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October 5, 2023

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Jo-Anne Galarneau
Executive Director and Board Secretary

Re: Newfoundland and Labrador Hydro – 2021 Capital Budget Supplemental Application Approval of the Construction of Hydro's Long-term Supply Plan for Southern Labrador – Revision 1 – Safe and Reliable Power Supply to Charlottetown – Reply

On May 31, 2023, Newfoundland and Labrador Hydro ("Hydro") filed a revision to its application for the approval of the construction of Hydro's long-term supply plan for southern Labrador.[1] The revised application incorporated the recommendations made in Midgard Consulting Inc.'s ("Midgard") "Southern Labrador Communities – Integrated Resource Plan," filed with the Board of Commissioners of Public Utilities ("Board") on March 31, 2023.[2]

In correspondence dated August 1, 2023,[3] the Board requested that Hydro provide additional information with regards to the analysis of alternatives that would enable reliable supply to the communities of Charlottetown and Pinsent's Arm. The Board requested further information related to refinement of certain alternatives, more information on cost estimates and additional sensitivities.

To address the Board's questions and provide a fulsome response to the Board's requests for additional information, Hydro engaged Midgard, the third-party consultant Hydro has previously retained to complete the Integrated Resource Plan for the region, to provide additional independent analysis of each of the scenarios outlined by the Board. Hydro's response to the Board's requests is provided herein. Midgard's report summarizing their analysis, and a summary of the technical briefing provided by Hydro to Midgard, are included as Attachments 1 and 2, respectively.

Timeline for Provision of Reliable Service

In its correspondence, the Board acknowledged correspondence from Hydro to the Town of Charlottetown; specifically, the statement that the timeframe to construct a regional plant would be equivalent to the timeframe to construct a local plant in the community of Charlottetown, one of the suggested alternatives. The Board requested further detail on the schedules for each alternative. A

[1] "Long-Term Supply for Southern Labrador," Newfoundland and Labrador Hydro, rev. May 31, 2023 (originally filed July 16, 2021).
[2] "Southern Labrador Communities - Integrated Resource Plan," Midgard Consulting Inc., March 28, 2023.
[3] "Newfoundland and Labrador Hydro - 2021 Capital Budget Supplemental Application Approval of the Construction of Hydro's Long-term Supply Plan for Southern Labrador - Revision 1 - Safe and Reliable Power Supply to Charlottetown," Board of Commissioners of Public Utilities, August 1, 2023.

summary of the in-service dates for each alternative assessed within this additional analysis is provided in Table 1. More detailed schedules for each alternative are provided in Attachment 1, Section 5.0.

Table 1: In-Service Dates of Analyzed Alternatives

Alternative	In-Service Date
Regional Plant (as proposed by Hydro)	2028
Islanded Operation[4] (replacing current configuration)	2028
Interconnection of Existing Plants (with no plant in Charlottetown)	2030
Two-Community Portable Generation[5]	2028

Given revised timelines for regulatory approval, environmental release, procurement, and engineering design activities, it is now anticipated that in-service date for the proposed regional plant alternative has now shifted to 2028 from 2027. Hydro notes that this shift in project schedule has resulted in marginal cost increases in the project estimate; this updated estimate is reflected in Midgard's analysis and is included in the cost and schedule update provided as Schedule 3 in the revised application to be filed with the Board in tandem with this submission.

As noted in Table 1, the in-service dates for the proposed regional plant alternative is the same timeframe as that of the alternatives involving an Islanded Operation and Two-Community Portable Generation. The in-service date for the latter two alternatives is driven by a number of factors, including but not limited to:

- Requirement for detailed Front-End Engineering Design ("FEED") and refinement of project estimate to AACE Class 3;
- Subsequent application to the Board, and timeline for Board decision;
- Environmental registration, assessment, and release; and
- Procurement of long-lead equipment.

Alternatives involving the interconnection of communities with existing plants, specifically the interconnection of existing plants and Two-Community Portable Generation alternatives, require substantive modifications to the existing generating plants to enable interconnection, requiring more time. The existing plants have been designed to enable the provision of the plants *firm capacity* to the existing distribution systems. Interconnection of these plants to multiple communities require upgrades to enable the provision of plant's *full installed capacity*. These modifications involve significant electrical upgrades to enable the provision of the plant's total generation capacity to the grid, and require plant extension to accommodate these upgrades, resulting in additional time and cost for implementation, as seen in the total project cost values in Table 2.

[4] Construction of a local plant in Charlottetown ("Islanded Operation").
[5] Interconnection of Charlottetown with Port Hope Simpson ("Two-Community Portable Generation").

None of the alternatives for which this filing provides additional information would provide improved reliability to the communities of Charlottetown and Pinsent's Arm in advance of the in-service timeline for Hydro's proposed alternative.

Environmental Permitting

In its correspondence to Hydro on August 1, 2023, the Board requested further information on the environmental permitting required for each alternative, along with estimated timelines for obtaining necessary permits. Environmental permitting is detailed in Attachment 1, Section 5.0.

Refinement of Cost Estimates

The Board expressed concerns with the evaluation of alternatives with similar net present costs using Class 5 estimates, which may carry an accuracy range of -50% to +100%. The Board requested that Hydro provide Class 4 estimates for the aforementioned alternatives, including the proposed regional plant alternative. Hydro notes that the estimate on record for the selected alternative is a Class 3 estimate, and is therefore considered more accurate than the Class 4 estimate requested by the Board.

Class 4 estimates for each alternative identified for further analysis, and the Class 3 estimate for the regional plant alternative, are provided in Table 2.

Table 2: Cost Analysis of Alternatives ($ Million)[6]

Alternative	Capital Cost[7]	Ten-Year Cumulative Cost	Total Project Cost (Net Present Cost)
Regional Plant	87.9	138.4	**190.7**
Islanded Operation	40.7	149.9	**257.5**
Interconnection of Existing Plants[8]	78.3	144.0	**270.8**
Two-Community Portable Generation	29.7	152.6	**205.2**

The regional plant alternative continues to be the least-cost option, both on a total project (net present cost) basis, and on a ten-year horizon. Hydro notes that a suitable level of engineering has been performed for a comparison of alternatives and that further assessment, including refinement of Class 4 cost estimates, would require Hydro to perform detailed FEED work.

As noted in the attached analysis, despite the higher initial capital cost, the preferred alternative has a lower cumulative cost over the near term and long term. This must be considered in light of Midgard's Integrated Resource Plan where it is noted that the cost of wind generation alone exceeded the total capital cost of Hydro's proposed alternative, with battery energy storage resulting in hundreds of millions in additional costs over the study period. It is expressed, based on available evidence, that the largest anticipated cost reduction in battery energy storage systems over a ten-year period would not be sufficient to render this alternative least cost. Hydro notes that the Government of Canada appears to

[6] In 2023 dollars.
[7] Includes escalation.
[8] The interconnection of existing plants would require a complex control system to enable load sharing and synchronization across multiple geographically dispersed plants. While reasonable Class 4 costs have been provided, further engineering would be required to determine the cost associated with making such an arrangement technically viable.

share this belief, as the draft Clean Energy Regulations aimed to produce a net-zero electrical system by 2035 provides an exemption for isolated systems, acknowledging the technical and economic challenges associated with supplying isolated systems solely with renewable, intermittent energy sources.

Hydro makes its proposals based on the best available information that supports the conclusion that a solution provides safe, adequate, reliable, least-cost service in an environmentally responsible manner. Hydro believes that this ensures that its decisions or actions are prudent ones.[9]

Annualized Net Present Costs, Capital Costs, and Fuel Costs

The Board requested that Hydro provide annualized net present costs, capital costs, and fuel costs for each year of the study period, for the base case and with a ten-year life extension of the existing diesel plants.

Annualized net present costs and capital costs are provided in Attachment 1, Section 6.0. Annualized net present costs and capital costs reflecting a ten-year life extension of the existing diesel plants is referenced in Attachment 1, Section 6.0 and detailed in Attachment 1, Appendix E. Annual forecasted fuel prices are provided in Attachment 1, Appendix B.

Sensitivity Analysis

The Board requested that Hydro provide multi-variate sensitivity analysis, considering changes in more than one variable impacting net present costs; this analysis is provided in Attachment 1, Section 6.0. Hydro had Midgard compete this analysis. Midgard's analysis considered sensitivities in plant costs, interconnection costs, fuel costs, and load. This analysis resulted in 300 unique configurations. Of these 300 unique configurations, the proposed regional plant alternative remains least cost in 87% or 260 configurations. The remaining 40 configurations are associated with a minimum 300% increase in interconnection capital costs. Midgard indicates that an increase in interconnection costs to 200% of baseline costs or more would require decades, based on the average annual cost increases on record. Hydro notes that the interconnection estimates utilized in Midgard's model are considered Class 3 estimates, with an accuracy range of -20% to +30%; Hydro therefore considers these configurations highly unlikely to materialize.[10]

Conclusion

Hydro trusts that the information provided in this correspondence, including the attached report from an independent consultant, has addressed the questions described by the Board in its August 1, 2023 correspondence.

This additional analysis continues to support Hydro's proposal of the immediate construction of a regional plant with a 25 kV interconnected system as the recommended solution for the long-term supply of southern Labrador, in line with Hydro's mandate to provide power at the lowest possible cost, consistent with reliable service in an environmentally responsible manner.

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[9] The Board in *Public Utilities Act,* RSNL 1990, c P-47, Board Order No. P.U. 13(2016), Board of Commissioners of Public Utilities, April 26, 2016 noted that in determining whether a decision or action is prudent, the Board considers: 1) information that was known or ought to have been known at the time of the decision or action (or inaction); 2) whether a utility applied reasonable foresight; perfect foresight is not required; and 3) whether the solution selected was within a range of reasonable alternatives.
[10] Hydro's average project variance for transmission and distribution projects in its 2022 Capital Expenditures Report was 13%.

Should you have any questions or comments about any of the enclosed, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

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Attachment 1

Southern Labrador Communities – Integrated Resource Plan Response to Newfoundland and Labrador Board of Commissioners of Public Utilities Information Request Issues Aug 1, 2023

Midgard Consulting Inc.

October 3, 2023

newfoundland labrador hydro

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SOUTHERN LABRADOR COMMUNITIES - INTEGRATED RESOURCE PLAN

Response to Newfoundland and Labrador Board of Commissioners of Public Utilities Information Request Issued Aug 1, 2023

SUBMITTED BY

Midgard Consulting Inc.

DATE

October 3, 2023

Midgard, established in 2009, provides consulting services across the electrical power and utility sector. Midgard's principals and staff have direct experience in project development, design, contract procurement, finance, construction, and operations. This combined experience has translated into mandates in project due diligence, lender's technical advisor, loan guarantee assessments, and Independent Engineer roles in Canada, the United States, and internationally. Midgard has worked for developers, utilities, government agencies, and both project lenders and equity providers.

Midgard's team has extensive experience modelling fuel sources, creating energy yield estimates, reviewing contracts, reviewing pro-formas, and assessing project risks from a construction, operations, and financial perspective.

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REPORT SIGN-OFF

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NOTE: ORIGINAL HARD COPY IS SIGNED, SEALED, AND RETAINED ON FILE BY MIDGARD

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EXECUTIVE SUMMARY

On March 28, 2023, Midgard Consulting Inc. (**"Midgard"**) submitted an Integrated Resource Plan (**"IRP")** to Newfoundland and Labrador Hydro (**"NLH"**) outlining the alternatives available to supply power to Southern Labrador. Based on the conclusions from that report, NLH submitted an application to proceed with the design and construction of a regional powerplant and interconnection to serve the six communities in Southern Labrador.

The Newfoundland and Labrador Board of Commissioners of Public Utilities (**"the Board"**) and interveners then issued a series of Requests for Information (**"RFIs"**) which were duly answered by either NLH directly or were answered by Midgard as appropriate. Following this, the Board had residual questions relating to the application which were noted in a letter to NLH dated August 1, 2023.

In that letter, several questions were raised by the Board. These questions regarded network configurations (termed "scenarios") provided in the IRP. Since Midgard was responsible for providing the IRP and consolidating many of the scenarios that are under consideration, NLH requested that Midgard work to facilitate a response to these questions. This report, along with additional work which will be provided directly by NLH, has been compiled to answer these questions.

The Board has requested further analysis and comparison of three scenarios, as well as NLH's recommended scenario as noted in Table 1.

Table 1: Scenarios Requested by the Board

Scenario Name	IRP Nomenclature	NLH Nomenclature
Regional Plant	C (N-1)	Option 3b
Islanded	B	Option 2
Interconnection of Existing Plants	E	6
2-Community Portable Generation	(Not Included)	7[1]

For each of these scenarios, the Board requested further analysis, to include:

1. Updated capital cost estimated to a Class 4 level of accuracy;
2. Anticipated schedules for the implementation of each scenario;
3. A list of anticipated environmental approvals or permits required for each scenario as well as an estimated time for their procurement;

[1] A variation of scenario 7, discussed in depth in the "Configuration" section below.

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4. Tables and graphs detailing updated net present costs for every year of the study period based on the Class 4 capital cost estimates;
5. A second set of tables and graphs that replicated the study results but that assume a 50-year life expectancy for the diesel generating plants; and
6. A sensitivity analysis for the above that include variations to fuel price, customer load, and capital cost conducted as a multi-variate analysis rather than as individual sensitivities.

The results of the updated scenarios and associated sensitivity analysis are consistent with the conclusions drawn from the 2023 IRP and have not changed the recommendation for supply to the region – namely, that the Regional Powerhouse scenario remains the lowest Net Present Cost (**"NPC"**). The only sensitivity instances that resulted in the Regional Powerhouse scenario being the second lowest cost scenario required interconnection costs to be 300% of current values, while other capital costs remained at or below current levels, which is considered exceedingly unlikely. In addition to the sensitivities assessed there are no other sensitivities (single or multi-variate) that are anticipated to cause any other scenario to become the lowest cost alternative.

Both NLH and the Board have expressed a desire that reliable service to Charlottetown and Pinsent's Arm be achieved, and that the long-term solution for service in Southern Labrador is expedited. There is a considerable amount of information available on the scenarios evaluated in this report, as well as other scenarios considered in both the IRP and the Long-Term Supply for Southern Labrador – Phase 1 submission (issued in July of 2021). This report includes relevant information from these and other documents to minimize the amount of cross reference to previous material. It is Midgard's hope that by providing a largely self-contained report that NLH and the Board can come to a common understanding of the challenges and opportunities available to resolve any outstanding issues and fulfill both parties' mandates to provide safe, reliable, and least-cost service in an environmentally responsible manner to Southern Labrador communities.

To ensure that the questions posed by the Board have been appropriately addressed, a tracking spreadsheet which outlines all of the requests from the Board with a concordance table outlining where in this document the answer to each specific question can be found is attached as Appendix A:, and can be used to find the response to specific questions posed.

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This report confirms the IRP conclusion that the immediate construction of a Regional Diesel Plant with a 25 kV interconnected system continues to be the most cost-effective solution to provide firm capacity to the six Southern Labrador communities, based on updated Class 4 estimates.

Based on the multi-variate sensitivity analysis, the Regional Plant scenario is the lowest NPC in 87% (260 of 300) of the examined sensitivity instances. Sensitivity instances where the Regional Plant scenario is not the lowest NPC are assessed as extremely unlikely to occur and would require transmission costs to increase by 300%, while all other capital costs remain constant or decrease by 25%. In addition, the Sensitivity Analysis demonstrated that the Regional Plant scenario was best able to accommodate load variations that could occur following commissioning.

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TABLE OF CONTENTS

Document Control and Sign-off 3
Executive Summary 4
1 Introduction and Background 11
1.1 Existing Facility Constraints 13
1.2 Regulatory Concerns 13
2 Scenarios Under Consideration 14
2.1 Regional Plant 14
2.2 Islanded Operation 14
2.3 Interconnection of Existing Plants 15
2.4 2-Community Portable Generation 15
3 Data Sources and Model Configuration 16
3.1 Cost Estimate Sources 16
3.2 Scenario Schedules 17
3.3 Sensitivity Configuration 17
4 Scenario Cost Components 19
4.1 Capital Costs 19
4.2 Recurring Capital Costs 20
4.3 Operating Costs 21
5 Schedule and Permitting 23
6 Scenario Comparisons 26
6.1 Overall Results 26
6.2 Regional Plant Scenario 30
6.3 Islanded Communities Scenario 31
6.4 Interconnection of Existing Plants Scenario 32
6.5 2-Community Portable Scenario 33
7 Multi-variate Sensitivity Analysis 35
7.1 Sensitivity Results 35
7.2 Evaluation of Sensitivity Configurations Favoring Islanded Operation 36
7.3 Load Change Effects 38
8 Conclusions 40
Appendix A: Concordance Table for Board Information Requests 42
Appendix B: Fuel Price Forecast 44
Appendix C: Cost Appendix – 5 and 10-year Cost Results 45
Appendix D: Sensitivity Results Tables 49
Appendix E: 50-year Scenario Results 59
Appendix F: Detailed Load Change Analysis 67

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LIST OF FIGURES

Figure 1: 2023 Fuel Price Forecast 21
Figure 2: Scenario Schedule Comparison 23
Figure 3: Net Present Costs (Real, CAD 2023) 28
Figure 4: Annual Capital Expenditures, All Scenarios (25 years) 29
Figure 5: Annual Capital Expenditures, Regional Plant (25 years) 30
Figure 6: Annual Capital Expenditures, Islanded (25 years) 31
Figure 7: Annual Capital Expenditures, Interconnect Existing (25 years) 32
Figure 8: Annual Capital Expenditures, 2 Comm Portable (25 years) 33
Figure 9: 5-year Price Increase of Selected BLS Indices 37
Figure 10: 20-year Price Increase of Selected BLS Indices 37
Figure 11: Net Present Costs (Real, CAD 2023) 40
Figure 12: Annual Capital Expenditures, Regional Plant (10 years) 45
Figure 13: Annual Capital Expenditures, Regional Plant (5 years) 45
Figure 14: Annual Capital Expenditures, Islanded (10 years) 46
Figure 15: Annual Capital Expenditures, Islanded (5 years) 46
Figure 16: Annual Capital Expenditures, Interconnection of Existing Plants (10 years) 47
Figure 17: Annual Capital Expenditures, Interconnection of Existing Plants (5 years) 47
Figure 18: Annual Capital Expenditures, 2 Comm Portable (10 years) 48
Figure 19: Annual Capital Expenditures, 2 Comm Portable (5 years) 48
Figure 20: Net Present Costs (Real, CAD 2023) 61
Figure 21: Annual Capital Expenditures, All Scenarios (25 years) 61
Figure 22: Annual Capital Expenditures, Regional Plant (50 years) 62
Figure 23: Annual Capital Expenditures, Islanded (50 years) 63
Figure 24: Annual Capital Expenditures, Local Interconnect (50 years) 64
Figure 25: Annual Capital Expenditures, 2 Comm Portable (50 years) 65

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LIST OF TABLES

Table 1: Scenarios Requested by the Board 4
Table 2: Scenarios Requested by the Board 12
Table 3 Board Requested Scenarios for Further Analysis 14
Table 4: Load Change Configurations 18
Table 5: Powerhouse Capital Cost Estimates ($000) 19
Table 6: Powerhouse Auxiliary Equipment Upgrade Capital Cost Estimates (Direct costs) ($000) 20
Table 7: Cost Estimates for Additional Upgrades ($000) 20
Table 8: Permits and Authorizations that may be Required for the Project 24
Table 9: Net Present Costs (Real, $k CAD 2023) 27
Table 10: Net Present Cost Comparison of Scenarios, Year 10 (2032) ($000) 28
Table 11: Net Present Cost Comparison of Scenarios, Year 26 (2048) ($000) 28
Table 12: Regional Plant Capital Expenditures by Year 30
Table 13 Islanded Capital Expenditures by Year 31
Table 14: Interconnection of Existing Plants Capital Expenditures by Year 33
Table 15: 2-Community Portable Capital Expenditures by Year 34
Table 16: Sensitivity Configuration Settings 35
Table 17: Sensitivity Results 36
Table 18: Load Change Impacts 39
Table 19: Net Present Costs (Real, $000 CAD 2023) 59
Table 20: Regional Plant Capital Expenditures by Year 62
Table 21: Islanded Capital Expenditures by Year 64
Table 22: Interconnection of Existing Plants Capital Expenditures by Year 64
Table 23: 2-Community Portable Capital Expenditures by Year 66

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LIST OF ACRONYMS

CAT	Caterpillar Inc.
CER	Clean Electricity Regulations
CHT	Charlottetown generating station
CPI	Consumer Price Index
DCF	Discounted Cash Flow
Firm [capacity]	The amount of generation available on-peak, while simultaneously allowing for redundant resources to account system outage according to the relevant planning reliability standard.
GHG	Greenhouse Gas
HMI/PLC	Human Machine Interface/ Programmable Logic Controller
IDC	Interest During Construction
IRP	Integrated Resource Plan
kW	Kilowatt
kWh	Kilowatt-Hour
MCC	Motor Control Center
MSH	Mary's Harbour generating station
MWh	Megawatt-Hour
N-1	Single Unit Contingency
N-2	Double Unit Contingency
NERC	North American Electric Reliability Corporation
NLH	Newfoundland and Labrador Hydro
NPC	Net Present Cost
NPV	Net Present Value
PHS	Port Hope Simpson generating station
PUB	Newfoundland and Labrador Board of Commissioners of Public Utilities
O&M	Operations and Maintenance
RFI	Request for Information
RPT-TN-089	NLH Document "RP-TN-089 Southern Labrador -– Summary Information for Midgard"
SLE	St. Lewis generating station

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1 INTRODUCTION AND BACKGROUND

NLH has studied the long-term supply options for certain communities in Southern Labrador since the early 2000's. In October 2019, the Diesel Generating facility serving Charlottetown and Pinsent's Arm (**"CHT"**) was destroyed by fire. This incident created a supply gap (loss of supply) for these two communities which has since been served with the temporary solution of mobile, trailer mounted diesel gensets. This "temporary" interim solution has been afflicted by ongoing issues which have affected both worker safety and service reliability including two additional fires and an alternator failure. These incidents have destroyed two portable gensets and caused significant damage to a third. The Southern Labrador region also has two generating stations that are scheduled for imminent retirement or reconstruction: Mary's Harbour generating station (**"MSH"**) which serves the communities of Mary's Harbour and Lodge Bay is due for retirement in 2030, and the Port Hope Simpson generating station, (**"PHS"**) which is due for retirement in 2035. MSH is currently in need of several outstanding upgrades to enable the facility to reach its scheduled retirement in 2030. The fourth station in the region, St. Lewis generating station (**"SLE"**), is relatively new and is scheduled for retirement in 2045. The existing generating stations range in age from 18 years (SLE) to 33 years (MSH) and several are scheduled for refits, including the addition of modern fire suppression systems. These refits have largely been deferred while a long-term plan for the region is developed to ensure that large capital expenditures are not made for assets that will be immediately retired.

As part of the long-term planning for this region, Midgard Consulting Inc. (**"Midgard"**) was retained to provide an Integrated Resource Plan (**"IRP"**). On March 28, 2023, Midgard submitted the IRP to Newfoundland and Labrador Hydro (**"NLH"**) outlining the alternatives available to supply power to Southern Labrador. Based on the conclusions from that report, NLH submitted an application to proceed with the design and construction of a regional powerplant and interconnection to serve the six communities in Southern Labrador. This proposal was similar to the initial proposal from NLH in the Phase 1 submission, with the main difference recommending against the phased construction of the interconnection, largely because the difference in start date eliminated the cost benefit of construction phasing.

The Newfoundland and Labrador Board of Commissioners of Public Utilities (**"the Board"**) and interveners issued a series of Requests for Information (**"RFIs"**) which were duly answered by either NLH directly or were answered by Midgard. Following this, the Board had residual questions relating to the application which were noted in a letter to NLH dated August 1, 2023.

These questions regarded network configurations (termed "scenarios") provided in the IRP. Since Midgard was responsible for providing the IRP and consolidating many of the scenarios that are under consideration, NLH requested that Midgard facilitate a response to these questions. This report, along with additional work that has been provided directly by NLH, has been compiled to answer these questions.

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The Board has requested further analysis and comparison of three scenarios, as well as NLH's recommended scenario as noted in Table 2.

Table 2: Scenarios Requested by the Board

Scenario Name	IRP Nomenclature	NLH Nomenclature
Regional Plant	C (N-1)	Option 3b
Islanded	B	Option 2
Interconnection of Existing Plants	E	6
2-Community Portable Generation	(Not Included)	7[2]

For each of these scenarios, the Board requested further analysis, to include:

1. Updated capital cost estimated to a Class 4 level of accuracy;
2. Anticipated schedules for the implementation of each scenario;
3. A list of anticipated environmental approvals or permits required for each scenario as well as an estimated time for their procurement;
4. Tables and graphs detailing updated net present costs for every year of the study period based on the Class 4 capital cost estimates;
5. A second set of tables and graphs that replicated the study results but that assume a 50-year life expectancy for the diesel generating plants; and
6. A sensitivity analysis for the above that include variations to fuel price, customer load, and capital cost conducted as a multi-variate analysis rather than as individual sensitivities.

For each of the four scenarios outlined above, NLH carried out sufficient design and project definition required to support capital cost estimates and prepared those updated capital cost estimates, as well as schedules and permitting requirements for each of these scenarios (items 1, 2, and 3). Midgard used the information generated by NLH to prepare a new sensitivity model, based on the financial model prepared for the IRP to determine the cost impacts of these changes, as well as the sensitivity evaluation requested by the Board (items 4, 5, and 6).

Key to understanding these issues is an understanding of the existing facilities and the input information used to model and draw conclusions from the selected scenarios and associated sensitivity analysis.

[2] A variation of scenario 7, discussed in depth in the "Configuration" section below.

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1.1 Existing Facility Constraints

The existing powerhouses were designed to serve their local loads and were not intended to be interconnected to serve multiple communities. As such, these powerhouses were designed and constructed to output their firm (N-1) capacity rather than their installed (sum of all generators) capacity. Any upgrades required to output at installed capacity (and thus serve loads outside the local community) would require increasing the size of the service conductors and increasing the size of the main system bus and associated switchgear at each powerhouse. Upgrading the system bus size would cause further cascading necessary changes, as it will require a significant increase in the size in each Motor Control Center (**"MCC"**) to accommodate the increased bus size, as well as requiring a switch from (relatively inexpensive) pole mounted transformers to ground mounted transformers. Finally, these changes would require a larger physical footprint for both the buildings and the associated substation. Photos of the substations and their layout are included in Section 6 of RPT-TN-089. These photos show the sites as well as interior photos, highlighting the areas of concern or congestion that would need to be modified to allow interconnection and export of energy in excess of the local community demand.

These stations were not designed to be used in this manner and would require upgrades and changes to be fit for this purpose. NLH has included estimates for these costs in scenarios that would require a change of purpose of an existing generation facility.

1.2 Regulatory Concerns

The Board has expressed concern regarding proposed changes to both federal and provincial energy regulations that could affect the viability of planned new or additional diesel burning generation.

This includes the federal Clean Electricity Regulation (**"CER"**). However, a recent Government of Canada release of the draft CER[3] confirms that NLH's remote service areas in Labrador are exempt from the CER. Specifically, the CER does not apply to diesel generators operating in areas not connected to an electricity system regulated by the North American Electric Reliability Corporation (**"NERC"**).

Provincially, the recent changes to Newfoundland and Electrical Power Control Act, 1994 add a requirement for NLH to consider environmental effects. However, as NLH has already been ensuring compliance with environmental regulations and has been actively working to reduce greenhouse gas (**"GHG"**) emissions, this new provincial legislation is not anticipated to impact the generator selection in Southern Labrador.

It is concluded that the current known regulatory regime does not impact the selection of this generation source for a load not interconnected to a NERC system as in Southern Labrador.

[3] https://www.gazette.gc.ca/rp-pr/p1/2023/2023-08-19/html/reg1-eng.html

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2 SCENARIOS UNDER CONSIDERATION

With this information as a starting point, both NLH and the Board have expressed a desire for a permanent generation solution for the southern Labrador region. As part of the information request submitted on August 1, 2023, the Board requested additional information from NLH focused on specific powerhouse and interconnection configurations, with a further request to examine an interim solution supplying power to the communities served by CHT using an interconnection to the existing powerhouse at PHS and the further use of mobile generators to be relocated there. As a result, this document will focus on the four scenarios presented in Table 3.

Table 3 Board Requested Scenarios for Further Analysis

Scenario Name	IRP Nomenclature	NLH Nomenclature
Regional Plant	C (N-1)	Option 3b
Islanded	B	Option 2
Interconnection of Existing Plants	E	Option 6[4]
2-Community Portable Generation	(Not Included)	Option 7[5]

These scenarios are described in detail below.

2.1 Regional Plant

This scenario involves the construction of a Regional Plant near PHS, along with the 25 kV interconnection of the Southern Labrador communities. Upcoming unit and powerhouse replacement would be suspended except for immediate genset replacements to ensure reliability. Once the regional plant and interconnection infrastructure is online the existing community plants would be decommissioned.

2.2 Islanded Operation

This scenario contemplates the construction of a new permanent generating station to be constructed outside the municipal limits of Charlottetown. The communities would continue to be serviced by their existing generating stations. Diesel gensets would be replaced as remaining useful life expires and the generating stations would be replaced sequentially (2030 for MSH; 2035 for PHS; and 2045 for SLE) at the end of their service lives.

[4] Included in RPT-TN-051 provided March 17, 2022, referenced above.

[5] A variant of the "Delayed Regional PH" alternative included in RPT-TN-054, provided March 17, 2022, above.

