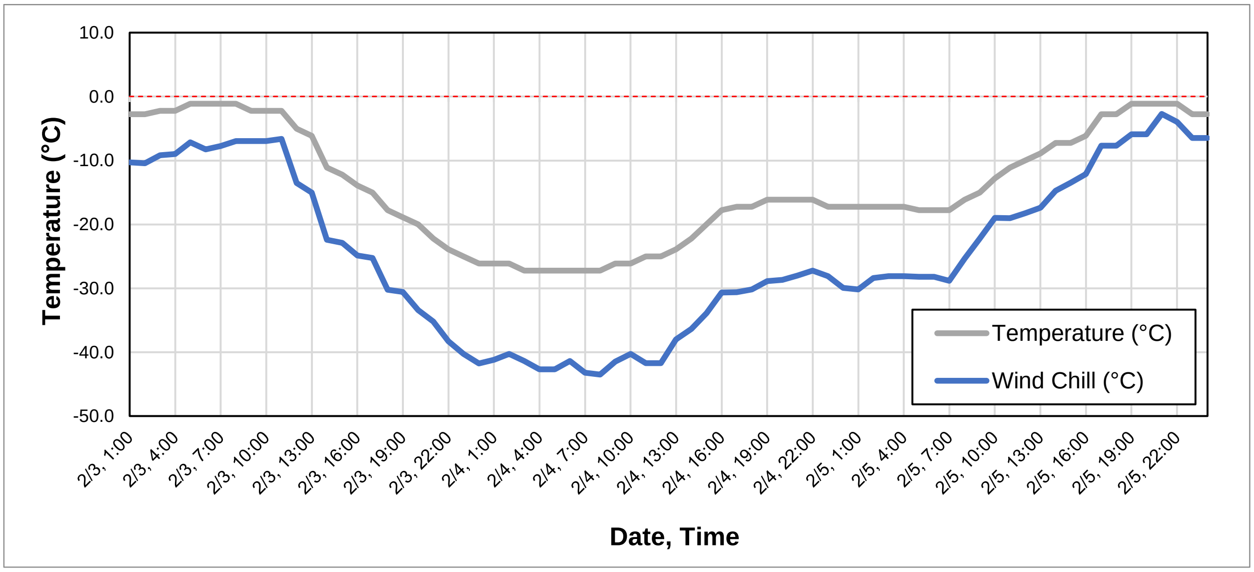
On December 9, 2022, Sargent & Lundy (S&L) issued a report titled *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company*, which included an evaluation of different electricity capacity resource technologies, cost estimates, and recommend technologies well suited to helping Maritime Electric Company, Limited (MECL) meet its goals and needs. MECL's most important goals include meeting capacity and energy obligations, improving its ability to serve load during interruptions in electricity, and achieving environmental sustainability targets. The report ultimately concluded that a portfolio of reciprocating internal combustion engines (RICE) / combustion turbines (CTs), onshore wind, and solar photovoltaic was best suited to help MECL meet these goals. Based on a review of MECL's forecasted peak load at the time the previous report was written, S&L originally recommended that a minimum of 85 MW of new RICE/CTs with biofuel compatibility should be installed on Prince Edward Island (PEI) as soon as possible to reduce the probability of load shedding and rolling blackouts in the event of electricity import limits and/or interruptions from the mainland. In addition, while S&L's report did not recommend a new battery energy storage system (BESS) as part of the recommended portfolio, S&L noted that a new BESS could provide some benefits for MECL and PEI. As a result, S&L's report suggested that a new BESS demonstration project could be pursued, potentially in coordination with interested PEI stakeholders, to better assess the BESS functions/use cases that offer the maximum benefit for the island.

The purpose of this addendum is to revisit and revise some of the recommendations made in the prior report based on the observations made during a recent extreme cold event that transpired in the Maritimes region between February 3 through 5, 2023. The recent event highlighted both that (1) PEI is more susceptible to mainland electricity import interruptions or curtailments than originally assumed and (2) MECL's peak load is higher than previously forecasted during the preparation of the prior report.

EXTREME COLD WEATHER EVENT ON FEBRUARY 3 TO 5, 2023

During the period between February 3 and 5, 2023, large areas of Eastern Canada and the Maritimes provinces experienced extreme cold, driven by the disrupted southward movement of the northern polar vortex. This caused wind temperatures and wind chills to drop to below -40°C, as shown in Figure ES-1.

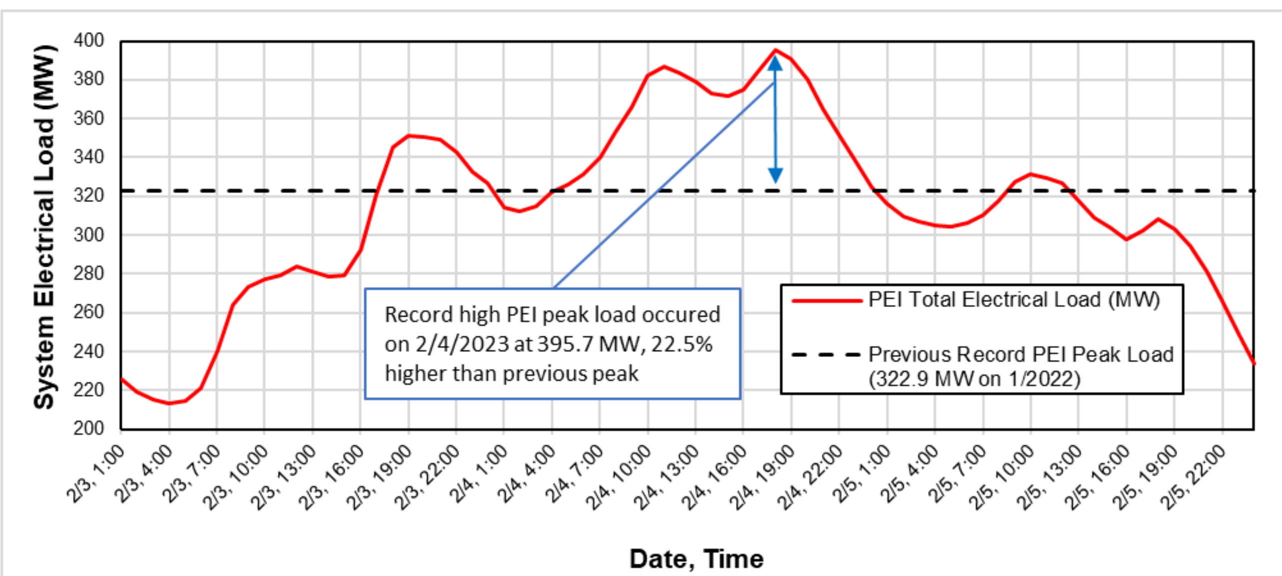
Figure ES-1 — Temperature and Wind Chill, Charlottetown (Feb. 3 to 5, 2023)



IMPACT TO PEI AND REGIONAL ELECTRICAL SYSTEMS

The extreme cold weather during February 3 to 5, 2023, caused record high demand for electricity on PEI and throughout Eastern Canada due to increased home heating load, commercial / industrial loads, and electrification. The high load resulted in significant stress on the electrical system, both locally and regionally. PEI experienced record electrical demand, with peak load for PEI soaring to 395.7 MW. This exceeded the previous load peak for PEI (set in 2022) by 22.5%.

Figure ES-2 — Electrical Load on PEI (Feb. 3 to 5, 2023)



This higher peak load experienced by PEI and in other parts of the Maritimes provinces, along with the stress the extreme weather had on other aspects of the electrical system (i.e., on generation and electrical equipment performance), resulted in a significant impact to grid operations and overall system reliability. The system's total hourly dispatch through the extreme cold event, in addition the wind generation through the event, are shown in Figure ES-3 and Figure ES-4. Given there is only enough dispatchable generation installed on PEI to meet a fraction (approximately 20%) of the peak electrical load experienced on PEI during the event, significant electricity imports from New Brunswick were required to meet PEI's electricity demand during the event. New Brunswick was able to provide imports with minimal curtailment; however, margins in New Brunswick were also very thin—to the point where New Brunswick had to declare an Energy Emergency Alert Level 2, which indicates that it was at serious risk of being unable to meet its firm load requirements (discussed further below). In addition, during the event the wind generation on PEI dropped significantly due to both the cold temperatures and high wind speeds resulting in equipment failures/shutdowns. PEI's relatively small amount of on-island dispatchable generation was dispatched without issue during the event.

Figure ES-3 — PEI Generation by Source (Feb. 3 to 5, 2023)

