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NEWFOUNDLAND POWER
A FORTIS COMPANY

HAND DELIVERED

February 12, 2021

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

Attention: G. Cheryl Blundon
Director of Corporate Services
and Board Secretary

Dear Ms. Blundon:

Re: NP 2021 Capital Budget Application (the "Application")
St. John's North – Portugal Cove System Planning Study Update

On December 15, 2020, the Board issued Order No. P.U. 37 (2020) approving certain capital expenditures associated with the Application. In its order, the Board requested that Newfoundland Power provide additional information in relation to the justification for those projects associated with the *St. John's North - Portugal Cove System Planning Study* (the "Planning Study").

In response to the Board's request, Newfoundland Power has updated its substation load forecast with the most current information available, including actual loads up to December 31, 2020. Based on the updated substation load forecast, the Company has reassessed the alternatives considered in the Planning Study and has updated the Planning Study accordingly. That reassessment and update is detailed in the enclosed *St. John's North - Portugal Cove System Planning Study Update*.

We trust the foregoing and enclosed are found to be in order.

If you have any questions, please contact us at your convenience.

Yours truly,

Gerard M. Hayes
Senior Counsel

Newfoundland Power Inc.
55 Kenmount Road • P.O. Box 8910 • St. John's, NL A1B 3P6
PHONE (709) 737-5609 • FAX (709) 737-2974 • **ghayes@newfoundlandpower.com**

Enclosure

c. Shirley Walsh
Newfoundland and Labrador Hydro

Dennis Browne, Q.C.
Browne Fitzgerald Morgan & Avis

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IN THE MATTER OF the *Public Utilities Act,* (the "Act"); and

IN THE MATTER OF capital expenditures and rate base of Newfoundland Power Inc.; and

IN THE MATTER OF an application by Newfoundland Power Inc. for an order pursuant to Sections 41 and 78 of the Act:
(a) approving a 2021 Capital Budget of $111,298,000;
(b) approving certain capital expenditures related to multi-year projects commencing in 2021; and
(c) fixing and determining a 2019 rate base of $1,153,556,000.

AFFIDAVIT

I, Byron Chubbs of the Town of Paradise, in the Province of Newfoundland and Labrador, make oath and say as follows:

1. That I am Vice President, Engineering and Energy Supply of Newfoundland Power Inc.

2. That in Order No. P.U. 37(2020) the Board requested that Newfoundland Power Inc. provide updated information with respect to certain capital expenditures proposed in the 2021 Capital Budget Application, and the requested information is provided in the *St. John's North - Portugal Cove System Planning Study Update* attached hereto.

3. To the best of my knowledge, information and belief, all matters, facts and things set out in the attached *St. John's North - Portugal Cove System Planning Study Update* are true.

SWORN to before me at St. John's
in the Province of Newfoundland and
Labrador this 12th day of February, 2021:

Barrister

Byron Chubbs

St. John's North - Portugal Cove System Planning Study Update

February 2021

Prepared by:
Kourtney Duff, E. I. T.
Robert Cahill, Eng. L.

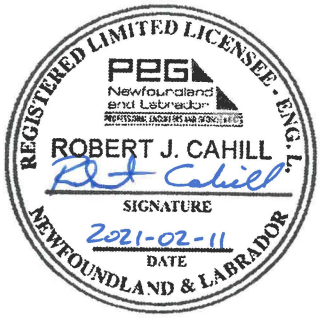

Table of Contents

1.0 Introduction

Newfoundland Power (the "Company") filed the *St. John's North-Portugal Cove System Planning Study* (the "Planning Study") with its *2021 Capital Budget Application* (the "Application"). The Planning Study proposed expenditures of $6,794,000 in 2021, including the construction of a new substation near the St. John's International Airport (the "Airport"). Construction of a new substation near the Airport is necessary to address the current and future electricity demands of customers in the St. John's North-Portugal Cove area (the "Study Area").

On December 15, 2020, the Board issued Order No. P.U. 37 (2020) approving $94,601,000 in capital expenditures associated with the Application.[1] The Board's approval excluded those projects related to the construction of the proposed Airport substation. The Board requested that Newfoundland Power provide additional information in relation to the justification for those projects.[2]

In response to the Board's request, Newfoundland Power updated its load forecast with the most current data available, including actual loads up to December 31, 2020. The Company also obtained an update from the St. John's International Airport Authority regarding the impact of the COVID-19 pandemic on expansion plans for the Airport. All of this most recent information has been reflected in an update to the Planning Study. The details of that update are provided in Attachment 1 to this report.[3]

The updated analysis confirms that the proposed 2021 expenditures recommended in the Planning Study continue to be the least-cost alternative for supplying customers in the Study Area, and should proceed as proposed.