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2.3 Interconnection of Existing Plants

This scenario would interconnect all existing community powerhouses with 25 kV service allowing the MSH, PHS and SLE powerhouses to also provide power to Charlottetown and Pinsent's Arm. Diesel gensets would be replaced as remaining useful life expires and the generating stations would be replaced sequentially (2030 for MSH; 2035 for PHS; and 2045 for SLE) at the end of their service lives.

2.4 2-Community Portable Generation

This scenario would interconnect PHS to CHT with 25 kV service creating a Northern interconnection powering Port Hope Simpson, Charlottetown, and Pinsent's Arm. Portable gensets would be moved from CHT to PHS to provide the required capacity, and the station at PHS would be upgraded to handle the additional load. In 2030 the interconnection would be extended to include all of the local communities and a regional powerhouse would be built in or near PHS, eliminating the need to rebuild the MSH powerplant. Once the regional plant is in operation the remaining community powerhouses would be retired.

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3 DATA SOURCES AND MODEL CONFIGURATION

The relative ranking of the respective Scenarios is based on a lowest cost basis as determined through a discounted cash flow (**"DCF"**) model. In this analysis, non-cash impacts, such as accelerated depreciation of existing useful assets is ignored. The ranking is based solely on estimates of go-forward cash cost.

The annual cash flows comprise staged capital spend, ongoing Operations and Maintenance (**"O&M"**) costs and fuel costs. Capital costs include costs associated with new construction and supply as well as ongoing genset overhauls & replacements, tank inspections, and general capital spending planned for existing stations that remain in operation.

The DCF model begins in 2023 and runs through 2048 (26-years) which allows for planned capital works to commence in 2024 and run for a 25-year planning period. In addition, consistent with the Board's request, Midgard developed a parallel DCF Model. This model uses a 50-year planning period. In order to account for a life extension for a 40-year diesel plant life to a 50-year planning model, a 10% capital cost life extension was applied in year 35 to each of the relevant scenarios. To account for different asset lives as well as deferred capital spending that would still retain some net book value at the end of the planning period, a "Terminal Value" allowance is appended to the end of the model, which comprises the residual un-used capital life assuming a straight-line depreciation. The Terminal Value is represented as a "negative cost" in the year 2049.

Unless otherwise stated, costs and schedules used are those prepared by NLH in August and September of 2023, and provided to Midgard for analysis. Midgard undertook an independent check of select costs. During this process and in discussions with NLH's design team, cost allocations for some of the FEED engineering was clarified and updated[6]. In Midgard's opinion the NLH cost estimates are appropriate. Midgard reviewed NLH's proposed schedules. These are considered to be reasonable and realistic based on Midgard's experience with similar projects in other jurisdictions (i.e., remote location and with similar, short construction seasons). Midgard discussed recent permit approval timelines with NLH's permitting staff and, combined with Midgard's own experience with project permits in other jurisdictions, concluded that the allowance for permit approval timelines is reasonable.

3.1 Cost Estimate Sources

The IRP used capital costs which were derived from cost estimates previously prepared by NLH and subsequently escalated to 2023 costs. Although these were largely based on estimates of higher accuracy, Midgard deemed these to be of a Class 5 nature owning uncertainty arising from the passage of time and inflationary conditions encountered at the time. The Board subsequently requested that Class 4 cost

[6] Camp costs and some FEED engineering costs were included as "Owners costs" rather than direct costs in the financials provided to Midgard. This point is clarified in Section 4 "Scenario cost components".

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estimates be used for further analysis. As a result, the estimates used in the sensitivity model are class 4 estimates based on the Class 3 estimates generated for the regional powerhouse and associated interconnection. The interconnection has been broken into "segments" which can be used alone or in combination to interconnect two or more of the islanded networks which formerly served their local areas.

Midgard has reviewed these estimates and applied select independent spot checks on input pricing and concludes that these costs are reasonable and reflect the recent (2020-2023) price escalation that has been observed on certain classes of equipment including generators, switchgear, and engines.

Indirect costs such as owner's costs, interest during construction, and contingency were applied based on NLH-provided information derived from its own corporate experience.

3.2 Scenario Schedules

Schedules were prepared by NLH based on previous projects. Permitting schedules were based on their current assessment of the level of permitting and stakeholder engagement required. Engineering and construction schedules were based on the regional (northern) climates which necessitate the execution of some construction components in the summer season. High level schedules are presented graphically in Section 5.

3.3 Sensitivity Configuration

A multi-variate sensitivity analysis was requested by the Board to investigate whether two or more sensitivities could interact and change the lowest cost alternative. Specifically, the Board requested:

> "Sensitivities to the analyses completed in item (5) that include variations to fuel price, customer load, capital costs, either as a whole or individual components, and any other reasonable variables that might significantly impact the net present cost analysis."

The ranges for these analyses are presented in the "Sensitivity" section below and elucidated in Table 4. In initial analysis including these factors as well as non-fuel operating costs was evaluated with non-fuel operating costs dropped from the assessment since it made no difference to the sensitivity assessment in a range of 75% to 300% of costs.

The extreme ends of the sensitivity analysis should be understood to have extremely low probabilities of occurrence. For context, cost increases over the last two years are among the highest observed in the period of record (starting in 1947 for motor and generator manufacturing) and these include a cost increase of 50% over two years, which is likely the limit of actual price increases that can be reasonably anticipated.

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3.3.1 Load Sensitivity Analysis

Load sensitivity required a different approach than the other sensitivities which were purely based on increasing or decreasing a set group of costs in the model. Load increases have two effects: the first is that they increase the cost of fuel required to provide the energy demand, The second is that they will increase the peak loads, which may result in the requirement of additional generation to meet firm (N-1 or N-2[7]) requirements at peak load. If loads decrease, then fuel use decreases and there may be an opportunity to reduce the size or number of gensets.

Five load "settings" were selected to reflect changes to the loads in Southern Labrador. These settings are described in Table 4.

Table 4: Load Change Configurations

-2%	2% load decline per year at all communities, applied to energy and peak load
-1 plant	Removal of one fish processing plant in Mary's Harbour in 2028: –448.9 MWH and -308 kW peak load
None	No Change
+1 plant	Addition of one fish processing plant in Mary's Harbour in 2028: +448.9 MWH and +308 kW peak load
+2%	2% load increase per year at all communities, applied to energy and peak load

The extremes of these load change scenarios assume that the load increases or decreases by 2% a year. "None" assumes that the load stays more or less constant, which has largely been the case for the last twenty years in Southern Labrador. The last two cases reflect the addition or closing of a fish plant in Mary's Harbour. Historic data from NLH allowed us to quantify the amount of energy and the change in peak load experienced by adding the last fish plant addition at Mary's Harbour. This was done by examining the difference between average peak loads and energy usage of an existing fish plant in the area from seven years before the fish plant was added, and from a 10-year period after the fish plant was operational post-construction. The average energy change calculated as a result of the fish plant addition was just under 449 MWh, and the average change in peak load was 308 kW. The "+1 fish plant" configuration assumes that a fish plant is added to Mary's Harbour, and increases the peak load by 308 kW, with an annual energy usage of 449 MWh, and the "-1 Fish Plant" configuration assumes that one of the existing fish plants is closed, with a reduction in annual energy usage of 449 MWh, and a peak load reduction of 309 kW.

[7] Due to the large number of small generators present in the "Interconnection of Existing Plants" scenario N-2 reliability is likely required to provide an appropriate level of redundancy.

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4 SCENARIO COST COMPONENTS

Midgard developed a financial model to support its March 2023 IRP. This model used Class 5 capital cost estimates which were obtained from variety of sources (predominantly previous NLH site specific Class 5 capital cost estimates) and updated using Consumer Price Index ("CPI") adjustments to 2023. Most of these source estimates dated from 2020 or earlier. As requested by the Board, NLH has developed new Class 4 capital cost estimates for the selected scenarios to facilitate an assessment using current costs.

4.1 Capital Costs

NLH developed updated Class 4 capital cost estimates for the select scenarios. These cost estimates were shared with and reviewed by Midgard. High inflation has recently been observed on some classes of capital equipment especially electrical and generation equipment. These include transformers, protection and controls, engines, and generators. Midgard confirms that the costs are in line with its own observations of the market and notes that these costs are in many cases significantly higher than projected in the model generated in late 2022 for the IRP.

A summary of capital costs used in the Sensitivity Model can be found in the Table 5.

Table 5: Powerhouse Capital Cost Estimates ($000)

	Regional	CHT	MSH	PHS	SLE
Total Costs[8]	**$49,010**	**$40,384**	**$37,413**	**$37,296**	**$36,546**

Additional capital costs required for the "interconnection of existing plants" and the "2-community portable" scenarios are not included in Table 5. These costs arise from upgrades noted as "Auxiliary Equipment Upgrades" in the document "RP-TN-089 Southern Labrador -– Summary Information for Midgard" ("RPT-TN-089"). These upgrades are required for existing powerhouses to be able to export power on an interconnected grid, rather than to their local community/communities, and can be found in Table 6 and Table 7. These costs represent a significant portion of the costs of a new powerhouse in large part due to the significant upgrades required and the requirement for this work to be performed without interrupting the supply of power to the communities. One of the major costs in these upgrades is the rental of portable gensets. It may make sense for NLH to procure gensets for this work rather than renting them, particularly if the "Interconnection of Existing Plants" scenario is pursued. These gensets would be required over multiple years and the rental cost may be higher than the cost of purchase – assuming that these gensets could be procured in time to meet the construction schedule.

[8] Total Costs do not include escalation, which is modelled at CPI (2%)

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A summary of the aggregate costs per powerhouse are as follows:

Table 6: Powerhouse Auxiliary Equipment Upgrade Capital Cost Estimates (Direct costs) ($000)

	MSH	PHS	SLE
Powerhouse Upgrade Costs	$10,273	$7,735	$8,128

Additionally other capital costs were updated, including refit costs for fire suppression systems, envelope repairs for MSH and the cost to relocate and connect CHT mobile gensets at PHS these costs are as follows:

Table 7: Cost Estimates for Additional Upgrades ($000)

MSH Outstanding Work	$1,376
Fire Suppression - Retrofit	$1,578
Fire Suppression - Aux Building	$350

Beyond the upgrades identified in Table 7 and potential interconnection upgrades it is not anticipated that any further work will be required on the MSH facility to ensure the reliable operation of the plant if its life is extended from 2027 to 2030 (or 2034 if the Interconnection of Existing Plants scenario is selected9).

4.2 Recurring Capital Costs

In addition to one-time capital costs, Midgard has included the following "recurring" capital costs in its model:

- **Genset Replacement:** Historically NLH has replaced its diesel gensets roughly every 25 years. Midgard considers this replacement schedule reasonable for planning purposes and has used it in this analysis. Genset replacements that occur for all scenarios include the SLE 365 kW unit in 2023 and the SLE 455 kW unit in 2027. PHS has a 545-kW unit scheduled for replacement in 2028, which will not be replaced in the "Regional Plant" scenario but will be replaced in all other scenarios.
- **Genset overhauls:** Overhauls result in an ongoing cost for all scenarios. In the model supporting this report, Midgard has assumed a major genset overhaul every five years. Actual overhaul cycles are dependent on the actual usage, so underutilized systems will have very infrequent overhauls, while units that are continuously in service will tend to require overhauls more frequently.
- **HMI/PLC Refits:** Control systems and their associated protocols continue to evolve, which generally requires a periodic upgrade of control systems. Each powerhouse is assumed to have a PLC upgrade every 15 years with a cost of $1.5 million dollars.

[9] Interconnection of Existing Plants requires significant powerhouse upgrades, which will enable an additional decade of working life for the MSH facility.

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- **Fuel Tank Inspections:** Fuel tanks must be regularly inspected for safety. A $250,000 tank inspection charge is applied to each powerhouse every 10 years.

4.3 Operating Costs

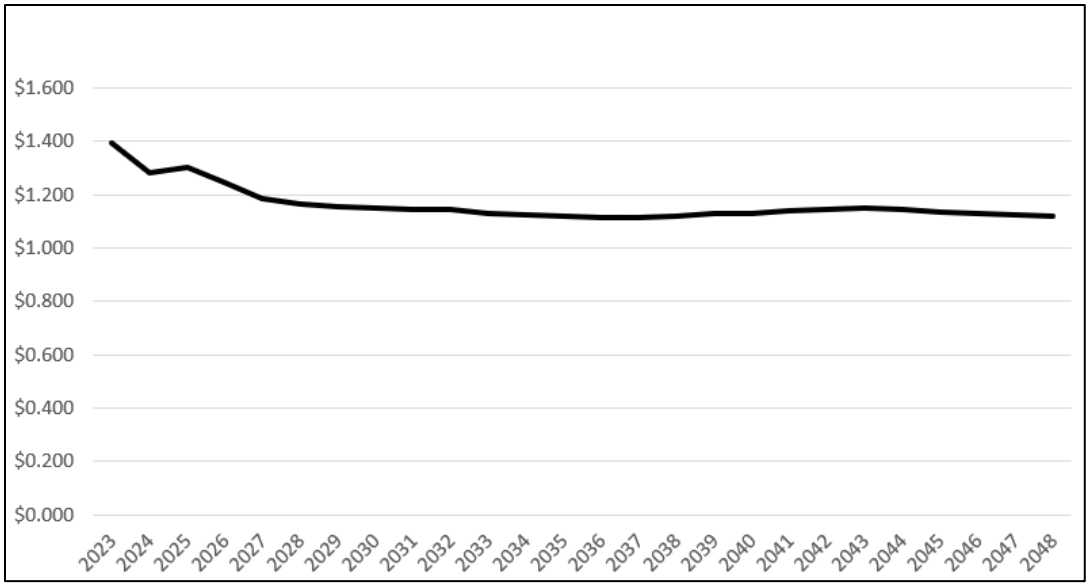
As part of the model reconfiguration for sensitivity analysis, Midgard wanted to ensure that operating costs were in line with the current situation. The major operating cost components identified in the IRP were:

- Fuel Costs
- Maintenance costs

4.3.1 Fuel Price forecast

Fuel prices were highly variable over 2021-2023, although this volatility appears to be stabilizing. Fuel costs have been updated based on the current (August 2023) NLH Diesel price forecast. Midgard has used NLH's latest fuel price forecast, which was updated in the Midgard Sensitivity Model to reflect cost delivered to PHS. Because the Midgard DCF models use escalated costs in 2023 dollars, it was necessary to net out that escalation using an assumed future CPI of 2%, resulting in a forecast of diesel fuel prices in "real" dollars. The fuel price forecast[10] used in these calculations is available as Appendix B and is presented graphically below in Figure 1:

Figure 1: 2023 Fuel Price Forecast



[10] The source data used was "*Southern Lab Study - LT Fuel Price Forecast July 2023.xlsx*" provided by Scott Henderson on Aug 21, 2023, vie email. A tabular version of this price forecast can be found in Appendix B: below.

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4.3.2 Maintenance Costs

Based on discussions with NLH, maintenance costs (all non-fuel operating costs) have not increased at the same level as capital costs. Since these components are relatively minor when compared to fuel costs, and have not notably increased, they have been modeled as being in line with CPI over the last two years. As a result, the Sensitivity Model uses the same non-fuel operating costs (i.e., constant real dollars) as the IRP model.

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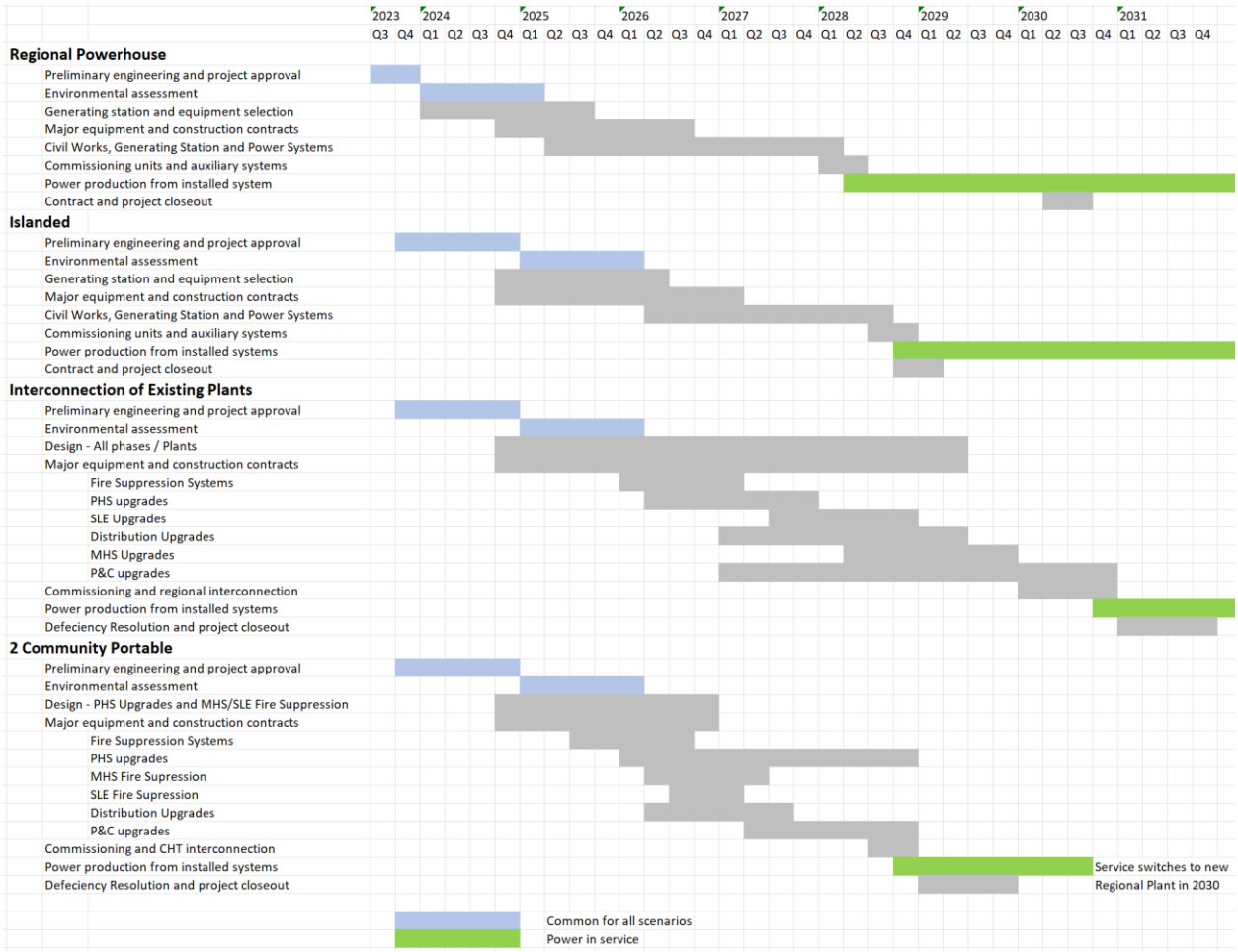
5 SCHEDULE AND PERMITTING

All of the scenarios will require environmental permitting and construction scheduling. Preliminary schedules have been developed by NLH. High-level representations of these schedules can be found below in Figure 2, with engineering, project approval, and environmental assessment having consistent timing and durations for all scenarios (highlighted in blue). The start of power generation (shown by the green bars) is significantly different across the scenarios, with the "Regional Powerhouse" expected to be online in Q2 of 2028, six months ahead of any other scenario. The "Interconnection of Existing Plants" scenario lags the other scenarios by two years in late 2030.

Figure 2: Scenario Schedule Comparison



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A brief overview of the permits anticipated for the various system configurations provided by NLH can be found in Table 8 below.

Table 8: Permits and Authorizations that may be Required for the Project

Permit or Authorization	Agency	Notes
Approval of Capital Works	NL Public Utilities Board	
Release of the Undertaking under the EA Regulations	NL Department of Environment, Climate Change, and Municipalities (NLDECCM) - EA Division,	This Registration document represents the "application" for this regulatory process.
Crown Land Approval for distribution line Easement	NL Department of Fisheries, Forestry and Agriculture (NLDFFA) - Crown Lands Division	NLH will apply via crown lands division to obtain legal easement for the distribution line. The crown lands review process involves a referral process managed by government agencies, a government review committee and legal survey.
Permit to Alter a Waterbody (Watercourse Crossing)	NLDECCM - Water Resources Management Division	Required for stream crossings (e.g., culvert, bridge)
Water Use Licence	NLDECCM - Water Resources Management Division	Required if water is being pumped from a local waterbody for Project use
Road Construction Permitting	NL Department of Transportation and Infrastructure	May be required if new access roads are required
Quarry Permit	NLDIET– Mineral Lands Division	A permit will be required to dig for, excavate, remove and dispose of Crown quarry material
Permit to Cut Crown Timber	NLDFFA - Forest Management	A permit is required for cutting of timber on crown land
Pesticide Operator License	NLDECCM – Pesticide Control Section	NLH currently holds a Pesticide Operator License 19-043
Letter of Advice	Fisheries and Oceans Canada (DFO)	NLH will work with DFO for the applicable construction approval under the revised *Fisheries Act*.

Note that the specific permits required will be dependent on the configuration of each project, many of which are not sufficiently advanced to determine exactly which permits will be needed. An Environmental Assessment is expected to be required for any thermal generating station (whether new or an expansion of an existing facility), and the distribution interconnection (25 kV overhead lines required in three of the Scenarios) is also expected to need an Environmental Assessment. Since all of the alternatives include at least

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one genset expansion or interconnection, the Environmental Assessment period is expected to be at least a year but may be longer depending on the specific project impacts.

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6 SCENARIO COMPARISONS

In its August 1 letter, the Board requested the following:

> "5. Tables and graphs detailing the Class 4 estimate updated net present costs for Midgard's IRP Scenario B and Midgard's IRP Scenario E versus Hydro's proposed solution for every year of the study period. Please include in the tables and graphs the major capital cost events and fuel cost forecasts during the study period. Please provide a second set of tables and graphs using a 50-year life expectancy for the diesel generating plants."

This section provides the financial analysis results derived from the Class 4 estimates for the four Scenarios under consideration, which includes the three specifically requested by the Board above.

A second set of scenario comparisons is provided in Appendix E which demonstrates the results for the same Scenarios over a 50-year lifespan. For these scenarios, a "Powerhouse Life Extension" cost equal to 10% of the original construction cost (not including gensets) was incurred at Year 35 of operation for each powerhouse. This cost was to stand in for upgrade costs and repairs needed to extend their service life from the normal design life of 40 years to the 50 years needed for this evaluation.

6.1 Overall Results

The net present cost of each scenario over time is presented in Table 9. The 2048 value represents the total costs for the total lifespan of each project, discounted at NLH's real weighted average cost of capital to 2023 dollars.

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Table 9: Net Present Costs (Real, $k CAD 2023)

	Regional Plant	Islanded	Interconnection of Existing Plants	2 Comm Portable
2023	$11,425	$11,425	$11,425	$11,425
2024	$21,846	$21,846	$21,846	$21,846
2025	$31,819	$31,819	$31,819	$31,819
2026	$39,208	$42,040	$40,624	$39,208
2027	$44,103	$51,688	$71,642	$70,777
2028	$119,167	$95,482	$99,212	$78,095
2029	$123,958	$103,203	$126,943	$85,441
2030	$128,512	$137,818	$132,571	$143,952
2031	$134,275	$143,142	$137,773	$148,383
2032	$138,367	$149,832	$143,953	$152,634
2033	$142,286	$154,693	$148,701	$156,678
2034	$146,047	$160,143	$178,284	$161,795
2035	$149,657	$188,861	$206,931	$165,405
2036	$154,547	$193,189	$211,041	$168,878
2037	$157,903	$198,486	$215,248	$172,234
2038	$161,146	$202,495	$219,731	$175,477
2039	$164,293	$208,126	$224,372	$179,895
2040	$167,337	$211,946	$228,001	$182,940
2041	$171,863	$215,501	$231,373	$185,890
2042	$174,722	$220,364	$234,946	$188,749
2043	$177,484	$223,771	$238,869	$191,512
2044	$180,141	$228,389	$242,308	$195,582
2045	$182,692	$247,996	$261,756	$198,133
2046	$186,127	$251,043	$264,650	$200,580
2047	$188,481	$254,767	$267,358	$202,934
2048	$190,743	$257,512	$270,839	$205,196

The costs above are presented graphically Figure 3, with the 5-year and 10-year points indicated.

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Figure 3: Net Present Costs (Real, CAD 2023)

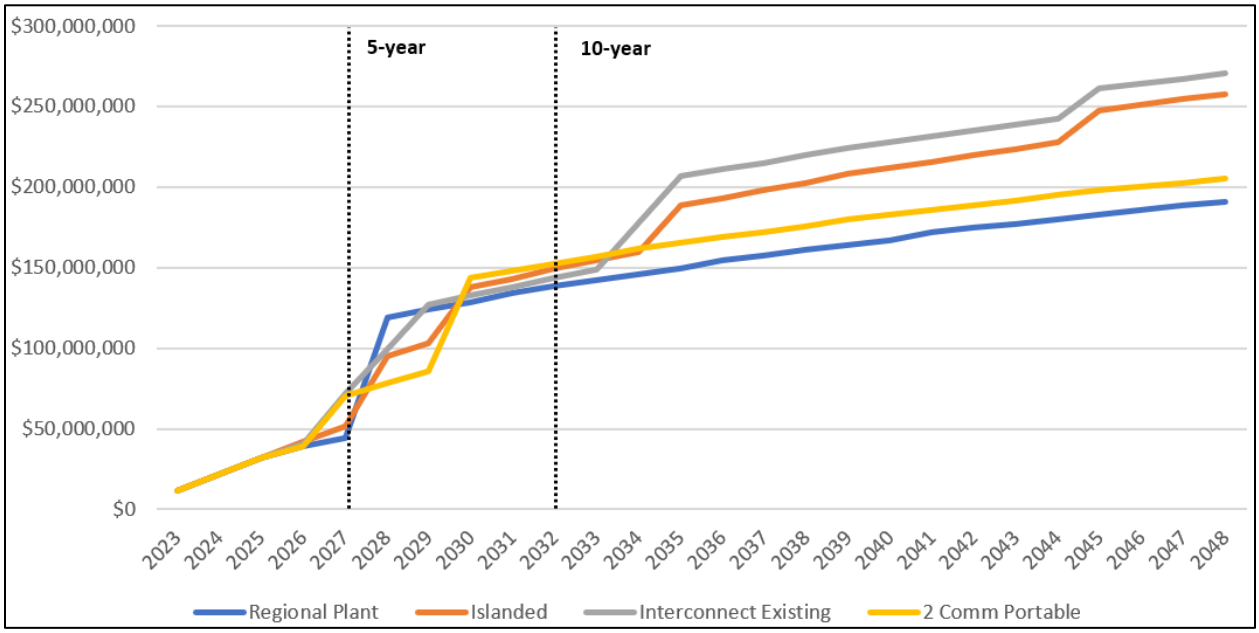

Table 10 and Table 11 summarize NPC for each Scenario at a snapshot in time (2032 and 2048 respectively) and show the difference for each scenario to the lowest NPC.

Table 10: Net Present Cost Comparison of Scenarios, Year 10 (2032) ($000)

	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable
Net Present Costs (Year 10)	$138,367	$149,832	$143,953	$152,634
Cost Difference vs. Lowest	$0	$11,465	$5,586	$14,267

Table 11: Net Present Cost Comparison of Scenarios, Year 26 (2048) ($000)

	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable
Net Present Costs (Year 26)	$190,743	$257,512	$270,839	$205,196
Cost Difference vs. Lowest	$0	$66,770	$80,096	$14,453

It is important to note that the 2048 Net Present Cost values presented above differ from the total NPC (equivalent to net present costs) presented in the "baseline" net present cost because the net present costs presented above do not include the terminal value of equipment.

The Regional Plant and the 2-community portable scenarios are similar, with a cost difference by 2048 of roughly $14.5M. As noted above, the Interconnection of Existing Plants scenario will lag all of the other scenarios in service dates by approximately two years as a result of the complexity of the construction, and the need to do work on an active system. This will take significantly more time than building new facilities

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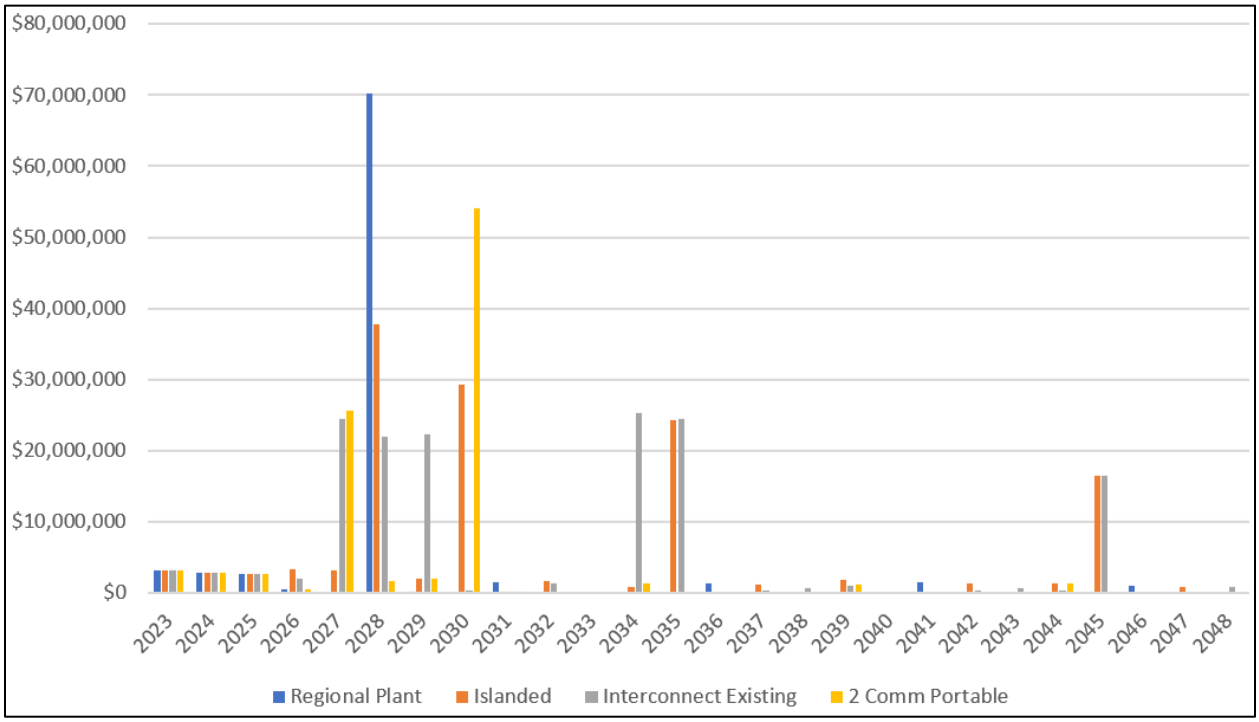
and then switching service over to the new facility. By 2030 (when MSH is scheduled for replacement) the Regional Plant becomes the lowest cost alternative, and by 2035 (when PHS is scheduled to be replaced) the cost difference between the scenarios that have a regional plant (Regional Plant, 2-Community Portable) and those that retain multiple local powerhouses (Islanded, Interconnection of Existing Plants) becomes increasingly large.