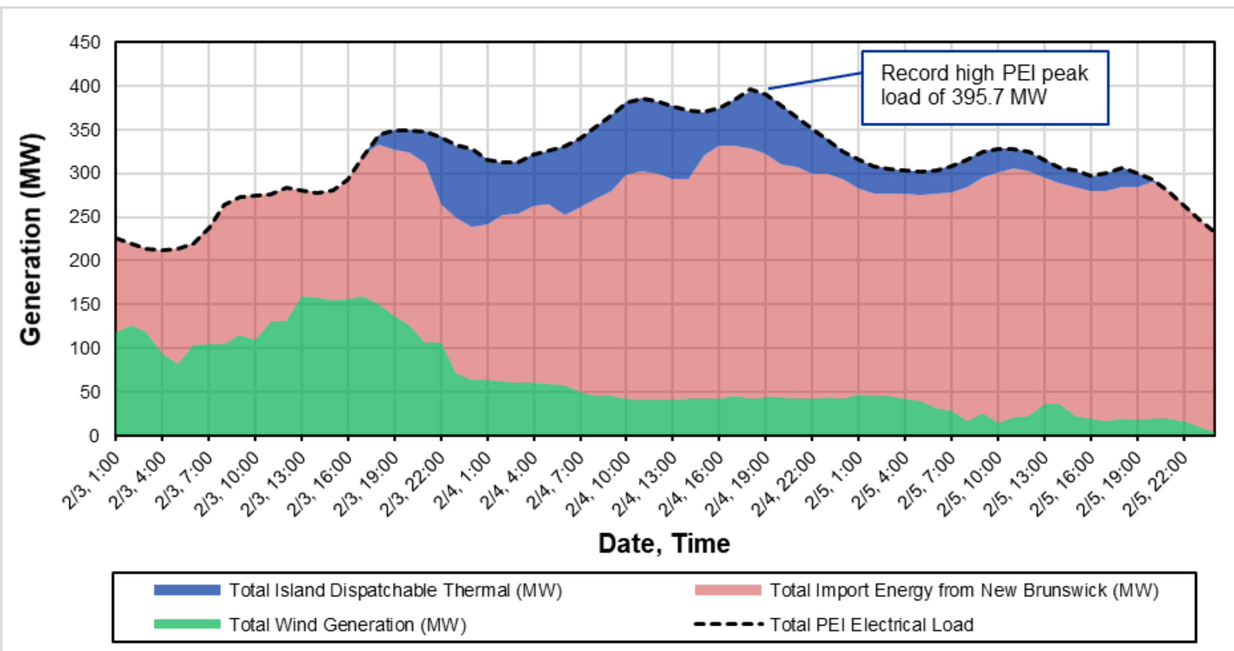
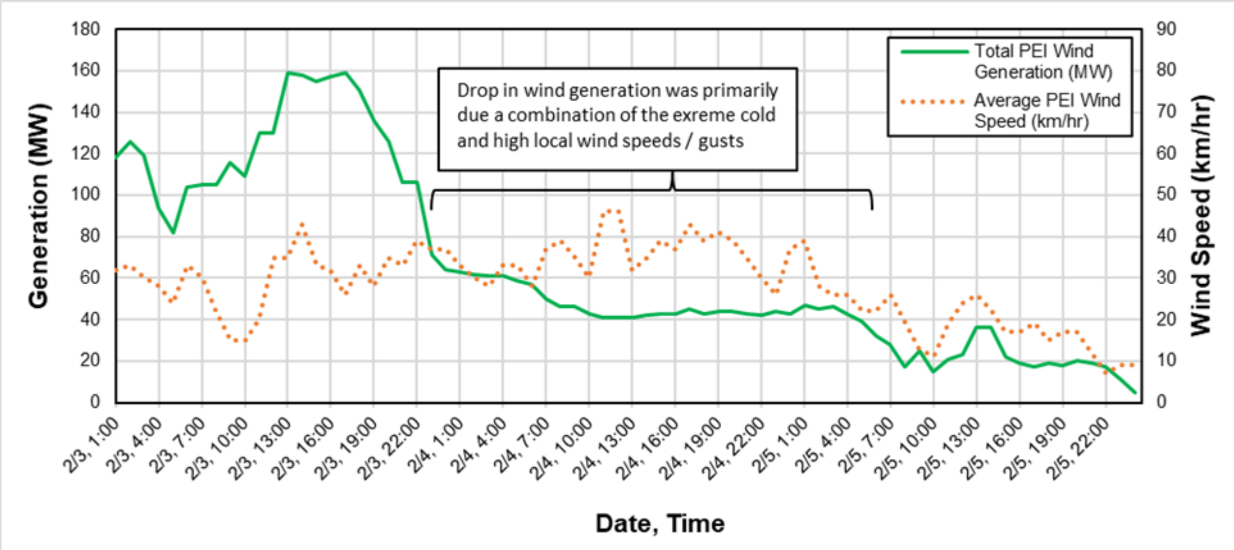
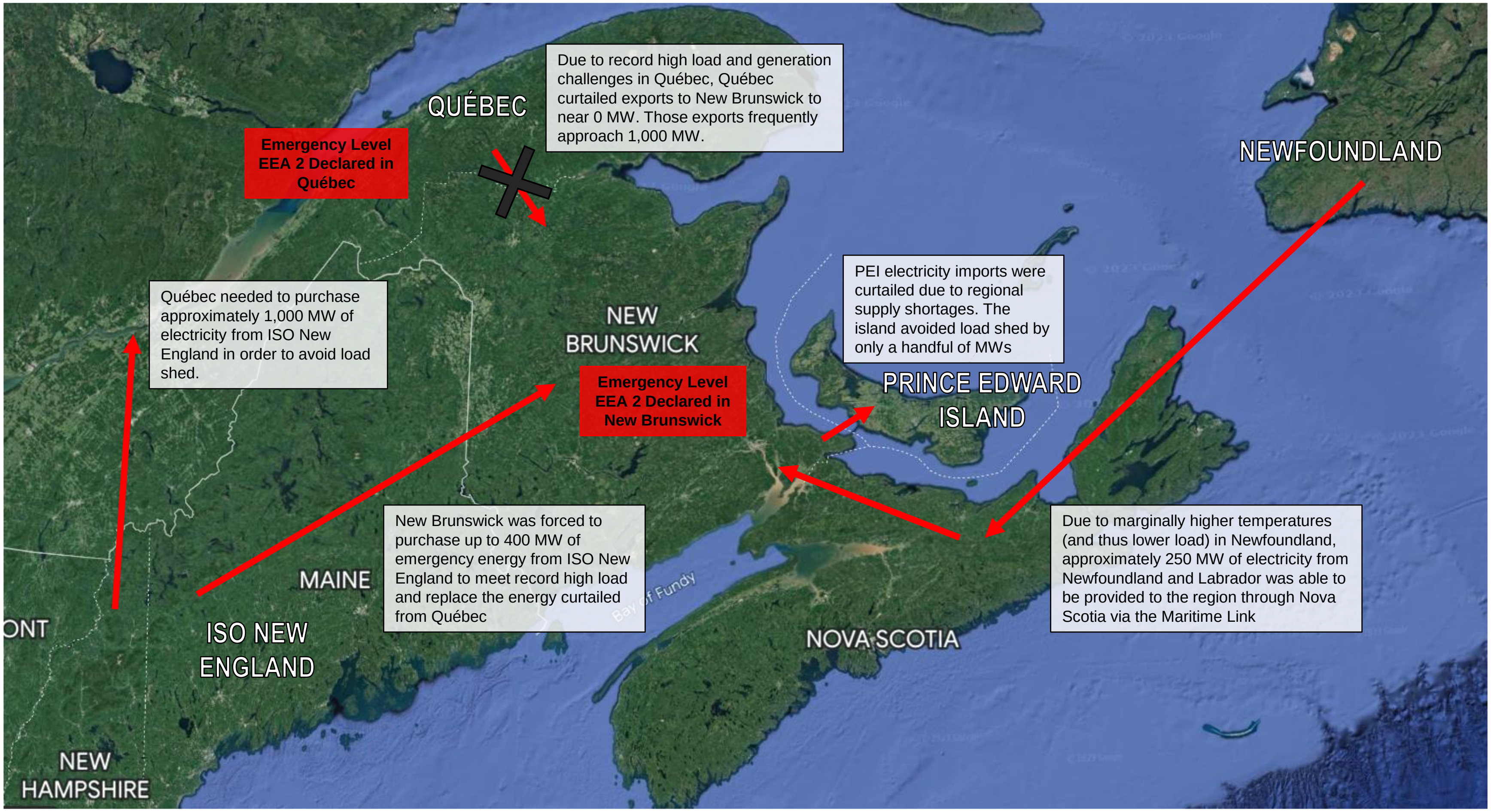


Figure ES-4 — PEI Wind Generation and Wind Speed (Feb. 3 to 5, 2023)



The extreme cold weather event severely strained the broader Maritimes regional electric system to the point where load shedding was a significant risk. Figure ES-5 summarizes the regional shortfalls, key electricity import/exports, and declared emergencies during the event. The provinces of Québec, Newfoundland and Labrador, Nova Scotia, and New Brunswick were all significantly impacted. Québec had to declare an Energy Emergency Alert Level 2 emergency and both (1) completely curtailed electricity exports to New Brunswick and (2) purchased emergency energy from New England, New York, and Ontario. As a result of the drop in electricity imports from Québec, in addition to record high peak electrical load, the New Brunswick electrical system was also pushed to emergency levels. Several factors, including electricity imports from ISO New England and Newfoundland and Labrador (through Nova Scotia), helped New Brunswick to avoid load shed. Had these imports not been available, it is likely that New Brunswick would have had to more significantly curtail electricity exports to PEI, which would likely have resulted in load shed on PEI during some of the coldest parts of the extreme cold event.

Figure ES-5 — Regional Recap, Evening February 3, Morning February 4, 2023



SIMILAR RECENT EVENTS AND INDUSTRY GUIDANCE

The extreme cold weather event that hit Eastern Canada on February 3 to 5, 2023, had many similarities to other recent events that also resulted in excessive strain on electric systems. The most notable recent event took place in 2021, when extreme cold from the North Pole pushed southward into the United States, all the way into Texas. In Texas, the cold also resulted in very high demand for electricity, disruptions to generators and the supply of natural gas, widespread power outages, and water shortages. The crisis led to billions in dollars of damage and the deaths of 246 people, two-thirds of which died from hypothermia.[2]

Given the stress recent extreme cold weather events have put on electrical systems, the North American Electric Reliability Corporation (NERC) has released a set of planning guidelines and recommendations regarding extreme cold weather events to come. For example, in November 2022, NERC released its *2022-2023 Winter Reliability Assessment,*[3] which highlighted that "some areas [of the bulk power system] are highly vulnerable to extreme and prolonged cold weather and may require load-shedding procedures to maintain reliability." The guideline notes that during extreme cold events, the Maritimes region is likely to have the second lowest electrical system reserve margins of all the electrical systems NERC oversees (see Figure ES-6 taken from the NERC guideline). Only Texas is estimated to have lower reserve margins. For PEI, this is an indication that electricity imports from the mainland to PEI are not guaranteed during future extreme cold events. Note that the reason for the estimated tight reserve margins in the Maritimes region is electrical load growth, which is driven by the rapid transition of buildings to electrical heating (and electrification in general) and commercial / industrial load.

In addition, on May 15, 2023, NERC released a Level 3 Essential Actions Alert titled *Cold Weather Preparations for Extreme Weather Events III.*[4] The alert was issued to "increase the Reliability Coordinators' (RC), Balancing Authorities' (BA), Transmission Operators' (TOP), and Generator Owners' (GO) readiness and enhance plans for, and progress toward, mitigating risk for the upcoming winter and beyond." For reference, a Level 3 Essential Actions Alert is the <u>highest</u> severity level that NERC issues and this is the <u>first time</u> a Level 3 Essential Actions Alert has ever been issued by NERC.

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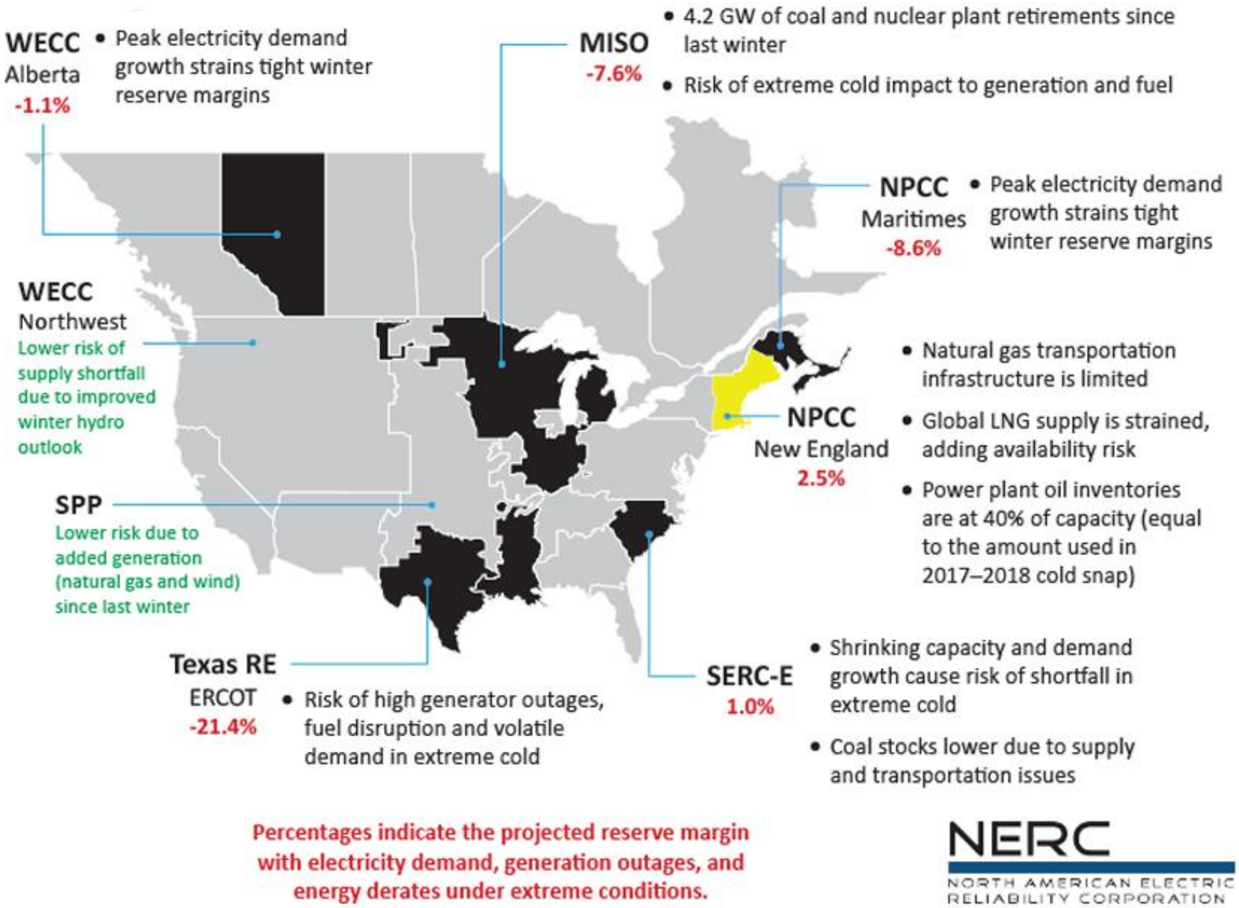
[2] https://www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246/
[3] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2022.pdf
[4]https://www.nerc.com/news/Pages/NERC-Releases-Essential-Action-Alert-Focused-on-Cold-Weather-Preparations.aspx

Figure ES-6 — NERC Reliability Assessment for Extreme Cold Events[5]



UPDATED RECOMMENDATIONS FOR MECL

Due to the shortage in dependable resources seen during the February 2023 event, S&L has revised its previous recommendation to MECL of installing a minimum of 85 MW of new RICE/CTs with biofuel compatibility to a higher range of 125 to 150 MW of the same technology. This recommendation is based on the record peak load of 395.7 MW experienced on February 4, 2023. S&L continues to recommend the integration of both onshore wind and solar photovoltaic to help meet MECL's decarbonization goals but notes that these non-dispatchable resources may not be able to provide reliable generation during an emergency event (as was observed during the event between February 3 and 5, 2023). In addition, S&L continues to note that a new BESS demonstration project could help identify the BESS functions/use cases that offer the maximum benefit for the island. As is shown in Figure ES-7, an additional 125 to 150 MW of dispatchable capacity (RICE/CTs) would help to keep the ratio of dispatchable capacity to system peak

[5] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2022.pdf

load, and thus risk of future load shed in the event of mainland electricity import shortages, near consistent with historical levels.