2.0 System Planning at Newfoundland Power

2.1 Purpose

System planning at Newfoundland Power involves the completion of system studies and load forecasts to identify impending technical constraints on the provision of electricity as a result of changing customer demands. Engineering analysis of different electricity system configurations is undertaken, and economic analysis of alternatives is carried out to determine the least-cost means of addressing such constraints. This requires the application of engineering standards, judgment and experience.

An independent review in 2014 that considered Newfoundland Power's approach to system planning, including the criteria and standards upon which it is based, confirmed it is consistent with good utility practice.[4] A recent survey of Canadian Electricity Association utilities

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1 Order No. P.U. 37, (2020), Schedule C.
2 Order No. P.U. 37, (2020), pages 8-9.
3 The contents of Attachment 1 correspond to sections 5, 6 and 7 of the Planning Study.
4 The Liberty Consulting Group observed: *"Newfoundland Power's system planning organization is appropriately staffed and uses capacity planning criteria that are consistent with good utility practice."* See *Report on Island Interconnected System to Interconnection with Muskrat Falls addressing Newfoundland Power Inc.,* December 17, 2014, page 10.

confirmed the Company's planning criteria continues to be consistent with current practice.[5]

2.2 System Planning Criteria

Newfoundland Power employs longstanding technical criteria in the planning of its electrical system. The criterion used to assess substation transformer capacity is the nameplate rating of the transformer.[6] An assessment of options to address substation load growth is triggered when this criterion is forecast to be exceeded under normal operating conditions.

The Company's system planning criteria allows power transformers to be overloaded in specific abnormal or emergency circumstances *in the short term* to facilitate continuity of customer service.[7] However, they do not allow for the overloading of substation transformers under normal operating conditions.

2.3 Substation Load Forecasting Methodology

Newfoundland Power reviews actual substation loads and develops a new Substation Load Forecast each year. The Substation Load Forecast provides a 5-year forecast of the peak demand required to be supplied through each of the Company's substation transformers. The Substation Load Forecast is completed using actual load data from the most recent year, forecast energy requirements, historical transformer peak demands, 5-year historic worst-case load factors, and local knowledge of load growth.[8]

Newfoundland Power's substation load forecasting methodology considers the impact of weather on capacity requirements. Weather that is colder than average will result in higher actual loads. Newfoundland Power's forecasting model incorporates load factor history to account for these above-average loading conditions.

Newfoundland Power's substation load forecasting process is as follows:

(i) Determine the base peak load on each transformer for the most recent year under normal operating conditions.
(ii) Adjust the base peak load using load factors from the previous 5-years to determine the forecast worst-case peak load conditions.
(iii) Project the base transformer peak load for each substation transformer into the future using the load forecast for the supply area.

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5 A 2021 survey of Canadian Electricity Association utilities showed that, as part of their planning criteria, 13 of 14 responding utilities avoid loading transformers in excess of 100% of their nameplate capacity under normal operating conditions.

6 Newfoundland Power's transformer loading guidelines are based on the American National Standards Institute ("ANSI") Guidelines C57.12.30-1981, *Guide for Loading Oil-immersed Distribution and Power Transformers*.

7 Newfoundland Power's approach to capacity planning accommodates the effects of equipment aging, and such reasonably anticipated conditions as above average peak load, cold-load pick-up and equipment failures. (See *St. John's North-Portugal Cove System Planning Study*, Appendix F, Technical Evaluation Criteria)

8 Load factors relate average loads (total energy delivered, in kWh, divided by the total number of hours over which it was delivered) to peak loads. Worst-case load factors reflect the lowest annual load factor over the previous 5-year period. Worst-case load factors are applied to adjust the actual peak load to reflect the extent to which the worst case supply area load factor was different from the actual load factor during the previous winter season.

The load forecast incorporated in the Planning Study and the updated load forecast provided in this report were both prepared using this methodology.

3.0 Additional Information Requested by the Board

3.1 General

In Order P.U. 37 (2020), the Board requested Newfoundland Power provide additional information reflecting the most current data available, including actuals up to December 31, 2020. The requested information includes the following:

(i) actual and forecast loads;
(ii) the basis of the forecasts;
(iii) the actual and forecast overloads and the impacts of these overloads; and
(iv) to the extent that there continues to be significant uncertainty as to the impact of the ongoing circumstances on the forecasts, a sensitivity analysis with respect to reasonable alternate scenarios.

Each of these matters is addressed below.

3.2 Load Forecast Update

The Planning Study uses a 20-year load forecast for each substation transformer in the Study Area. The load forecast included in the Planning Study used Newfoundland Power's 2019 Substation Load Forecast, which was based on the latest information available at the time of filing.