A visual representation showing the capital expenditures in each year (by scenario) over the 25-year study timeframe can be found in Figure 4.

Figure 4: Annual Capital Expenditures, All Scenarios (25 years)



Commonalities in the programs include the powerhouse replacements for the scenarios that retain local powerhouses in 2035 and 2045, as well as the significant capital spending required over the next decade for reliable power production in Southern Labrador, regardless of the specific scenario configuration chosen.

Descriptions of the specific scenarios and their capital expenditures follow. A number of recurring capital costs are included in the graphs but are not included in the tables below since these cost components are small relative to major infrastructure such as interconnection expenses and new powerhouses and occur frequently.

For simplicity of modelling and ease of data audit, costs are assigned when the bulk of the costs are anticipated to occur, rather than breaking up total costs into annual phases. As an example, the costs for the

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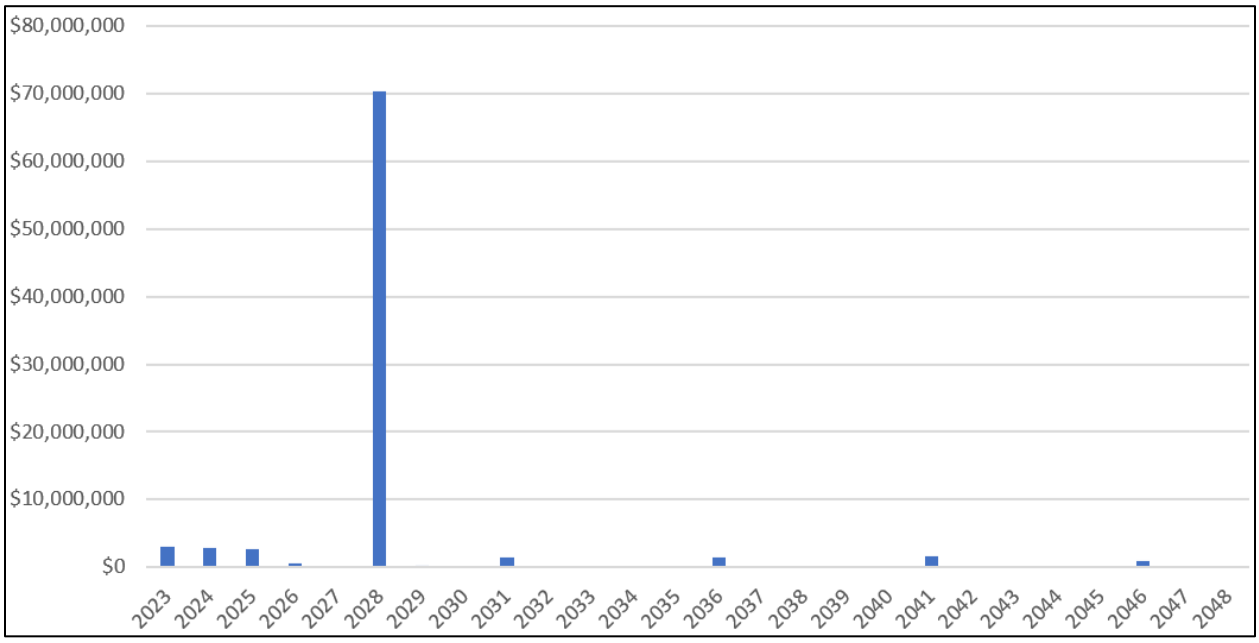
regional powerhouse are incurred in 2028, rather than spread from 2023 to 2029 since the plurality of costs will occur in this year.

6.2 Regional Plant Scenario

The Regional Plant capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 5: Annual Capital Expenditures, Regional Plant (25 years)



The regional plant scenario consists of the following major capital expenditures are shown in Table 12.

Table 12: Regional Plant Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2028	Construction of Regional Powerhouse including 1x910, 1x1,000, 1x 1,833 and 1x2,220 kW Gensets	$49,010
2028	Interconnection of CHT, MSH, PHS and SLE including voltage conversion	$34,917

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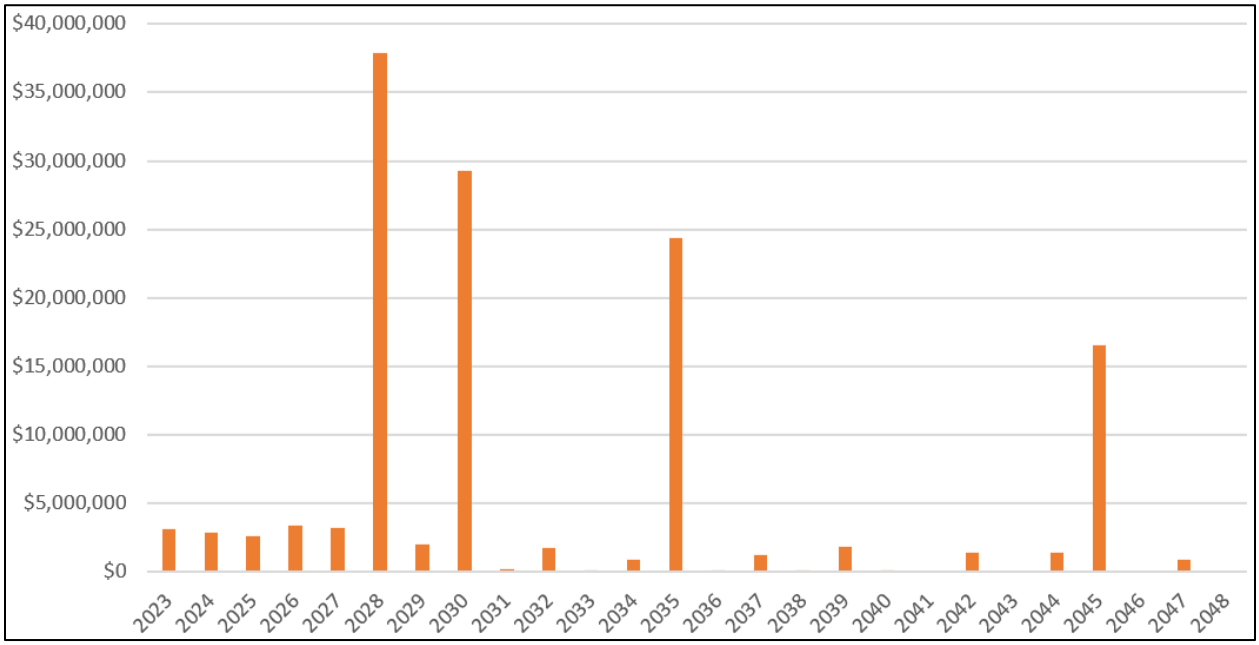
6.3 Islanded Communities Scenario

The Islanded Communities capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 6: Annual Capital Expenditures, Islanded (25 years)



The Islanded Communities scenario consists of the following major capital expenditures are shown in Table 13.

Table 13 Islanded Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2025	Retrofit of fire suppression systems at MSH and PHS.	$3,156
2026	Retrofit of fire suppression systems at SLE. Addition of an external building to house the fire suppression system at SLE	$1,928
2028	Construction of a new CHT powerhouse including 1x600, 1x800 and 2x1,000 kW gensets	$40,384
2030	Replacement of MSH powerhouse including 1x600 and 2x910 kW gensets	$37,413
2035	Replacement of PHS Powerhouse including 1x600 and 2x800 kW gensets	$37,297
2045	Replacement of SLE Powerhouse including 1x600 and 2x800 kW gensets	$36,547

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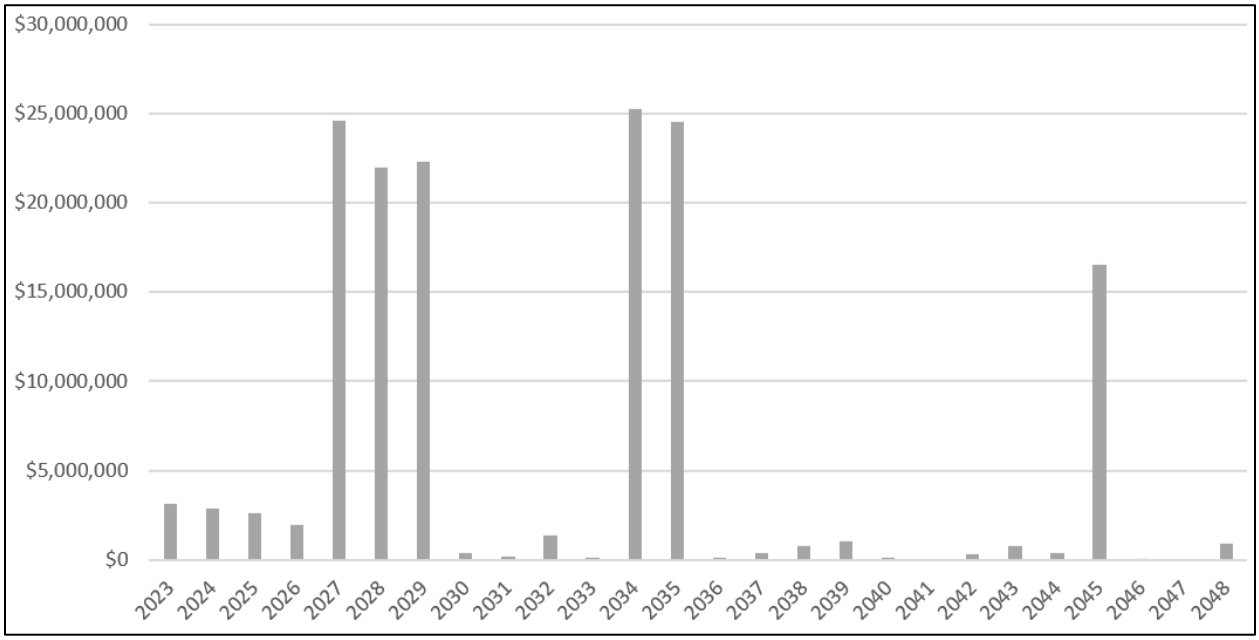
6.4 Interconnection of Existing Plants Scenario

The 6.4 Interconnection of Existing Plants capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 7: Annual Capital Expenditures, Interconnect Existing (25 years)



The Interconnection of Existing Plants scenario consists of the following major capital expenditures are shown in Table 14.

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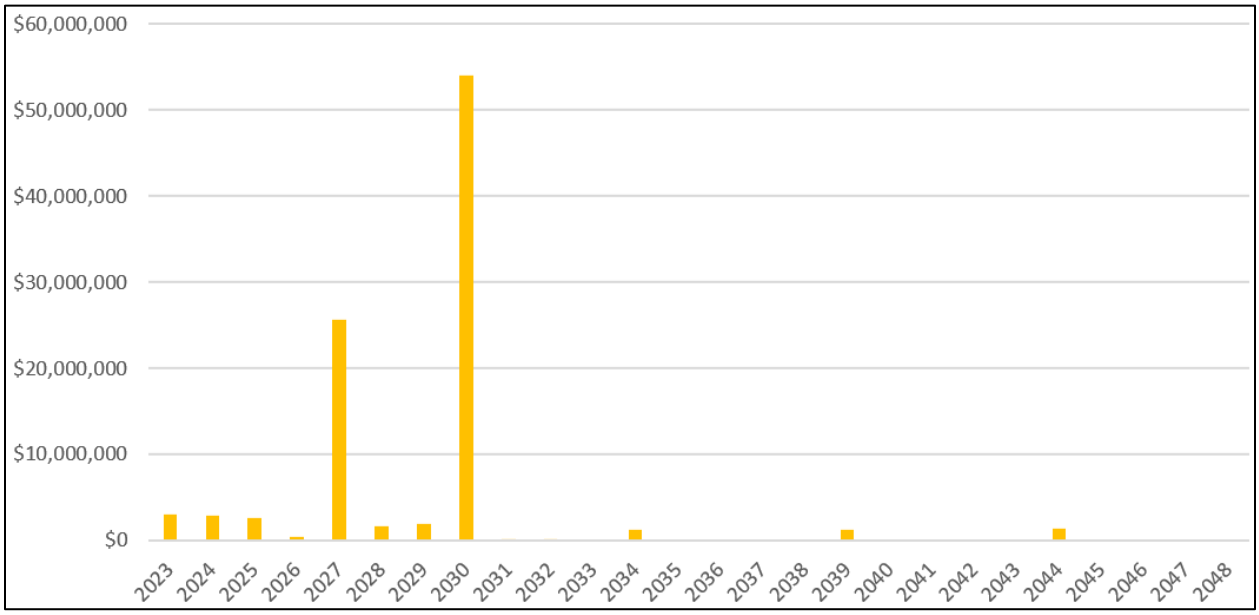
Table 14: Interconnection of Existing Plants Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2026	Retrofit of fire suppression systems at PHS.	$1,578
2027	PHS Plant Upgrade	$10,342
2027	PHS-CHT interconnection and voltage conversions	$14,278
2028	Retrofit of fire suppression systems at SLE. Addition of an external building to house the fire suppression system at SLE	$1,928
2028	MSH Plant Upgrade	$13,735
2028	PHS-SLE interconnection and voltage conversions	$7,641
2029	Retrofit of fire suppression systems at MSH.	$1,578
2029	SLE Plant Upgrade	$10,867
2034	Replacement of MSH powerhouse including 1x600 and 2x910 kW gensets	$37,413
2035	Replacement of PHS Powerhouse including 1x600 and 2x800 kW gensets	$37,537
2045	Replacement of SLE Powerhouse including 1x600 and 2x800 kW gensets	$36,547

6.5 2-Community Portable Scenario

The 2-Community Portable capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 8: Annual Capital Expenditures, 2 Comm Portable (25 years)



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The 2-community portable scenario consists of the following major capital expenditures are shown in Table 15.

Table 15: 2-Community Portable Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2027	Retrofit of fire suppression systems at PHS.	$1,578
2027	PHS Plant Upgrade	$12,595
2027	PHS-CHT interconnection and voltage conversions	$14,278
2028	Retrofit of fire suppression systems at SLE. Addition of an external building to house the fire suppression system at SLE	$1,928
2030	Construction of Regional Powerhouse including 1x910, 1x1,000, 1x 1,833 and 1x2,220 kW Gensets	$49,010
2030	PHS-SLE and PHS-MSH interconnection and voltage conversions	$20,639

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7 MULTI-VARIATE SENSITIVITY ANALYSIS

The IRP conducted a sensitivity analysis on a number of variables in isolation. The Board has requested an analysis of

> "…variations to fuel price, customer load, capital costs, either as a whole or individual components, and any other reasonable variables that might significantly impact the net present cost analysis. The Board notes that previous sensitivities performed by NLH and Midgard focused primarily on the impact of one of these sensitivities occurring. The Board requests that NLH analyze combinations of these sensitivities to assess the impact of two or more events, such as increased capital costs and reduced load occurring together."

A multi-variate sensitivity analysis has therefore been performed on interconnection capital costs, fuel costs, non-interconnection capital costs (i.e., powerhouses and generators) and changes in demand (load).

Midgard developed a separate Sensitivity Model to iteratively analyze the solution space that contains the range of inputs detailed in Table 16.

Table 16: Sensitivity Configuration Settings

Category	Values				
Interconnection Costs	75%	100%	150%	200%	300%
Fuel Costs	75%	100%	150%	200%	
Non-Interconnection Capital Costs	75%	100%	200%		
Load Change	-2%	-1 plant	None	+1 plant	+2%

For clarity: the percentages indicated in Table 16 represent a multiplier on the "baseline" cost, and not an "adder". Therefore, a 100% value means no change from the baseline, a 75% value means a 25% decrease from the baseline, etc.

This configuration results in 300 unique configurations (5 * 4 * 3 * 5). Each of these configurations is a sensitivity instance. Each of these instances has had costs for each scenario calculated based on the appropriate input multipliers, and these were compared to rank the scenario configurations within this cost instance. A summary table was also prepared outlining the results of each instance, as well as flagging scenarios where there was a change (any difference in order) from the baseline (all settings at 100%), and whether there was a change in the lowest cost scenario. This table can be reviewed in Appendix D

7.1 Sensitivity Results

Review of the sensitivity instances demonstrate the following:

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- The "Regional Plant" scenario remains the top-ranked scenario in 260 of the 300 sensitivity instances examined.
- The "Islanded" scenario is the top-ranked scenario in 40 instances.

The situations that result in the "Islanded" scenario being top ranked are summarized in Table 17.

Table 17: Sensitivity Results

Interconnection Cost Change	Capital Cost Change	Fuel Cost Change	Load Change	Sensitivity Instances Included	New Lowest Cost Scenario
300%	75%, 100%	Any	Any	40 of 300	Islanded

Fuel costs and load change have less impact on the results than interconnection costs and capital costs. Load change secondary effects (additional capacity in the system or requirements to build additional capacity to meet load) are described in detail in Section 7.3 below, but in general the scenarios that use a regional powerhouse (Regional Powerhouse, 2-Community Portable) can more readily adjust to changes in load than scenarios that are using the existing powerhouse infrastructure.

7.2 Evaluation of Sensitivity Configurations Favoring Islanded Operation

The situations in which the "Islanded" scenario is the preferred scenario require interconnection capital costs to triple while other capital costs either decrease by 25% or remain constant. While there have recently been large sector specific price increases in motors, generators and switchgear, transmission & distribution equipment tends to be much less price volatile. This can be seen in Figure 9 and Figure 10, which show 5-year and 20-year increases in costs based on data from the United States Bureau of Labour Statistics (**"BLS"**), as well as the Statistics Canada consumer price index (**"CPI"**) for Newfoundland and Labrador for the same time period.

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Figure 9: 5-year Price Increase of Selected BLS Indices

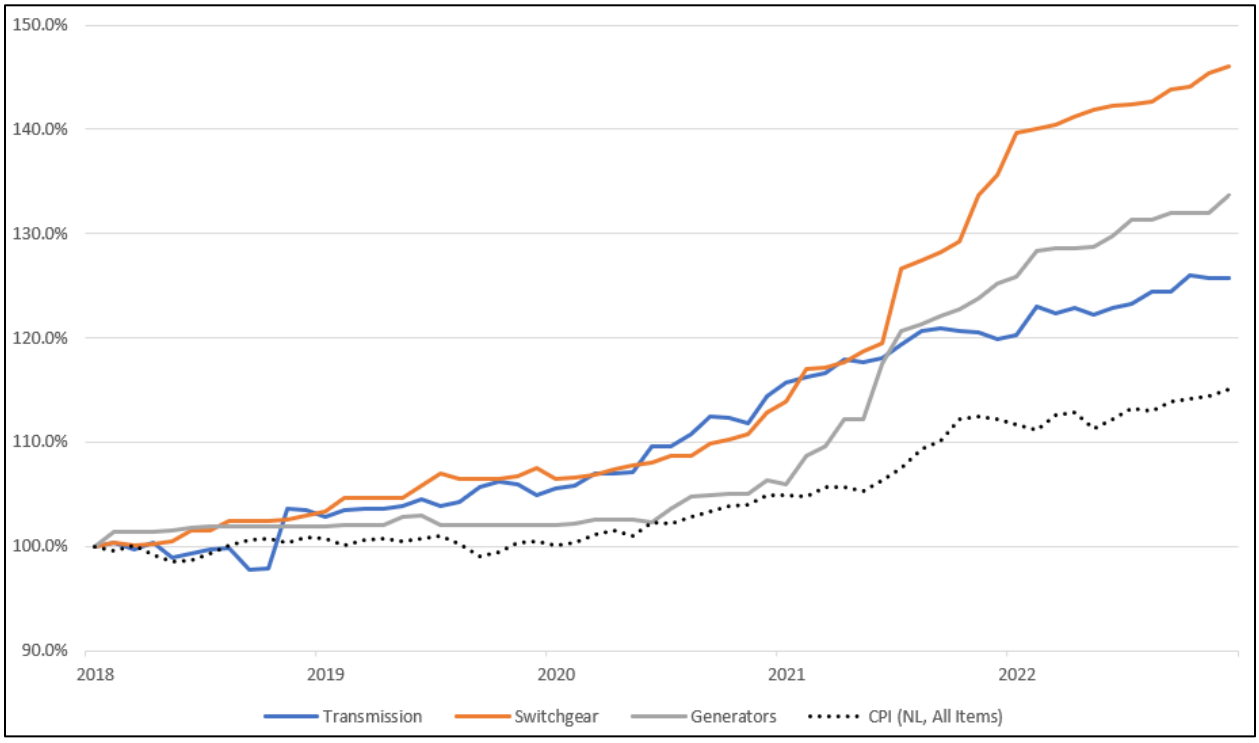
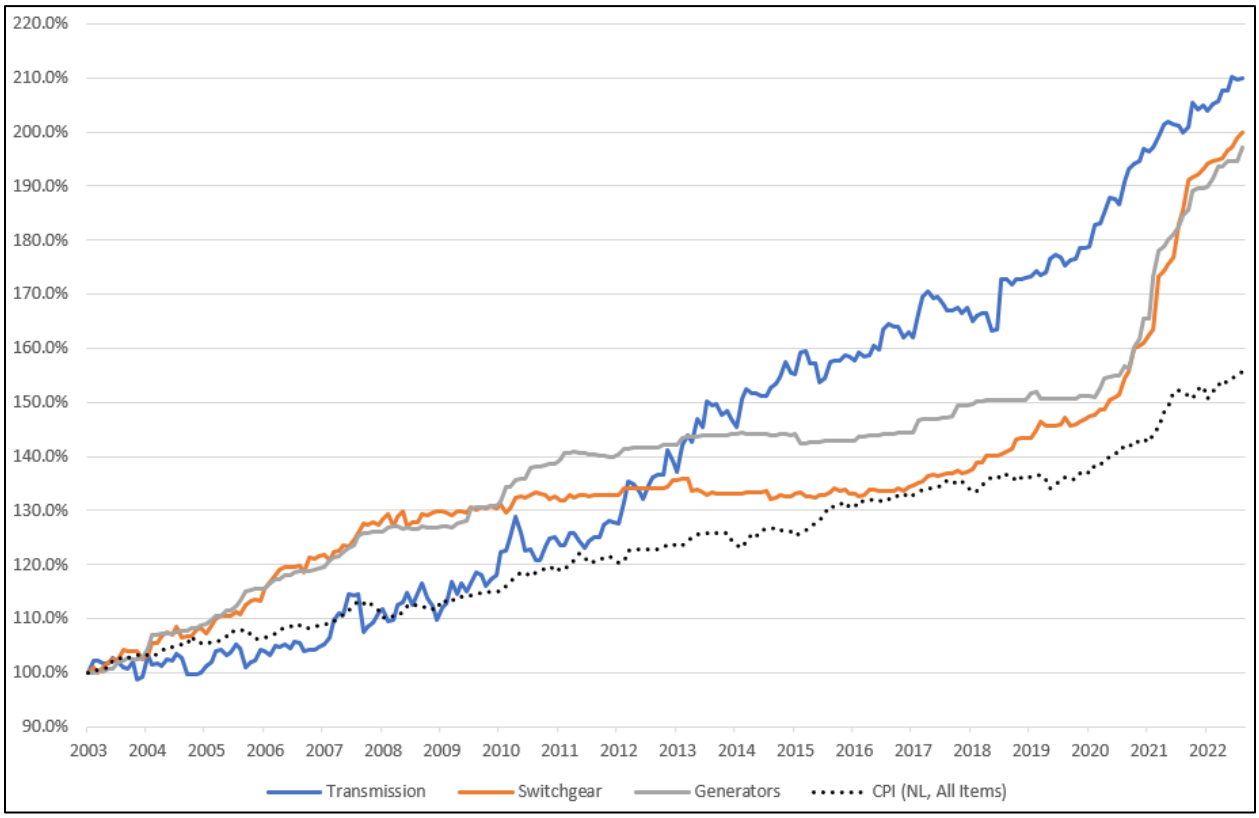


Figure 10: 20-year Price Increase of Selected BLS Indices



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There has been no period of record where the transmission index[11] has experienced similar volatility to switchgear[12] or motor and generator manufacturing[13]. As a result, it is extremely unlikely that these sensitivity instances (i.e., in which interconnection costs triple but other capital costs stay the same or decrease) will occur. While there have been periods, some of which are visible in the 20-year graphs, where transmission costs increased while these costs have remained stable, an increase in transmission costs to 200% of baseline costs or more would require decades, based on the average cost increases on record. It therefore becomes increasingly unlikely that other capital costs would remain constant or decrease over such a long period.

7.3 Load Change Effects

The primary effect of load changes is to increase or decrease the amount of fuel consumed in a given year: this is automatically calculated. Configuration of load change settings is described in Section 3.3.1.

In addition to changing the amount of fuel used in a given instance, the load change configuration (setting) could also result in a requirement to add generation to meet firm demand or result in under-utilized generation assets and sunk costs at a future time.

The scenario configuration that is best able to handle load variations (Regional Plant) is also the configuration that has the lowest cost and maintains the lowest cost through almost all sensitivity instances. The Regional Plant configuration also has the lowest effects (lowest cost to mitigate) of all the configurations that require additional generation to be added as a result of load change. As a result, most load change secondary effects would result in the “Regional Plant” configuration being lowest cost. This further suggests that the “Regional Plant” configuration is favored due to resilience to potential load changes.

A description of each load change alternative in the context of their respective scenario follows. Note that there are current capacity constraints at MSH and CHT which are being met using portable gensets in the interim. The expected timelines to resolve these constraints with permanent infrastructure are largely driven by the regulatory permitting requirements and procurement processes discussed in the “Schedule” section above. The fastest route to resolving these shortages is to finalize the preferred regional solution and commence design and permitting on the chosen alternative. Appendix D incudes the load sensitivity tables, which highlight the years in which a specific load scenario does not have sufficient firm capacity to meet the peak load with N-1 reliability. The “Networked Existing” scenario was also evaluated at N-2 reliability, as this was the level of redundancy assumed to meet reliability requirements for this configuration prior to a detailed reliability assessment.

[11] BLS code PCU22112-22112- Electric power transmission, control, and distribution

[12] BLS code PCU335313335313 Switchgear and switchboard apparatus mfg

[13] BLS code PCU335312335312 Motor and generator mfg

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Most alternatives encounter challenges with load growth. The only scenario where this is readily managed are in the "Regional Plant" and "2-Community Portable" scenarios following construction of the regional plant, both of which contain a regional powerplant designed to allow expansion through the provision of an additional genset bay.

Table 18: Load Change Impacts

	Regional Plant	Islanded	Interconnection of Existing Plants	2-Community Portable
-2%	Excess Capacity After 2028	MSH Meets Capacity in 2027	Excess Capacity After 2028	Excess Capacity After 2030
-1 plant	Excess Capacity After 2028	MSH Meets Capacity in 2028	No Change	Excess Capacity after 2030
None	No Change	No Change	No Change	No Change
+1 plant	Insufficient Capacity	No Change	Insufficient Capacity	Insufficient Capacity
+2%	Insufficient Capacity	Insufficient Capacity	Insufficient Capacity	Insufficient Capacity

For a detailed description of the impacts of load change settings on specific scenarios, please refer to Appendix F:, which outlines the specific impacts of load changes by scenario, year and powerhouse. In general load change results that are yellow can either be accommodated by increasing generator size as part of the plant design, or by adding generation to an expansion bay provided as part of the powerhouse design. Orange color coding indicates that replacement of an existing genset, or significant retrofits to add an additional bay would be required. For scenarios that include an interconnection these changes can be made at any powerhouse, while for the islanded scenario the changes must be made in the affected community.