Figure ES-7 — Outlook of Dispatchable On-Island Capacity versus Peak Load

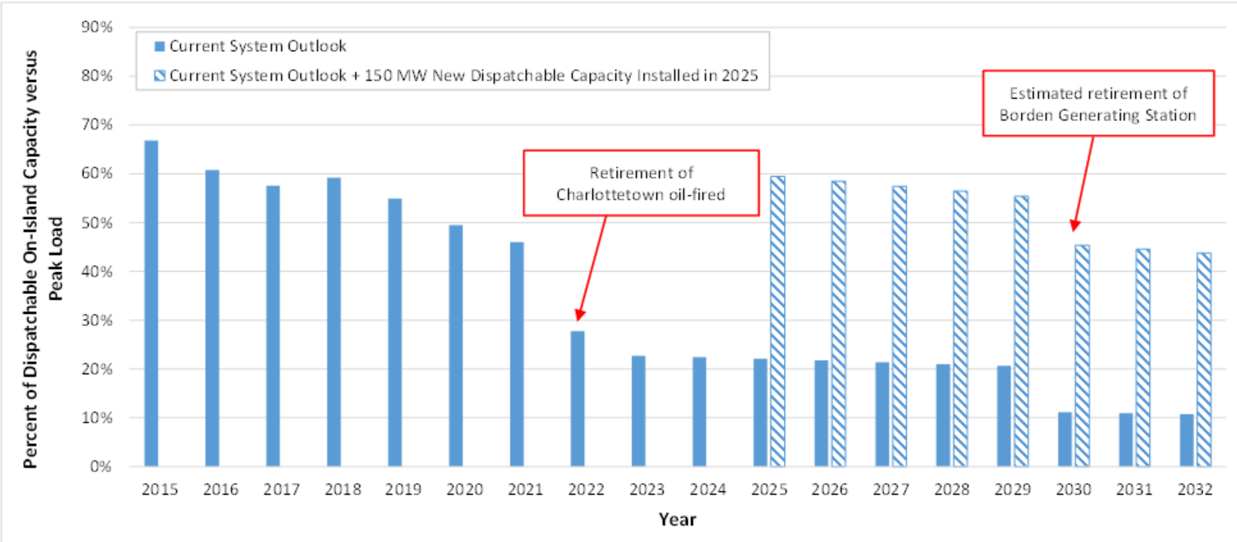


Table ES-1 summarizes the key operating details and levelized costs for CT and RICE options. A more detailed estimate of the CT design is included in Appendix A with the RICE details included in the previous report. Note the manufacturer and type of CT/RICE unit are chosen for comparison purposes only—many other manufacturers make similar units.

Table ES-1 — Estimated Costs for New CTs/RICE

Title	CT – Aeroderivative		RICE	
	GE LM6000 PF+ SPRINT		Wartsila 20V32	
Fuel Type	Diesel Only	Biodiesel Compatible	Diesel Only	Biodiesel Compatible
Winter Output (MW)	57.1 per turbine	57.1 per turbine	10.6 per engine	9.4 per engine
Net Heat Rate (Btu/kWh)	9,000	9,500	8,400	8,400
Levelized Install Cost (CAD/kW)	1,744	1,817	1,845	2,074
Synchronous Condenser Cost	Included	Included	Not included	Not included

There is also a need on PEI for additional electrical system support to maintain voltage levels and system stability, which is an ongoing challenge on PEI as additional wind generation is added to the electrical system. The 2020 MECL Integrated System Plan noted that after island load exceeds 350 MW, additional system voltage support (i.e., a synchronous condenser) will be needed on PEI[6]. Previous forecasts of island load estimated that levels higher than 350 MW would not be reached for a number of years; however, given PEI's load nearly reached 400 MW on February 4, 2023, additional system voltage support is needed today. For reference, both RICE and CTs can operate as synchronous condensers, which would help to improve the system's electrical performance; however, CTs are much more commonly used as synchronous condensers than RICE in the electricity industry. As a result, S&L recommends MECL pursue CTs over RICE if it is determined that a unit with synchronous condenser capability is required.

Finally, due to the unavailability of many of the wind generators on PEI during the February 3 to 5, 2023, event (as a result of equipment shutdowns caused by both the extreme cold and strong/turbulent winds), S&L recommends further information sharing and/or a technical conference, between MECL, the wind operators, and the wind generator original equipment manufacturers to fully understand what transpired and find solutions to prevent a repeat of the challenges experienced between February 3 and 5, 2023.

[6] Maritime Electric 2020 Integrated System Plan, page 44 and 47

1. INTRODUCTION AND EVENT DESCRIPTION

On December 9, 2022, Sargent & Lundy (S&L) issued the *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company,* report number SL-017203. The report was developed for the purposes of evaluating a variety of different electricity capacity resource technologies, developing cost estimates, and recommending technologies well suited to help Maritime Electric Company, Limited ("MECL" or "Maritime Electric") cost-effectively achieve its most critical goals and needs, which are described as follows:

1. Meet both its capacity and energy obligations
2. Improve its ability to serve load during interruptions and/or curtailments in electricity imported from the mainland
3. Achieve sustainability targets

The report ultimately concluded that a portfolio of reciprocating internal combustion engines (RICE) / combustion turbines (CTs), onshore wind, and solar photovoltaic was best suited to help Maritime Electric meet these goals and needs. Based on a review of Maritime Electric's forecasted peak load at the time the report was written, S&L originally recommended that a minimum of 85 MW of new RICE/CTs with biofuel compatibility should be installed on Prince Edward Island (PEI) as soon as possible to reduce the probability of load shedding and rolling blackouts in the event of electricity import limits and/or interruptions from the mainland. Since the PEI system is winter peaking (i.e., the highest annual electricity demand occurs in the winter due to the demands of electric heating), in addition to the fact that winter in the Maritimes region can be particularly harsh, any load shed or rolling blackout events on PEI in the winter could have serious consequences both in terms of property damage and resident safety.

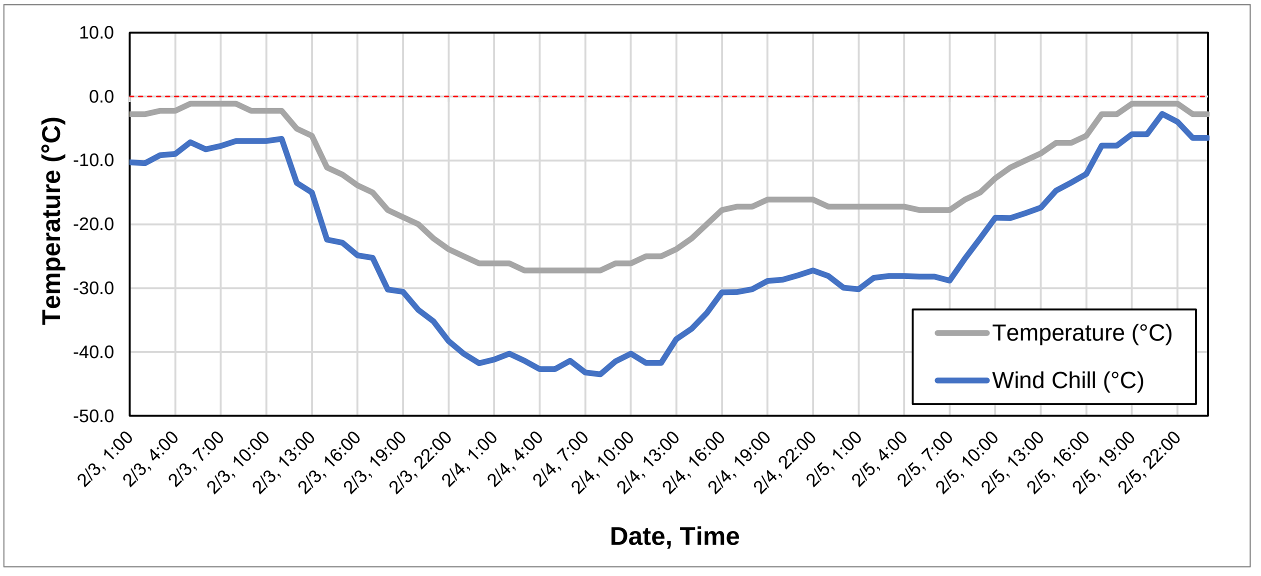
In addition, while S&L's report did not recommend a new battery energy storage system (BESS) as part of the recommended portfolio, S&L noted that a new BESS could provide some benefits for MECL and PEI. As a result, S&L's report suggested that a new BESS demonstration project could be pursued, potentially in coordination with interested PEI stakeholders, to better assess the BESS functions/use cases that offer the maximum benefit for the island.

The purpose of this addendum is to revisit and revise some of the recommendations made in the prior report based on the observations made during a recent extreme cold event that transpired in the Maritimes region between February 3 through 5, 2023. The recent event highlighted both that (1) PEI is more susceptible to mainland electricity import interruptions or curtailments than originally estimated when the prior report was written and (2) Maritime Electric's peak load is higher than what was previously forecasted. S&L is of the opinion that the events that transpired on February 3 to 5, 2023, should serve as an early warning example of the challenges PEI faces with respect to potential electricity disruptions during future extreme weather events.

1.1. EXTREME COLD WEATHER BETWEEN FEBRUARY 3 AND 5, 2023

During the period between February 3 and 5, 2023, large areas across Eastern Canada and the Maritimes provinces experienced extreme cold. Figure 1-1 illustrates the temperature and wind chill experienced in Charlottetown, PEI, between February 3 and 5, 2023. During the event, temperatures and wind chill values dipped significantly, with wind chill values falling to under -40°C. The high winds experienced across Eastern Canada and the Maritimes provinces drove the very low wind chill values, which also resulted in record electrical demand (as is shown in Figure 2-1) as residents heated their homes.

Figure 1-1 — Temperature and Wind Chill, Charlottetown (Feb. 3 to 5, 2023)[7,8]



1.1.1. Extreme Cold and the Atmospheric Polar Vortex

The extreme cold in Eastern Canada that occurred between February 3 and 5, 2023, was the result of a disrupted polar vortex, which resulted in extremely cold air over the North Pole migrating southward. For reference, the polar vortex is a circulating mass of frigid air that is typically centered over the Earth's poles, held in place by strong jet stream air currents. In the event the jet stream air currents holding the frigid air over the Earth's poles weaken or fluctuate, the polar vortex can become disrupted and migrate towards the equator. Figure 1-2 helps to illustrate both stable and disrupted polar vortex atmospheric conditions.

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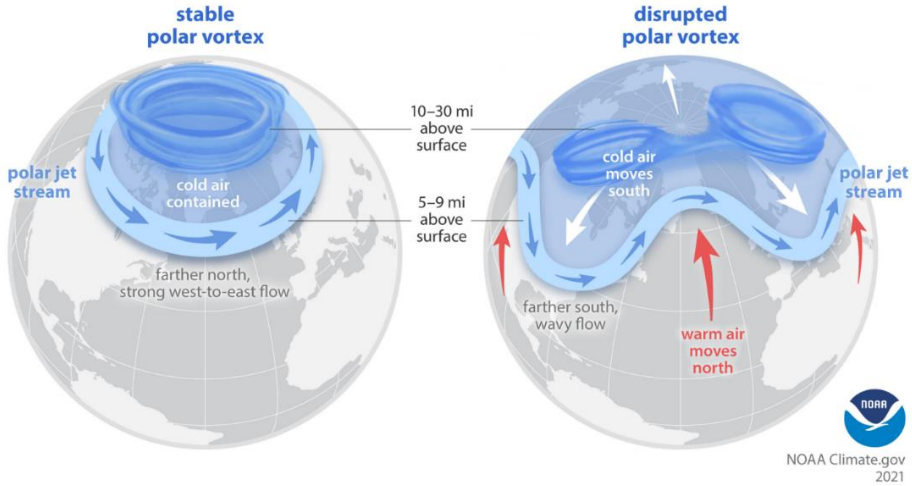
[7] https://www.wunderground.com/history/daily/ca/charlottetown/CYYG/date/2023-2-3
[8] https://www.wpc.ncep.noaa.gov/html/windchill.shtml

Figure 1-2 — Polar Vortex Illustration[9]



As a result of the overall warming trend of the Earth, there is significant research ongoing by atmospheric and climate scientists as to whether more frequent and/or pronounced disruptions in the polar vortex will occur in the future, which could result in more extreme cold temperatures at southern latitudes during winter months. Some evidence suggests that frequent disruptions could be expected in the future. In S&L's opinion, regardless of whether global warming is found to increase the rate and/or severity of polar vortex disruptions in the future, extreme cold weather events already occur with sufficient regularity that proper planning and cold weather hardening of the electrical system is essential, especially when considering the growth of electric heating throughout the Maritimes region and Canada.

Listed below are notable recent extreme cold weather events for illustrative purposes. As can be seen, these events occur regularly.