The update provided in this report is based on the 2020 Substation Load Forecast, and includes actual peak load data for the period from April 1, 2019 to December 31, 2020. The updated forecast also includes inputs from the Company's most recent Customer, Energy and Demand ("CED") Forecast and load factors for the most recent 5-year period.[9]

[9] The development of a Substation Load Forecast typically requires between 6 and 9 months to complete. As such, each Substation Load Forecast is based on the spring CED Forecast from the previous year. The Planning Study included with the Application reflected the Company's CED Forecast dated April 2019. Newfoundland Power's most recent CED Forecast, as applied in this analysis, is dated April 2020. A comparison of the 2020 CED Forecast to 2020 actuals indicates the 2020 CED Forecast was reasonable. Actual energy sales in 2020 were 1.1% lower than forecast. This is within the 10-year historical range of -1.2% to 1.3%. Actual total customers in 2020 were within 0.03% of the April 2020 forecast, with a forecast of 270,192 and a year-end actual result of 270,285.

Table 1 provides the most recent actual and forecast 2021 peak loads for the transformers in the Study Area.[10]

Table 1
Transformer Load

Transformer	Transformer Rated Capacity (MVA)	2019-2020 Actual Peak Load (MVA)	2019-2020 Worst-Case Peak Load (MVA)	2021 Forecast Peak Load (MVA)
BCV-T1	25	23.2	26.5	25.2
RRD-T2	20	18.1	20.6	19.6
RRD-T3	20	20.4	23.3	22.1
VIR-T1	25	20.2	23.6	23.3
VIR-T2	25	22.7	25.9	25.9
VIR-T3	25	15.7[11]	17.9	17.1
Total	140	120.3	137.8	133.2

Unless additional capacity is added, 3 of the 6 transformers [shaded] are forecast to be overloaded in 2021. One of the 3 transformers, RRD-T3, experienced overload conditions in the 2019-2020 winter season.

3.3 Impact of Transformer Overload Conditions

Newfoundland Power's substation transformer loading guidelines permit short-term overloading above the manufacturer's nameplate rating to permit continuity in customer service during *abnormal* or *emergency* operating conditions. The amount of overload permitted is based on controlled conditions, and is dependent on the ambient temperature, the temperature of the transformer's cooling medium, and the operational history and age of the transformer. The updated forecast of transformer loading set out in Table 1 indicates that 3 of the 6 transformers in the Study Area will be overloaded in 2021 under *normal* operating conditions.

Newfoundland Power plans and designs its electrical system to avoid loading substation transformers beyond their nameplate ratings during normal operating conditions. This approach ensures the capacity of power transformers to be overloaded for short periods of time is available for operational purposes when abnormal or emergency conditions are encountered. This is important, for example, in the event of a widespread customer outage during very cold weather. In such circumstances, the phenomenon of "cold load pickup" can impose very high electrical demands on equipment, practically limiting the pace of restoration. The overload capacity of substation transformers can accommodate the effects of cold load pickup and allow power to be

[10] The detailed 20-year load forecast is provided in Attachment 1.

[11] The 2019-2020 peak load of 15.7 MVA on VIR-T3 compares to the 2018-2019 peak load of 22.38 MVA indicated in Appendix B of the Planning Study. The value of 22.38 MVA in the Planning Study inadvertently included load associated with a temporary load transfer from VIR-T1 and VIR-T2 to VIR-T3 which occurred on February 22, 2019 in response to a feeder level outage on VIR-04 feeder. The 2021 forecast load for VIR-T1 and VIR-T2 has increased as a result of actual load added in 2019.

restored to customers sooner than would otherwise be the case. Should a power transformer fail in service, the overload capacity of other transformers can also be utilized to ensure service to customers can continue until such time as the transformer is repaired or its capacity is replaced.

The overloading of substation transformers during normal operating conditions violates the Company's planning criteria. When such conditions are forecast, the Company's system planners will undertake a detailed examination of all viable technical alternatives to determine the least-cost solution.

The actual and forecast overload conditions shown in Table 1 violate Newfoundland Power's substation planning criteria, and must be addressed. The Planning Study has identified the least-cost approach to resolving the supply constraints in the Study Area.

3.4 Study Area Outlook

Customer growth in the Study Area has not been significantly impacted by the negative economic conditions associated with the COVID-19 pandemic in 2020. The continued development of commercial buildings and residential subdivisions in the Study Area suggests customer growth will continue.

The number of customers in the Study Area increased by 54 in 2019 and 94 in 2020. This included a number of new commercial customers in the vicinity of the Airport and Hebron Way.[12] Additional commercial properties are under development in the Hebron Way area, with a new office building already connected in 2021 and several others in various stages of construction. With approximately 300 residential building lots in existing subdivisions fully developed and ready for construction, the potential for future customer growth in the Study Area remains high.[13]

In light of the impact of COVID-19 travel restrictions on the airline industry, Newfoundland Power sought an update from the St. John's International Airport Authority on the timing of the Phase 2 expansion of the Airport. Information provided by the Airport Authority in late January 2021 indicates that recommencement of the expansion could be delayed to 2026, with the full electrical load related to the expansion not being realized until 2030.[14] The updated load forecast incorporates this information.