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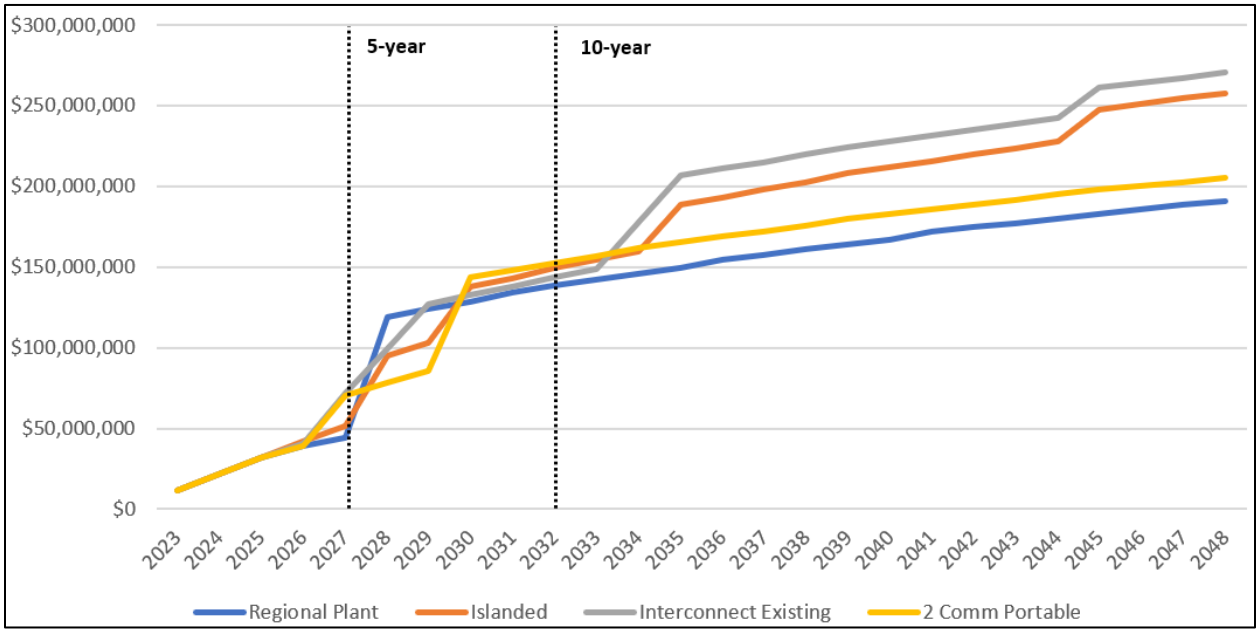
8 CONCLUSIONS

Using Class 4 cost estimates derived by NLH, a cost analysis was performed on four scenarios, Regional Powerhouse, Islanded, Interconnect existing Plants, and 2-Community Portable. In keeping with the results of the IRP, the lowest cost scenario was the Regional Powerhouse. A multi-variate sensitivity analysis was also performed, and the only scenario other than the Regional Powerhouse scenario (87% of instances) that was lowest cost was the Islanded scenario. The probability of transmission infrastructure (i.e., pole structures and conductors) escalating while other equipment costs do not increase is extremely low. This is the only combination of factors that would allow the Islanded scenario to be lower cost than the regional powerhouse. This combination of conditions has never been seen in the historical data. The result of the sensitivity analysis is similar to the single variable sensitivity analysis performed in the IRP, which suggested that if sufficient costs could be saved by not building the interconnection, it could offset the additional operational costs of operating multiple smaller plants.

Reviewing the cumulative costs, it is anticipated that the Regional Powerhouse will be the lowest cost alternative within the decade, as indicated in Figure 11 (which is a duplicate of Figure 3).

Figure 11: Net Present Costs (Real, CAD 2023)



Investigation of the "2-Community Portable' scenario suggests that this is not a cost-effective scenario, as it provides power from mobile Gensets 6 months after permanent power could be provided from the regional powerhouse, with a significantly increased cost.

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Based on the estimates of costs required to upgrade the existing plants in the "Interconnect Existing Plants" scenario, this scenario will be more costly than the regional plant by 2030 and has the longest schedule of all of the scenarios proposed due to the requirement of keeping plants online during upgrades.

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APPENDIX A: CONCORDANCE TABLE FOR BOARD INFORMATION REQUESTS

Board request					Response		
Identifier	Page	Point	subpoint	Board Question	Document	Location	Summary
1	1	N/A	N/A	In this proceeding, the Board must assess alternatives with similar net present costs and is concerned that using input cost estimates that may vary from +100% to -50% will not allow it to make properly informed comparisons of project alternatives. As such, the Board believes it would be prudent for Hydro to refine its cost estimates to Class 4 for certain of the proposed scenarios.	RP-TN-089		Class 4 estimates were prepared by NLH for the 4 scenarios of interest
2	2	N/A	N/A	In relation to service to Charlottetown, the Board notes that Hydro stated, in correspondence to the Town of Charlottetown (PUB-NLH-052, Attachment 1), that the time frame for constructing a replacement diesel generating station in Charlottetown would be equivalent to the time frame for constructing a regional diesel generating station. The Board requires further details on the alignment of the time frame of these two construction alternatives	Midgard Doc	Section 5 figure 2	A comparison of all of the schedules can be found in section 5 figure 2. The regional plant is projected to be online roughly 6 months ahead of a new plant at Charlottetown since permitting has not started for a local plant at this location
3	2	N/A	N/A	The Board also requires further details of any other alternative that would restore reliable, least cost service to Charlottetown in an environmentally responsible manner, including interconnection of Charlottetown to the existing generating plant in Port Hope Simpson to provide additional backup to the mobile gensets.	RP-TN-089		A new scenario was created to explore a temporary 2-community interconenction using portable gensets at PHS. This "2 Community Portable" scenario is examined in detail and compared against the other scenarios in the assessment and sensitivity analysis
4	2	1	a	Midgard's IRP Scenario B Class 4 cost estimate	RP-TN-089		A Class 4 estimate was prepared by NLH for this scenario
5	2	1	b	Midgard's IRP Scenario B Schedule	Midgard Doc	Section 5 figure 2	The schedule overview of all scenarios can be found in section 5 figure 2. Detailed schedules prepared by NLH (in document RP-TN-089) are referenced there
6	2	1	c	Midgard's IRP Scenario B a listing of the environmental approvals required and the estimated time to obtain them	Midgard Doc	Section 5	Table 7 outlines the anticipated permits and timelines. A more detailed evaluation of permits can be found in document RP-TN-089, provided by NLH
7	2	2	a	Midgard's IRP Scenario E Class 4 cost estimate	RP-TN-089		A Class 4 estimate was prepared by NLH for this scenario
8	2	2	b	Midgard's IRP Scenario E Schedule	Midgard Doc	Section 5	The schedule overview of all scenarios can be found in section 5 figure 2. Detailed schedules prepared by NLH (in document RP-TN-089) are referenced there
9	2	2	c	Midgard's IRP Scenario E a listing of the environmental approvals required and the estimated time to obtain them	Midgard Doc	Section 5	Table 7 outlines the anticipated permits and timelines. A more detailed evaluation of permits can be found in document RP-TN-089, provided by NLH
10	2	2	d	Midgard's IRP Scenario E identification and discussion of how many, if any, mobile gensets would remain in Charlottetown to service the summer load and/or provide emergency backup power in the event of an interconnection outage	Midgard Doc		We do not have any gensets remaiing in CHT - Portable generation units are not seeen as an appropriate alternative to provide base load for Charlottetown
11	2	2	e	Midgard's IRP Scenario E any other issues/considerations that would be associated with this variation of the analyzed scenario	RP-TN-089	Section 2.2	Section 2.2 provides an overview of the considerations associated with this configuration including the requirement to upgrade stations during operation and significant synchronization challenges associated with operating a large number of small gensets across a large geographic area
12	2	N/A	N/A	In addition to concerns with supplying Charlottetown with reliable power... the Board requires an assessment of any alternatives that would meet the criteria of minimal capital spending, in both a five-year and ten-year period	Midgard Doc	Section 7	Multiple alternatives weere assessed in both the IRP and previous work proposed by NLH. No additional alternatives were disccovered during this phase of work

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13	2	N/A	N/A	In the ten-year period scenario, please include discussion of any work required in Mary's Harbour to ensure the reliable operation of the plant there beyond 2027	Midgard Doc	last paragraph of section 4.2	Beyond the Addition Upgrades identified in Table 5 and potential interconnection upgrades it is not anticipated that any further work will be required on the MSH facility to ensure the reliable operation of the plant if its life is extended from 2027 to 2030 (or 2034 if the Interconnection of Existing Plants scenario is selected).
14	3	3	a	In relation to the proposed project (Scenario C N-1): a Class 4 cost estimate	RP-TN-089		A Class 4 estimate was prepared by NLH for this scenario
15	3	3	b	In relation to the proposed project (Scenario C N-1): a listing of the environmental approvals required and the estimated time to obtain them	Midgard Doc	Section 5	Environmental approvals and anticipated timelines are summarized in Section 5
16	3	4	a	Midgard's IRP Scenario E Class 4 cost estimate	RP-TN-089		A Class 4 estimate was prepared by NLH for this scenario
17	3	4	b	Midgard's IRP Scenario E Schedule	Midgard Doc	Section 5	NLH Schedule was prepared for this scenario
18	3	4	c	Midgard's IRP Scenario E a listing of the environmental approvals required and the estimated time to obtain them	Midgard Doc	Section 5	Environmental approvals and anticipated timelines are summarized in Section 5
19		5	N/A	Tables and graphs detailing the Class 4 estimate updated net present costs for Midgard's IRP Scenario B and Midgard's IRP Scenario E versus Hydro's proposed solution for every year of the study period. Please include in the tables and graphs the major capital cost events and fuel cost forecasts during the study period.	Midgard Doc	Fuel price Forecast is in appendix C and Figure 1, Tables and Graphs are in Section 6	Section 6 covers costs in tabular and graphical formats: 6.2 is the Regional Plant 6.3 is "Islanded" 6.4 is "Existing Interconnnect" 6.5 is the "2-Community Portable" scenario
20		5	N/A	Please provide a second set of tables and graphs using a 50-year life expectancy for the diesel generating plants.	Midgard Doc	Appendix F	Appendix F covers the 50 year projection for the all 4 scenarios. F.2 is the Regional Plant F.3 is "Islanded" F.4 is "Existing Interconnnect" F.5 is the "2-Community Portable" scenario
21		6	N/A	6.Sensitivities to the analyses completed in item (5) that include variations to fuel price, customer load, capital costs, either as a whole or individual components, and any other reasonable variables that might significantly impact the net present cost analysis.	Midgard Doc	Section 7	Sensitivity analysis is presented in Sectioon 7 of the Midgard report
22		6	N/A	The Board notes that previous sensitivities performed by Hydro and Midgard focused primarily on the impact of one of these sensitivities occurring. The Board requests that Hydro analyze combinations of these sensitivities to assess the impact of two or more events, such as increased capital costs and reduced load occurring together	Midgard Doc	Section 7	Section 7 provides a multi-variate analysis with 300 unique combinations of parameters
23		7		Any other alternative, not listed above, that would meet the above minimal capital spending while developing longer-term renewable resources criteria.	Midgard Doc		A large number of potential scenarios were investigated, and the most viable ones were presented. We would be pleased to investigate any suggestions from the board, but an open-ended "Any other alternative" is unlikely to result in a prudent use of resources.

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APPENDIX B: FUEL PRICE FORECAST

Diesel Fuel Price Forecast

Forecast as of June 30, 2023

	Charlottetown ($Cdn/l)	Mary's Harbour ($Cdn/l)	Port Hope Simpson ($Cdn/l)	St. Lewis ($Cdn/l)
2023	1.369	1.349	1.492	1.479
2024	1.276	1.256	1.398	1.386
2025	1.325	1.305	1.450	1.435
2026	1.290	1.270	1.415	1.400
2027	1.250	1.230	1.375	1.360
2028	1.250	1.230	1.375	1.360
2029	1.265	1.245	1.390	1.380
2030	1.285	1.265	1.410	1.400
2031	1.300	1.280	1.435	1.420
2032	1.325	1.305	1.460	1.445
2033	1.340	1.320	1.475	1.460
2034	1.355	1.330	1.495	1.480
2035	1.375	1.350	1.515	1.500
2036	1.395	1.370	1.540	1.525
2037	1.425	1.400	1.575	1.560
2038	1.460	1.435	1.610	1.595
2039	1.500	1.475	1.655	1.635
2040	1.540	1.515	1.695	1.68
2041	1.580	1.550	1.740	1.720
2042	1.620	1.590	1.785	1.765
2043	1.660	1.630	1.825	1.810
2044	1.680	1.655	1.855	1.835
2045	1.705	1.675	1.880	1.860
2046	1.730	1.700	1.905	1.890
2047	1.755	1.725	1.935	1.915
2048	1.775	1.745	1.965	1.945

Notes:

1. Price forecast reflects the delivered cost of No. 2 fuel specifications used by NLH.
2. Pricing excludes carbon taxation as per Federal Government Carbon Plan.
3. Price forecast reflects existing fuel supply delivery methods.
4. Basis for 2023-2048 price forecast is Platts Analytics fuel price outlook, June 2023 WOMF and May 2023 SPS Long Term; consistent with Nalcor Corporate Assumptions for July 2023.

21-Aug-23

Source: Market Analysis and Load Forecasting Section,

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APPENDIX C: COST APPENDIX – 5 AND 10-YEAR COST RESULTS

Note: the following graphs are presented in 2023 Canadian dollars

Figure 12: Annual Capital Expenditures, Regional Plant (10 years)

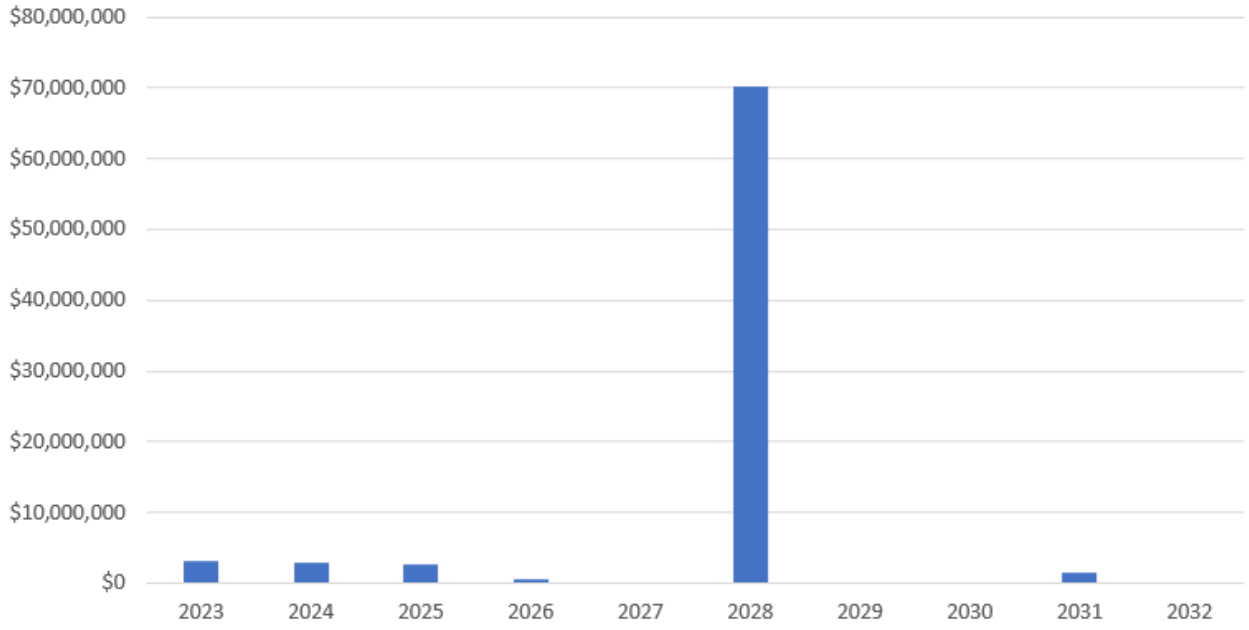

Figure 13: Annual Capital Expenditures, Regional Plant (5 years)

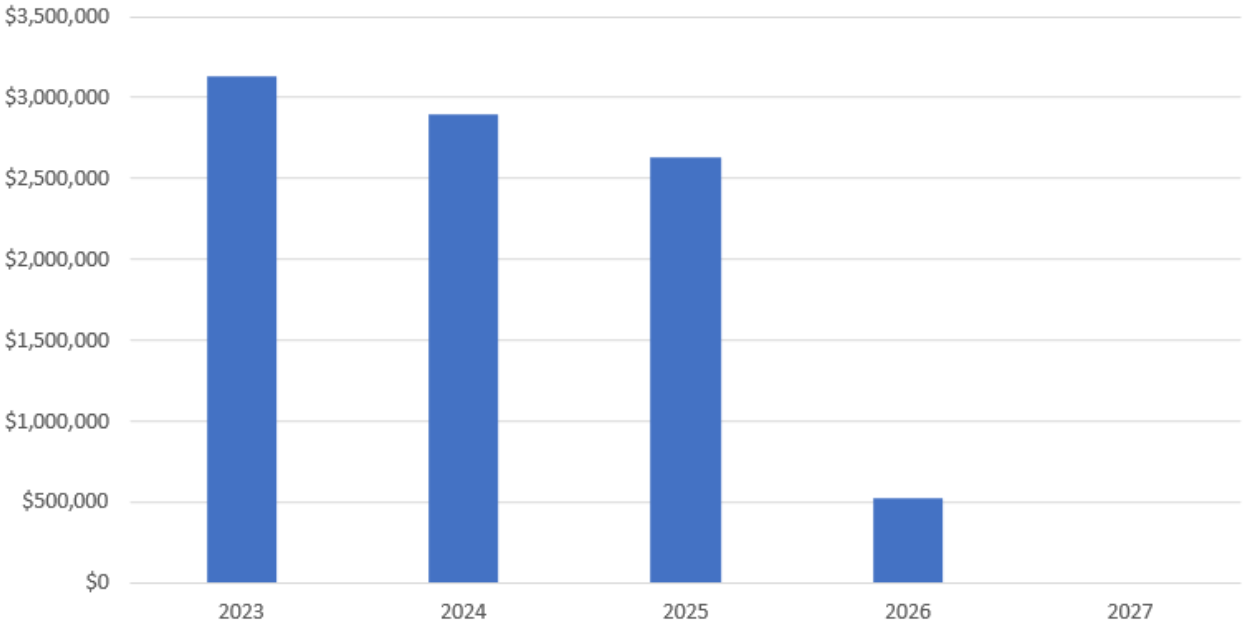

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Figure 14: Annual Capital Expenditures, Islanded (10 years)

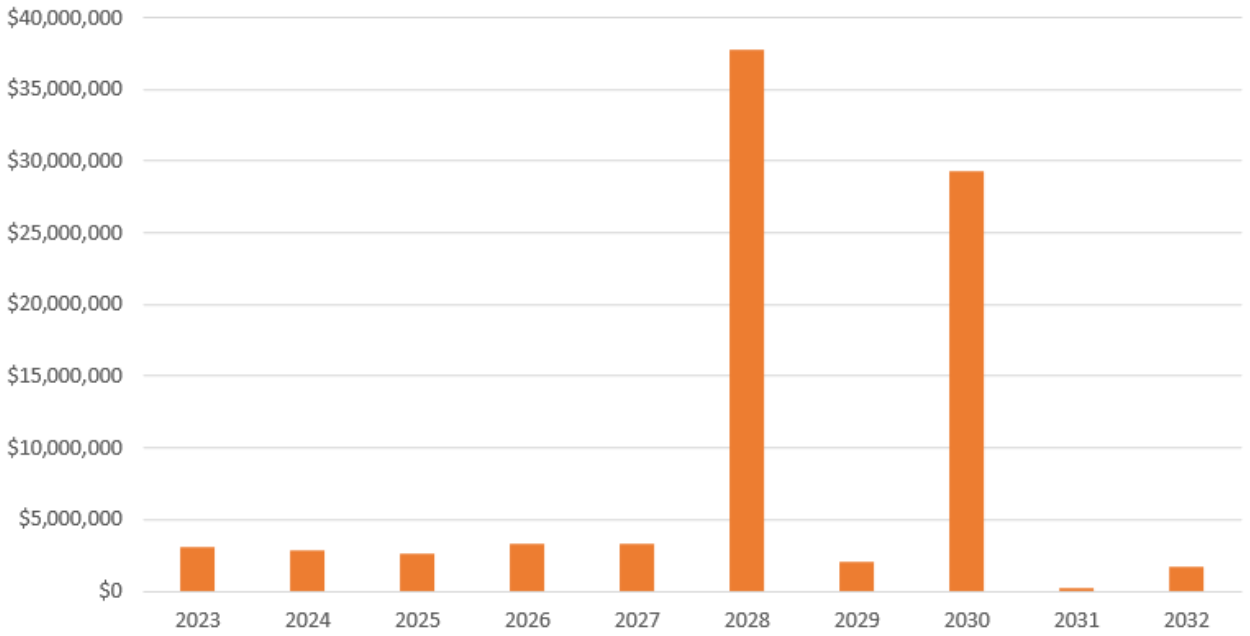

Figure 15: Annual Capital Expenditures, Islanded (5 years)

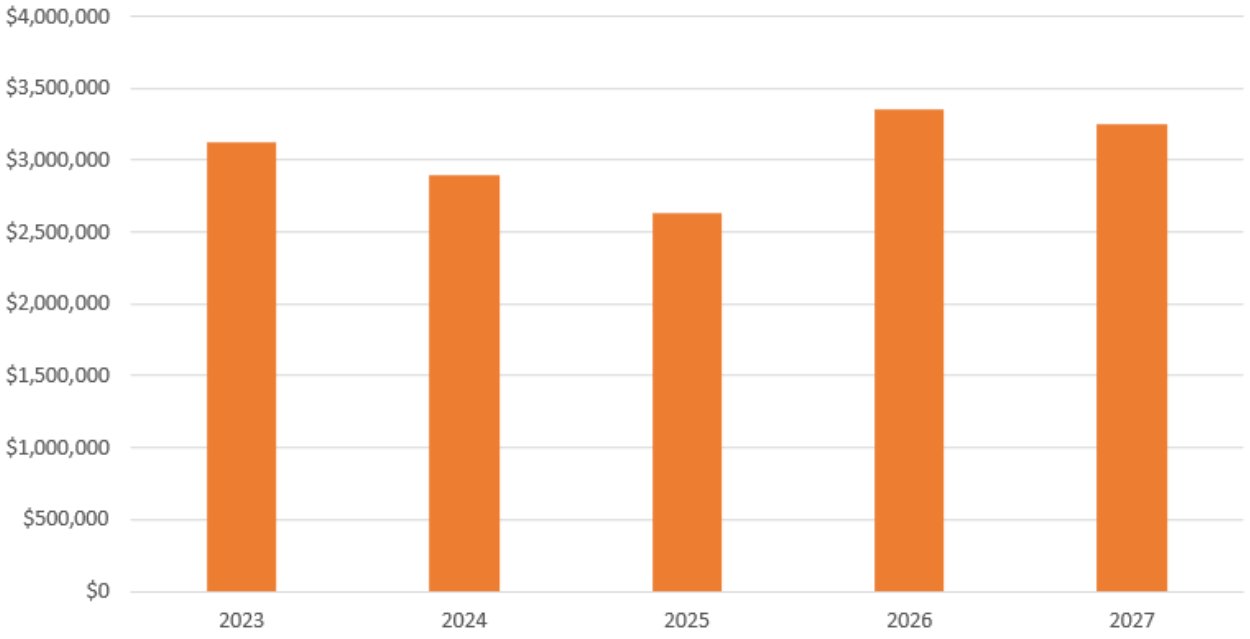

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Figure 16: Annual Capital Expenditures, Interconnection of Existing Plants (10 years)

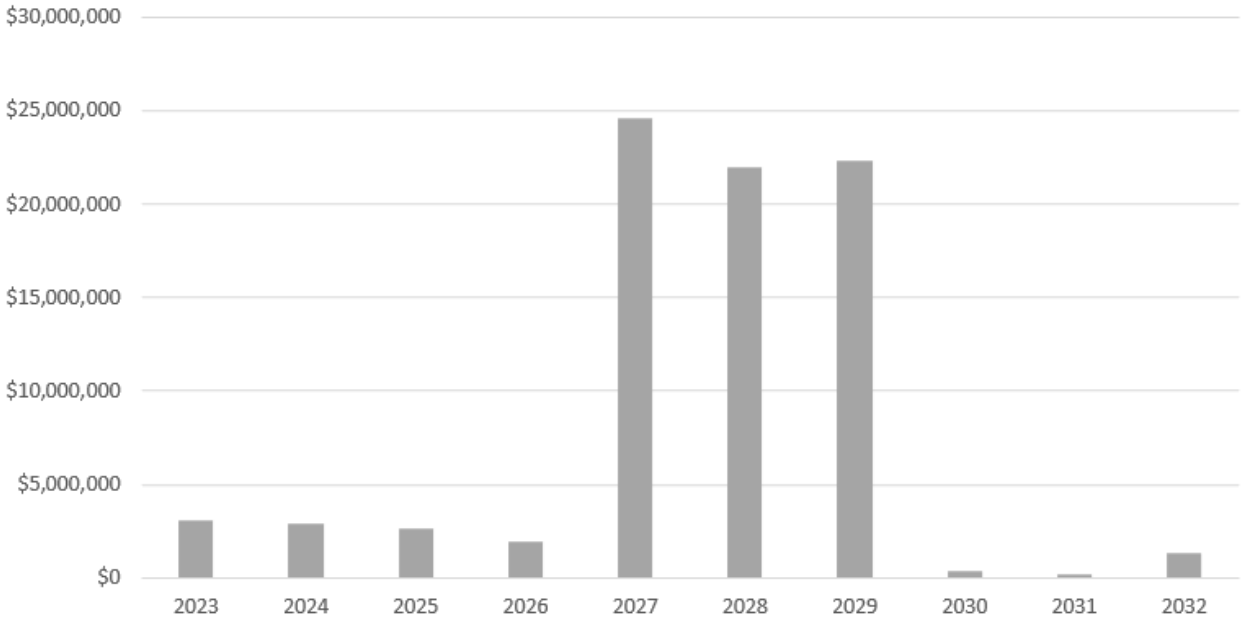

Figure 17: Annual Capital Expenditures, Interconnection of Existing Plants (5 years)

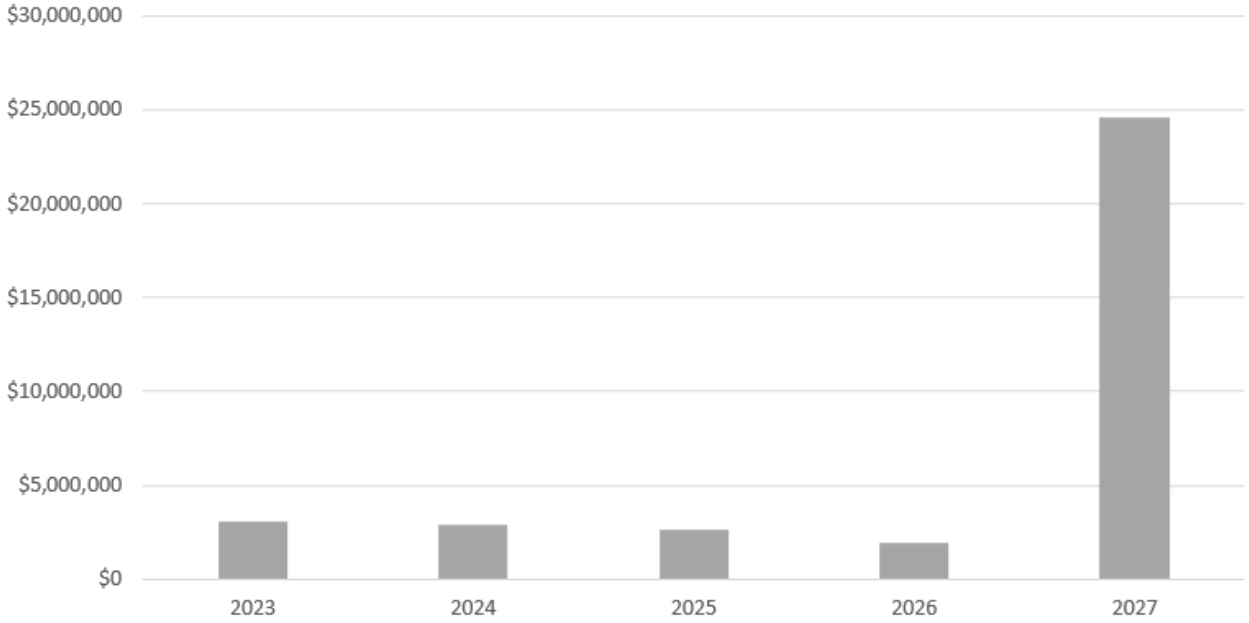

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Figure 18: Annual Capital Expenditures, 2 Comm Portable (10 years)

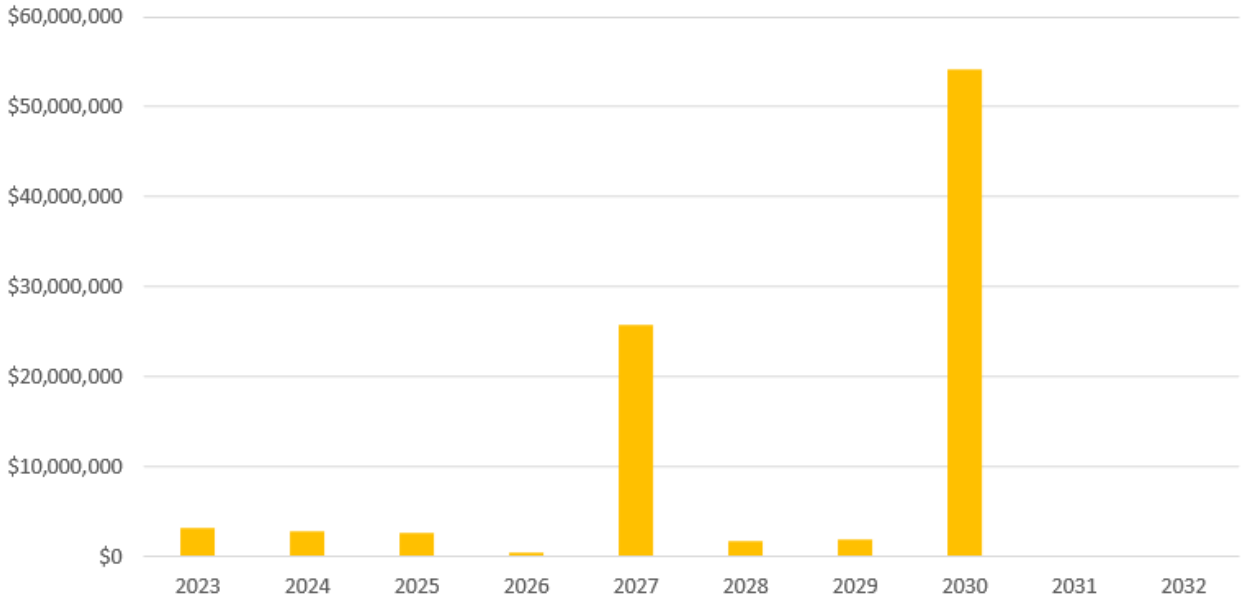
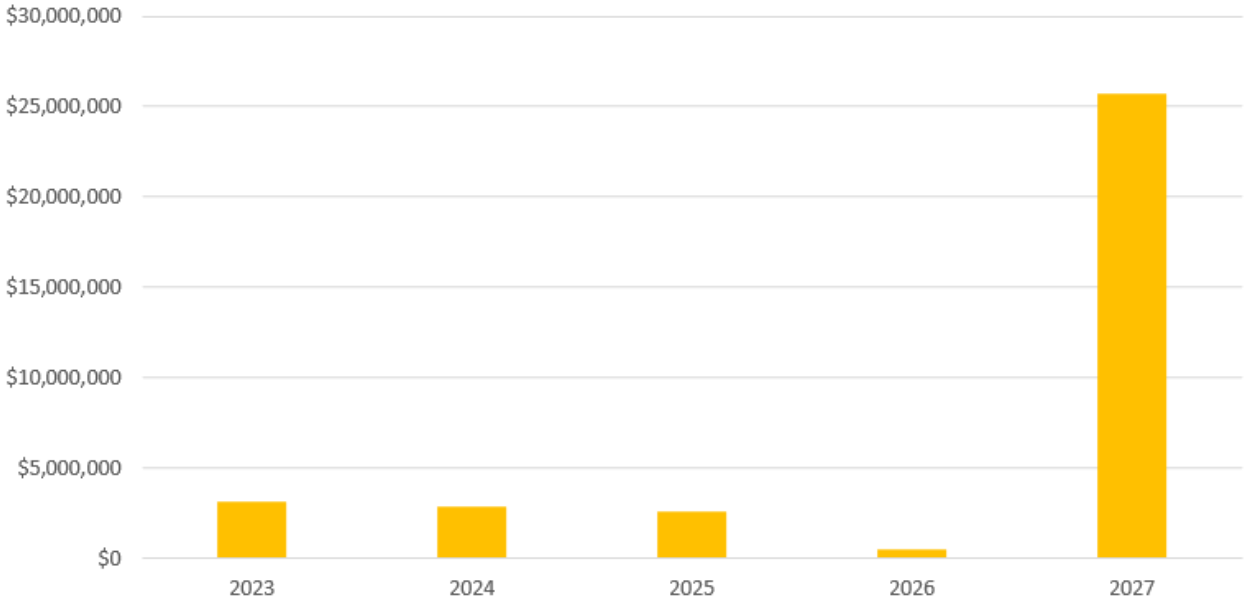


Figure 19: Annual Capital Expenditures, 2 Comm Portable (5 years)



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APPENDIX D: SENSITIVITY RESULTS TABLES

The table below presents the results of the sensitivity analysis. The following notes are provided for the interpretation of the table:

- Sensitivity Instance ID 88 is the "baseline" instance, i.e., the instance in which all inputs are set to either "100%" or "No load change", as applicable.
- The "Sensitivity Inputs" show how each of the various inputs to each of the Scenarios (Interconnection Costs; Capital Costs; Fuel Costs; and Load Change) are adjusted in that given sensitivity instance.
- The "Rank" of a given scenario in a given sensitivity instance is its position in an ascending list of the NPVs of all the scenarios of that instance. I.e., the scenario with rank 1 has the lowest NPV in that instance, and the scenario with rank 4 has the highest NPV in that instance.
- The "Same Rank 1?" flag identifies whether or not the Scenario ranked first in that sensitivity instance is the same as the Scenario ranked first in the baseline instance (i.e., instance 88, in red text in the table below).
- The "Same Ranking?" flag identifies whether or not all of the Scenarios have the same rank as they do in the baseline instance (i.e., instance 88).