- February 2023: The most recent extreme cold weather event and the subject of this report.
- December 2022: During the end of 2022, storms and a cold weather snap gripped much of North America, resulting in many record low temperatures across the continent and power outages across Canada and the United States.
- February 2021: This extreme cold event resulted in significant damage and loss of life across North America, with the state of Texas' electrical system suffering from widespread outages. This recent event, specifically what transpired in Texas, is discussed in detail in the following subsection.
- January 2019: This significant cold weather event struck Canada bringing both record snowfalls and cold weather to many provinces. Wind chills in parts of Ontario (both Toronto and Windsor), Manitoba, Saskatchewan, Alberta, and British Columbia approached -40°C during this event. Extreme cold temperatures also stretched into the United States, with the state of Michigan declaring

[9] https://www.climate.gov/news-features/understanding-climate/understanding-arctic-polar-vortex

a state of emergency due to the record cold temperatures and wind chills in the city of Chicago, Illinois, dropping to nearly -50°C.

- January 2014: Extreme cold weather and winter storms hit much of Eastern Canada and the United States, resulting in significant damage. High electrical demand as a result of the low temperatures, in addition to electrical equipment failures, resulted in the collapse of the electrical system in Newfoundland, where many residents were left without power for days. This event is described further in the following subsection.

1.2. ELECTRICAL SYSTEM FAILURES FROM EXTREME WEATHER

As is further described in Sections 2 and 3, the extreme cold weather event experienced in the Maritimes region between February 3 to 5, 2023, very nearly resulted in significant load shed across Eastern Canada, including on PEI. Two previous events where cold weather contributed to the failure of electrical systems are described below.

1.2.1. 2021 Texas Electrical System Failure

The 2021 Texas electrical system failure occurred as a result of a severe winter weather polar vortex event that pushed south into Texas for several days in February 2021, resulting in widespread power outages, water shortages, and other disruptions. The crisis was caused by a combination of factors, including extreme cold temperatures, high demand for electricity, insufficient electrical equipment winterization, and disruptions in the supply of natural gas.

Temperatures in the state dropped to a low of -19°C during the event,[10] which was the coldest temperature reached in over seven decades in some parts of the state, and the freezing temperatures lasted for up to eight days in some areas. The event had a significant impact on the state's electric grid, which is managed by the Electric Reliability Council of Texas. The extreme cold caused a surge in demand for electricity as people tried to keep their homes warm, while at the same time the extreme cold resulted in many power plants and natural gas facilities failing to operate. Much of the electrical and natural gas equipment in Texas was not winterized sufficiently, which resulted in frozen wind turbines, mechanical failures at natural gas plants, as well as fuel supply shortages, all of which crippled the generation capacity of the Electric Reliability Council of Texas.

The effects were far-reaching and profound. Approximately 4.5 million homes and businesses were left without power.[11,12] Many Texans were without power for days, and some were forced to resort to unsafe

[10] https://www.dallasnews.com/news/weather/2021/02/16/thousands-still-without-power-as-north-texas-reaches-record-low-temperature/
[11] https://www.nbcnews.com/news/weather/knocked-out-texas-millions-face-record-lows-without-power-new-n1257964
[12] https://time.com/5940232/millions-without-power-texas/

methods to stay warm—approximately 246 people lost their lives during the event, of which two-thirds died from hypothermia.[13] The freezing temperatures also caused water pipes to burst, leading to water shortages in some areas. Some residents had to boil water or rely on bottled water for drinking and cooking. It is estimated that the event caused nearly $200 billion in damage.[14]

While PEI did not experience load shed during the recent February 3 to 5, 2023, extreme cold event, PEI came extremely close to being unable to meet load; thus, it is instructive to consider the many parallels between Texas and PEI, highlighted below.

- The Texas's power grid (Electric Reliability Council of Texas) is designed to operate independently from the rest of the grid in the United States, effectively making the Electric Reliability Council of Texas an "island" that has very limited access to additional generating resources from other states in the United States during times of crisis. This resulted in Texas being unable to import emergency power from its neighbors during the 2021 polar vortex event. Because PEI is an island with both (1) a limited interconnection to the mainland (via New Brunswick) and (2) an insufficient amount of dispatchable on-island generating capacity to fully meet its own electrical load, PEI nearly was unable to fully meet electrical demand during the cold weather event between February 3 and 5, 2023. As is further described in Sections 2 and 3, PEI's mainland neighbors were nearly unable to meet their own load; thus, there was a significant risk that New Brunswick would have been forced to curtail electricity exports to PEI between February 3 and 5, 2023.
- The high demand for electricity in both Texas and recently on PEI (see Section 2) during the cold events was driven primarily by home heating, highlighting the need to plan for higher winter demand as in-home electric heating demand increases.
- Texas experienced the shutdown of many wind generators due to the freezing temperatures, stressing a need to further examine potential weatherization solutions to prevent turbines from freezing in future. As is discussed in Section 2, PEI also experienced a similar drop in wind turbine generation during the recent extreme cold event between February 3 and 5, 2023.

1.2.2. 2014 Newfoundland System Outages

During the period of January 2 to 8, 2014, Newfoundland experienced significant power outages following a winter storm and associated very cold weather. Investigations on the cause of the outages determined that they stemmed from two primary reasons:[15]

- An insufficiency of generating resources to meet customer demand
- A series of untimely system disruptions (electrical equipment failure, etc.)

[13] https://www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246/
[14] https://www.austintexas.gov/sites/default/files/files/HSEM/2021-Winter-Storm-Uri-AAR-Findings-Report.pdf
[15] http://www.pub.nf.ca/applications/IslandInterconnectedSystem/index.htm, Liberty Report - addressing Newfoundland and Labrador Hydro

During the event, the shortages in available generation required the province's utility to implement unprecedented rotating power outages. At the height of the event, nearly 200,000 customers in total were without power,[16] with some areas remaining in the dark for several days. The outages also affected critical infrastructure such as hospitals and water treatment facilities, leading to concerns about public health and safety. The storm also resulted in damage to power lines on the island, which further contributed to outages in Newfoundland. Thankfully, despite the severity of the storm and the cold temperatures, there were no deaths or serious injuries reported as a result of the power outages.

The assessment of the event showed that insufficient generation capacity, combined with both a peak load that surpassed the forecast and untimely system equipment failure, resulted in major system disruptions and blackouts. PEI is in a similar position to Newfoundland due to the fact that both islands have limited interconnections to neighbors. In addition, similar to Newfoundland, PEI is unable to fully meet its own electrical load with dispatchable on-island generation. As a result, it is not unlikely that the events that transpired between January 2 to 8, 2014, on Newfoundland could occur on PEI.

[16]https://www.theglobeandmail.com/news/national/newfoundland-closes-schools-as-power-outage-enters-fourth-day/article16203471/

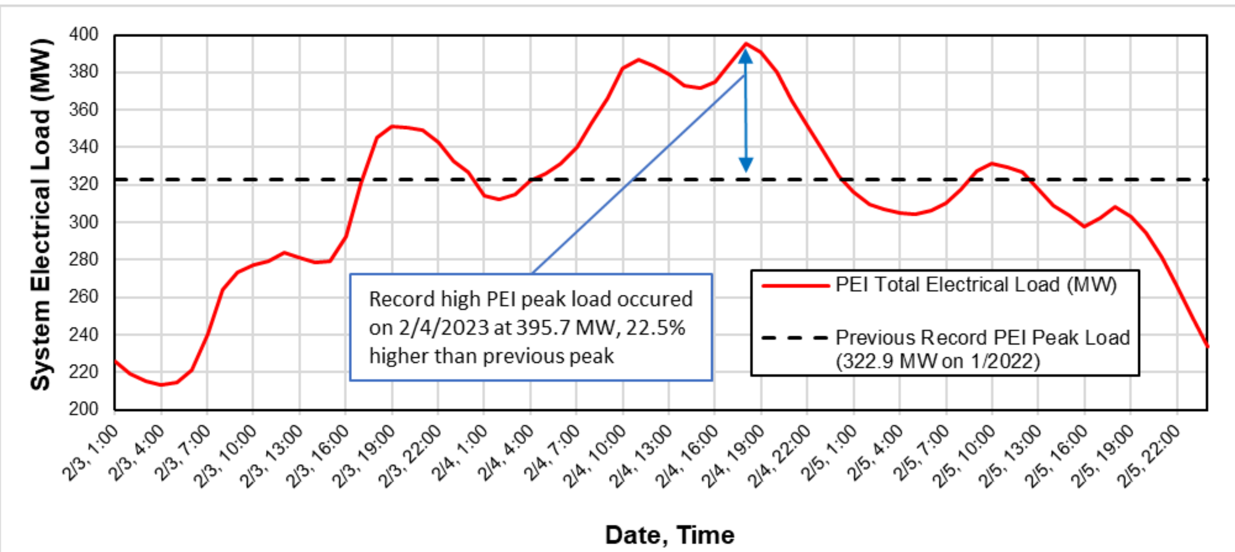
2. ELECTRICAL SYSTEM IMPACT – PEI

The extreme cold that hit Eastern Canada between February 3 and 5, 2023, resulted in a significant amount of stress on the electrical system both on PEI and throughout Eastern Canada in terms of high system load, generation disruptions, electricity import limitations, and load shed. This section focuses on the impacts to PEI, followed by a more general assessment of what transpired at the regional level in Section 3.

2.1. SYSTEM ELECTRICAL LOAD

The extreme cold weather experienced on PEI drove system electricity consumption levels to all-time records due to extremely high demand for electricity to heat homes and other buildings. Both PEI and MECL experienced record peak electrical load. Peak load for PEI soared to 395.7 MW (average between hours ending 17:00 and 18:00 on February 4, 2023, 399.2 MW instantaneously) and peak load for MECL hit a record high of 357 MW. Figure 2-1 illustrates the electrical load profile for PEI between February 3 and 5, 2023. As can be observed in Figure 2-1, the peak load experienced on February 4, 2023, was 22.5% higher than the previous peak set in January 2022.[17]

Figure 2-1 — Electrical Load on PEI (Feb. 3 to 5, 2023)



In the *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company* issued by S&L on December 9, 2022, the electrical load that MECL serves was expected to increase in the coming years; however, peak load levels were not expected to rise to the levels experienced by MECL between February 3 and 5, 2023, for several years. As such, the recommendation for dispatchable capacity

[17] The previous peak load for PEI was 322.9 MW experienced between the hours of 17:00 and 18:00 on January 11, 2022.

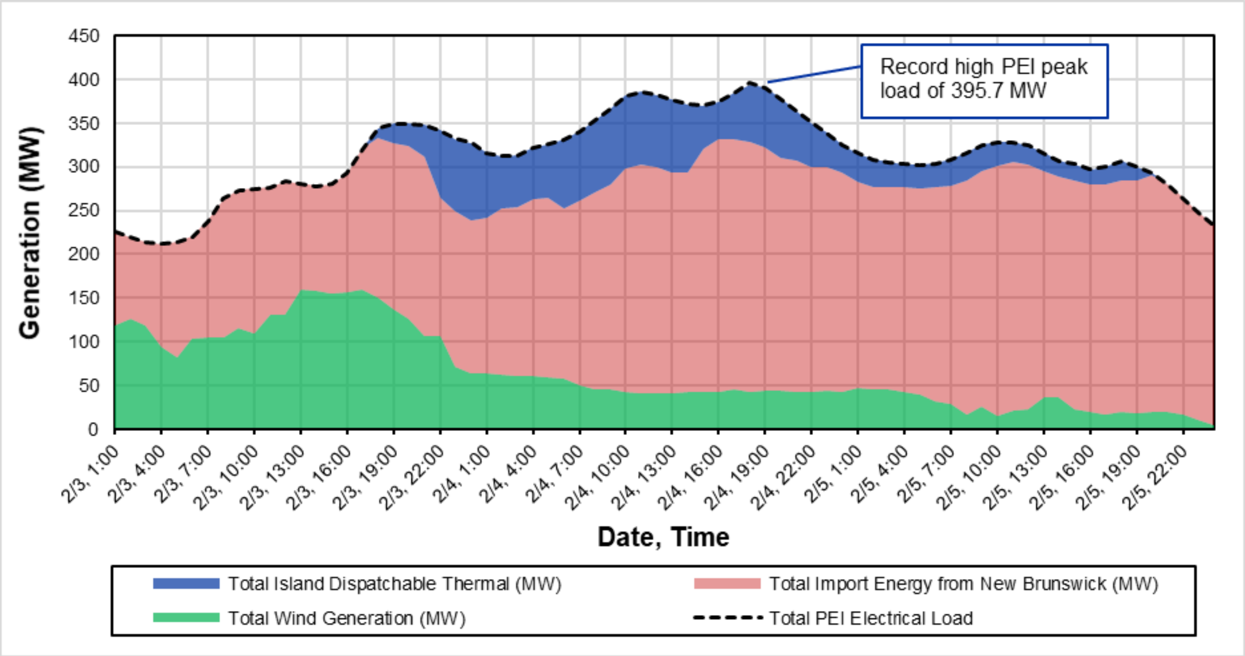
that MECL should install in the near future has been revised upward from the previous recommendation of 85 MW to a range of 125 to 150 MW, depending on the peak load forecast. A further discussion of this recommendation is provided in Section 5.1.