[12] New commercial customers include a new restaurant in the vicinity of the Airport as well as the Verafin and Exxon office buildings on Hebron Way.

[13] Examples of these subdivision developments include Clovelly Estates in St. John's, Big Meadow in Logy Bay-Middle Cove-Outer Cove, and The Porches and Oliver's Pond in Portugal Cove-St, Phillips.

[14] In the Planning Study, the load associated with the Phase 2 expansion of the Airport was included in the forecast load for 2023.

3.5 Reassessment of Alternatives

Newfoundland Power undertook a review of all reasonable alternatives using the updated load forecast. The review determined that the 3 alternatives included in the Planning Study continue to be the most viable alternatives for supplying the forecasted loads over the next 20 years.[15]

Based on the updated load forecast, the timing of certain individual expenditures included in the alternatives has changed.[16] However, the results of the updated economic analysis of alternatives are essentially consistent with the results of the Planning Study. The analysis reaffirmed that the recommendation to construct a new substation near the Airport is the least-cost alternative to address the loading constraints in the Study Area. This recommendation is confirmed by the updated sensitivity analysis, which assumes the permanent cancellation of the Phase 2 Airport expansion and removes any future load growth associated with the Airport expansion under the low load growth scenario.

Attachment 1 provides details of the reassessment of alternatives resulting from the updated load forecast.

4.0 Conclusion

The Planning Study filed with Newfoundland Power's *2021 Capital Budget Application* recommended construction of a new substation near the Airport as the least-cost alternative to meet the current and future electrical system requirements of customers in the Study Area.

Newfoundland Power's reassessment of all viable alternatives, using its updated load forecast, has not altered the outcome of the Planning Study. Based on the latest forecast information, 3 of the 6 transformers supplying the Study Area are still forecast to be overloaded in 2021. If not addressed, the forecast overloading of these transformers will limit the ability of Newfoundland Power to maintain or restore service to customers in the event of abnormal system conditions and customer outages.

Newfoundland Power's reassessment of the Planning Study recommendations confirms that there have been no changes to the forecast electrical system requirements in the Study Area that have impacted the justification for the construction of the proposed Airport substation in 2021. There are no reasonable alternatives that would allow the proposed capital expenditures to be deferred.

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[15] The other alternatives evaluated were either ruled out based on the significantly higher capital costs or were determined to not be technically viable. The responses to Requests for Information CA-NP-095 and CA-NP-100, *Newfoundland Power 2021 Capital Budget Application*, outline additional alternatives that were eliminated as viable alternatives due to (i) physical space limitations which impacts the feasibility of the alternative, (ii) the geography of the distribution network in the area, and/or (iii) the limited transfer ability between substations.

[16] See Tables 1, 2 and 3 of Attachment 1.

Attachment 1

St. John's North – Portugal Cove System Planning Study
Reassessment of Alternatives

Attachment 1
Table of Contents

Page

1.0 Introduction

On December 15, 2020, the Board issued Order No. P.U. 37 (2020) in relation to Newfoundland Power's *2021 Capital Budget Application*. The Board's approval excluded those projects related to the construction of the Airport Substation recommended in the Planning Study, and requested that Newfoundland Power provide additional information.

In response to the Board's request, Newfoundland Power has updated its load forecast with the most current data available, including actual loads up to December 31, 2020. On the basis of the updated load forecast, the Company has reassessed the alternatives considered in the Planning Study.

2.0 Development of Alternatives

Three alternatives have been developed to address the forecasted overload conditions using a set of defined technical criteria. Each of these alternatives include estimates for all of the costs involved, including new substation transformers and feeders that will provide sufficient capacity to meet the forecasted loads over the next 20 years.

The alternatives primarily reflect the option of increasing transformer capacity at Broad Cove ("BCV") and Virginia Waters ("VIR") Substations or the construction of new substations. Increasing capacity at Ridge Road ("RRD") Substation was eliminated as a viable alternative due to physical space limitations which impacts the feasibility of the alternative.

2.1 Alternative 1 - New Transformers at BCV and VIR Substations

Alternative 1 involves the following in 2021, with the last item completed in 2025:

(i) Add a new 25 MVA, 66/12.5 kV transformer (BCV-T2) and associated protection devices to BCV Substation. The additional transformer would be configured to operate in parallel with the existing 25 MVA, 66/12.5 kV, BCV-T1.

(ii) Extend a new 3-phase feeder (VIR-09) from VIR Substation to transfer load from RRD-T3 and VIR-T2 to VIR-T3. This involves installing a new feeder termination at the VIR Substation, including a breaker and associated switches.