A summary of the ranking results is presented in the following table:

	Regional Plant	Islanded	Local Interconnect	2 Comm Portable
Instances Ranked 1st	260	40	0	0
Instances Ranked 2nd	40	15	0	245
Instances Ranked 3rd	0	225	20	55
Instances Ranked 4th	0	20	280	0

The full results are presented in the following table:

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	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
1	75%	75%	75%	-2%	$128,928	$163,183	$172,365	$138,340	1	3	4	2	TRUE	TRUE
2	75%	75%	75%	-1 plant	$140,083	$175,269	$184,051	$149,549	1	3	4	2	TRUE	TRUE
3	75%	75%	75%	None	$141,584	$176,905	$185,632	$151,064	1	3	4	2	TRUE	TRUE
4	75%	75%	75%	+1 plant	$143,085	$178,542	$187,212	$152,579	1	3	4	2	TRUE	TRUE
5	75%	75%	75%	+2%	$158,484	$195,229	$203,332	$168,038	1	3	4	2	TRUE	TRUE
6	75%	75%	100%	-2%	$145,479	$181,023	$189,931	$155,150	1	3	4	2	TRUE	TRUE
7	75%	75%	100%	-1 plant	$159,649	$196,431	$204,859	$169,397	1	3	4	2	TRUE	TRUE
8	75%	75%	100%	None	$161,556	$198,518	$206,879	$171,323	1	3	4	2	TRUE	TRUE
9	75%	75%	100%	+1 plant	$163,462	$200,605	$208,899	$173,249	1	3	4	2	TRUE	TRUE
10	75%	75%	100%	+2%	$183,022	$221,877	$229,489	$192,893	1	3	4	2	TRUE	TRUE
11	75%	75%	150%	-2%	$178,579	$216,704	$225,063	$188,771	1	3	4	2	TRUE	TRUE
12	75%	75%	150%	-1 plant	$198,782	$238,757	$246,476	$209,094	1	3	4	2	TRUE	TRUE
13	75%	75%	150%	None	$201,499	$241,743	$249,373	$211,841	1	3	4	2	TRUE	TRUE
14	75%	75%	150%	+1 plant	$204,216	$244,730	$252,271	$214,589	1	3	4	2	TRUE	TRUE
15	75%	75%	150%	+2%	$232,098	$275,172	$281,804	$242,604	1	3	4	2	TRUE	TRUE
16	75%	75%	200%	-2%	$211,680	$252,384	$260,194	$222,392	1	3	4	2	TRUE	TRUE
17	75%	75%	200%	-1 plant	$237,915	$281,082	$288,093	$248,791	1	3	4	2	TRUE	TRUE
18	75%	75%	200%	None	$241,442	$284,968	$291,868	$252,360	1	3	4	2	TRUE	TRUE
19	75%	75%	200%	+1 plant	$244,970	$288,854	$295,644	$255,929	1	3	4	2	TRUE	TRUE
20	75%	75%	200%	+2%	$281,174	$328,468	$334,118	$292,315	1	3	4	2	TRUE	TRUE
21	75%	100%	75%	-2%	$137,484	$181,904	$189,210	$148,862	1	3	4	2	TRUE	TRUE
22	75%	100%	75%	-1 plant	$148,639	$193,989	$200,895	$160,071	1	3	4	2	TRUE	TRUE
23	75%	100%	75%	None	$150,140	$195,626	$202,476	$161,586	1	3	4	2	TRUE	TRUE
24	75%	100%	75%	+1 plant	$151,641	$197,263	$204,057	$163,102	1	3	4	2	TRUE	TRUE
25	75%	100%	75%	+2%	$167,040	$213,949	$220,176	$178,560	1	3	4	2	TRUE	TRUE
26	75%	100%	100%	-2%	$154,035	$199,744	$206,776	$165,673	1	3	4	2	TRUE	TRUE
27	75%	100%	100%	-1 plant	$168,205	$215,152	$221,704	$179,919	1	3	4	2	TRUE	TRUE
28	75%	100%	100%	None	$170,112	$217,238	$223,723	$181,845	1	3	4	2	TRUE	TRUE
29	75%	100%	100%	+1 plant	$172,018	$219,325	$225,743	$183,772	1	3	4	2	TRUE	TRUE
30	75%	100%	100%	+2%	$191,578	$240,597	$246,334	$203,416	1	3	4	2	TRUE	TRUE
31	75%	100%	150%	-2%	$187,135	$235,424	$241,907	$199,294	1	3	4	2	TRUE	TRUE
32	75%	100%	150%	-1 plant	$207,338	$257,477	$263,320	$219,616	1	3	4	2	TRUE	TRUE

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	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
33	75%	100%	150%	None	$210,055	$260,464	$266,218	$222,364	1	3	4	2	TRUE	TRUE
34	75%	100%	150%	+1 plant	$212,772	$263,450	$269,116	$225,112	1	3	4	2	TRUE	TRUE
35	75%	100%	150%	+2%	$240,654	$293,893	$298,648	$253,126	1	3	4	2	TRUE	TRUE
36	75%	100%	200%	-2%	$220,236	$271,104	$277,039	$232,915	1	3	4	2	TRUE	TRUE
37	75%	100%	200%	-1 plant	$246,471	$299,803	$304,937	$259,313	1	3	4	2	TRUE	TRUE
38	75%	100%	200%	None	$249,998	$303,689	$308,713	$262,882	1	3	4	2	TRUE	TRUE
39	75%	100%	200%	+1 plant	$253,526	$307,575	$312,488	$266,452	1	3	4	2	TRUE	TRUE
40	75%	100%	200%	+2%	$289,730	$347,188	$350,963	$302,837	1	3	4	2	TRUE	TRUE
41	75%	200%	75%	-2%	$171,708	$256,785	$256,588	$190,952	1	4	3	2	TRUE	FALSE
42	75%	200%	75%	-1 plant	$182,863	$268,870	$268,273	$202,161	1	4	3	2	TRUE	FALSE
43	75%	200%	75%	None	$184,364	$270,507	$269,854	$203,676	1	4	3	2	TRUE	FALSE
44	75%	200%	75%	+1 plant	$185,865	$272,144	$271,435	$205,191	1	4	3	2	TRUE	FALSE
45	75%	200%	75%	+2%	$201,264	$288,831	$287,555	$220,650	1	4	3	2	TRUE	FALSE
46	75%	200%	100%	-2%	$188,259	$274,625	$274,154	$207,763	1	4	3	2	TRUE	FALSE
47	75%	200%	100%	-1 plant	$202,429	$290,033	$289,082	$222,009	1	4	3	2	TRUE	FALSE
48	75%	200%	100%	None	$204,336	$292,120	$291,101	$223,935	1	4	3	2	TRUE	FALSE
49	75%	200%	100%	+1 plant	$206,242	$294,207	$293,121	$225,861	1	4	3	2	TRUE	FALSE
50	75%	200%	100%	+2%	$225,802	$315,479	$313,712	$245,505	1	4	3	2	TRUE	FALSE
51	75%	200%	150%	-2%	$221,359	$310,306	$309,285	$241,383	1	4	3	2	TRUE	FALSE
52	75%	200%	150%	-1 plant	$241,562	$332,359	$330,698	$261,706	1	4	3	2	TRUE	FALSE
53	75%	200%	150%	None	$244,279	$335,345	$333,596	$264,454	1	4	3	2	TRUE	FALSE
54	75%	200%	150%	+1 plant	$246,996	$338,331	$336,494	$267,201	1	4	3	2	TRUE	FALSE
55	75%	200%	150%	+2%	$274,878	$368,774	$366,026	$295,216	1	4	3	2	TRUE	FALSE
56	75%	200%	200%	-2%	$254,460	$345,986	$344,417	$275,004	1	4	3	2	TRUE	FALSE
57	75%	200%	200%	-1 plant	$280,695	$374,684	$372,315	$301,403	1	4	3	2	TRUE	FALSE
58	75%	200%	200%	None	$284,223	$378,570	$376,091	$304,972	1	4	3	2	TRUE	FALSE
59	75%	200%	200%	+1 plant	$287,750	$382,456	$379,866	$308,541	1	4	3	2	TRUE	FALSE
60	75%	200%	200%	+2%	$323,954	$422,070	$418,341	$344,927	1	4	3	2	TRUE	FALSE
61	100%	75%	75%	-2%	$135,518	$163,183	$179,003	$144,774	1	3	4	2	TRUE	TRUE
62	100%	75%	75%	-1 plant	$146,672	$175,269	$190,688	$155,982	1	3	4	2	TRUE	TRUE
63	100%	75%	75%	None	$148,173	$176,905	$192,269	$157,498	1	3	4	2	TRUE	TRUE
64	100%	75%	75%	+1 plant	$149,675	$178,542	$193,850	$159,013	1	3	4	2	TRUE	TRUE
65	100%	75%	75%	+2%	$165,073	$195,229	$209,970	$174,472	1	3	4	2	TRUE	TRUE
66	100%	75%	100%	-2%	$152,068	$181,023	$196,569	$161,584	1	3	4	2	TRUE	TRUE

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ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
67	100%	75%	100%	-1 plant	$166,239	$196,431	$211,497	$175,831	1	3	4	2	TRUE	TRUE
68	100%	75%	100%	None	$168,145	$198,518	$213,517	$177,757	1	3	4	2	TRUE	TRUE
69	100%	75%	100%	+1 plant	$170,052	$200,605	$215,536	$179,683	1	3	4	2	TRUE	TRUE
70	100%	75%	100%	+2%	$189,611	$221,877	$236,127	$199,327	1	3	4	2	TRUE	TRUE
71	100%	75%	150%	-2%	$185,169	$216,704	$231,700	$195,205	1	3	4	2	TRUE	TRUE
72	100%	75%	150%	-1 plant	$205,372	$238,757	$253,114	$215,528	1	3	4	2	TRUE	TRUE
73	100%	75%	150%	None	$208,088	$241,743	$256,011	$218,275	1	3	4	2	TRUE	TRUE
74	100%	75%	150%	+1 plant	$210,805	$244,730	$258,909	$221,023	1	3	4	2	TRUE	TRUE
75	100%	75%	150%	+2%	$238,687	$275,172	$288,441	$249,038	1	3	4	2	TRUE	TRUE
76	100%	75%	200%	-2%	$218,269	$252,384	$266,832	$228,826	1	3	4	2	TRUE	TRUE
77	100%	75%	200%	-1 plant	$244,505	$281,082	$294,730	$255,224	1	3	4	2	TRUE	TRUE
78	100%	75%	200%	None	$248,032	$284,968	$298,506	$258,794	1	3	4	2	TRUE	TRUE
79	100%	75%	200%	+1 plant	$251,559	$288,854	$302,281	$262,363	1	3	4	2	TRUE	TRUE
80	100%	75%	200%	+2%	$287,764	$328,468	$340,756	$298,748	1	3	4	2	TRUE	TRUE
81	100%	100%	75%	-2%	$144,074	$181,904	$195,847	$155,296	1	3	4	2	TRUE	TRUE
82	100%	100%	75%	-1 plant	$155,228	$193,989	$207,533	$166,505	1	3	4	2	TRUE	TRUE
83	100%	100%	75%	None	$156,729	$195,626	$209,114	$168,020	1	3	4	2	TRUE	TRUE
84	100%	100%	75%	+1 plant	$158,231	$197,263	$210,695	$169,535	1	3	4	2	TRUE	TRUE
85	100%	100%	75%	+2%	$173,629	$213,949	$226,814	$184,994	1	3	4	2	TRUE	TRUE
86	100%	100%	100%	-2%	$160,624	$199,744	$213,413	$172,107	1	3	4	2	TRUE	TRUE
87	100%	100%	100%	-1 plant	$174,795	$215,152	$228,341	$186,353	1	3	4	2	TRUE	TRUE
88	100%	100%	100%	None	$176,701	$217,238	$230,361	$188,279	1	3	4	2	TRUE	TRUE
89	100%	100%	100%	+1 plant	$178,608	$219,325	$232,381	$190,205	1	3	4	2	TRUE	TRUE
90	100%	100%	100%	+2%	$198,167	$240,597	$252,971	$209,849	1	3	4	2	TRUE	TRUE
91	100%	100%	150%	-2%	$193,725	$235,424	$248,545	$205,727	1	3	4	2	TRUE	TRUE
92	100%	100%	150%	-1 plant	$213,928	$257,477	$269,958	$226,050	1	3	4	2	TRUE	TRUE
93	100%	100%	150%	None	$216,645	$260,464	$272,856	$228,798	1	3	4	2	TRUE	TRUE
94	100%	100%	150%	+1 plant	$219,361	$263,450	$275,753	$231,545	1	3	4	2	TRUE	TRUE
95	100%	100%	150%	+2%	$247,243	$293,893	$305,286	$259,560	1	3	4	2	TRUE	TRUE
96	100%	100%	200%	-2%	$226,825	$271,104	$283,677	$239,348	1	3	4	2	TRUE	TRUE
97	100%	100%	200%	-1 plant	$253,061	$299,803	$311,575	$265,747	1	3	4	2	TRUE	TRUE
98	100%	100%	200%	None	$256,588	$303,689	$315,350	$269,316	1	3	4	2	TRUE	TRUE
99	100%	100%	200%	+1 plant	$260,115	$307,575	$319,126	$272,885	1	3	4	2	TRUE	TRUE
100	100%	100%	200%	+2%	$296,320	$347,188	$357,600	$309,271	1	3	4	2	TRUE	TRUE

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	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
101	100%	200%	75%	-2%	$178,298	$256,785	$263,226	$197,386	1	3	4	2	TRUE	TRUE
102	100%	200%	75%	-1 plant	$189,452	$268,870	$274,911	$208,595	1	3	4	2	TRUE	TRUE
103	100%	200%	75%	None	$190,953	$270,507	$276,492	$210,110	1	3	4	2	TRUE	TRUE
104	100%	200%	75%	+1 plant	$192,455	$272,144	$278,073	$211,625	1	3	4	2	TRUE	TRUE
105	100%	200%	75%	+2%	$207,853	$288,831	$294,192	$227,084	1	3	4	2	TRUE	TRUE
106	100%	200%	100%	-2%	$194,848	$274,625	$280,791	$214,196	1	3	4	2	TRUE	TRUE
107	100%	200%	100%	-1 plant	$209,019	$290,033	$295,719	$228,443	1	3	4	2	TRUE	TRUE
108	100%	200%	100%	None	$210,925	$292,120	$297,739	$230,369	1	3	4	2	TRUE	TRUE
109	100%	200%	100%	+1 plant	$212,832	$294,207	$299,759	$232,295	1	3	4	2	TRUE	TRUE
110	100%	200%	100%	+2%	$232,391	$315,479	$320,349	$251,939	1	3	4	2	TRUE	TRUE
111	100%	200%	150%	-2%	$227,949	$310,306	$315,923	$247,817	1	3	4	2	TRUE	TRUE
112	100%	200%	150%	-1 plant	$248,152	$332,359	$337,336	$268,140	1	3	4	2	TRUE	TRUE
113	100%	200%	150%	None	$250,869	$335,345	$340,234	$270,887	1	3	4	2	TRUE	TRUE
114	100%	200%	150%	+1 plant	$253,586	$338,331	$343,131	$273,635	1	3	4	2	TRUE	TRUE
115	100%	200%	150%	+2%	$281,467	$368,774	$372,664	$301,650	1	3	4	2	TRUE	TRUE
116	100%	200%	200%	-2%	$261,049	$345,986	$351,055	$281,438	1	3	4	2	TRUE	TRUE
117	100%	200%	200%	-1 plant	$287,285	$374,684	$378,953	$307,837	1	3	4	2	TRUE	TRUE
118	100%	200%	200%	None	$290,812	$378,570	$382,728	$311,406	1	3	4	2	TRUE	TRUE
119	100%	200%	200%	+1 plant	$294,339	$382,456	$386,504	$314,975	1	3	4	2	TRUE	TRUE
120	100%	200%	200%	+2%	$330,544	$422,070	$424,978	$351,361	1	3	4	2	TRUE	TRUE
121	150%	75%	75%	-2%	$148,697	$163,183	$192,278	$157,641	1	3	4	2	TRUE	TRUE
122	150%	75%	75%	-1 plant	$159,851	$175,269	$203,964	$168,850	1	3	4	2	TRUE	TRUE
123	150%	75%	75%	None	$161,352	$176,905	$205,545	$170,365	1	3	4	2	TRUE	TRUE
124	150%	75%	75%	+1 plant	$162,854	$178,542	$207,126	$171,880	1	3	4	2	TRUE	TRUE
125	150%	75%	75%	+2%	$178,252	$195,229	$223,245	$187,339	1	3	4	2	TRUE	TRUE
126	150%	75%	100%	-2%	$165,247	$181,023	$209,844	$174,452	1	3	4	2	TRUE	TRUE
127	150%	75%	100%	-1 plant	$179,417	$196,431	$224,772	$188,698	1	3	4	2	TRUE	TRUE
128	150%	75%	100%	None	$181,324	$198,518	$226,792	$190,624	1	3	4	2	TRUE	TRUE
129	150%	75%	100%	+1 plant	$183,230	$200,605	$228,812	$192,550	1	3	4	2	TRUE	TRUE
130	150%	75%	100%	+2%	$202,790	$221,877	$249,402	$212,195	1	3	4	2	TRUE	TRUE
131	150%	75%	150%	-2%	$198,348	$216,704	$244,976	$208,073	1	3	4	2	TRUE	TRUE
132	150%	75%	150%	-1 plant	$218,550	$238,757	$266,389	$228,395	1	3	4	2	TRUE	TRUE
133	150%	75%	150%	None	$221,267	$241,743	$269,287	$231,143	1	3	4	2	TRUE	TRUE
134	150%	75%	150%	+1 plant	$223,984	$244,730	$272,184	$233,890	1	3	4	2	TRUE	TRUE

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828 – 1130 West Pender St.
Vancouver BC, Canada
V6E 4A4

	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
135	150%	75%	150%	+2%	$251,866	$275,172	$301,717	$261,905	1	3	4	2	TRUE	TRUE
136	150%	75%	200%	-2%	$231,448	$252,384	$280,108	$241,694	1	3	4	2	TRUE	TRUE
137	150%	75%	200%	-1 plant	$257,683	$281,082	$308,006	$268,092	1	3	4	2	TRUE	TRUE
138	150%	75%	200%	None	$261,211	$284,968	$311,781	$271,661	1	3	4	2	TRUE	TRUE
139	150%	75%	200%	+1 plant	$264,738	$288,854	$315,557	$275,231	1	3	4	2	TRUE	TRUE
140	150%	75%	200%	+2%	$300,942	$328,468	$354,031	$311,616	1	3	4	2	TRUE	TRUE
141	150%	100%	75%	-2%	$157,253	$181,904	$209,123	$168,164	1	3	4	2	TRUE	TRUE
142	150%	100%	75%	-1 plant	$168,407	$193,989	$220,808	$179,372	1	3	4	2	TRUE	TRUE
143	150%	100%	75%	None	$169,908	$195,626	$222,389	$180,888	1	3	4	2	TRUE	TRUE
144	150%	100%	75%	+1 plant	$171,410	$197,263	$223,970	$182,403	1	3	4	2	TRUE	TRUE
145	150%	100%	75%	+2%	$186,808	$213,949	$240,090	$197,862	1	3	4	2	TRUE	TRUE
146	150%	100%	100%	-2%	$173,803	$199,744	$226,689	$184,974	1	3	4	2	TRUE	TRUE
147	150%	100%	100%	-1 plant	$187,973	$215,152	$241,617	$199,221	1	3	4	2	TRUE	TRUE
148	150%	100%	100%	None	$189,880	$217,238	$243,636	$201,147	1	3	4	2	TRUE	TRUE
149	150%	100%	100%	+1 plant	$191,786	$219,325	$245,656	$203,073	1	3	4	2	TRUE	TRUE
150	150%	100%	100%	+2%	$211,346	$240,597	$266,247	$222,717	1	3	4	2	TRUE	TRUE
151	150%	100%	150%	-2%	$206,904	$235,424	$261,820	$218,595	1	3	4	2	TRUE	TRUE
152	150%	100%	150%	-1 plant	$227,106	$257,477	$283,233	$238,918	1	3	4	2	TRUE	TRUE
153	150%	100%	150%	None	$229,823	$260,464	$286,131	$241,665	1	3	4	2	TRUE	TRUE
154	150%	100%	150%	+1 plant	$232,540	$263,450	$289,029	$244,413	1	3	4	2	TRUE	TRUE
155	150%	100%	150%	+2%	$260,422	$293,893	$318,561	$272,428	1	3	4	2	TRUE	TRUE
156	150%	100%	200%	-2%	$240,004	$271,104	$296,952	$252,216	1	3	4	2	TRUE	TRUE
157	150%	100%	200%	-1 plant	$266,239	$299,803	$324,850	$278,614	1	3	4	2	TRUE	TRUE
158	150%	100%	200%	None	$269,767	$303,689	$328,626	$282,184	1	3	4	2	TRUE	TRUE
159	150%	100%	200%	+1 plant	$273,294	$307,575	$332,401	$285,753	1	3	4	2	TRUE	TRUE
160	150%	100%	200%	+2%	$309,498	$347,188	$370,876	$322,138	1	3	4	2	TRUE	TRUE
161	150%	200%	75%	-2%	$191,477	$256,785	$276,501	$210,253	1	3	4	2	TRUE	TRUE
162	150%	200%	75%	-1 plant	$202,631	$268,870	$288,186	$221,462	1	3	4	2	TRUE	TRUE
163	150%	200%	75%	None	$204,132	$270,507	$289,767	$222,977	1	3	4	2	TRUE	TRUE
164	150%	200%	75%	+1 plant	$205,634	$272,144	$291,348	$224,493	1	3	4	2	TRUE	TRUE
165	150%	200%	75%	+2%	$221,032	$288,831	$307,468	$239,951	1	3	4	2	TRUE	TRUE
166	150%	200%	100%	-2%	$208,027	$274,625	$294,067	$227,064	1	3	4	2	TRUE	TRUE
167	150%	200%	100%	-1 plant	$222,197	$290,033	$308,995	$241,311	1	3	4	2	TRUE	TRUE
168	150%	200%	100%	None	$224,104	$292,120	$311,015	$243,237	1	3	4	2	TRUE	TRUE

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828 – 1130 West Pender St.
Vancouver BC, Canada
V6E 4A4

	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
169	150%	200%	100%	+1 plant	$226,011	$294,207	$313,034	$245,163	1	3	4	2	TRUE	TRUE
170	150%	200%	100%	+2%	$245,570	$315,479	$333,625	$264,807	1	3	4	2	TRUE	TRUE
171	150%	200%	150%	-2%	$241,128	$310,306	$329,198	$260,685	1	3	4	2	TRUE	TRUE
172	150%	200%	150%	-1 plant	$261,330	$332,359	$350,612	$281,007	1	3	4	2	TRUE	TRUE
173	150%	200%	150%	None	$264,047	$335,345	$353,509	$283,755	1	3	4	2	TRUE	TRUE
174	150%	200%	150%	+1 plant	$266,764	$338,331	$356,407	$286,503	1	3	4	2	TRUE	TRUE
175	150%	200%	150%	+2%	$294,646	$368,774	$385,939	$314,518	1	3	4	2	TRUE	TRUE
176	150%	200%	200%	-2%	$274,228	$345,986	$364,330	$294,306	1	3	4	2	TRUE	TRUE
177	150%	200%	200%	-1 plant	$300,463	$374,684	$392,228	$320,704	1	3	4	2	TRUE	TRUE
178	150%	200%	200%	None	$303,991	$378,570	$396,004	$324,273	1	3	4	2	TRUE	TRUE
179	150%	200%	200%	+1 plant	$307,518	$382,456	$399,779	$327,843	1	3	4	2	TRUE	TRUE
180	150%	200%	200%	+2%	$343,722	$422,070	$438,254	$364,228	1	3	4	2	TRUE	TRUE
181	200%	75%	75%	-2%	$161,875	$163,183	$205,554	$170,509	1	2	4	3	TRUE	FALSE
182	200%	75%	75%	-1 plant	$173,030	$175,269	$217,239	$181,718	1	2	4	3	TRUE	FALSE
183	200%	75%	75%	None	$174,531	$176,905	$218,820	$183,233	1	2	4	3	TRUE	FALSE
184	200%	75%	75%	+1 plant	$176,032	$178,542	$220,401	$184,748	1	2	4	3	TRUE	FALSE
185	200%	75%	75%	+2%	$191,431	$195,229	$236,520	$200,207	1	2	4	3	TRUE	FALSE
186	200%	75%	100%	-2%	$178,426	$181,023	$223,119	$187,319	1	2	4	3	TRUE	FALSE
187	200%	75%	100%	-1 plant	$192,596	$196,431	$238,047	$201,566	1	2	4	3	TRUE	FALSE
188	200%	75%	100%	None	$194,503	$198,518	$240,067	$203,492	1	2	4	3	TRUE	FALSE
189	200%	75%	100%	+1 plant	$196,409	$200,605	$242,087	$205,418	1	2	4	3	TRUE	FALSE
190	200%	75%	100%	+2%	$215,969	$221,877	$262,678	$225,062	1	2	4	3	TRUE	FALSE
191	200%	75%	150%	-2%	$211,526	$216,704	$258,251	$220,940	1	2	4	3	TRUE	FALSE
192	200%	75%	150%	-1 plant	$231,729	$238,757	$279,664	$241,263	1	2	4	3	TRUE	FALSE
193	200%	75%	150%	None	$234,446	$241,743	$282,562	$244,010	1	2	4	3	TRUE	FALSE
194	200%	75%	150%	+1 plant	$237,163	$244,730	$285,460	$246,758	1	2	4	3	TRUE	FALSE
195	200%	75%	150%	+2%	$265,045	$275,172	$314,992	$274,773	1	3	4	2	TRUE	TRUE
196	200%	75%	200%	-2%	$244,627	$252,384	$293,383	$254,561	1	2	4	3	TRUE	FALSE
197	200%	75%	200%	-1 plant	$270,862	$281,082	$321,281	$280,960	1	3	4	2	TRUE	TRUE
198	200%	75%	200%	None	$274,390	$284,968	$325,057	$284,529	1	3	4	2	TRUE	TRUE
199	200%	75%	200%	+1 plant	$277,917	$288,854	$328,832	$288,098	1	3	4	2	TRUE	TRUE
200	200%	75%	200%	+2%	$314,121	$328,468	$367,307	$324,484	1	3	4	2	TRUE	TRUE
201	200%	100%	75%	-2%	$170,432	$181,904	$222,398	$181,031	1	3	4	2	TRUE	TRUE
202	200%	100%	75%	-1 plant	$181,586	$193,989	$234,084	$192,240	1	3	4	2	TRUE	TRUE