2.2. SYSTEM DISPATCH

Figure 2-2 illustrates total system dispatch by source during the period from February 3 through February 5, 2023. As is illustrated in Figure 2-2, electrical load on PEI was primarily met via imports from New Brunswick during the event. Wind generation was initially high on February 3, 2023; however, wind generation fell significantly throughout the event due to the extreme cold and high wind speeds experienced. Since the contract with New Brunswick is for a maximum of 300 MW, MECL chose to operate its dispatchable thermal generation installed on PEI to stay under this limit or risk curtailments from New Brunswick (New Brunswick did have to partially curtail imports to PEI by 50 MW on the evening of February 3, 2023). MECL's CTs also provided additional benefits such as voltage control and transformer offloading that enabled higher grid stability during this time. The peak imported power from New Brunswick was approximately 290 MW on February 4, 2023, at approximately 16:00.

As is discussed further in Section 3.3, due to the challenges of operating its own system through the extreme cold temperatures, there was a significantly high risk that New Brunswick was not going to be able to export any electricity to PEI. The fact that New Brunswick was able to provide PEI with between 200 and 300 MW of imports through the event (with minimal curtailments of 50 MW) was very fortunate and saved PEI from having to shed firm load. It is also worth noting that PEI's peak occurred during the evening of February 4, 2023, while some of the other provinces had peaks that occurred earlier in the day. Thus, it is a reasonable conclusion that if PEI had a coincident peak with the other provinces, New Brunswick may not have been able to provide PEI with this critical imported power.

Figure 2-2 — PEI Generation by Source (Feb. 3 to 5, 2023)



2.2.1. Generator Performance During Event

2.2.1.1. Wind Generation

As the extremely cold temperatures hit PEI between the evening of February 3, 2023, and the morning of February 4, 2023, there was a subsequent sharp drop in wind generation. Going into the evening of February 3, 2023, it was reported that approximately 80% of the individual wind turbines on PEI were operational. By February 5, 2023, only about 25% of the individual wind turbines on PEI were operational (i.e., 75% were in forced or planned outage). Figure 2-3 and Figure 2-4 illustrate the historical PEI wind generation along with wind speed and ambient temperature during the cold weather event.

Figure 2-3 — PEI Wind Generation and Wind Speed (Feb. 3 to 5, 2023)

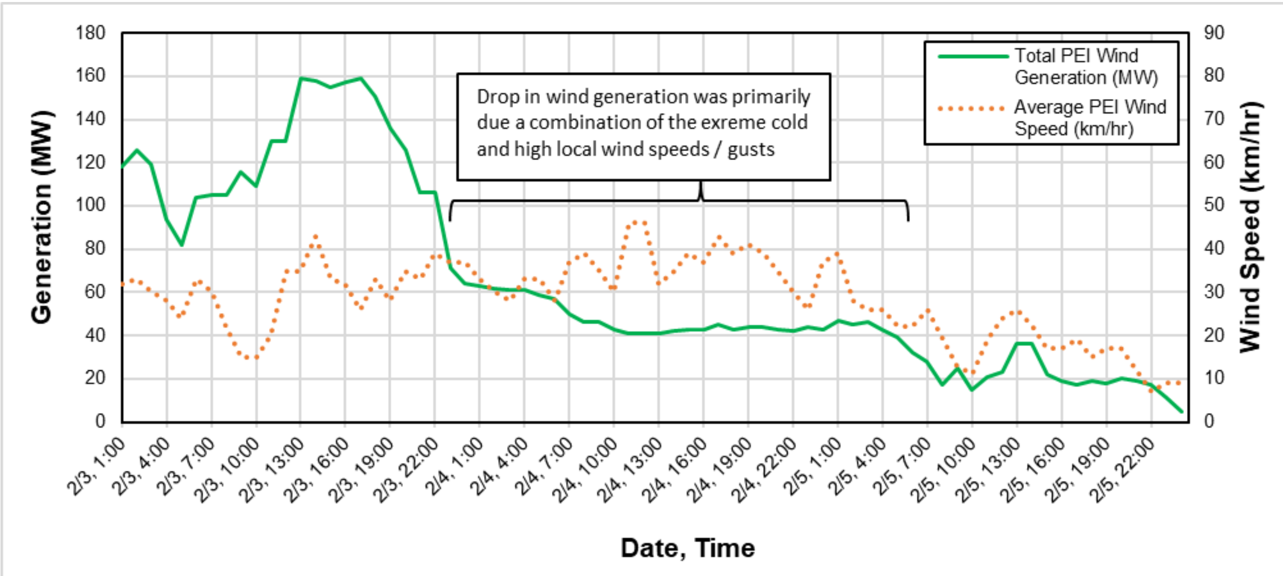
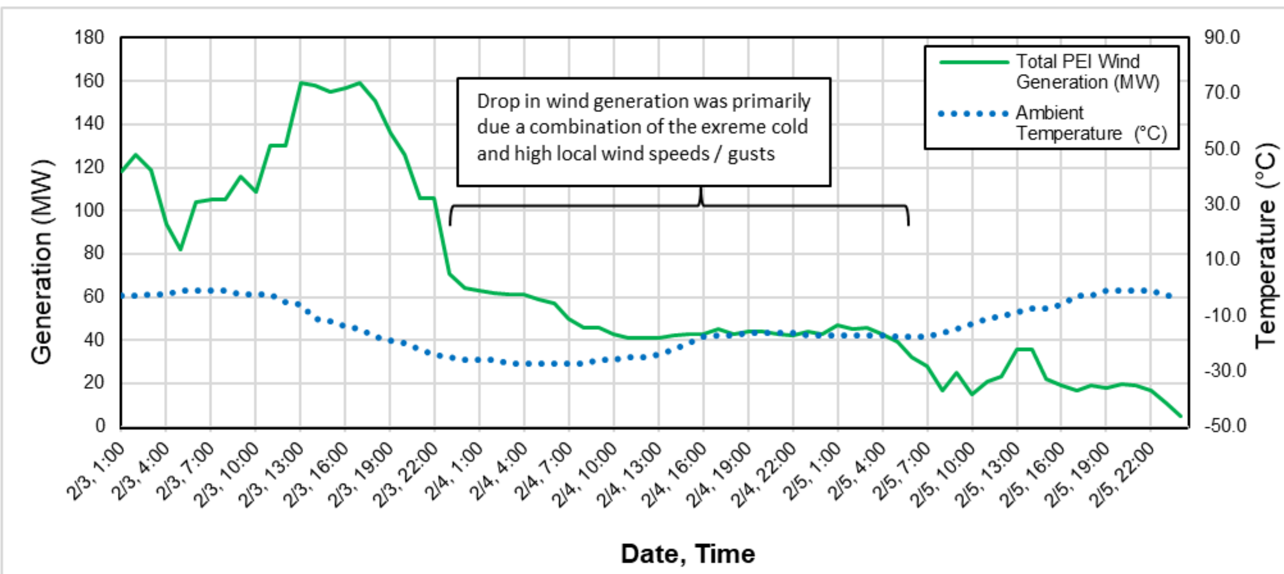


Figure 2-4 — PEI Wind Generation and Temperature (Feb. 3 to 5, 2023)



S&L had the opportunity to speak with the Wind Energy Institute of Canada (WEICAN) regarding the events that took place between February 3 and 5, 2023. WEICAN operates a number of wind turbine generators on PEI, some for research purposes. Per S&L's discussion with WEICAN, the drop in wind generation can be primarily tied to the following reasons:

- **Extreme Cold:** To avoid damage associated with extremely cold temperatures (which can cause equipment lubrication to harden, equipment material properties to change, etc.), wind turbine generators have safe shutdown setpoints that engage when temperatures drop below certain levels. A subset of the wind turbine generators that went offline on PEI experienced cold weather-related shutdowns. WEICAN explained that wind generators can be equipped with cold weather packages that allow the wind generators to operate at lower temperatures; however, the temperatures experienced on PEI were low enough to push the limits of even the wind generators equipped with cold weather packages.

- **Wind Speeds and Turbulence:** During the event, wind speeds (especially gusts) were very high, and the wind was turbulent. To avoid damage because of high wind speeds / high turbulence, wind turbine generators have safe shutdown setpoints that engage when wind speeds and/or turbulence rises above certain levels over a set period of time (i.e., over a 10-minute span). A subset of the wind generators that went offline on PEI experienced wind speed / turbulence-related shutdowns. If a wind generator goes into safe shutdown due to wind speed / turbulence, it is typically relatively easy to restart the generator again, once wind speeds / turbulence fall to levels low enough to safely operate the generator. However, this was not the case during the cold weather event in February because once the turbines went into shutdown, many quickly became too cold to easily restart. As a result, a subset of the turbines that went into shutdown due to high wind speeds / turbulence were unable to quickly restart and operate again because they were too cold.

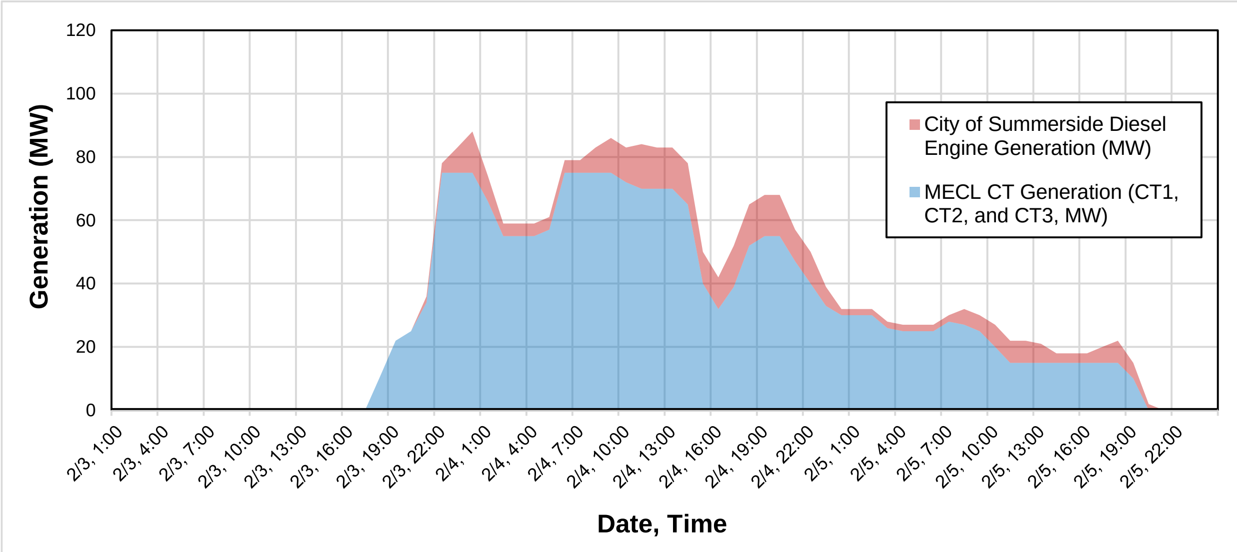
As a result of the large drop in wind generation, MECL was forced to rely even more on imported electricity from New Brunswick, in addition to operating its limited amount of dispatchable thermal generation installed on PEI, to serve load. As is discussed in Section 3.3, there was a significantly high risk that New Brunswick was going to be forced to curtail electricity exports to PEI during the event; thus, the drop in wind generation could have resulted in load shed across PEI.

2.2.1.2. Dispatchable Thermal Generation

The dispatchable thermal generation installed on PEI, which includes the Borden CT1 and CT2 units, the Charlottetown CT3 unit, and the Summerside engines (which are not owned by MECL), ran without incident throughout the event, with units started during the evening of February 3, 2023, and operating until February 5, 2023. The following figure provides the total generation of the thermal generation installed on PEI through the cold weather event.

As discussed above, the generation from the thermal resources was used to help meet record peak loads and offset the drop in wind generation experienced during the cold weather event, which helped PEI to stay below the 300 MW import limit from New Brunswick. During the event, the CTs also provided voltage control and transformer offloading, both of which helped to keep the grid stable.