(iii) Add a new 25 MVA, 66/12.5 kV transformer (VIR-T4) and associated protection devices to VIR Substation. The additional transformer would be configured to operate in parallel with the existing 25 MVA, 66/12.5 kV, VIR-T3. This transformer addition would increase the total substation transformer capacity from 75 MVA to 100 MVA, split between 12.5 kV buses.

Table 1 provides the capital costs estimated for Alternative 1.

Table 1
Alternative 1 Capital Costs
($000s)

Year	Item	Cost
2021	Distribution portion of the construction of a new 12.5 kV distribution feeder (VIR-09).	$1,536
2021	Substation portion of the construction of a new 12.5 kV distribution feeder (VIR-09).	$250
2021	Purchase and install a new 25 MVA transformer and associated protection devices at BCV Substation in parallel with the existing BCV-T1.	$2,345
2025	Purchase and install a new 25 MVA transformer and associated protection devices at VIR Substation in parallel with the existing VIR-T3.	$3,360
	Total	**$7,491**

2.2 Alternative 2 - New Substation near St. John's International Airport

Alternative 2 involves the following in 2021:

(i) Build a new 25 MVA 66/12.5 kV substation at the corner of Portugal Cove Road and Airport Heights Drive. This involves installing a new 25 MVA power transformer, transmission breakers, a control building, protection and control, new feeder terminations at the new substation, including breakers and associated switches.

(ii) Build 2 new 66 kV transmission line extensions from the existing 35L transmission line. This project will involve splitting the existing 35L into 2 transmission lines, 1 from OXP Substation and 1 from KEN Substation, and terminating these lines with breakers at the new substation.[17]

(iii) Expand the fibre optic network in the St. John's area to include the proposed

[17] The addition of 2 separate transmission lines is required due to the coordination of protection devices between the distribution and transmission systems, and between multiple transmission lines, to achieve proper critical clearing times for transmission line faults.

substation and transmission lines for transmission teleprotection.[18]

(iv) Build distribution feeder exits from the new substation to the existing distribution feeders to interconnect the new substation to surrounding distribution feeders.

(v) Upgrade 3.9 kilometres of 2/0 ACSR conductor on RRD-10 along Portugal Cove Road to create feeder capacity to offload BCV load to the new substation via the existing RRD-10.

Table 2 provides the capital costs estimated for Alternative 2.

Table 2
Alternative 2 Capital Costs
($000s)

Year	Item	Cost
2021	Build a new 25 MVA 66/12.5 kV substation near St. John's International Airport.	$4,296
2021	Build 2 new 66 kV transmission lines to the new substation.	$1,343
2021	Expand fibre optic network to new substation for transmission line protection.	$350
2021	Construct distribution feeder exits from new substation to existing surrounding distribution feeders.	$151
2021	Upgrade existing RRD-10 feeder.	$654
	Total	**$6,794**

2.3 Alternative 3 - New Substation in Portugal Cove

Alternative 3 involves the following in 2021, with the last item completed in 2025:

(i) Build a new 25 MVA 66/12.5 kV substation at the corner of Old Broad Cove Road and Maggie's Place. This involves installing a new 25 MVA power transformer, transmission breakers, a control building, protection and control, new feeder terminations at the new substation, including breakers and associated switches.

[18] The teleprotection equipment communicates using fibre optic cable in order to meet the critical clearing time requirements for differential line protection. The teleprotection system is critical to Newfoundland Power's operations as it ensures the protection and reliability of substations and transmission lines within St. John's.

(ii) Build a new 66 kV transmission line from BCV Substation to the new substation, terminating this line with a breaker to provide supply to the new substation.

(iii) Build distribution feeder exits from the new substation to the existing distribution feeders to interconnect the new substation to the existing distribution system.

(iv) Upgrade 3.9 kilometres of 2/0 ACSR conductor on RRD-10 along Portugal Cove Road to create feeder capacity to offload RRD-10 feeder onto the new substation.

(v) Extend 0.3 kilometres of 3-phase distribution feeder from RRD-09 along Viscount Street to Portugal Cove Road, to transfer load from the RRD Substation to the VIR Substation.

(vi) Construct a new 3-phase feeder from the new substation to Airport Heights to serve the residential customers in the area and transfer load from RRD substation.

Table 3 provides the capital costs estimated for Alternative 3.