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828 – 1130 West Pender St.
Vancouver BC, Canada
V6E 4A4

	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
203	200%	100%	75%	None	$183,087	$195,626	$235,664	$193,755	1	3	4	2	TRUE	TRUE
204	200%	100%	75%	+1 plant	$184,588	$197,263	$237,245	$195,270	1	3	4	2	TRUE	TRUE
205	200%	100%	75%	+2%	$199,987	$213,949	$253,365	$210,729	1	3	4	2	TRUE	TRUE
206	200%	100%	100%	-2%	$186,982	$199,744	$239,964	$197,842	1	3	4	2	TRUE	TRUE
207	200%	100%	100%	-1 plant	$201,152	$215,152	$254,892	$212,088	1	3	4	2	TRUE	TRUE
208	200%	100%	100%	None	$203,059	$217,238	$256,912	$214,014	1	3	4	2	TRUE	TRUE
209	200%	100%	100%	+1 plant	$204,965	$219,325	$258,932	$215,941	1	3	4	2	TRUE	TRUE
210	200%	100%	100%	+2%	$224,525	$240,597	$279,522	$235,585	1	3	4	2	TRUE	TRUE
211	200%	100%	150%	-2%	$220,082	$235,424	$275,096	$231,463	1	3	4	2	TRUE	TRUE
212	200%	100%	150%	-1 plant	$240,285	$257,477	$296,509	$251,785	1	3	4	2	TRUE	TRUE
213	200%	100%	150%	None	$243,002	$260,464	$299,406	$254,533	1	3	4	2	TRUE	TRUE
214	200%	100%	150%	+1 plant	$245,719	$263,450	$302,304	$257,281	1	3	4	2	TRUE	TRUE
215	200%	100%	150%	+2%	$273,601	$293,893	$331,837	$285,295	1	3	4	2	TRUE	TRUE
216	200%	100%	200%	-2%	$253,183	$271,104	$310,227	$265,084	1	3	4	2	TRUE	TRUE
217	200%	100%	200%	-1 plant	$279,418	$299,803	$338,126	$291,482	1	3	4	2	TRUE	TRUE
218	200%	100%	200%	None	$282,946	$303,689	$341,901	$295,051	1	3	4	2	TRUE	TRUE
219	200%	100%	200%	+1 plant	$286,473	$307,575	$345,676	$298,621	1	3	4	2	TRUE	TRUE
220	200%	100%	200%	+2%	$322,677	$347,188	$384,151	$335,006	1	3	4	2	TRUE	TRUE
221	200%	200%	75%	-2%	$204,656	$256,785	$289,776	$223,121	1	3	4	2	TRUE	TRUE
222	200%	200%	75%	-1 plant	$215,810	$268,870	$301,462	$234,330	1	3	4	2	TRUE	TRUE
223	200%	200%	75%	None	$217,311	$270,507	$303,043	$235,845	1	3	4	2	TRUE	TRUE
224	200%	200%	75%	+1 plant	$218,812	$272,144	$304,623	$237,360	1	3	4	2	TRUE	TRUE
225	200%	200%	75%	+2%	$234,211	$288,831	$320,743	$252,819	1	3	4	2	TRUE	TRUE
226	200%	200%	100%	-2%	$221,206	$274,625	$307,342	$239,931	1	3	4	2	TRUE	TRUE
227	200%	200%	100%	-1 plant	$235,376	$290,033	$322,270	$254,178	1	3	4	2	TRUE	TRUE
228	200%	200%	100%	None	$237,283	$292,120	$324,290	$256,104	1	3	4	2	TRUE	TRUE
229	200%	200%	100%	+1 plant	$239,189	$294,207	$326,310	$258,030	1	3	4	2	TRUE	TRUE
230	200%	200%	100%	+2%	$258,749	$315,479	$346,900	$277,674	1	3	4	2	TRUE	TRUE
231	200%	200%	150%	-2%	$254,307	$310,306	$342,474	$273,552	1	3	4	2	TRUE	TRUE
232	200%	200%	150%	-1 plant	$274,509	$332,359	$363,887	$293,875	1	3	4	2	TRUE	TRUE
233	200%	200%	150%	None	$277,226	$335,345	$366,785	$296,623	1	3	4	2	TRUE	TRUE
234	200%	200%	150%	+1 plant	$279,943	$338,331	$369,682	$299,370	1	3	4	2	TRUE	TRUE
235	200%	200%	150%	+2%	$307,825	$368,774	$399,215	$327,385	1	3	4	2	TRUE	TRUE
236	200%	200%	200%	-2%	$287,407	$345,986	$377,605	$307,173	1	3	4	2	TRUE	TRUE

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828 – 1130 West Pender St.
Vancouver BC, Canada
V6E 4A4

	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
237	200%	200%	200%	-1 plant	$313,642	$374,684	$405,504	$333,572	1	3	4	2	TRUE	TRUE
238	200%	200%	200%	None	$317,170	$378,570	$409,279	$337,141	1	3	4	2	TRUE	TRUE
239	200%	200%	200%	+1 plant	$320,697	$382,456	$413,055	$340,710	1	3	4	2	TRUE	TRUE
240	200%	200%	200%	+2%	$356,901	$422,070	$451,529	$377,096	1	3	4	2	TRUE	TRUE
241	300%	75%	75%	-2%	$188,233	$163,183	$232,104	$196,244	2	1	4	3	FALSE	FALSE
242	300%	75%	75%	-1 plant	$199,387	$175,269	$243,790	$207,453	2	1	4	3	FALSE	FALSE
243	300%	75%	75%	None	$200,889	$176,905	$245,371	$208,968	2	1	4	3	FALSE	FALSE
244	300%	75%	75%	+1 plant	$202,390	$178,542	$246,952	$210,483	2	1	4	3	FALSE	FALSE
245	300%	75%	75%	+2%	$217,788	$195,229	$263,071	$225,942	2	1	4	3	FALSE	FALSE
246	300%	75%	100%	-2%	$204,783	$181,023	$249,670	$213,054	2	1	4	3	FALSE	FALSE
247	300%	75%	100%	-1 plant	$218,954	$196,431	$264,598	$227,301	2	1	4	3	FALSE	FALSE
248	300%	75%	100%	None	$220,860	$198,518	$266,618	$229,227	2	1	4	3	FALSE	FALSE
249	300%	75%	100%	+1 plant	$222,767	$200,605	$268,638	$231,153	2	1	4	3	FALSE	FALSE
250	300%	75%	100%	+2%	$242,326	$221,877	$289,228	$250,797	2	1	4	3	FALSE	FALSE
251	300%	75%	150%	-2%	$237,884	$216,704	$284,802	$246,675	2	1	4	3	FALSE	FALSE
252	300%	75%	150%	-1 plant	$258,087	$238,757	$306,215	$266,998	2	1	4	3	FALSE	FALSE
253	300%	75%	150%	None	$260,804	$241,743	$309,113	$269,746	2	1	4	3	FALSE	FALSE
254	300%	75%	150%	+1 plant	$263,521	$244,730	$312,010	$272,493	2	1	4	3	FALSE	FALSE
255	300%	75%	150%	+2%	$291,403	$275,172	$341,543	$300,508	2	1	4	3	FALSE	FALSE
256	300%	75%	200%	-2%	$270,985	$252,384	$319,934	$280,296	2	1	4	3	FALSE	FALSE
257	300%	75%	200%	-1 plant	$297,220	$281,082	$347,832	$306,695	2	1	4	3	FALSE	FALSE
258	300%	75%	200%	None	$300,747	$284,968	$351,607	$310,264	2	1	4	3	FALSE	FALSE
259	300%	75%	200%	+1 plant	$304,275	$288,854	$355,383	$313,833	2	1	4	3	FALSE	FALSE
260	300%	75%	200%	+2%	$340,479	$328,468	$393,857	$350,219	2	1	4	3	FALSE	FALSE
261	300%	100%	75%	-2%	$196,789	$181,904	$248,949	$206,766	2	1	4	3	FALSE	FALSE
262	300%	100%	75%	-1 plant	$207,943	$193,989	$260,634	$217,975	2	1	4	3	FALSE	FALSE
263	300%	100%	75%	None	$209,445	$195,626	$262,215	$219,490	2	1	4	3	FALSE	FALSE
264	300%	100%	75%	+1 plant	$210,946	$197,263	$263,796	$221,006	2	1	4	3	FALSE	FALSE
265	300%	100%	75%	+2%	$226,344	$213,949	$279,916	$236,464	2	1	4	3	FALSE	FALSE
266	300%	100%	100%	-2%	$213,340	$199,744	$266,515	$223,577	2	1	4	3	FALSE	FALSE
267	300%	100%	100%	-1 plant	$227,510	$215,152	$281,443	$237,824	2	1	4	3	FALSE	FALSE
268	300%	100%	100%	None	$229,416	$217,238	$283,463	$239,750	2	1	4	3	FALSE	FALSE
269	300%	100%	100%	+1 plant	$231,323	$219,325	$285,482	$241,676	2	1	4	3	FALSE	FALSE
270	300%	100%	100%	+2%	$250,883	$240,597	$306,073	$261,320	2	1	4	3	FALSE	FALSE

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	Sensitivity Inputs				Scenario Results (25-year NPC $000)				Rank					
ID	Trans. Costs	Cap Costs	Fuel Costs	Load Change	Regional Plant	Islanded	Interconnect Existing	2 Comm Portable	Reg.	Isl.	Int. Ex.	2-C Port	Same Rank 1?	Same Ranking?
271	300%	100%	150%	-2%	$246,440	$235,424	$301,646	$257,198	2	1	4	3	FALSE	FALSE
272	300%	100%	150%	-1 plant	$266,643	$257,477	$323,060	$277,520	2	1	4	3	FALSE	FALSE
273	300%	100%	150%	None	$269,360	$260,464	$325,957	$280,268	2	1	4	3	FALSE	FALSE
274	300%	100%	150%	+1 plant	$272,077	$263,450	$328,855	$283,016	2	1	4	3	FALSE	FALSE
275	300%	100%	150%	+2%	$299,959	$293,893	$358,387	$311,031	2	1	4	3	FALSE	FALSE
276	300%	100%	200%	-2%	$279,541	$271,104	$336,778	$290,819	2	1	4	3	FALSE	FALSE
277	300%	100%	200%	-1 plant	$305,776	$299,803	$364,676	$317,217	2	1	4	3	FALSE	FALSE
278	300%	100%	200%	None	$309,303	$303,689	$368,452	$320,786	2	1	4	3	FALSE	FALSE
279	300%	100%	200%	+1 plant	$312,831	$307,575	$372,227	$324,356	2	1	4	3	FALSE	FALSE
280	300%	100%	200%	+2%	$349,035	$347,188	$410,702	$360,741	2	1	4	3	FALSE	FALSE
281	300%	200%	75%	-2%	$231,013	$256,785	$316,327	$248,856	1	3	4	2	TRUE	TRUE
282	300%	200%	75%	-1 plant	$242,168	$268,870	$328,012	$260,065	1	3	4	2	TRUE	TRUE
283	300%	200%	75%	None	$243,669	$270,507	$329,593	$261,580	1	3	4	2	TRUE	TRUE
284	300%	200%	75%	+1 plant	$245,170	$272,144	$331,174	$263,095	1	3	4	2	TRUE	TRUE
285	300%	200%	75%	+2%	$260,568	$288,831	$347,294	$278,554	1	3	4	2	TRUE	TRUE
286	300%	200%	100%	-2%	$247,564	$274,625	$333,893	$265,667	1	3	4	2	TRUE	TRUE
287	300%	200%	100%	-1 plant	$261,734	$290,033	$348,821	$279,913	1	3	4	2	TRUE	TRUE
288	300%	200%	100%	None	$263,641	$292,120	$350,841	$281,839	1	3	4	2	TRUE	TRUE
289	300%	200%	100%	+1 plant	$265,547	$294,207	$352,860	$283,765	1	3	4	2	TRUE	TRUE
290	300%	200%	100%	+2%	$285,107	$315,479	$373,451	$303,410	1	3	4	2	TRUE	TRUE
291	300%	200%	150%	-2%	$280,664	$310,306	$369,025	$299,288	1	3	4	2	TRUE	TRUE
292	300%	200%	150%	-1 plant	$300,867	$332,359	$390,438	$319,610	1	3	4	2	TRUE	TRUE
293	300%	200%	150%	None	$303,584	$335,345	$393,335	$322,358	1	3	4	2	TRUE	TRUE
294	300%	200%	150%	+1 plant	$306,301	$338,331	$396,233	$325,105	1	3	4	2	TRUE	TRUE
295	300%	200%	150%	+2%	$334,183	$368,774	$425,765	$353,120	1	3	4	2	TRUE	TRUE
296	300%	200%	200%	-2%	$313,765	$345,986	$404,156	$332,909	1	3	4	2	TRUE	TRUE
297	300%	200%	200%	-1 plant	$340,000	$374,684	$432,054	$359,307	1	3	4	2	TRUE	TRUE
298	300%	200%	200%	None	$343,527	$378,570	$435,830	$362,876	1	3	4	2	TRUE	TRUE
299	300%	200%	200%	+1 plant	$347,055	$382,456	$439,605	$366,446	1	3	4	2	TRUE	TRUE
300	300%	200%	200%	+2%	$383,259	$422,070	$478,080	$402,831	1	3	4	2	TRUE	TRUE

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APPENDIX E: 50-YEAR SCENARIO RESULTS

E.1 Overall Results

The cumulative annual cost of each scenario over time is presented in Table 19. The 2073 value represents the total costs for the total lifespan of each project, discounted at NLH's real weighted average cost of capital to 2023 dollars. As noted in Section 3, Midgard developed a parallel DCF Model which allowed for a 50-year planning period. In order to account for a life extension for a 40-year diesel plant life to a 50-year planning model, a 10% capital cost life extension was applied in year 35 to each of the relevant scenarios.

Table 19: Net Present Costs (Real, $000 CAD 2023)

	Regional Plant	Islanded	Local Interconnect	2 Comm Portable
2023	$11,425	$11,425	$11,425	$11,425
2024	$21,846	$21,846	$21,846	$21,846
2025	$31,819	$31,819	$31,819	$31,819
2026	$39,208	$42,040	$40,624	$39,208
2027	$44,103	$51,688	$71,642	$70,777
2028	$119,167	$95,482	$99,212	$78,095
2029	$123,958	$103,203	$126,943	$85,441
2030	$128,512	$137,818	$132,571	$143,952
2031	$134,275	$143,142	$137,773	$148,383
2032	$138,367	$149,832	$143,953	$152,634
2033	$142,286	$154,693	$148,701	$156,678
2034	$146,047	$160,143	$178,284	$161,795
2035	$149,657	$188,861	$206,931	$165,405
2036	$154,547	$193,189	$211,041	$168,878
2037	$157,903	$198,486	$215,248	$172,234
2038	$161,146	$202,495	$219,731	$175,477
2039	$164,293	$208,126	$224,372	$179,895
2040	$167,337	$211,946	$228,001	$182,940
2041	$171,863	$215,501	$231,373	$185,890
2042	$174,722	$220,364	$234,946	$188,749
2043	$177,484	$223,771	$238,869	$191,512
2044	$180,141	$228,389	$242,308	$195,582
2045	$182,692	$247,996	$261,756	$198,133
2046	$186,127	$251,043	$264,650	$200,580
2047	$188,481	$254,767	$267,358	$202,934
2048	$190,743	$257,512	$270,839	$205,196
2049	$192,892	$261,675	$274,313	$208,232
2050	$194,934	$264,161	$276,669	$210,274
2051	$205,082	$266,526	$278,910	$212,214

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	Regional Plant	Islanded	Local Interconnect	2 Comm Portable
2052	$206,926	$274,532	$282,039	$214,058
2053	$208,678	$276,674	$284,546	$215,810
2054	$210,344	$283,044	$287,146	$224,841
2055	$211,926	$284,986	$288,982	$226,423
2056	$214,424	$286,834	$290,730	$227,928
2057	$215,854	$289,492	$292,394	$229,358
2058	$217,214	$291,167	$297,146	$230,718
2059	$218,507	$296,890	$302,122	$232,902
2060	$219,736	$298,409	$303,557	$234,131
2061	$221,417	$299,856	$304,924	$235,300
2062	$222,528	$301,680	$306,225	$236,412
2063	$224,436	$303,761	$308,033	$237,469
2064	$225,442	$305,971	$309,907	$238,934
2065	$226,398	$307,862	$311,031	$240,682
2066	$227,788	$308,998	$312,101	$241,592
2067	$228,654	$310,502	$313,121	$242,458
2068	$229,478	$311,534	$314,322	$243,282
2069	$230,262	$314,830	$317,897	$244,496
2070	$231,008	$316,358	$319,369	$245,242
2071	$232,251	$317,252	$320,210	$245,952
2072	$232,927	$318,584	$321,011	$246,628
2073	$233,570	$319,396	$322,007	$247,271

The figures above are presented graphically in Figure 20.

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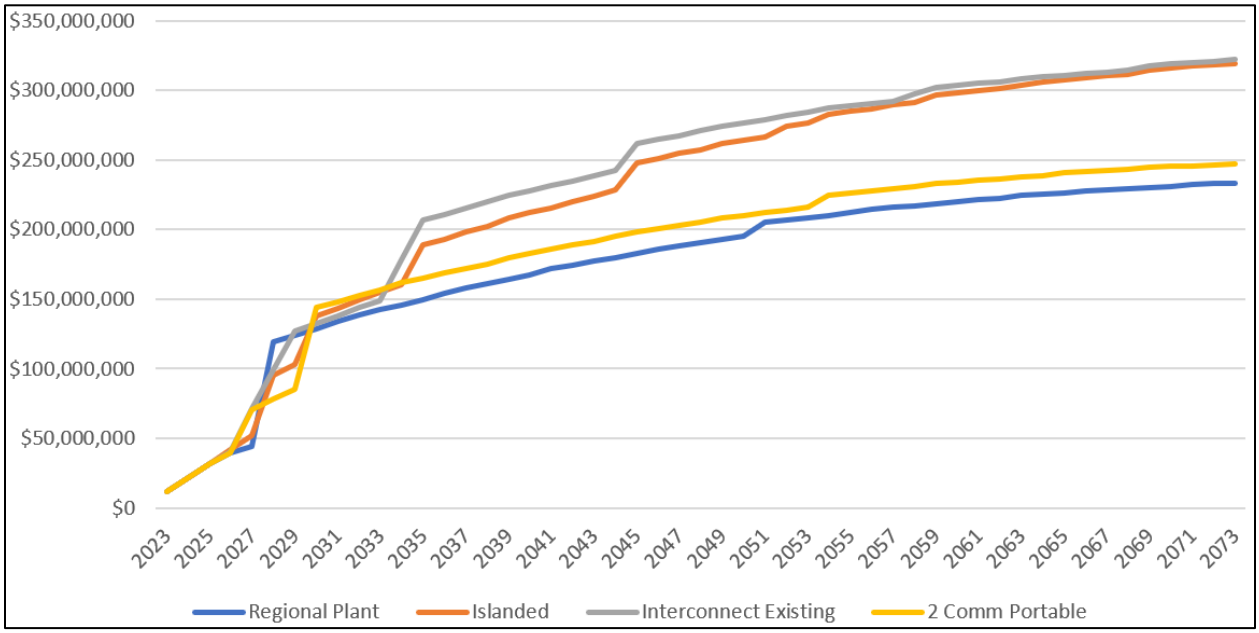
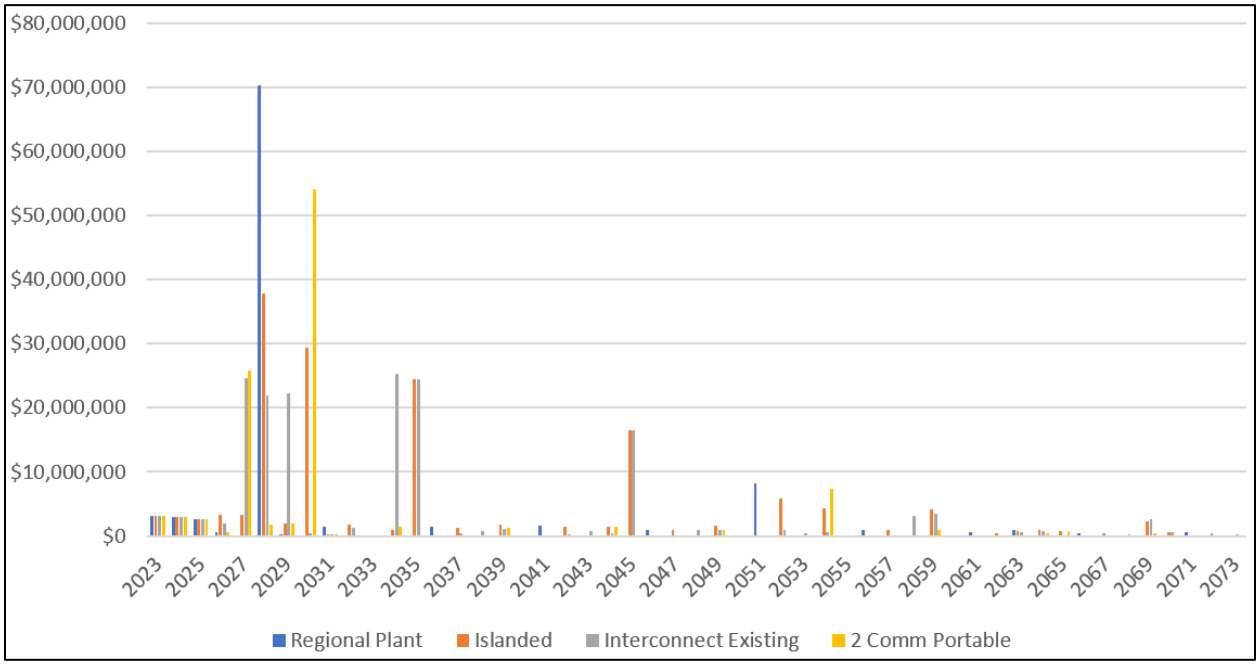
Figure 20: Net Present Costs (Real, CAD 2023)



It is important to note that the 2073 Net Present Cost values presented above differ from the total NPV (equivalent to net present costs) presented in the "baseline" instance because this net present cost comparison does not account for the influence of the terminal value of equipment.

A visual representation showing the capital expenditures in each year (by scenario) over the 50-year study timeframe can be found in Figure 21.

Figure 21: Annual Capital Expenditures, All Scenarios (25 years)



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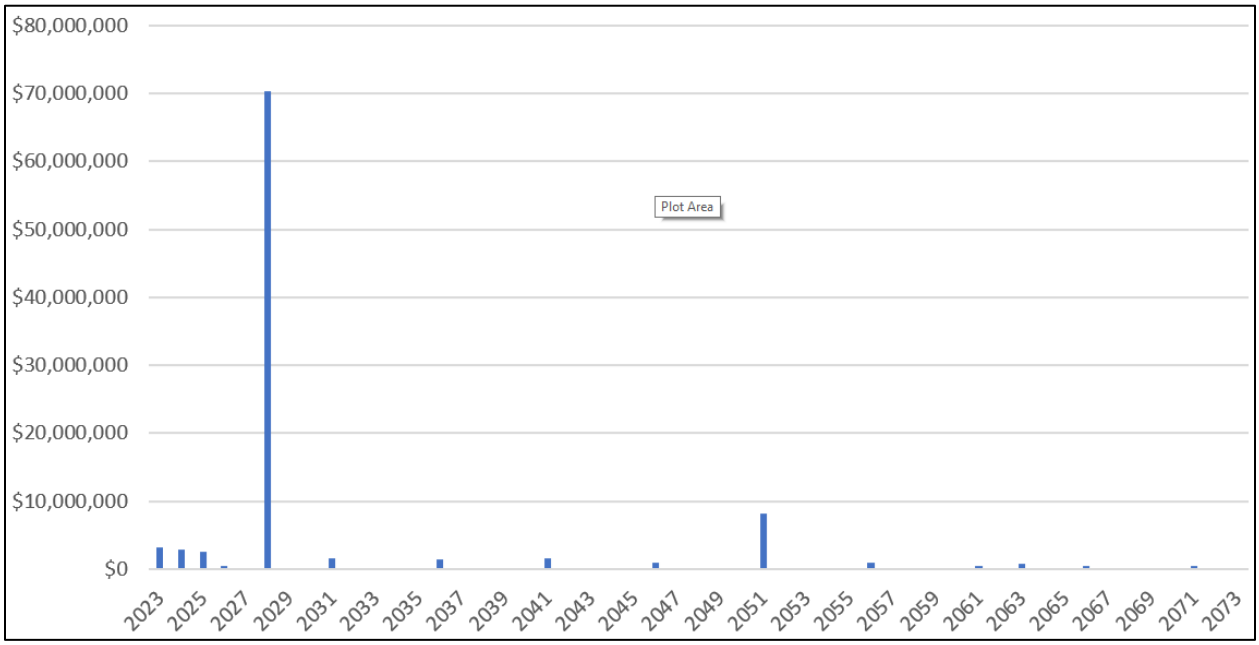
Descriptions of the specific scenarios and their capital expenditures follow. A number of recurring capital costs are included in the graphs but are not included in the tables below since these cost components are small relative to major infrastructure such as interconnection expenses and new powerhouses and occur frequently.

For simplicity of modelling and ease of data audit, costs are assigned when the bulk of the costs are anticipated to occur, rather than breaking up total costs into annual phases. As an example, the costs for the regional powerhouse are incurred in 2028, rather than spread from 2023 to 2029 since the plurality of costs will occur in this year.