Figure 2-5 — PEI Dispatchable Thermal Generation (Feb. 3 to 5, 2023)



3. ELECTRICAL SYSTEM IMPACT – REGIONAL

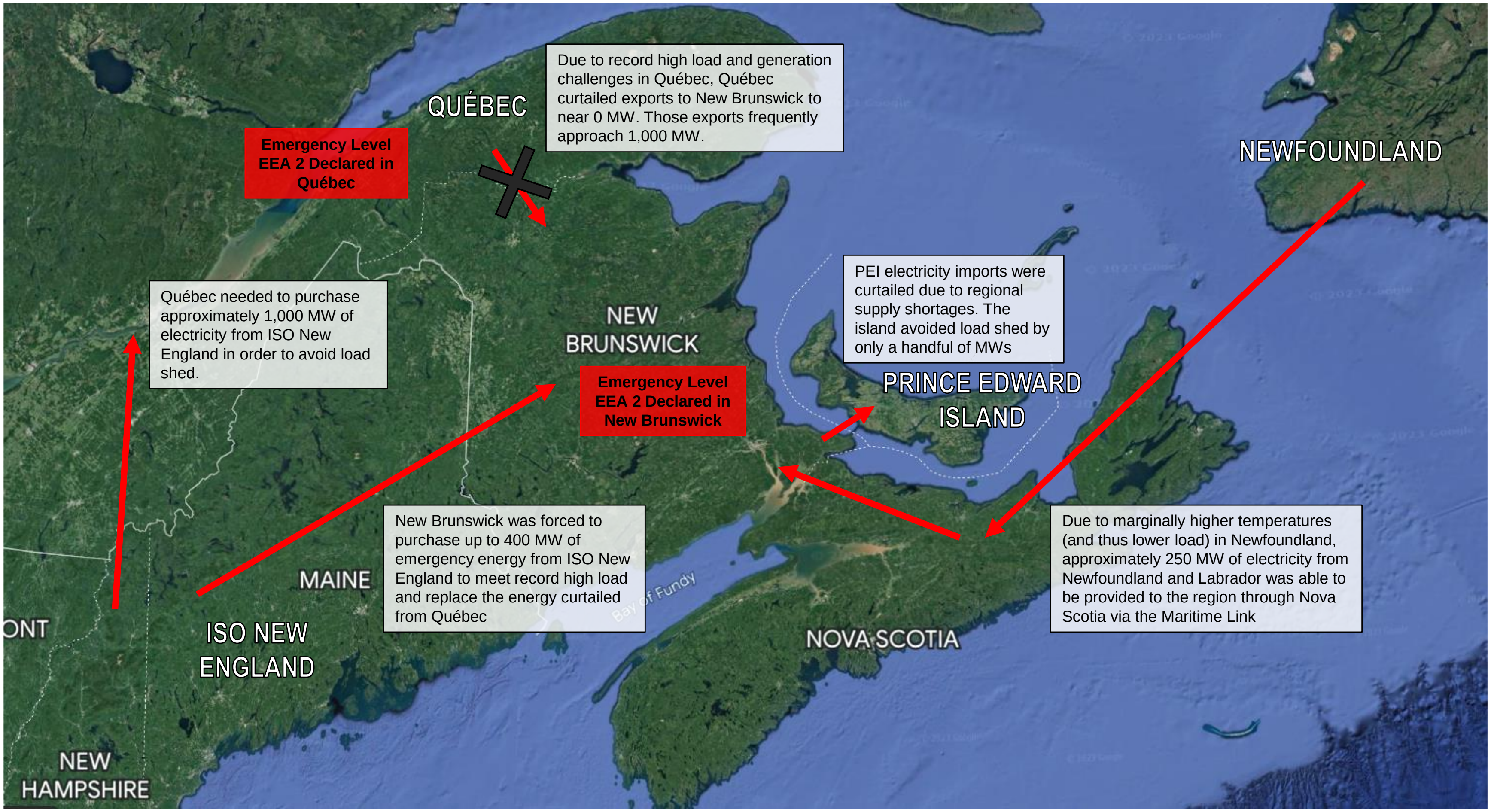
The extreme cold weather experienced in Eastern Canada on February 3 through February 5, 2023, severely strained regional electrical systems to the point that load shedding was a significant risk. To illustrate the severity of what occurred, it is first important to understand the levels at which system emergencies are classified within electrical systems. Below are the different Energy Emergency Alert (EEA) levels, with EEA 3 being the most severe. During the event, both Québec and New Brunswick declared emergencies at an EEA 2 level. The following classifications are provided by the North American Electric Reliability Corporation (NERC)[18].

- **EEA 1:** This is the first emergency level and is defined as “the balancing authority is experiencing conditions where all available generation resources are committed to meet firm load, firm transactions, and reserve commitments, and is concerned about sustaining its required contingency reserves.” As part of EEA 1, non-firm wholesale energy sales have been curtailed.
- **EEA 2:** EEA 2 is defined as a situation where “the balancing authority is no longer able to provide its expected energy requirements and is an energy deficient balancing authority.” Under an EEA 2 situation, the balancing authority still is able to maintain minimum contingency reserve requirements. A balancing authority experiencing an EEA 2 emergency is at serious risk of having to shed firm load and will take all potential steps possible to avoid firm load shed.
- **EEA 3:** Under an EEA 3 situation, the balancing authority is either currently shedding firm load or firm load shed is imminent. EEA 3 is the most serious of the EEA levels as it means there are or will be power outages / rolling blackouts.

Figure 3-1 provides an overview of the Maritimes region electrical system through the evening of February 3, 2023, and into the morning of February 4, 2023, which was the point at which the risk of load shed became the highest. Additionally, a brief overview of the challenges experienced within each area of the region is provided in the following subsections.

[18] https://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-011-1.pdf

Figure 3-1 — Regional Recap, Evening of February 3 and Early February 4, 2023



3.1. QUÉBEC

The extreme cold drove electrical demand in Québec to record levels. That, in combination with generator operational challenges driven by the cold, resulted in Québec becoming energy deficient and needing to declare an EEA 2 level emergency. To serve its own system and avoid significant load shed, Québec curtailed exports to New Brunswick down to 0 MW. For reference, the export capacity from Québec to New Brunswick is approximately 1,000 MW, and real-time exports rising to this level is not uncommon. In addition, Québec purchased nearly 1,000 MW of emergency energy from ISO New England, in addition to electricity from New York and Ontario. For perspective, Québec is usually a net exporter of electricity to ISO New England and had not purchased energy from New England since 2016.[19] Since Québec is a very large and relied-upon producer of electricity in the region, the challenges experienced in Québec reverberated throughout the region.

During this time, Québec did not have excess generation capacity to spare and was thus unable to export any electricity to New Brunswick, even though the existing intertie is approximately 1,000 MW.

3.2. NEWFOUNDLAND AND LABRADOR

Newfoundland and Labrador is intertied to Nova Scotia via a sub-sea electrical cable system known as the Maritime Link. This linkage allows for the export of up to 500 MW of electricity from Newfoundland and Labrador to Nova Scotia. Between February 3 and 5, 2023, Newfoundland and Labrador was able to export over 200 MW of electricity to Nova Scotia, which helped to alleviate the electricity shortfalls throughout the region. One of the key reasons that Newfoundland and Labrador was able to export this electricity was because temperatures in Newfoundland and Labrador did not fall to the record lows experienced to the immediate south; thus, electrical demand in Newfoundland and Labrador was relatively lower than the record electrical demand levels experienced in Québec, Nova Scotia, New Brunswick, and PEI.

Throughout the event, a key concern related to Newfoundland and Labrador's ability to export electricity to Nova Scotia was the availability of the Labrador Island Link (LIL), a transmission line that connects Labrador, where the 824-MW Muskrat Falls hydroelectric generating station is located, to the island of Newfoundland. Availability of the LIL is essential to allow electricity generated in Labrador to flow to Newfoundland, where it can then be exported south into Nova Scotia. The island of Newfoundland alone does not have enough excess generation capacity installed to support significant export to Nova Scotia; if

[19] https://isonewswire.com/2023/04/06/winter-2022-2023-recap-wholesale-prices-drop-during-warm-season-marked-by-cold-snaps/

the LIL is out of service, generation from Labrador cannot flow into Newfoundland to be exported to Nova Scotia.

Historically, Newfoundland and Labrador Hydro, the operator of the Muskrat Falls generating station and the LIL, had estimated the forced outage rate of the LIL to be 0.0114%.[20] However, in late 2022, Newfoundland and Labrador Hydro issued a report titled *Reliability and Resource Adequacy Study Review; Reliability and Resource Adequacy Study – 2022 Update*, in which the previously estimated forced outage rate of the LIL was revised from 0.0114% to a range of between 1% and 10% (to be more precisely quantified at a later date), which equates to a reliability level that is approximately 100 times to 1,000 times less than previously estimated. Fortunately, the LIL was in service between February 3 and February 5, 2023. Had it been out of service during this time, the result would have been an increased likelihood of load shed on PEI during the coldest part of the event.

3.3. NEW BRUNSWICK

New Brunswick saw record electrical load levels between February 3 and 5, 2023, similar to the other Eastern Canada areas. New Brunswick Power indicated to MECL that their peak load hit a high of 3,395 MW on the morning of February 4, 2023, 62 MW higher than their previous peak electrical demand level of 3,333 set in January 2004. It is worth noting that high winds caused approximately 4,000 customers in New Brunswick to lose power on February 4, 2023, which resulted in peak electrical demand being about 20 MW lower than it would have been had those customers not been disconnected. In addition, New Brunswick Power had cut 130 MW of interruptible load. Combined with high load, New Brunswick also experienced similar drop-offs in wind generation to what was experienced on PEI, and some of New Brunswick's generators experienced operational challenges because of the extreme cold weather.

The most significant event that led to New Brunswick having to declare an emergency of level EEA 2 was Québec's need to stop the export of electricity to New Brunswick. The capacity of the interconnection between Québec and New Brunswick is significant at approximately 1,000 MW; thus, the lack of any imports from Québec pushed New Brunswick to the brink of having to further curtail electricity exports to PEI and to also shed load within New Brunswick. Fortunately, New Brunswick only had to curtail exports to PEI by 50 MW. Three of the most significant events that allowed New Brunswick to avoid more significant, or complete, curtailment of exports to PEI were the following:

[20] Link to the recently released *Reliability and Resource Adequacy Study Review*
Reliability and Resource Adequacy Study – 2022, released by Newfoundland and Labrador Hydro in October 2022: UpdateRehttp://www.pub.nf.ca/applications/NLH2018ReliabilityAdequacy/correspondence/From%20NLH%20-%20Reliability%20and%20Resource%20Adequacy%20Study%20-%202022%20Update%20-2022-10-03.PDF

1. **Electricity Imported from ISO New England**: This electricity proved to be essential, and it allowed New Brunswick to continue to export electricity to PEI. It was fortunate that ISO New England was able to provide electricity to New Brunswick because New England also faces challenges (primarily related to fuel supply) in the face of extreme cold weather events. These challenges are highlighted in recent NERC guidance and further described in Section 4 of this report.
2. **Electricity Imported from Nova Scotia and Newfoundland and Labrador:** The electricity that Nova Scotia was able to provide to New Brunswick also helped New Brunswick continue to export electricity to PEI. Part of the reason that Nova Scotia was able to export electricity to New Brunswick was because Nova Scotia was able to import electricity from Newfoundland and Labrador via the Maritime Link, as discussed previously.
3. **Operation of the Thermal Resources on PEI:** The operation of the thermal generation located on PEI (all three MECL CTs and the Summerside engines) helped to generate approximately 80 MW of electricity from late February 3 through February 4, 2023, which were the most critical times during the extreme cold event. The thermal generation on PEI helped to partially offset the failure of the wind generation located on PEI that was experienced during the event. Without the generation from the thermal generators on PEI, the need for imported power would have been greater, increasing the risk from import curtailments.

3.4. ISO NEW ENGLAND

During the extreme cold event, ISO New England was able to serve as an essential import provider to both Québec and New Brunswick as both purchased significant amounts of electricity from ISO New England. Approximately 1,000 MW of electricity exports were sent to Québec and a peak of 400 MW of exports were sent to New Brunswick during the most critical times of the event. Real-time electricity prices soared to $500/MWh on February 4, 2023, (typically prices are in the $20 to $40/MWh range) which is an indication that total electrical demand approached the available supply within ISO New England. ISO New England notes that demand would likely have been higher if February 3 through 5, 2023, had not been weekend days.[21]

3.5. NOVA SCOTIA

Information regarding the electrical system challenges faced by Nova Scotia during the extreme cold weather event that transpired between February 3 and 5, 2023, mirrored much of which was experienced in the rest of the region. Nova Scotia's peak load experienced on February 4, 2023, was 10% higher than the previous peak experienced in 2004. As previously discussed, Nova Scotia was able to import electricity from Newfoundland and Labrador throughout the event, which helped to not only allow Nova Scotia to meet

21 https://isonewswire.com/2023/04/06/winter-2022-2023-recap-wholesale-prices-drop-during-warm-season-marked-by-cold-snaps/

system load, but also export some excess electricity to New Brunswick (which ultimately helped to avoid New Brunswick from further having to curtail PEI).