Table 3
Alternative 3 Capital Costs
($000s)

Year	Item	Cost
2021	Build a new 25 MVA 66/12.5 kV substation at the corner of Old Broad Cove Road and Maggie's Place.	$4,296
2021	Build a new 66 kV transmission line from the BCV Substation to the new substation.	$2,050
2021	Upgrade 3.9 kilometres of 2/0 ACSR conductor on RRD-10.	$654
2021	Construct distribution feeder exits from the new 25 MVA 66/12.5 kV substation to surrounding distribution feeders.	$151
2021	Extend RRD-09 three phase distribution feeder along Viscount Street.	$51
2025	Construct a distribution feeder from the new substation to Airport Heights to transfer load from RRD substation.	$780
	Total	**$7,982**

3.0 Evaluation of Alternatives

The economic impact of each alternative was evaluated through a Net Present Value ("NPV") analysis of customer revenue requirement. Capital costs from 2021 were converted to the customer revenue requirement. The resulting customer revenue requirement was reduced to an NPV using the Company's incremental weighted average cost of capital. Capital costs required beyond the 20-year forecast period that are required to balance the installed transformer capacity across all 3 alternatives are also included in the NPV calculation and are known simply as end-effect capital costs.[19]

Table 4 provides the NPV of customer revenue requirement for each alternative under the base case load forecast.

Table 4
Net Present Value Analysis
($000s)

Alternative 1	$8,698
Alternative 2	$8,290
Alternative 3	$9,544

Alternative 2 has the lowest NPV of customer revenue requirement under the base case load forecast.

3.1 Sensitivity Analysis

A sensitivity analysis was completed to evaluate the impact of potential changes in forecast load growth on the Study Area.[20] Each alternative was analyzed under a low growth factor of 0%, and a high growth factor of 1.26%, which is derived from the 10-year compounded annual growth rate in the Study Area. The low growth forecast also permanently removes the future forecast load of the Phase 2 Airport expansion in 2030.

Table 5 provides the NPV of customer revenue requirement for each alternative under the different sensitivities.

[19] The economic analysis for Alternatives 2 and 3 includes an additional cost of $891,000 in year 2040 of the analysis to balance the total installed transformer capacity of Alternatives 2 and 3 at the end of the study period with Alternative 1.

[20] The 20-year substation load forecasts have been developed for all alternatives and are shown in Appendices B to D.

Table 5
Sensitivity Analysis
($000s)

Alternative	Base Case Forecast (0.40%)[21] NPV	High Load Forecast (1.26%)[22] NPV	Low Load Forecast (0%) NPV
1	$8,698	$9,896	$8,048
2	$8,290	$9,240	$7,055
3	$9,544	$10,680	$8,292

Alternative 2 is the least-cost alternative under all load growth scenarios.

4.0 Recommendation

Based on this evaluation, Alternative 2 is recommended as the least-cost alternative to meet the long-term electrical requirements of customers in the Study Area.

Table 6 provides estimated costs for the recommended alternative by item.

Table 6
Project Capital Costs
($000s)

Year	Item	Cost
2021	Build a new 25 MVA 66/12.5 kV substation near St. John's International Airport.	$4,296
2021	Build 2 new 66 kV transmission lines to the new substation.	$1,343
2021	Expand fibre optic network to new substation for transmission line protection.	$350
2021	Construct distribution feeder exits from new substation to existing surrounding distribution feeders.	$151
2021	Upgrade existing RRD-10 feeder.	$654
	Total	**$6,794**

[21] The base case forecast growth percentage has been reduced from 0.70% to 0.40% as a result of the updated 2020 Substation Load forecast.

[22] The high load forecast growth percentage has been reduced from 1.59% to 1.26% as a result of the updated 2020 Substation Load forecast.

Appendix A
2020 Substation Load Forecast – Base Case

20-Year Substation Load Forecast – Base Case

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73
Year	**Forecasted Undiversified Peak (MVA)**					
2020	25.41	19.73	22.30	22.77	25.44	17.20
2021	25.24	19.58	22.13	23.29	25.93	17.09
2022	25.21	19.53	22.08	23.28	25.93	17.06
2023	25.14	19.46	22.00	23.25	25.89	17.01
2024	25.23	19.51	22.05	23.37	26.02	17.07
2025	25.24	19.74	22.30	23.40	26.06	17.07
2026	25.34	19.82	22.39	23.50	26.16	17.14
2027	25.44	19.90	22.48	23.59	26.27	17.21
2028	25.54	19.98	22.57	23.69	26.37	17.28
2029	25.65	20.06	22.66	23.78	26.48	17.35
2030[23]	25.75	20.14	22.75	23.88	26.58	20.42
2031	25.85	20.22	22.84	23.97	26.69	20.50
2032	25.95	20.30	22.93	24.07	26.80	20.58
2033	26.06	20.38	23.02	24.16	26.91	20.66
2034	26.16	20.46	23.12	24.26	27.01	20.75
2035	26.27	20.54	23.21	24.36	27.12	20.83
2036	26.37	20.62	23.30	24.45	27.23	20.91
2037	26.48	20.71	23.40	24.55	27.34	21.00
2038	26.58	20.79	23.49	24.65	27.45	21.08
2039	26.69	20.87	23.58	24.75	27.56	21.16
2040	26.80	20.96	23.68	24.85	27.67	21.25

[23] Additional load from St. John's International Airport.