E.2 Regional Plant Scenario

The Regional Plant capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 22: Annual Capital Expenditures, Regional Plant (50 years)



The regional plant scenario consists of the following major capital expenditures:

Table 20: Regional Plant Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2028	Construction of Regional Powerhouse including 1x910, 1x1,000, 1x 1,833 and 1x2,220 kW Gensets	$49,010

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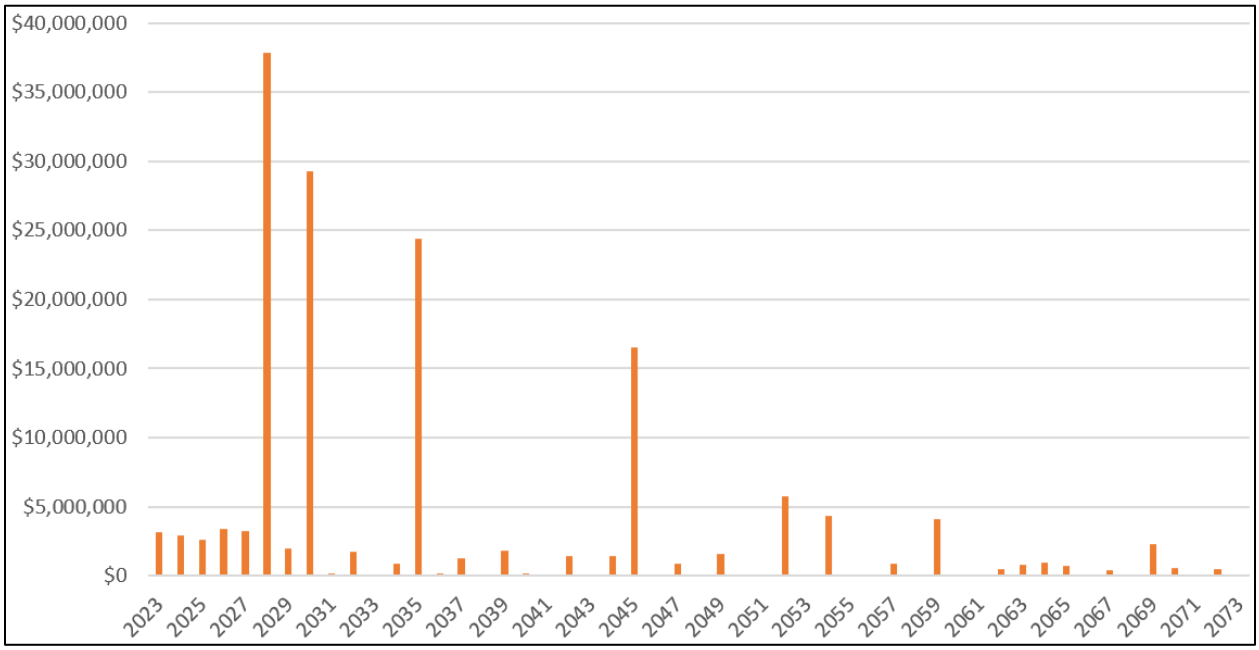
2028	Interconnection of CHT, MSH, PHS and SLE including voltage conversion	$34,917
2063	Regional Powerhouse Life Extension	$3,605

E.3 Islanded Communities Scenario

The Islanded Communities capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 23: Annual Capital Expenditures, Islanded (50 years)



The islanded scenario consists of the following major capital expenditures:

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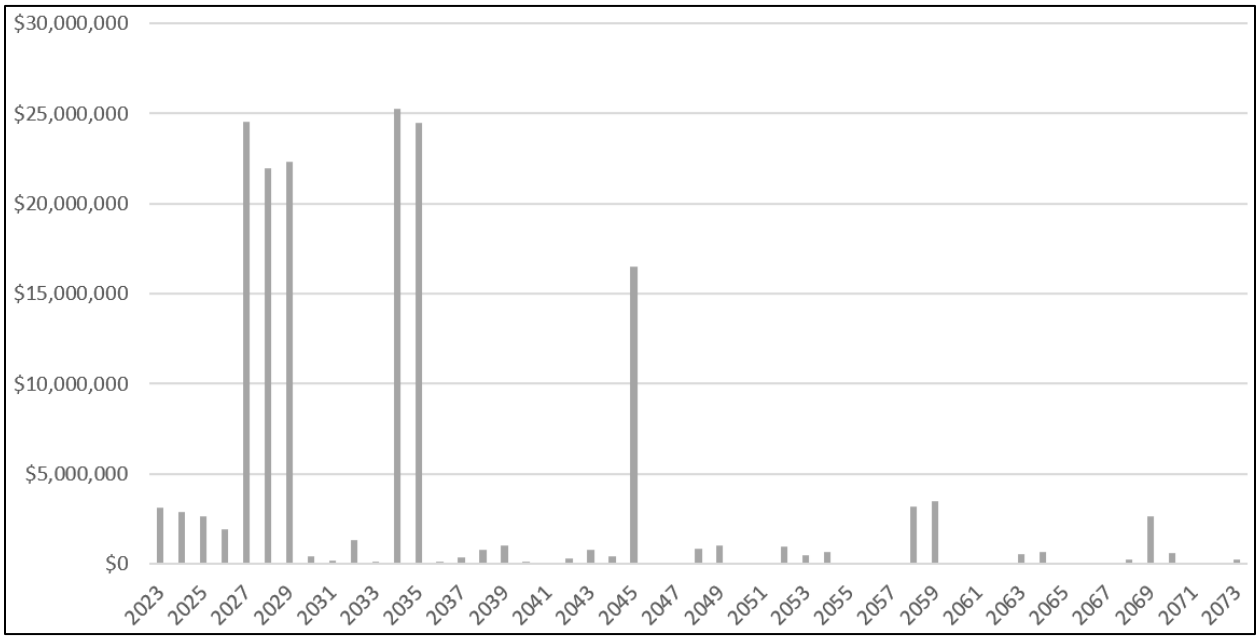
Table 21: Islanded Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2025	Retrofit of fire suppression systems at MSH and PHS.	$3,156
2026	Retrofit of fire suppression systems at SLE. Addition of an external building to house the fire suppression system at SLE	$1,928
2028	Construction of a new CHT powerhouse including 1x600, 1x800 and 2x1,000 kW gensets	$40,384
2030	Replacement of MSH powerhouse including 1x600 and 2x910 kW gensets	$37,413
2035	Replacement of PHS Powerhouse including 1x600 and 2x800 kW gensets	$37,297
2045	Replacement of SLE Powerhouse including 1x600 and 2x800 kW gensets	$36,547
2063	CHT Powerhouse Life Extension	$3,225
2065	MSH Powerhouse Life Extension	$3,184
2070	PHS Powerhouse Life Extension	$3,223

E.4 Interconnection of Existing Plants Scenario

The Local Interconnect capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 24: Annual Capital Expenditures, Local Interconnect (50 years)



The Interconnection of Existing Plants scenario consists of the following major capital expenditures:

Table 22: Interconnection of Existing Plants Capital Expenditures by Year

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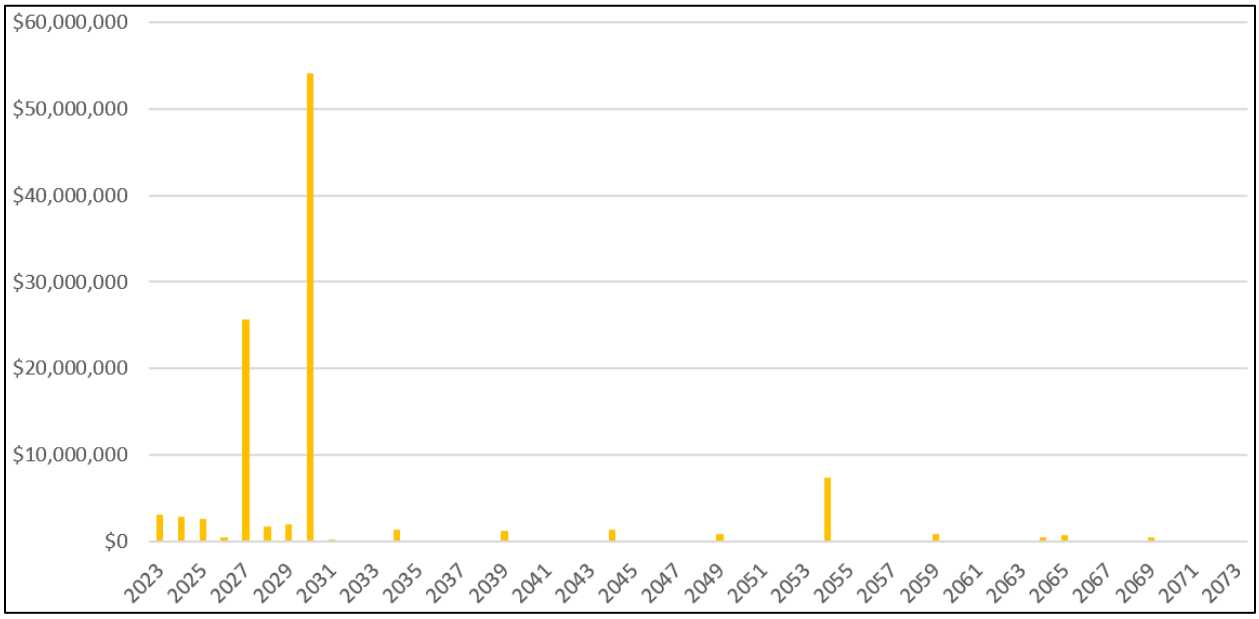
Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2026	Retrofit of fire suppression systems at PHS.	$1,578
2027	PHS Plant Upgrade	$10,342
2027	PHS-CHT interconnection and voltage conversions	$14,278
2028	Retrofit of fire suppression systems at SLE. Addition of an external building to house the fire suppression system at SLE	$1,928
2028	MSH Plant Upgrade	$13,735
2028	PHS-SLE interconnection and voltage conversions	$7,641
2029	Retrofit of fire suppression systems at MSH.	$1,578
2029	SLE Plant Upgrade	$10,867
2034	Replacement of MSH powerhouse including 1x600 and 2x910 kW gensets	$37,413
2035	Replacement of PHS Powerhouse including 1x600 and 2x800 kW gensets	$37,537
2045	Replacement of SLE Powerhouse including 1x600 and 2x800 kW gensets	$36,547
2069	MSH Powerhouse Life Extension	$3,184
2070	PHS Powerhouse Life Extension	$3,223

E.5 2-Community Portable Scenario

The 2-Community Portable capital program is represented graphically below. The figures presented are in 2023 Canadian dollars.

Figure 25: Annual Capital Expenditures, 2 Comm Portable (50 years)



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The 2-community portable scenario consists of the following major capital expenditures:

Table 23: 2-Community Portable Capital Expenditures by Year

Year	Component(s)	Cost ($000, CAD 2023)
2025	MSH Life Extension (Roof repairs, Reconductoring, Service conductor)	$1,839
2027	Retrofit of fire suppression systems at PHS.	$1,578
2027	PHS Plant Upgrade	$12,595
2027	PHS-CHT interconnection and voltage conversions	$14,278
2028	Retrofit of fire suppression systems at SLE. Addition of an external building to house the fire suppression system at SLE	$1,928
2030	Construction of Regional Powerhouse including 1x910, 1x1,000, 1x 1,833 and 1x2,220 kW Gensets	$49,010
2030	PHS-SLE and PHS-MSH interconnection and voltage conversions	$20,639
2065	Regional Powerhouse Life Extension	$3,605

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APPENDIX F: DETAILED LOAD CHANGE ANALYSIS

Loads were analyzed assuming N-1 reliability for all scenarios other than the "Interconnection of Existing Plants" scenarios which used N-2 reliability to reflect the decrease in reliability using a large number of smaller gensets. A spreadsheet was created to compare projected loads, and flagged any loads that were in excess of firm generation in red with a yellow background. These tables are presented at the beginning of the sections discussing load secondary effects, and a description of the actual effects (by configuration and plant) follows. The bottom row of each scenario (or each powerhouse in the case of the Islanded scenario) lists the firm generation available in that year, updating in years where powerhouses are built or upgraded. Green highlights indicate years in which firm generation is in excess of peak load by at least 300 kW, indicating the potential to reduce replacement generator size when these systems are due for replacement.

F.1 Regional Plant

For the Regional Plant scenario, changes in load were evaluated for the aggregate load of all six communities, which was forecast to have a peak (summer) load of 3,613 kW. In cases of increased loads, an additional genset could be installed in the empty (spare) powerhouse bay which was assumed included to accommodate potential load growth or N-2 reliability.

Regional Plant Combined	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
-2%	3,657	3,584	3,512	3,442	3,373	3,306	3,240	3,175	3,111	3,049	2,988	2,928
-1 plant	3,657	3,657	3,657	3,657	3,657	3,349	3,349	3,349	3,349	3,349	3,349	3,349
None	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
+1 plant	3,657	3,657	3,657	3,657	3,657	3,965	3,965	3,965	3,965	3,965	3,965	3,965
+2%	3,657	3,730	3,805	3,881	3,958	4,038	4,118	4,201	4,285	4,370	4,458	4,547
Regional Firm						3,743	3,743	3,743	3,743	3,743	3,743	3,743

2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
2,870	2,812	2,756	2,701	2,647	2,594	2,542	2,491	2,441	2,393	2,345	2,298	2,252	2,207
3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349
3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965
4,638	4,731	4,825	4,922	5,020	5,121	5,223	5,328	5,434	5,543	5,654	5,767	5,882	6,000
3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743

F.1.1 2% Annual Load Decline (Regional Plant)

The "2% Decline" sensitivity setting would result in excess capacity in the system and may result in one or more gensets being downsized or eliminated at end of service life (25 years). Reduced loads would result in lower operating costs (fuel and maintenance)

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F.1.2 Loss of a Fish Processing Plant (Regional Plant)

The "-1 Fish Plant" sensitivity setting would result in excess capacity in the system and may result in one or more gensets being downsized or eliminated at end of service life (25 years). Reduced loads would result in lower operating costs (fuel and maintenance)

F.1.3 No Change (Regional Plant)

This is the design case for the scenario.

F.1.4 Addition of a Fish Processing Plant (Regional Plant)

The addition of a fish plant would exceed the planned firm capacity of the system. Since there is generally lead time ahead of the construction and operation of such an expansion, if this was known ahead of (or during) construction then replacement of the 1,000-kW unit with a 1,250-kW unit would meet the firm energy requirements of this expansion. If this was later in the service life of the facility, then an additional unit could be added to meet this load growth.

F.1.5 2% Annual Load Increase (Regional Plant)

2% annual load growth would exceed the planned firm capacity of the system prior to construction of the facility. If consistent load growth occurred prior to the procurement of gensets then resizing of the gensets for installation could take place before construction. On continued load growth an additional unit could be added to meet this load growth, after which smaller units would need to be replaced with larger units.

F.2 Islanded Operation (construction of new CHT plant)

For the Islanded Operation scenario, changes in load were evaluated for each powerhouse serving an islanded community (or communities). Note that the change in fish processing plant impacts are outlined for MSH but would have identical effects if the plant were located in Charlottetown instead (assuming that the new CHT plant was built). For all other communities the change in fish processing plants has no effect on their operation.

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CHT	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
-2%	1,557	1,526	1,495	1,465	1,436	1,407	1,379	1,352	1,325	1,298	1,272	1,247
None	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557
+2%	1,557	1,588	1,620	1,652	1,685	1,719	1,753	1,789	1,824	1,861	1,898	1,936
Firm Capacity						2,400	2,400	2,400	2,400	2,400	2,400	2,400

MSH	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
-2%	1,177	1,153	1,130	1,108	1,086	1,064	1,043	1,022	1,001	981	962	942
-1 plant	1,177	1,177	1,177	1,177	1,177	869	869	869	869	869	869	869
None	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177
+1 plant	1,177	1,177	1,177	1,177	1,177	1,485	1,485	1,485	1,485	1,485	1,485	1,485
+2%	1,177	1,201	1,225	1,249	1,274	1,300	1,325	1,352	1,379	1,407	1,435	1,463
Firm Capacity	1,090	1,090	1,090	1,090	1,090	1,090	1,090	1,510	1,510	1,510	1,510	1,510

PHS	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
-2%	753	738	723	709	695	681	667	654	641	628	615	603
None	753	753	753	753	753	753	753	753	753	753	753	753
+2%	753	768	783	799	815	831	848	865	882	900	918	936
Firm Capacity	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

SLE	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
-2%	384	376	369	361	354	347	340	333	327	320	314	307
None	384	384	384	384	384	384	384	384	384	384	384	384
+2%	384	392	400	408	416	424	432	441	450	459	468	477
Firm Capacity	565	565	565	565	565	565	565	565	565	565	565	565

2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
1,222	1,197	1,173	1,150	1,127	1,104	1,082	1,061	1,039	1,019	998	978	959	940
1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557
1,975	2,014	2,054	2,096	2,137	2,180	2,224	2,268	2,314	2,360	2,407	2,455	2,504	2,554
2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400

2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
924	905	887	869	852	835	818	802	786	770	755	740	725	710
869	869	869	869	869	869	869	869	869	869	869	869	869	869
1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177
1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485
1,493	1,523	1,553	1,584	1,616	1,648	1,681	1,715	1,749	1,784	1,820	1,856	1,893	1,931
1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510

2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
591	579	567	556	545	534	523	513	503	493	483	473	464	454
753	753	753	753	753	753	753	753	753	753	753	753	753	753
955	974	994	1,013	1,034	1,054	1,075	1,097	1,119	1,141	1,164	1,187	1,211	1,235
1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400

2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
301	295	289	284	278	272	267	262	256	251	246	241	236	232
384	384	384	384	384	384	384	384	384	384	384	384	384	384
487	497	507	517	527	538	548	559	571	582	594	606	618	630
565	565	565	565	565	565	565	565	565	565	1,400	1,400	1,400	1,400

F.2.1 2% Annual Load Decline (Islanded)

The ”2% Decline” sensitivity setting would bring MSH into N-1 reliability by 2027 for its installed generators, and the planned gensets could be replaced with the existing suite rather than the planned gensets in the current plant replacement project scheduled in 2030. The MSH plant replacement design includes 1x600 and 2x910 kW units. With continued load decline, other planned replacement projects (PHS in 2035 and SLE in 2045) would likely also have their genset sizes reduced, possibly retaining their existing configurations. It is

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V6E 4A4

unlikely that this would result in a significant cost saving as a result of downsizing, since the standard design for remote diesel systems is typically a 3-bay or 4-bay powerhouse to allow for N-1 reliability with more than a single redundant genset. Reductions in the sizing of the main bus and switchgear could save money, but this would be more than offset if loads increased requiring an increase in power output.

F.2.2 Loss of a Fish Processing Plant (Islanded)

The "-1 Fish Plant" sensitivity setting would bring MSH into N-1 reliability by 2027 for its installed generators and could allow one or more gensets to be downsized on plant replacement, or to have the gensets replaced with the existing suite rather than the planned 600 and 2x910 kW units. As with the above scenario it is unlikely that this would result in a significant cost saving, since the standard design for remote diesel systems is typically a 3-bay powerhouse. Reductions in the sizing of the main bus and switchgear could save money, but this would be more than offset if loads increased requiring an increase in power output.

F.2.3 No Change (Islanded)

If loads remain constant, then all plants would have sufficient firm capacity to manage the addition or reduction once the plants were rebuilt (CHT in 2028) or upgraded (2030 for the MSH upgrade).

F.2.4 Addition of a Fish Processing Plant (Islanded)

The addition of a fish processing plant would Increase the period that MSH would not meet N-1 reliability and would likely increase the amount of time that one or more portable gensets would be needed at MSH. Once the replacement powerhouse is built in 2030 MSH would meet existing peak load requirements.

F.2.5 2% Annual Load Increase (Islanded)

2% Annual load growth would cause all powerhouses in the region with the exception of PHS to eventually fall below N-1 reliability requirements for peak load. As these systems are islanded, the most likely solution would be to replace the smallest generator with a larger generator. As has been noted with the "Networked Existing" scenario, there will be a limit at which the bus and switchgear sizing (and associated protection and controls) will require an upgrade. At that point, early replacement may be more cost effective than a plant upgrade.

Mary's Harbour and Lodge Bay: load growth would immediately increase the amount of time that MSH would not meet N-1 reliability and would likely increase the amount of time that one or more portable gensets would need to be operated at MSH. Once the replacement powerhouse is built in 2030 MSH would meet existing peak load requirements until 2036, at which point it would no longer meet reliability requirements. If the proposed 600 kW genset was replaced with a 910 kW unit, then MSH would meet N-1 reliability until 2045.

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Charlottetown and Pinsent's Arm: load growth would exceed reliability requirements in 2045. Replacing the 600 kW genset with a 1,000 kW genset at CHT at this time would resolve this issue over the study period, and if 2% load growth continued would need a further genset replacement in 2053.

St. Lewis: Load growth would exceed reliability in 2043. The most cost-effective solution would likely be an early plant replacement, with planning starting in the late 2030's driven by projected load growth. Another alternative would be to use the spare bay in SLE to install an additional genset until plant replacement, since even a 50 kW unit would be sufficient to meet this requirement.

F.3 Interconnection of Existing Plants

The Interconnection of Existing Plants scenario immediately adds an additional 545 kW genset to the existing spare genset bay at SLE. Even with this addition, the peak load is close to the combined (N-2) capacity of all generators on the system. If additional firm capacity is required, then gensets must be replaced, likely starting with the smaller gensets such as the existing 200 kW genset at SLE. Continued load growth would either require further replacement or additional gensets, the latter of which would incur significant expense for powerhouse expansions.

Local Interconnect (N-2)												
Combined	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
-2%	3,657	3,584	3,512	3,442	3,373	3,306	3,240	3,175	3,111	3,049	2,988	2,928
-1 plant	3,657	3,657	3,657	3,657	3,657	3,349	3,349	3,349	3,349	3,349	3,349	3,349
None	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
+1 plant	3,657	3,657	3,657	3,657	3,657	3,965	3,965	3,965	3,965	3,965	3,965	3,965
+2%	3,657	3,730	3,805	3,881	3,958	4,038	4,118	4,201	4,285	4,370	4,458	4,547
N-2						3,655	3,655	3,890	3,890	3,890	3,890	3,890

2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
2,870	2,812	2,756	2,701	2,647	2,594	2,542	2,491	2,441	2,393	2,345	2,298	2,252	2,207
3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349
3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965
4,638	4,731	4,825	4,922	5,020	5,121	5,223	5,328	5,434	5,543	5,654	5,767	5,882	6,000
4,365	4,365	4,365	4,365	4,365	4,365	4,365	4,365	4,365	4,365	5,000	5,000	5,000	5,000

F.3.1 2% Annual Load Decline (Interconnection of Existing Plants)

The "2% Decline" sensitivity setting may drive the reduction in size of powerhouse replacements: PHS in 2035 and SLE in 2045 would likely have their genset sizes reduced or eliminate one or more replacement gensets.

F.3.2 Loss of a Fish Processing Plant (Interconnection of Existing Plants)

The "-1 Fish Plant" sensitivity setting would increase the amount of reserve capacity available on the system. As with the above scenario it is unlikely that this would result in a significant cost saving as a result of downsizing.

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F.3.3 No Change (Interconnection of Existing Plants)

This is the design case for the scenario. As noted in NLH's technical memo, in this case there is very little reserve capacity available on the system.

F.3.4 Addition of a Fish Processing Plant (Interconnection of Existing Plants)

The addition of a fish plant would exceed the planned firm capacity of the system at N-2 redundancy. Replacement of the MSH plant in 2030 would somewhat alleviate this but it would not be resolved until the replacement of the PHS plant on 2035 without replacement (upsizing) of one or more gensets on the system, likely replacing the 200 kW genset at SLE with a 545 kW genset.

F.3.5 2% Annual Load Increase (Interconnection of Existing Plants)

2% Annual load growth would cause the system to fall below N-1 reliability requirements for peak load in 2043, and 2044 (before replacement of SLE) and again after 2048. At N-2 reliability the system fails to meet reliability at the time of interconnection. While plant replacements would alleviate this, it would likely need to be solved by either significantly upsizing either the MSH replacement in 2030 which currently assumes 1x600 and 2x910 kW gensets, or the PHS facility in 2035 which currently assumes 1x600 and 2x800 kW gensets. Based on the planned unit and plant replacement schedule, this load increase would result in an additional requirement for almost 1,000 kW of additional capacity by 2048.

F.4 2-Community Portable Alternative

Once the regional powerhouse is built in 2030 the 2-community portable alternative would act identically to the Regional Plant Scenario. The end result of this alternative is the same as the Regional Powerhouse scenario, with additional expense, complexity and later in service date to provide power for Charlottetown and Pinset's Arm.

Table containing all load configurations and all powerhouses (and powerhouse combinations) below.

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CHT	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	1,557	1,526	1,495	1,465	1,436	1,407	1,379	1,352	1,325	1,298	1,272	1,247	1,222	1,197	1,173	1,150	1,127	1,104	1,082	1,061	1,039	1,019	998	978	959	940
None	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557	1,557
+2%	1,557	1,588	1,620	1,652	1,685	1,719	1,753	1,789	1,824	1,861	1,898	1,936	1,975	2,014	2,054	2,096	2,137	2,180	2,224	2,268	2,314	2,360	2,407	2,455	2,504	2,554
Firm Capacity						2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400

MSH	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	1,177	1,153	1,130	1,108	1,086	1,064	1,043	1,022	1,001	981	962	942	924	905	887	869	852	835	818	802	786	770	755	740	725	710
-1 plant	1,177	1,177	1,177	1,177	1,177	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869	869
None	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,177
+1 plant	1,177	1,177	1,177	1,177	1,177	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485	1,485
+2%	1,177	1,201	1,225	1,249	1,274	1,300	1,325	1,352	1,379	1,407	1,435	1,463	1,493	1,523	1,553	1,584	1,616	1,648	1,681	1,715	1,749	1,784	1,820	1,856	1,893	1,931
Firm Capacity	1,090	1,090	1,090	1,090	1,090	1,090	1,090	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510

PHS	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	753	738	723	709	695	681	667	654	641	628	615	603	591	579	567	556	545	534	523	513	503	493	483	473	464	454
None	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753	753
+2%	753	768	783	799	815	831	848	865	882	900	918	936	955	974	994	1,013	1,034	1,054	1,075	1,097	1,119	1,141	1,164	1,187	1,211	1,235
Firm Capacity	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400

SLE	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	384	376	369	361	354	347	340	333	327	320	314	307	301	295	289	284	278	272	267	262	256	251	246	241	236	232
None	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384	384
+2%	384	392	400	408	416	424	432	441	450	459	468	477	487	497	507	517	527	538	548	559	571	582	594	606	618	630
Firm Capacity	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	1,400	1,400	1,400	1,400

Regional Plant

Combined	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	3,657	3,584	3,512	3,442	3,373	3,306	3,240	3,175	3,111	3,049	2,988	2,928	2,870	2,812	2,756	2,701	2,647	2,594	2,542	2,491	2,441	2,393	2,345	2,298	2,252	2,207
-1 plant	3,657	3,657	3,657	3,657	3,657	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349
None	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
+1 plant	3,657	3,657	3,657	3,657	3,657	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965
+2%	3,657	3,730	3,805	3,881	3,958	4,038	4,118	4,201	4,285	4,370	4,458	4,547	4,638	4,731	4,825	4,922	5,020	5,121	5,223	5,328	5,434	5,543	5,654	5,767	5,882	6,000
Regional Firm						3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743	3,743

Local Interconnect (N-1)

Combined	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	3,657	3,584	3,512	3,442	3,373	3,306	3,240	3,175	3,111	3,049	2,988	2,928	2,870	2,812	2,756	2,701	2,647	2,594	2,542	2,491	2,441	2,393	2,345	2,298	2,252	2,207
-1 plant	3,657	3,657	3,657	3,657	3,657	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349
None	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
+1 plant	3,657	3,657	3,657	3,657	3,657	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965
+2%	3,657	3,730	3,805	3,881	3,958	4,038	4,118	4,201	4,285	4,370	4,458	4,547	4,638	4,731	4,825	4,922	5,020	5,121	5,223	5,328	5,434	5,543	5,654	5,767	5,882	6,000
Network Firm						4,380	4,380	4,800	4,800	4,800	4,800	4,800	5,275	5,275	5,275	5,275	5,275	5,275	5,275	5,275	5,275	5,275	5,910	5,910	5,910	5,910

Local Interconnect (N-2)

Combined	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
-2%	3,657	3,584	3,512	3,442	3,373	3,306	3,240	3,175	3,111	3,049	2,988	2,928	2,870	2,812	2,756	2,701	2,647	2,594	2,542	2,491	2,441	2,393	2,345	2,298	2,252	2,207
-1 plant	3,657	3,657	3,657	3,657	3,657	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349
None	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657	3,657
+1 plant	3,657	3,657	3,657	3,657	3,657	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965	3,965
+2%	3,657	3,730	3,805	3,881	3,958	4,038	4,118	4,201	4,285	4,370	4,458	4,547	4,638	4,731	4,825	4,922	5,020	5,121	5,223	5,328	5,434	5,543	5,654	5,767	5,882	6,000
N-2						3,655	3,655	3,890	3,890	3,890	3,890	3,890	4,365	4,365	4,365	4,365	4,365	4,365	4,365	4,365	4,365	4,365	5,000	5,000	5,000	5,000

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Attachment 2

Summary of Technical Note RP-TN-089

Southern Labrador – Summary of Information Provided to Midgard

Doc #: TP-TN-089
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Summary of RP-TN-089

Southern Labrador – Summary of Information Provided to Midgard

1 Purpose

The following note provides additional detail on three alternatives considered as part of the proposed southern Labrador interconnection project. The details include updated capacity analysis, project scope, class 4 estimates, project schedules, and environmental permitting. This information is to be used by Midgard Consulting Inc. ("Midgard") in their portion of the response to the Board of Commissioners of Public Utilities ("Board") request issued August 1, 2023.

The alternatives that require additional detail are listed in Table 1.

Table 1: Alternatives Requiring Additional Detail

Hydro Alternative #	Midgard Scenario	Title
2	B	Islanded Operation
6	E	Interconnection of Existing Plants
7(New)	N/A	2-Community Portable Generation

2 Analysis and Scope of Work

2.1 Alternative 2 – Islanded Operation (Midgard Scenario B)

This alternative involves the construction of a new diesel plant in Charlottetown at a new location. Each community in southern Labrador (Port Hope Simpson ("PHS"), Charlottetown ("CHT"), St. Lewis ("SLE"), and Mary's Harbour ("MHS")) would remain electrically isolated for the foreseeable future and rely on its respective diesel generating plant to provide a reliable source of electricity. The diesel plants in each of these systems would be required to be replaced at their end of life (MHS in 2030, PHS in 2035 and SLE in 2045). It would also be necessary to install fire suppression at each plant as soon as possible and complete outstanding capital work in Mary's Harbour.[1]

This alternative was investigated as part of Hydro's Long-Term Supply Study for southern Labrador and Midgard's Southern Labrador Communities – Integrated Resource Plan. Additional analysis and scope of work is included in previous Board submittals.

[1] Fire suppression and other outstanding work have been on hold in anticipation of the regional diesel plant and interconnection project.

2.2 Alternative 6 – Interconnection of Existing Plants (Midgard Scenario E)

This alternative is to interconnect all four communities, but without constructing a centralized diesel plant, not replacing the Charlottetown Diesel Plant, and instead, relying on the existing three remaining diesel plants to provide firm capacity to the region. This alternative was already investigated at a high level as part of technical notes RP-TN-051 and RP-TN-054. These technical notes determined that this alternative is not least cost even while leaving out the cost for a significant portion of the capital work required to implement this alternative. Within the current analysis this alternative will be studied in more detail and include the additional capital required to implement this alternative.

The suggested system requires N-2 redundancy using only diesel engines located inside engine halls. There are concerns that additional redundancy beyond N-2 may be required, given the large number of units (9-10 depending on the season) and the potential impact on customers if two units of the 9-10 are out of service.

Hydro sizes the auxiliary diesel plant equipment (main electrical bus, service conductors, and substation transformer) based on the system demand forecast and not the installed diesel plant capacity and therefore the diesel plant is incapable of supplying its full capacity. This trapped generation would be required to meet the overall firm capacity requirements to implement Alternative 6 and therefore upgrades to the auxiliary equipment would be necessary.

These upgrades are significant by themselves and do not increase the amount of space in the plants' engine halls. These upgrades may extend the life of the Mary's Harbour Diesel Plant to 2035 but are not expected to extend the life of any other plant. The additional scope of work, beyond what was already provided in RP-TN-051 and RP-TN-054, necessary to complete the auxiliary diesel plant systems upgrades, and implement a control system is included in Section 2.2.1.

2.2.1 Alternative 6 – Scope of Work

To implement Alternative 6, it is necessary to construct the full set of interconnection distribution lines, complete a voltage conversion in each system as the distribution voltage in the existing assets is not appropriate to transmit over the distances required, and upgrade the diesel plants to allow the full installed capacity to be transmitted to the regional system as required. Due to site and building footprint constraints, there is a not enough space in the existing diesel plant or on the diesel plant sites to facilitate the necessary upgrades unless building extensions and site extension are constructed. As such, a building and site expansion is included in this alternative.