3.6. PRINCE EDWARD ISLAND

Fortunately, PEI was able to get through the events of February 3 through 5, 2023, without having to implement load shed due to electricity shortages. However, in many respects, PEI was in the most precarious position of any location within the entire region. This is because PEI does not have enough dependable capacity installed on the island to fully meet peak load and thus required continuous imported electricity from New Brunswick in order to avoid load shed. While the wind generation installed on PEI is an excellent resource from the perspective of lowering carbon emissions for the island, wind generation is not a dispatchable resource in an emergency. This was evident during the extreme cold event that took place as only 25% of the wind turbines were operational (i.e., 75% were in forced or planned outage) during the most critical, coldest time of the event. PEI was fortunate that ISO New England, Newfoundland and Labrador, and Nova Scotia had some small amount of excess electricity to send to New Brunswick during the event—without electricity from these locations, New Brunswick would have been forced to further or completely curtail electricity exports to PEI, which would have resulted in significant load shed on PEI.

In the *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company*, issued by S&L on December 9, 2022, an important focus was related to a scenario where PEI is electrically disconnected from the mainland. Many of the recommendations in the study were rooted in that specific scenario, which has occurred infrequently in the past. The extreme cold weather event that transpired between February 3 and 5, 2023, illustrates a similar, but fundamentally different scenario—one where the interconnection between PEI and the mainland remains operational, but electricity shortages on the mainland result in the curtailment of electricity imports to PEI. In terms of impact to PEI, this scenario is essentially equivalent to a scenario where the interconnection to the mainland becomes inoperable—both scenarios are likely to result in electricity shortages on PEI and thus load shed.

One important point to note is that when a utility experiences a shortage of electrical generation, its first priority is to serve its own load, which may require the utility to cut exports (for example, Québec cut exports to New Brunswick during the February cold weather event so that it could meet its own electrical load). In the event that PEI's thermal generators and wind and solar power plants are unable to generate a sufficient amount of electricity to support PEI's load, which they did not during the February 2023 event, PEI is dependent on imported electricity from the mainland to serve load. As was demonstrated during the February 2023 event, MECL and the other utilities in the region will attempt to generate and secure enough electricity to fully serve regional load during an emergency event; however, if there is not enough generation in the region to fully serve load, the other regional utilities will first prioritize their own load over exporting electricity to PEI. In this situation, the risk for load shed on PEI is high, which would put the residents of PEI in danger.

4. NERC WINTER RELIABILITY ASSESSMENTS

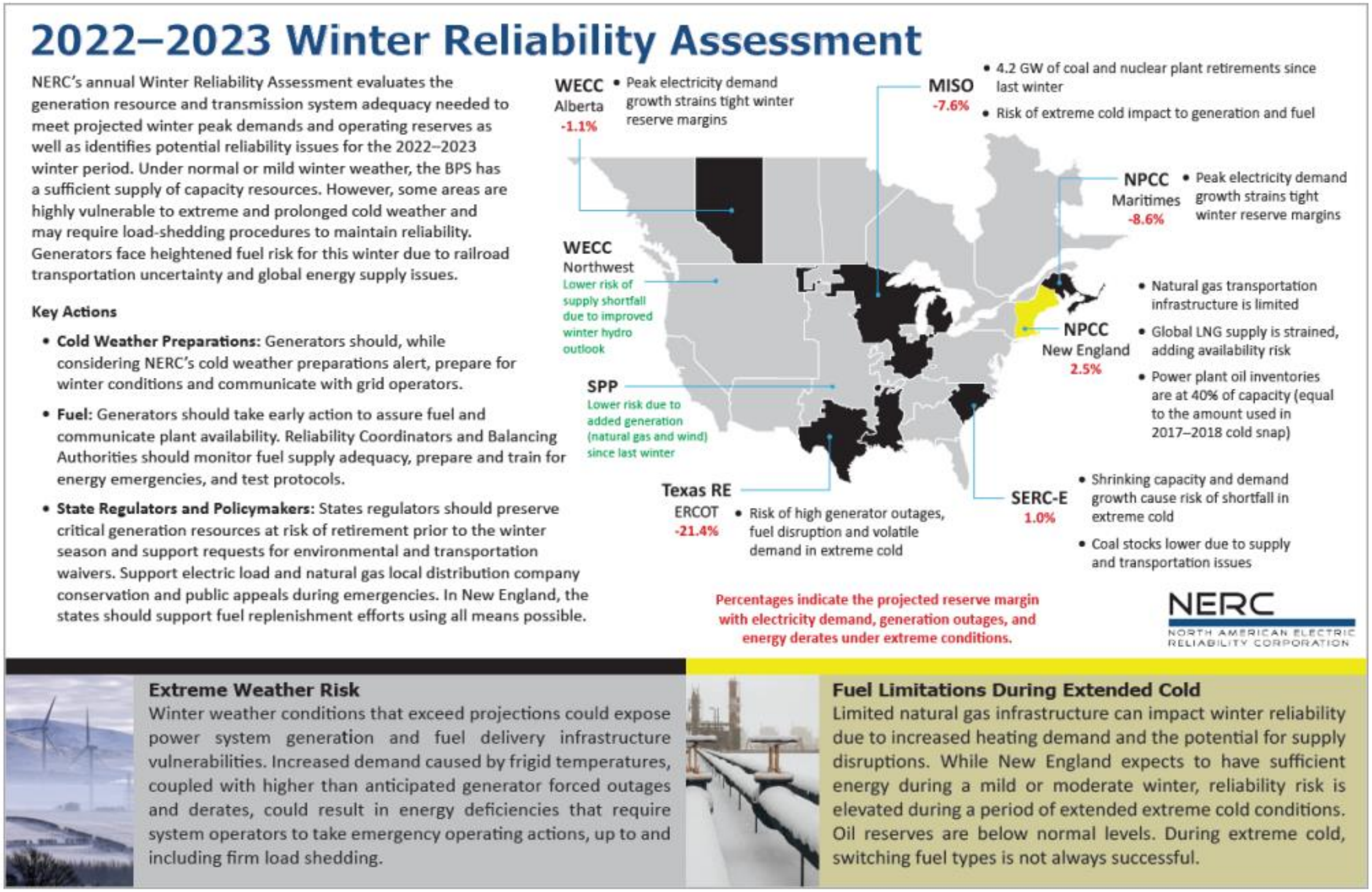
Given the stress recent extreme cold weather events have put on electrical systems, NERC has released a set of planning guidelines and recommendations regarding extreme cold weather events to come. For example, in November 2022, NERC released its *2022-2023 Winter Reliability Assessment,*[22] which highlighted that "some areas [of the bulk power system] are highly vulnerable to extreme and prolonged cold weather and may require load-shedding procedures to maintain reliability." The report is meant to inform industry leaders, planners, operators, and regulatory bodies to take necessary actions to ensure reliability. The guideline notes that during extreme cold events, the Maritimes region is likely to have the second lowest electrical system reserve margins of all the electrical systems NERC oversees (see Figure 4-1 taken from the NERC guideline). Only Texas is estimated to have lower reserve margins. The reason for the estimated tight reserve margins in the Maritimes region is electrical load growth, which is driven by the rapid transition of buildings to electrical heating (and electrification in general) and commercial / industrial load. In addition, NERC also notes that New England faces challenges during extreme cold events, primarily due to fuel supply constraints.

In addition, on May 15, 2023, NERC released a Level 3 Essential Actions Alert titled *Cold Weather Preparations for Extreme Weather Events III.*[23] The alert was issued to "increase the Reliability Coordinators' (RC), Balancing Authorities' (BA), Transmission Operators' (TOP), and Generator Owners' (GO) readiness and enhance plans for, and progress toward, mitigating risk for the upcoming winter and beyond." For reference, a Level 3 Essential Actions Alert is the <u>highest</u> severity level that NERC issues and this is the <u>first time</u> a Level 3 Essential Actions Alert has ever been issued by NERC.

The assessments and recommendations from NERC illustrate that many parts of North America are at risk during extreme cold weather events. Among the locations facing the greatest challenge is the Maritimes region. For PEI, this is an indication that electricity imports from the mainland to PEI are not guaranteed during future extreme cold events.

[22] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2022.pdf
[23] https://www.nerc.com/news/Pages/NERC-Releases-Essential-Action-Alert-Focused-on-Cold-Weather-Preparations.aspx

Figure 4-1 — NERC 2022–2023 Winter Reliability Assessment[24]



[24] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2022.pdf

5. RECOMMENDATIONS

The following sections highlight updated recommendations to the *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company* issued by S&L on December 9, 2022. All recommendation updates are based on lessons learned from the extreme cold weather event that took place between February 3 and 5, 2023. Note that the recommendations in this section supersede those in the previous report, unless explicitly noted.

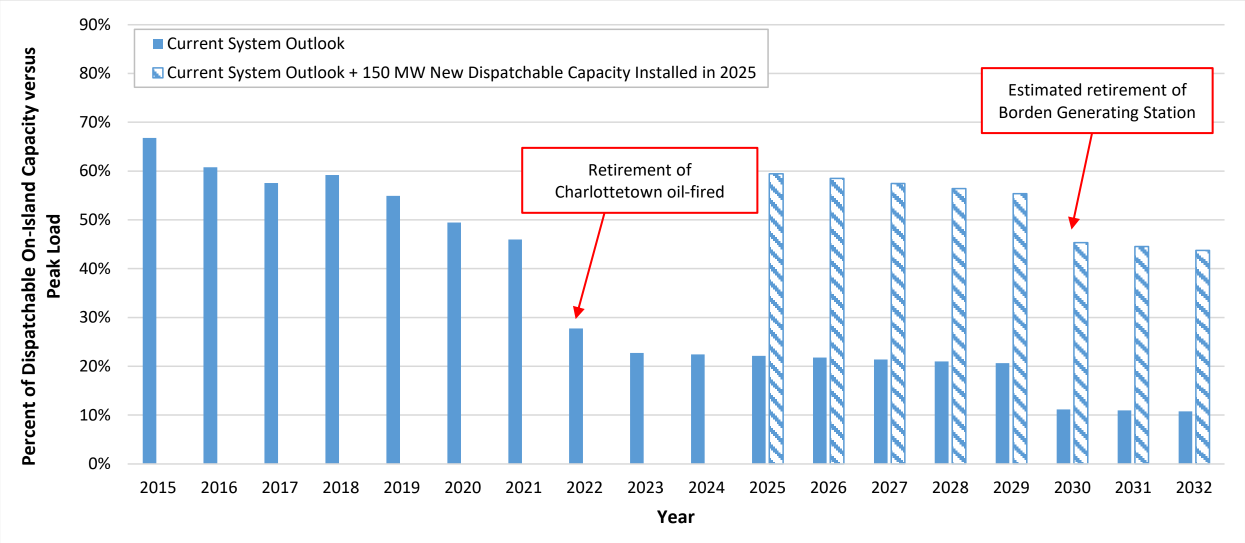
5.1. UPDATED RESOURCE RECOMMENDATIONS

On December 9, 2022, S&L issued the *Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company*. The report ultimately concluded that a portfolio of RICE/CTs, onshore wind, and solar photovoltaic was best suited to help Maritime Electric meet its most critical needs and goals. Based on a review of Maritime Electric's current and forecasted peak load, S&L previously recommended that a minimum of 85 MW of new RICE/CTs with biofuel compatibility should be installed on PEI as soon as possible to reduce the probability of load shed and rolling blackouts in the event of electricity import limits and/or interruptions from the mainland.

The extreme cold weather event that occurred between February 3 to 5, 2023, resulted in record peak load of 395.7 MW, which was over 72 MW higher (22.5%) than the previous peak load of 322.9 MW experienced in January 2022. As a result, S&L has revised its previous recommendation of a minimum of 85 MW of new RICE/CTs with biofuel compatibility to a range of 125 to 150 MW of the same technology, to bring the ratio of dispatchable capacity to peak load back in line with the 50% historical threshold (which would equate the risk of potential load shed in the event of mainland import curtailments to near historical levels). A range of additional capacity was specified because there is uncertainty regarding the future peak load forecast for PEI. The lower end of the recommended range is based on MECL's recently updated internal 10-year peak forecast and the higher end of the range is based on an escalation of the 395.7 MW peak experienced on February 4, 2023. In addition, MECL should continue to prioritize integration of both onshore wind and solar photovoltaic to help meet decarbonization goals, consistent with what was recommended in S&L's original report. Note that even with up to 150 MW of additional dispatchable capacity, there may still be a need for load shed to be implemented if PEI were not able to secure enough electricity imports to fully meet load; however, the additional 125 to 150 MW would help to bring the risk of load shed to be consistent with historical levels.