Appendix B
Alternative 1 – 20-Year Substation Load Forecasts

Alternative 1
20-Year Substation Load Forecast – Base Case

Device	BCV-T1	BCV-T2	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	VIR-T4
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	--	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**							
2020	25.41	--	19.73	22.30	22.77	25.44	17.20	--
2021[24]	12.62	12.62	17.59	19.93	22.28	24.94	23.29	--
2022	12.60	12.60	17.54	19.87	22.28	24.93	23.26	--
2023	12.57	12.57	17.47	19.79	22.25	24.90	23.21	--
2024[25]	12.62	12.62	17.52	19.85	21.61	24.28	24.77	--
2025[26]	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2026	12.67	12.67	17.35	19.66	21.74	24.42	12.92	12.92
2027	12.72	12.72	17.43	19.75	21.83	24.53	12.95	12.95
2028	12.77	12.77	17.51	19.84	21.92	24.63	12.99	12.99
2029	12.82	12.82	17.59	19.93	22.02	24.74	13.02	13.02
2030[27]	12.87	12.87	16.24	18.44	22.11	24.85	16.06	16.06
2031	12.93	12.93	16.32	18.53	22.21	24.95	16.10	16.10
2032[28]	12.98	12.98	17.45	19.78	21.20	23.97	16.14	16.14
2033	13.03	13.03	17.53	19.87	21.29	24.07	16.18	16.18
2034	13.08	13.08	17.61	19.97	21.39	24.18	16.22	16.22
2035[29]	13.13	13.13	17.17	19.48	21.49	24.29	16.81	16.81
2036	13.19	13.19	17.25	19.57	21.59	24.40	16.86	16.86
2037	13.24	13.24	17.34	19.67	21.68	24.51	16.90	16.90
2038	13.29	13.29	17.42	19.76	21.78	24.62	16.94	16.94
2039	13.35	13.35	17.50	19.85	21.88	24.73	16.98	16.98
2040	13.40	13.40	17.59	19.95	21.98	24.84	17.02	17.02

[24] 4.2 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3, 2.0 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[25] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[26] 1.0 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3 and VIR-T4.
[27] Additional load from St. John's International Airport, 3.0 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3 and VIR-T4.
[28] 2.2 MVA load transfer from VIR-T1 and VIR-T2 to RRD-T2 and RRD-T3
[29] 1.1 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3 and VIR-T4.

Alternative 1
20-Year Substation Load Forecast – High Growth

Device	BCV-T1	BCV-T2	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	VIR-T4
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	--	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**							
2020	25.41	--	19.73	22.30	22.77	25.44	17.20	--
2021[30]	12.62	12.62	17.59	19.93	22.28	24.94	23.29	--
2022	12.61	12.60	17.54	19.87	22.28	24.93	23.26	--
2023	12.57	12.57	17.47	19.79	22.25	24.90	23.21	--
2024[31]	12.62	12.62	17.52	19.85	21.61	24.28	24.77	--
2025[32]	12.62	12.62	15.75	17.89	21.64	24.32	14.49	14.49
2026	12.78	12.78	16.00	18.17	21.94	24.65	14.59	14.59
2027	12.94	12.94	16.25	18.45	22.24	24.98	14.70	14.70
2028[33]	13.10	13.10	16.51	18.74	21.18	23.98	16.16	16.16
2029	13.27	13.27	16.76	19.03	21.49	24.32	16.27	16.27
2030[34]	13.44	13.43	17.03	19.33	21.80	24.66	17.89	17.89
2031[35]	13.61	13.60	17.29	19.63	20.85	23.77	19.27	19.27
2032	13.78	13.78	17.56	19.93	21.17	24.12	19.41	19.41
2033[36]	13.95	13.95	17.83	20.24	21.49	24.48	19.54	19.54
2034	14.13	14.12	18.10	20.55	21.82	24.85	19.68	19.68
2035[37]	14.31	14.30	18.38	20.86	20.79	23.87	21.17	21.17
2036	14.49	14.48	18.66	21.18	21.12	24.24	21.31	21.31
2037	14.67	14.67	18.95	21.50	21.46	24.62	21.46	21.46
2038[38]	14.85	14.85	19.24	21.83	20.90	24.11	22.50	22.50
2039	15.04	15.04	19.53	22.16	21.25	24.49	22.65	22.65
2040	15.23	15.23	19.83	22.50	21.60	24.89	22.80	22.80

[30] 4.2 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3, 2.0 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[31] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[32] 4.2 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3 and VIR-T4.
[33] 2.7 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3 and VIR-T4
[34] Additional load from St. John's International Airport.
[35] 2.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3 and VIR-T4
[36] RRD-T3 replaced with a 25 MVA transformer.
[37] 2.7 MVA from VIR-T1 and VIR-T2 to VIR-T3 and VIR-T4.
[38] 1.8 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3 and VIR-T4.