Upgrades are required at all diesel plants to implement Alternative 6, including:

- Main switchgear replacement including supporting electrical re-conductoring;
- Substation service conductor replacement;
- New substation;
- Installation of fire suppression systems (St. Lewis required an Auxiliary building);
- Motor control center and stationservice upgrades;
- Ventilation upgrades;
- Wall relocations;
- Site extensions;
- Temporary substations;

- Mobile genset rentals; and
- Protection and control upgrades.

In St. Lewis, it is also necessary to install a 545 kW diesel generating unit in a spare engine bay, install new switchgear for the new diesel generating unit, and upgrade the fuel system.

In Mary's Harbour and Port Hope Simpson, it would also be necessary to complete a building extension and site expansion.

2.2.2 Firm Capacity Analysis

Port Hope Simpson, Mary's Harbour and St. Lewis together have an installed capacity of 4,560 kW and a Firm (N-2) Capacity of 3,110 kW[2] without including mobile generation. This aligns with Midgard's approach, from its Southern Labrador Communities – Integrated Resource Plan, to not use any mobile generation to calculate firm capacity.

According to the *Labrador Isolated Load Forecast Spring 2022 – 25 year Projection,* the 2023–2024 winter peak load for the region is expected to be 2,908 kW growing to 2,939 kW by 2033. This indicates there is approximately 202 kW of excess capacity available during the winter of 2023. Details are included in Table 2.

Table 2: Alternative 6 – Winter Capacity

	2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
CHT – Gross Winter Peak (kW)	764	767	770	772	775	778	780	782	784	786	787
PHS – Gross Winter Peak (kW)	753	753	753	753	753	753	754	754	754	754	754
MSH – Gross Winter Peak (kW)	1,007	1,009	1,011	1,013	1,014	1,015	1,015	1,016	1,017	1,017	1,018
SLE – Gross Winter Peak (kW)	384	383	383	383	383	383	383	382	380	380	380
Total	**2,908**	**2,912**	**2,917**	**2,921**	**2,925**	**2,929**	**2,932**	**2,934**	**2,935**	**2,937**	**2,939**
Firm (N-2) Capacity	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110
Total Excess Firm Capacity	**202**	**198**	**193**	**189**	**185**	**181**	**178**	**176**	**175**	**173**	**171**

The same forecast indicates that the 2023 summer peak load for the region is 3,657 kW growing to 3,701 kW by 2033. This indicated there is a capacity deficit of 547 kW in the summer of 2023. To address this capacity deficit, it is assumed that a 545 kW unit will be added in the spare bay in St. Lewis and that Unit 2039 will be upgraded from 365 kW to 455 kW (as already proposed in Hydro's 2023 Capital Budget Application). This adds 635 kW of capacity. Details are included in Table 3 and corrects the known deficit. Even with this plan, there is minimal excess capacity for load growth.

[2] This does not include the proposed project to replace a 365 kW (Unit 2039) in St. Lewis with a 455 kW unit.

Table 3: Alternative 6 – Summer Capacity

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
CHT – Gross Summer Peak (kW)	1,557	1,560	1,563	1,566	1,569	1,573	1,577	1,581	1,585	1,589	1,591
PHS – Gross Summer Peak (kW)	600	600	600	600	600	600	601	601	601	601	601
MSH – Gross Summer Peak (kW)	1,177	1,179	1,181	1,184	1,186	1,186	1,187	1,188	1,188	1,189	1,189
SLE – Gross Summer Peak (kW)	323	322	322	322	322	322	322	321	320	320	320
Total	**3,657**	**3,661**	**3,666**	**3,672**	**3,677**	**3,681**	**3,687**	**3,691**	**3,694**	**3,699**	**3,701**
Firm (N-2) Capacity w/o mobiles (kW)	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110	3,110
Total Excess Firm Capacity	**-547**	**-551**	**-556**	**-562**	**-567**	**-571**	**-577**	**-581**	**-584**	**-589**	**-591**
Firm (N-2) Capacity w/o mobiles w/SLE upgrades (kW)	3,745	3,745	3,745	3,745	3,745	3,745	3,745	3,745	3,745	3,745	3,745
Total Excess Firm Capacity	**88**	**84**	**79**	**73**	**68**	**64**	**58**	**54**	**51**	**46**	**44**

2.2.3 Synchronizing Analysis

To consider this option, Hydro must analyze implications for when generation is being brought onto the regional grid, initially, or in outage events as must be planned for.

Based on the current interconnection distribution line layout, the generation at Mary's Harbour and St. Lewis is essentially locked behind the load in each community. This means that in order to add that generation to the regional grid, the community load needs to be connected to the grid before the generation can be added. The generation at Port Hope Simpson will not have this issue as it can be separated from any of the individual communities using the three reclosers.

To pick up the load from a black start point of view, the first step can be to start the Port Hope Simpson plant without any community load, then connect St Lewis to start the St. Lewis plant. At this point there would be enough online capacity to pick up Mary's Harbour which will allow that plant to be synchronized. Port Hope Simpson and Charlottetown would be synchronized last.

If Mary's Harbour or St. Lewis tripped off during peak and one or two units were out of service, then Charlottetown or Port Hope Simpson may have to be dropped before picking up Mary's Harbour or St. Lewis. This would have a negative impact on reliability. To compensate for this, it may be necessary to extend the distribution interconnection lines to each diesel plant directly instead of the distribution feeder. This additional cost is excluded for capital cost estimates included in this technical note however could increase the cost further than is currently contemplated.

2.2.4 Auxiliary Diesel Plant Capacity

As stated in RP-TN-054, within Hydro's isolated diesel generation stations, plant auxiliary systems such as the main bus, service conductors, and substation transformers are sized based on the system's peak load and not the full plant installed capacity. To allow each plant included within this alternative to output the required amount of power for all four communities but without any supply at Charlottetown, it is necessary to upgrade the main bus, service conductor, and substation transformer at each site. This

includes the service conductor and main bus in St. Lewis, which was not included in RP-TN-054 as the required capacity is 1,655 kW instead of 1,001 kW (as was indicated in RP-TN-054). This change is largely driven by the need to install an addition diesel unit in St. Lewis to prevent Hydro from needing to rely on the mobile generation located at Mary's Harbour for firm capacity during summer months. This aligns with Midgard's approach, from its Southern Labrador Communities – Integrated Resource Plan, to not use any mobile generation to calculate firm capacity.

2.3 Alternative 7 – 2-Community Portable Generation

This alternative is to interconnect Charlottetown to Port Hope Simpson to enable Charlottetown to be partially served by the existing diesel generation station in Port Hope Simpson. This solution is assumed to be in place until 2030 (the expected end of life of the Mary's Harbour plant).

In 2030, the diesel plant in Mary's Harbour would be replaced with a regional diesel plant and the distribution interconnection would be extended to Mary's Harbour and St. Lewis allowing for those plants in Mary's Harbour and St. Lewis to be decommissioned.

2.3.1 Scope of Work

To implement Alternative 7 it is necessary to construct the interconnection distribution lines between Port Hope Simpson and Charlottetown, relocate the mobile gensets currently in Charlottetown to Port Hope Simpson, complete a voltage conversion in each system, and upgrade the diesel plant in Port Hope Simpson to allow the full installed capacity to be transmitted to the system. The relocation of the mobile generation currently in Charlottetown to Port Hope Simpson is required to ensure there is enough firm capacity to serve the expected demand for both the interconnected communities. It would also eliminate the need to construct a controls building at Charlottetown and allow for a simpler control system. The site in Port Hope Simpson is also further away from residential customers then the current location in Charlottetown.

Due to site and building footprint constraints, there is a significant amount of civil work required to construct building and site expansions.

Upgrades required at Port Hope Simpson to implement Alternative 7 include:

- Main switchgear replacement including supporting electrical re-conductoring;
- Substation service conductor replacement;
- New substation;
- Installation of fire suppression systems;
- Motor control center and station service upgrades;
- Ventilation upgrades;
- Wall relocations;
- Site extensions;
- Temporary substations;
- Mobile genset rentals; and
- Protection and control upgrades.

If this alternative were to be implemented, it would also be necessary to proceed with outstanding work required at Mary's Harbour and proceed with fire suppression upgrades in all three diesel plants.

2.3.2 Firm Capacity Analysis

Port Hope Simpson has an installed capacity of 1,725 kW and a firm (N-1) capacity of 1,000 kW.

According to the *Labrador Isolated Load Forecast Spring 2022 – 25 year Projection,* the 2023–2024 winter peak load for the combination of Port Hope Simpson and Charlottetown is expected to be 1,517 kW growing to 1,541 kW by 2033. This indicates there is a firm capacity deficit of approximately 517 kW during the winter. Only when all units in Port Hope Simpson are in service, can the combined load of both Port Hope Simpson and Charlottetown be supplied by the diesel plant in Port Hope Simpson. This would violate Hydro's planning criteria for isolated diesel systems.

Table 4: Alternative 7 – Winter Capacity

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
CHT – Gross Winter Peak (kW)	764	767	770	772	775	778	780	782	784	786	787
PHS – Gross Winter Peak (kW)	753	753	753	753	753	753	754	754	754	754	754
Total	**1,517**	**1,520**	**1,523**	**1,525**	**1,528**	**1,531**	**1,534**	**1,536**	**1,538**	**1,540**	**1,541**
Firm (N-1) Capacity w/o mobiles (kW)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Excess Firm Capacity	**-517**	**-520**	**-523**	**-525**	**-528**	**-531**	**-534**	**-536**	**-538**	**-540**	**-541**
Firm (N-2) Capacity w/ existing mobiles (kW)	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635
Total Excess Firm Capacity	**1,118**	**1,115**	**1,112**	**1,110**	**1,107**	**1,104**	**1,101**	**1,099**	**1,097**	**1,095**	**1,094**

The same forecast indicates that the 2023 summer peak load for the combination of Port Hope Simpson and Charlottetown is expected to be 2,157 kW growing to 2,192 kW by 2033. This indicates there is a firm capacity deficit of 1,157 kW in the summer of 2023. Even when all units in Port Hope Simpson are in service there is still a deficit of 432 kW in the summer of 2023.

Table 5: Alternative 7 – Summer Capacity

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
CHT – Gross Summer Peak (kW)	1,557	1,560	1,563	1,566	1,569	1,573	1,577	1,581	1,585	1,589	1,591
PHS – Gross Summer Peak (kW)	600	600	600	600	600	600	601	601	601	601	601
Total	**2,157**	**2,160**	**2,163**	**2,166**	**2,169**	**2,173**	**2,178**	**2,182**	**2,186**	**2,190**	**2,192**
Firm (N-1) Capacity w/o existing Mobiles (kW)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Excess Firm Capacity	**-1,157**	**-1,160**	**-1,163**	**-1,166**	**-1,169**	**-1,173**	**- 1,178**	**-1,182**	**-1,186**	**-1,190**	**-1,192**
Firm (N-2) Capacity w/ existing mobiles (kW)	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635
Total Excess Firm Capacity	**478**	**475**	**472**	**469**	**466**	**462**	**457**	**453**	**449**	**445**	**443**

To meet the combined peak demand in both Port Hope Simpson and Charlottetown, it would be necessary to rely on mobile generation on a temporary basis until another long-term solution is in place. While doing so, it is required to have a redundancy of N-2 to account for the frequent mobile genset failures Hydro has experienced in recent years. To offset the deficits above, it would be necessary to move three of the mobile gensets from Charlottetown to Port Hope Simpson. The three gensets should be the 1,825 kW unit and the two 910 kW units.

2.3.3 Auxiliary Equipment Analysis

As is the case for Alternative 6, to allow the Port Hope Simpson Diesel plant to output its full installed capacity it is necessary to upgrade the main bus, service conductor and substation. Additional details are included with RP-TN-054.

3 Estimates

3.1 Diesel Plant Replacement Costs

The updated cost estimate for a regional diesel plant and new individual diesel plants in each community is included in Table 6. The regional diesel plant estimate is updated to reflect a delayed project start from 2023 to 2024. The class four community diesel plant estimates are based on the class three estimates prepared for the regional diesel plant and full regional interconnection alternative.

Table 6: Capital Costs of Diesel Plant Construction ($000)[3]

	Regional	CHT	MSH	PHS	SLE
Total Costs	**49,010**	**40,384**	**37,413**	**37,296**	**36,546**

3.2 Distribution Interconnection Costs

The updated cost estimates for the distribution interconnection costs are based on the class three estimates prepared for the regional diesel plant and full regional interconnection alternative. These estimates are included in Table 7. These cost estimates include the voltage conversion in each system.

Table 7: Distribution Interconnection Cost by Leg ($000)[4]

Distribution Interconnection Leg	Total Cost
Port Hope Simpson and Charlottetown	**14,277**
Mary's Harbour	**12,999**
St. Lewis	**7,641**

[3] The total cost estimates include the overhead costs which are based on the class three estimates prepared for the regional diesel plant and full regional interconnection alternative.

[4] For the purposes of Midgard's analysis overhead percentages were applied differently than the estimates provided in Hydro's response to PUB-NLH-055 of this proceeding.

3.3 Fire Suppression Costs

The updated cost estimate for fire suppression is based on an ongoing project to install fire suppression in Ramea. This includes a cost estimate for a fire suppression system and an auxiliary building to house a fire suppression system as outlined in Table 8.

Table 8: Fire Suppression Costs ($000)

Fire Suppression Projects	Total Cost[5]
Fire Suppression System	1,578
Auxiliary Building	350

3.4 Diesel Plant Upgrade Costs

3.4.1 Alternative 6 – Interconnection of Existing Plants

Estimate Assumptions

Assumptions used when developing these estimates include:

- Land for site expansions is available.
- Rental mobiles can be used during winter months.
- Charge rates for use of mobile units are based on internal personnel and don't include contractor markups.
- There is enough space for people to stay in the communities during construction and no camp is required.
- No overall costs are carried for accommodations for Hydro forces during construction.
- No allowance for rental equipment for installation has been included.
- Substation designs can be achieved.
- Temporary substation can be built in Mary's Harbour for temporary connection while the new substation is built.
- There is no mobile required in Mary's Harbour after installation.
- Automatic load dispatching of units is required to make this alternative a viable solution.

Additional design considerations include:

- More research required to determine the feasibility of synchronizing two live plants together. In the interest of time, the estimated scheme is to bring one community plant online then extend the live bus to next community and synchronize units one at time, then extend bus to final community and synchronize units one at time until all communities are energized.
- More research required to determine the feasibility of load sharing and load dispatching across multiple community generators.

[5] Includes escalation.

- More research required to determine renewable P&C interface requirements. This is required in any scenario including Hydro's proposed scenario but has already advanced and is functioning in Mary's Harbour.
- Operator training for this more complex grid is not included.
- Creation of operation procedures not included.

Estimated Cost

The cost estimate for the necessary plant upgrades required for this alternative are broken out by component and is included in Table 9.

Table 9: Alternative 6 Upfront Capital Cost Estimate ($000)

Component	Total Cost
Fire Suppression	**5,084**
Auxiliary Equipment Upgrades in Port Hope Simpson:	**10,341**
Auxiliary Equipment Upgrades in St. Lewis:	**10,867**
Auxiliary Equipment Upgrades in Mary's Harbour:	**13,736**

3.4.2 Alternative 7 – 2-Community Portable Generation

Estimate Assumptions

Assumptions used to develop this estimate include:

- Automated load dispatching of units is not required for this alternative (both Port Hope Simpson and Charlottetown gensets). Diesel gensets will be started and stopped by local operator due to the complexity and cost of automating a diesel plant with multiple mobile generators and multiple permanent units inside an engine hall.
- HMI and PLC information added for data collection (no control from HMI).
- Port Hope Simpson unit and Charlottetown Mobile (relocated to Port Hope Simpson) will be available to load share.
- Meters added to mobiles for collection of load data.

Estimated Cost

The cost estimate (without owners cost, interest during construction or contingency) for this alternative are broken out by component and is included in Table 10.

Table 10: Alternative 7 – Upfront Capital Cost Estimate ($000)

Component	Total Cost
Fire Suppression (without building)	(See Table 8)
Auxiliary Equipment Upgrades in Port Hope Simpson	**12,594**

3.4.3 Mary's Harbour – Life Extension

To extend the life of Mary's Harbour beyond 2027 as is required by this alternative, it is necessary to complete outstanding capital work that has been delayed due to the ongoing regulatory process. This included projects for roof replacement, distribution re-conductoring, and service conductor replacement as outlined in Table 11.

Table 11: Alternative 7 – Cost Estimates for Additional Upgrades ($000)

MSH Life Extension Projects	Total Cost
Roof Replacement	811
Distribution Re-conductoring	354
Service Conductor	311

4 Detailed Project Schedules

4.1 Alternative 2 – Islanded Operation

Construction of Alternative 2 is dependent on regulatory process, Environmental Assessment ("EA") release, and short construction seasons in Labrador. The in-service year for this alternative is the same as the in-service year for the Hydro's proposed regional plant.

For the purposes of providing an in-service date for this alternative, it is assumed that further FEED and regulatory process will occur in 2024, with regulatory approval granted by the end of the year. In 2025, EA activities will start and the project will optimistically be released by the first quarter of 2026.

Long lead procurement will commence upon project approval with genset data required by the EA process. Gensets will likely be received before they are ready to install but need to be ordered to meet the EA timelines. Most of the equipment will not be the critical path items in this scenario, but rather the EA process and ability to develop the site and erect the building in the short construction windows.

The site works contract may be complete by winter weather 2026 (early Q4). Building construction and station service finish in 2027 with building made weather tight by Q3/Q4 2027. Power systems installation (gensets, switchgear, fuel systems, etc.) will commence when the building is weather tight with completion in Q3 2028 and commissioning/serving customers by year end 2028.

The Summary Schedule for Alternative 2 is include in Table 12.

Table 12: Alternative 2 – Summary Schedule

Activity	Start Date	End Date
Planning:		
Preliminary engineering and project approval	Q4 2023	Q4 2024
Planning:		
Environmental assessment	Q1 2025	Q1 2026
Design:		
Generating station and equipment selection	Q4 2024	Q2 2026
Procurement:		
Major equipment and construction contracts	Q4 2024	Q1 2027
Construction:		
Civil Works, Generating Station and Power Systems	Q2 2026	Q3 2028
Commissioning:		
Commissioning units and auxiliary systems	Q3 2028	Q4 2028
Decommissioning:		
Decommission Charlottetown mobile plant	Q4 2028	Q2 2029
Closeout:		
Contract and project closeout	Q3 2028	Q4 2028

A summary Schedule for a separate but required fire suppression project is included in Table 13.

Table 13: Summary Schedule – Fire Suppression to Accompany Alternative 2

Activity	Start Date	End Date
Mary's Harbour		
Planning:		
Preliminary engineering and project approval	Q1 2024	Q4 2024
Design and Procurement:		
Building Extension and Fire Suppression	Q1 2025	Q3 2025
Construction:		
Building Extension	Q2 2026	Q3 2026
Fire Suppression System	Q4 2026	Q4 2026
Port Hope Simpson		
Planning:		
Preliminary engineering and project approval	Q1 2025	Q4 2025
Design and Procurement:		
Building Extension and Fire Suppression	Q1 2026	Q3 2026
Construction:		
Building Extension	Q2 2027	Q3 2027
Fire Suppression System	Q4 2027	Q4 2027
St. Lewis		
Planning:		
Preliminary engineering and project approval	Q1 2026	Q4 2026
Design and Procurement:		
Suppression Building and Fire Suppression	Q1 2027	Q3 2027
Construction:		
Suppression Building	Q2 2028	Q3 2028
Fire Suppression System	Q4 2028	Q4 2028

4.2 Alternative 6 – Interconnection of Existing Plants

Construction of Alternative 6 is dependent on regulatory process, EA release, and short construction seasons in Labrador. The in-service year for this alternative is two years beyond the in-service year for Hydro's regional plant proposal.

For the purposes of providing an in-service date for this alternative, it is assumed further FEED and regulatory process will occur in 2024 with regulatory approval granted by the end of the year. In 2025, EA activities will start and the project will optimistically be released by the first quarter of 2026.

This Alternative will need to be constructed in a phased approach with upgrades occurring at one diesel plant at a time. The upgrades at Port Hope Simpson, St. Lewis and Mary's Harbour will start in 2026, 2027,

and 2028 then end in 2027, 2028, and 2029 respectively. Following the plant upgrades it will be necessary to install the protection and control upgrades, complete the distribution connections, and commission equipment in 2030 and decommission the Charlottetown mobile plant in 2031.

The two year timeframe for each plant upgrade is aggressive and may not be feasible, further detailed planning and study is required before committing to execute this Alternative.

Rental mobile generation cannot be used throughout winter seasons as Hydro is unable to make winter modifications to third-party equipment. If utilized without these modifications it will almost certainly result in significant, prolonged outages. To avoid using rental mobile gensets during the winter it may be possible to extend electrical equipment into the diesel plant's kitchen/workshop area, being rebuilt the following year when extension work is complete, however, this may not be feasible.

The Summary Schedule for Alternative 6 is presented in Table 14.

Table 14: Alternative 6 Summary Schedule

Activity	Start Date	End Date
Planning:		
Preliminary engineering and project approval	Q4 2023	Q4 2024
Planning:		
Environmental assessment	Q1 2025	Q1 2026
Design:		
All phases/plants	Q4 2024	Q2 2029
Procurement:		
Major equipment and construction contracts	Q4 2024	Q2 2029
Construction:		
PHS Upgrades	Q2 2026	Q4 2027
SLE Upgrades	Q2 2027	Q4 2028
MHS Upgrades	Q2 2028	Q4 2029
P&C Upgrades (All Phases)	Q1 2027	Q4 2030
Distribution Upgrades	Q1 2027	Q2 2029
Commissioning:		
Commissioning and regional interconnection	Q1 2030	Q4 2030
Decommissioning:		
Decommission Charlottetown mobile plant	Q2 2031	Q3 2031
Closeout:		
Deficiencies and project closeout	Q1 2031	Q4 2031

4.3 Alternative 7 – 2-Community Portable Generation

Construction of Alternative 7 is dependent on regulatory process, EA release, and short construction seasons in Labrador. The in-service year for this alternative is similar to the in-service year for Hydro's larger interconnected proposal. For the purposes of providing an in-service date for this alternative, it is assumed further front-end engineering design and regulatory process will occur in 2024 with regulatory approval granted by the end of the year. In 2025, EA activities will start and the project will optimistically be released by the first quarter of 2026.

Upgrades in Port Hope Simpson and the interconnection to Charlottetown are expected to occur in between 2026 and 2028 with decommissioning of the mobile plant in 2029. Due to the high winter peak loads and timing of fish plant start up, there is risk that scheduling/phasing will be challenging to plan around peak winter loads and start up of fish plant in CHT. This adds a level of complexity and could potentially require outages during winter or fish plant season. There are also concerns around continued mobile generation use during winter weather. A summary schedule for Alternative 7 is included in Table 15.

Table 15: Summary Schedule Alternative 7

Activity	Start Date	End Date
Planning:		
Preliminary engineering and project approval	Q4 2023	Q4 2024
Planning:		
Environmental assessment	Q1 2025	Q1 2026
Design:		
PHS Upgrades and MHS/SLE Suppression	Q4 2024	Q4 2026
Procurement:		
Major equipment and construction contracts	Q4 2024	Q4 2026
Construction:		
PHS Upgrades	Q1 2026	Q4 2028
P&C Upgrades	Q2 2027	Q4 2028
Distribution Upgrades	Q2 2026	Q3 2027
Commissioning:		
Commissioning and CHT interconnection	Q3 2028	Q4 2028
Decommissioning:		
Decommission Charlottetown mobile plant	Q2 2029	Q4 2029
Closeout:		
Deficiencies and project closeout	Q1 2029	Q4 2029

A summary schedule for a separate but required fire suppression project is included in Table 16.

Table 16: Summary Schedule – Fire Suppression to Accompany Alternative 7

Activity	Start Date	End Date
Mary's Harbour		
Planning:		
Preliminary engineering and project approval	2024	Q1 2025
Design and Procurement:		
Building Extension and Fire Suppression	Q1 2025	Q3 2025
Construction:		
Building Extension	Q2 2026	Q3 2026
Fire Suppression System	Q4 2026	Q4 2026
St. Lewis		
Planning:		
Preliminary engineering and project approval	2026	Q1 2027
Design and Procurement:		
Suppression Building and Fire Suppression	Q1 2027	Q3 2027
Construction:		
Suppression Building	Q2 2028	Q3 2028
Fire Suppression System	Q4 2028	Q4 2028

5 Environmental Permits

A list of relevant and required environmental approvals will be identified upon project approval and will be a condition of our release from the EA process. These are anticipated to be as listed in Table 17. Each approval is understood to be well within the schedules included in Section 4.

Table 17: List of Potential Permits or Authorizations

Permit or Authorization	Agency	Notes
Approval of Capital Works	NL Public Utilities Board	
Release of the Undertaking under the EA Regulations	NL Department of Environment, Climate Change, and Municipalities (NLDECCM) - EA Division,	This Registration document represents the "application" for this regulatory process.
Crown Land Approval for distribution line Easement	NL Department of Fisheries, Forestry and Agriculture (NLDFFA) - Crown Lands Division	Hydro will apply via crown lands division to obtain legal easement for the distribution line. The crown lands review process involves a referral process managed by government agencies, a government review committee and legal survey.
Permit to Alter a Waterbody (Watercourse Crossing)	NLDECCM - Water Resources Management Division	Required for stream crossings (e.g., culvert, bridge)
Water Use Licence	NLDECCM - Water Resources Management Division	Required if water is being pumped from a local waterbody for Project use
Road Construction Permitting	NL Department of Transportation and Infrastructure	May be required if new access roads are required
Quarry Permit	NLDIET– Mineral Lands Division	A permit will be required to dig for, excavate, remove and dispose of Crown quarry material
Permit to Cut Crown Timber	NLDFFA - Forest Management	A permit is required for cutting of timber on crown land
Pesticide Operator License	NLDECCM – Pesticide Control Section	Hydro currently holds a Pesticide Operator License 19-043
Letter of Advice	Fisheries and Oceans Canada (DFO)	Hydro will work with DFO for the applicable construction approval under the revised *Fisheries Act.*

6 Diesel Plant Photos

6.1 Mary's Harbour

Figure 1: Mary's Harbour Site Layout - Showing Congestion

Figure 2: Mary's Harbour Site Layout - Surrounded by Road and Assisted Living Facility

Figure 3: Mary's Harbour Engine Hall – Limited Space for Expansion

Figure 4: Mary's Harbour Engine Hall – Limited Space for Expansion

Figure 5: Mary's Harbour Control Room – Congested - Minimal Space for Expansion

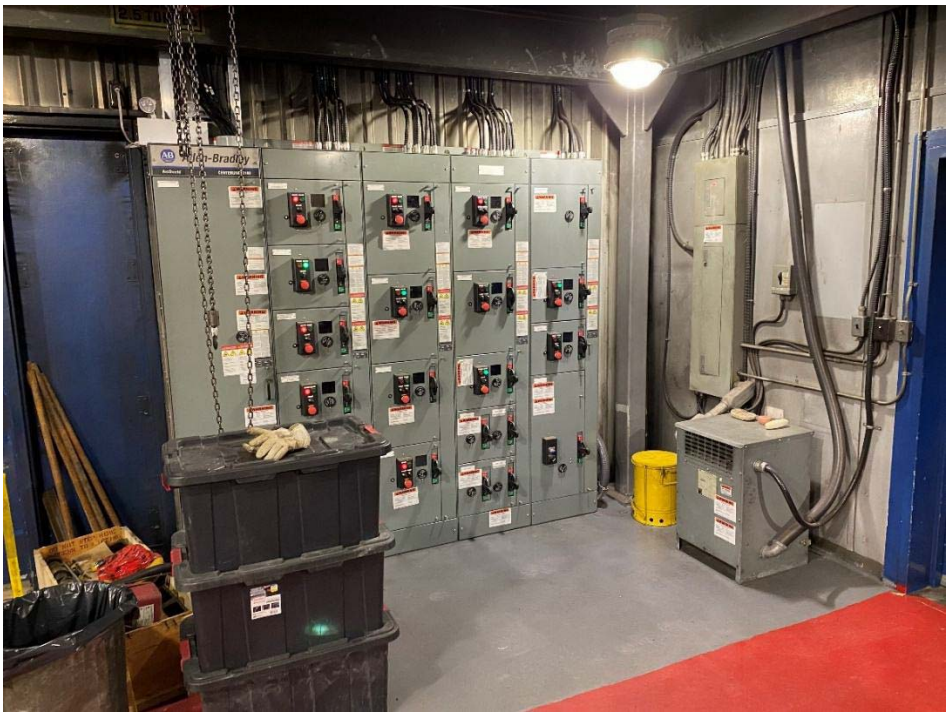

Figure 6: Mary's Harbour Motor Starters - No Room for Expansion

6.2 Port Hope Simpson

Figure 7: Port Hope Simpson - Site Layout and Limited Expansion Space

Figure 8: Port Hope Simpson - Site Layout and Limited Expansion Space

Figure 9: Port Hope Simpson Engine Hall - Limited Space for Expansion

Figure 10: Port Hope Simpson Engine Hall - Limited Space for Expansion

Figure 11: Port Hope Simpson - Control Room with Limited Operator and Meeting Area

Figure 12: Port Hope Simpson - Control Room with Limited Space

6.3 St. Lewis

Figure 13: St. Lewis - Existing Site

Figure 14: St. Lewis - Existing Site

Figure 15: Engine Hall with One Spare Engine Bay

Figure 16: St. Lewis Control Room with Limited Operator Space

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