Figure 5-1 illustrates the ratio of dispatchable on-island generation capacity versus peak load both historically and forecasted through 2032. A second set of data points are included on the figure to illustrate how the ratio of dispatchable capacity versus peak load increases if 150 MW of additional dispatchable capacity is added on PEI in 2025. Note that current estimates for the retirement of the Borden Generating Station (40 MW) is approximately 2030. Additional capacity, beyond the 150 MW assumed in 2025, would have to be added to the system in 2030 to replace Borden's retired 40 MW capacity to maintain a 50% ratio of capacity to peak load. Figure 5-1 does not add any additional capacity to replace Borden; however, it does illustrate the impact of Borden's retirement in terms of the capacity to peak load ratio.

Figure 5-1 — Outlook of Dispatchable On-Island Capacity versus Peak Load



In addition, S&L continues to note that a new BESS demonstration project could help identify the BESS functions/use cases that offer the maximum benefit for the island.

5.1.1. Synchronous Condenser Considerations

Given the large distance between PEI and the large mainland generators, PEI must be self-sufficient in reactive power supply capability, which is necessary for maintaining voltage levels and system stability on PEI. This is an ongoing challenge, especially as more wind generation is added to PEI. A synchronous condenser is an example of electrical equipment than can help improve an electrical system's voltage regulation and overall stability. RICE and CTs have the ability to operate as a synchronous condenser when they are not generating electricity; under this mode of operation, the units use a modest amount of energy from the grid to synchronize (spin), helping to improve the system's electrical performance. The units do not consume fuel when operating as synchronous condensers. The 2020 MECL Integrated System Plan noted that after island load exceeds 350 MW, additional system voltage support (i.e., a synchronous condenser) will be needed on PEI[25]. Previous forecasts of island load estimated that levels higher than 350 MW would not be reached for a number of years; however, given PEI's load nearly reached 400 MW on February 4, 2023, additional system voltage support is needed today.

While both a CT and RICE can be fitted with the appropriate equipment to allow them to function as synchronous condensers when they are not generating electricity, the use of CTs as synchronous condensers is much more common than the use of RICE. In the December 9, 2022, report issued by S&L (*Capacity Resource Study: Evaluation of Various Technology Options for Maritime Electric Company*), S&L considered both CT and RICE options to be virtually equivalent from a technical capability perspective, with RICE being modestly less expensive. However, if MECL wishes to pursue an option with a strong pedigree of synchronous condenser operation, S&L recommends MECL pursue CTs over RICE.

5.1.2. Estimated Costs

Appendix A of this addendum provides a detailed high-level cost estimate of purchasing approximately 170 MW of additional CTs, represented by a 3x0 simple-cycle design with General Electrical LM6000 PF+ SPRINT CT generators (three turbines at a 57.1 MW winter rating each). The estimate includes options for operation exclusively on diesel fuel as well as operation with biodiesel. Other manufacturers make units of similar technical capabilities that MECL could pursue, including varying capacities of CTs and RICE units—the unit types and manufacturers shown in the following table are for illustration and high-level costing comparisons only. S&L recommends biodiesel fuel compatibility to reduce the risk of having a stranded asset in the event government fuel regulations change in the future—biodiesel is considered a renewable fuel by the Canadian government. The cost of equipment related to synchronous condenser operation is also included in this indicative estimate for the CTs (this is not included for the RICE due to the reasons described in Section 5.1.1).

The following table provides a summary of the key operating details and levelized costs for the LM6000 option, along with an alternative RICE design. Additional details and assumptions are noted in Appendix A for the CT design with the RICE details included in the previously report.

[25] Maritime Electric 2020 Integrated System Plan, page 44 and 47

Table 5-1 — Estimated Costs for New CTs/RICE

Title	CT – Aeroderivative		RICE	
	GE LM6000 PF+ SPRINT		Wartsila 20V32	
Fuel Type	Diesel Only	Biodiesel Compatible	Diesel Only	Biodiesel Compatible
Winter Output (MW)	57.1 per turbine	57.1 per turbine	10.6 per engine	9.4 per engine
Net Heat Rate (Btu/kWh)	9,000	9,500	8,400	8,400
Levelized Install Cost (CAD/kW)	1,744	1,817	1,845	2,074
Synchronous Condenser Cost	Included	Included	Not included	Not included

The levelized install cost (dollars per kW) for the LM6000 CT shown above is lower than the smaller RICE design (note that the levelized cost values consider economies of scale associated with the purchase of multiple generators to total approximately 150 MW). Furthermore, the cost for the synchronous condenser is already included for the CT option. However, the RICE design may provide more flexible operation due to the smaller unit capacities, as well as the ability to implement a staggered install schedule over time. As described in S&L's previous report, the RICE units also require less modification to operate on biodiesel fuel. At a capacity of 125–150 MW, along with the known synchronous condenser operational benefits of CTs, either the larger CT design alone, or a portfolio of CTs and RICE, are likely the best options for MECL.

5.2. WIND GENERATION LESSONS LEARNED

During the extreme cold weather event that took place between February 3 and 5, 2023, wind generation dropped substantially because of a number of cascading wind generator and system failures related to the cold temperatures and high wind speed / high wind turbulence. The drop in wind generation resulted in PEI having to import a significant amount of energy from the mainland during the event to avoid load shed. Fortunately, electricity imports, generation produced from the dispatchable generators on PEI, and the remaining wind generation on PEI were able to fully meet the record load experienced on the island; however, PEI came very close to having load shed during the coldest part of the event.

As discussed earlier, S&L had the opportunity to speak with WEICAN during the preparation of this addendum on the topic of what transpired between February 3 and 5, 2023. WEICAN operates several wind turbine generators on PEI for research purposes. During S&L's conversations with WEICAN, it became clear that there are several lessons learned that can and should be shared related to the wind generator and grid operation during the cold weather event between MECL, the wind operators, and the wind turbine original equipment manufacturers. These lessons learned will help to identify various improvements and changes to avoid a similar drop off in wind generator production during a future extreme cold event.

Given these considerations, S&L recommends further information sharing, and/or a technical conference, between MECL, the wind operators, and the wind generator original equipment manufacturers to fully understand what transpired and find solutions to prevent a repeat of the challenges experienced between February 3 and 5, 2023.

APPENDIX A. NEW THERMAL GENERATION COST ESTIMATES

Appendix A contains capital and operations and maintenance estimates for 14x0 and 3x0 simple-cycle designs with Wärtsilä 20V32 RICE and General Electric LM6000 PF+ SPRINT CT generators, respectively. The estimate includes options for operation exclusively on diesel fuel as well as operation with biodiesel. All values in CAD.

Technology	**Reciprocating Internal Combustion Engine**	**Reciprocating Internal Combustion Engine**	**Combustion Turbine - Aeroderivative**	**Combustion Turbine - Aeroderivative**
Unit Type (Representative Manufacturer)	Wartsila 20V32 (14x)	Wartsila 20V32 (14x)	GE LM6000 PF+ SPRINT w/ Sync Condenser (3x)	GE LM6000 PF+ SPRINT w/ Sync Condenser (3x)
Cycle Type	Simple Cycle	Simple Cycle	Simple Cycle	Simple Cycle
Fuel Type	Diesel Fuel	Biodiesel Fuel	Diesel Fuel Only	Biodiesel Fuel Compatible
Net Plant Output (MW) - Summer (27˚C, 47% RH, 0 m)	148.4	131.2	119.7	119.7
Net Plant Output (MW) - Winter (-26˚C, 60% RH, 0 m)	148.4	131.2	171.3	171.3
Net Heat Rate (Btu/kWh) (HHV) (ISO: 15˚C, 60% RH, 0 m	8,400	8,400	9,000	9,500
Project Costs				
Owner Furnished Equipment				
Prime Mover	$ 82,377,000	$ 82,377,000	$ 92,979,000	$ 101,079,000
Emission Control	$ -	$ -	$ -	$ -
Synchronous Condenser	$ -	$ -	$ 11,138,000	$ 11,138,000
Sales Tax	$ 12,357,000	$ 12,357,000	$ 15,617,000	$ 16,832,000
Total Owner Furnished Equipment	**$ 94,734,000**	**$ 94,734,000**	**$ 119,734,000**	**$ 129,049,000**
EPC Costs				
Other Equipment	$ 16,137,000	$ 16,137,000	$ 22,462,000	$ 22,462,000
Diesel/Biodiesel Infrastructure (Fuel Handling and Stora	$ 6,827,000	$ 7,711,000	$ 4,749,000	$ 5,364,000
Materials	$ 26,958,000	$ 26,958,000	$ 10,440,000	$ 10,440,000
Construction Labour	$ 34,490,000	$ 34,490,000	$ 46,567,000	$ 46,567,000
Other Labour	$ 14,954,000	$ 14,954,000	$ 12,126,000	$ 12,126,000
Sales Tax	$ 6,464,000	$ 6,464,000	$ 4,935,000	$ 4,935,000
EPC Contractor Fee	$ 11,646,000	$ 11,646,000	$ 13,261,000	$ 13,856,000
EPC Contingency	$ 16,045,000	$ 16,045,000	$ 17,681,000	$ 18,475,000
Total EPC Costs	**$ 133,521,000**	**$ 134,405,000**	**$ 132,221,000**	**$ 134,225,000**
Total Project Costs	**$ 228,255,000**	**$ 229,139,000**	**$ 251,955,000**	**$ 263,274,000**
Non-EPC Costs				
Project Development	$ 6,676,000	$ 6,676,000	$ 6,611,000	$ 6,711,000
Mobilization and Start-Up	$ 1,335,000	$ 1,335,000	$ 1,322,000	$ 1,342,000
Non-Fuel Inventories	$ 668,000	$ 668,000	$ 662,000	$ 671,000
Owner's Contingency	$ 10,681,000	$ 10,681,000	$ 10,577,000	$ 10,738,000
Electrical Interconnection	$ 6,210,000	$ 6,210,000	$ 6,885,000	$ 6,885,000
Land	$ 2,700,000	$ 2,700,000	$ 2,700,000	$ 2,700,000
Fuel Inventories	$ 15,290,000	$ 13,514,000	$ 16,058,000	$ 16,951,000
Working Capital	$ 2,003,000	$ 2,003,000	$ 1,983,000	$ 2,013,000
Subtotal - Non-EPC Costs w/o Financing Fees	**$ 45,563,000**	**$ 43,787,000**	**$ 46,798,000**	**$ 48,011,000**
Total Non-EPC Costs	**$ 45,563,000**	**$ 43,787,000**	**$ 46,798,000**	**$ 48,011,000**
Overnight Capital Costs ($)	**$ 273,818,000**	**$ 272,926,000**	**$ 298,753,000**	**$ 311,285,000**
Overnight Capital Costs ($/kW-Winter)	$ 1,845	$ 2,074	$ 1,744	$ 1,817

(1) Costs based on EPC contracting approach.
(2) Interconnection and land costs are assumed values.
(3) Property taxes and insurance costs are not included in the above estimate.

Technology	Reciprocating Internal Combustion Engine	Reciprocating Internal Combustion Engine	Combustion Turbine - Aeroderivative	Combustion Turbine - Aeroderivative
Unit Type (Representative Manufacturer)	Wartsila 20V32 (14x)	Wartsila 20V32 (14x)	GE LM6000 PF+ SPRINT w/ Sync Condenser (3x)	GE LM6000 PF+ SPRINT w/ Sync Condenser (3x)
Cycle Type	Simple Cycle	Simple Cycle	Simple Cycle	Simple Cycle
Fuel Type	Diesel Fuel	Biodiesel Fuel	Diesel Fuel Only	Biodiesel Fuel Compatible
Net Plant Output (MW) - Summer (27˚C, 47% RH, 0 m)	148.4	131.2	119.7	119.7
Net Plant Output (MW) - Winter (-26˚C, 60% RH, 0 m)	148.4	131.2	171.3	171.3
Net Heat Rate (Btu/kWh) (HHV) (ISO: 15˚C, 60% RH, 0 m	8,400	8,400	9,000	9,500
Fixed O&M				
Labor - Routine O&M	$ 880,000	$ 880,000	$ 659,000	$ 659,000
Maintenance Materials and Services	$ 190,000	$ 190,000	$ 154,000	$ 154,000
G&A	$ 331,000	$ 331,000	$ 267,000	$ 267,000
Total Fixed O&M ($)	**$ 1,401,000**	**$ 1,401,000**	**$ 1,080,000**	**$ 1,080,000**
Total Fixed O&M ($/kW-year)	$ 9.44	$ 10.68	$ 6.30	$ 6.30
Variable O&M				
Annualized Equipment Maintenance	$ 568,000	$ 568,000	$ 459,000	$ 459,000
VOM (non-fuel)	$ 274,000	$ 274,000	$ 221,000	$ 221,000
Variable O&M - Hours Based ($/MWh)	$ 64.79	$ 73.31	$ 45.34	$ 45.34

O&M expenses assume low utilization (1% capacity factor); thus predominately allocate O&M spend on a variable basis.