Alternative 1
20-Year Substation Load Forecast – Low Growth

Device	BCV-T1	BCV-T2	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	VIR-T4
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	--	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**							
2020	25.41	--	19.73	22.30	22.77	25.44	17.20	--
2021[39]	12.62	12.62	17.59	19.93	22.28	24.94	23.29	--
2022	12.61	12.61	17.54	19.87	22.28	24.93	23.26	--
2023	12.57	12.57	17.47	19.79	22.25	24.90	23.21	--
2024[40]	12.62	12.62	17.52	19.85	21.61	24.28	24.77	--
2025[41]	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2026[42]	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2027	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2028	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2029	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2030	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2031	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2032	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2033	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2034	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2035	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2036	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2037	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2038	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2039	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89
2040	12.62	12.62	17.27	19.57	21.64	24.32	12.89	12.89

[39] 4.1 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3, 2.0 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[40] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3
[41] 1.0 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3 and VIR-T4.
[42] Forecast for 2026 to 2040 applies the 0% low load growth factor.

Appendix C
Alternative 2 – 20-Year Substation Load Forecasts

Alternative 2
20-Year Substation Load Forecast – Base Case

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	NEW-T1
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**						
2020	25.41	19.73	22.30	22.77	25.44	17.20	--
2021[43]	20.74	16.26	18.46	22.28	24.94	15.09	14.50
2022	20.71	16.21	18.40	22.28	24.93	15.06	14.48
2023	20.64	16.14	18.32	22.25	24.90	15.01	14.44
2024[44]	20.73	16.19	18.38	21.61	24.28	16.57	14.50
2025	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2026	20.84	16.49	18.71	21.74	24.42	16.64	14.62
2027	20.94	16.57	18.80	21.83	24.53	16.71	14.68
2028	21.04	16.65	18.89	21.92	24.63	16.78	14.74
2029	21.15	16.73	18.98	22.02	24.74	16.85	14.79
2030[45]	21.25	16.81	19.07	22.11	24.85	16.92	17.85
2031	21.35	16.89	19.17	22.21	24.95	17.00	17.92
2032[46]	21.45	16.97	19.26	21.20	23.97	19.28	18.00
2033	21.56	17.06	19.35	21.29	24.07	19.36	18.07
2034	21.66	17.14	19.44	21.39	24.18	19.45	18.14
2035	21.77	17.22	19.53	21.49	24.29	19.53	18.21
2036	21.87	17.30	19.63	21.59	24.40	19.61	18.29
2037	21.98	17.38	19.72	21.68	24.51	19.70	18.36
2038	22.08	17.47	19.81	21.78	24.62	19.78	18.43
2039	22.19	17.55	19.91	21.88	24.73	19.86	18.51
2040[47]	22.30	17.40	19.74	21.98	24.84	19.95	19.08

[43] 2 MVA load transfer from BCV-T1 to the new substation, 2.5 MVA from BCV-T1 to PUL, 7 MVA from RRD-T2 and RRD-T3 to the new substation, 1.5 MVA from PUL to the new substation, 4 MVA from VIR-T3 to the new substation, and 2 MVA from VIR-T1 and VIR-T2 to VIR-T3.
[44] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[45] Additional load from St. John's International Airport.
[46] 2.2 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3
[47] 0.5 MVA load transfer from RRD-T2 and RRD-T3 to the new substation.

Alternative 2
20-Year Substation Load Forecast – High Growth

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	NEW-T1	NEW-T2
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73	--	--
Year	**Forecasted Undiversified Peak (MVA)**							
2020	25.41	19.73	22.30	22.77	25.44	17.20	--	--
2021[48]	20.74	16.26	18.46	22.28	24.94	15.09	14.50	--
2022	20.71	16.21	18.40	22.28	24.93	15.06	14.48	--
2023	20.64	16.14	18.32	22.25	24.90	15.01	14.44	--
2024[49]	20.73	16.19	18.38	21.61	24.28	16.57	14.50	--
2025	20.74	16.41	18.62	21.64	24.32	16.57	14.56	--
2026	21.06	16.66	18.91	21.94	24.65	16.79	14.74	--
2027	21.38	16.92	19.19	22.24	24.98	17.01	14.93	--
2028[50]	21.71	17.17	19.48	21.18	23.98	16.93	18.12	--
2029	22.04	17.43	19.77	21.49	24.32	17.15	18.35	--
2030[51]	22.37	15.79	17.96	21.80	24.66	17.38	12.79	12.79
2031[52]	22.71	16.06	18.26	19.59	22.53	17.64	15.45	15.45
2032	23.06	16.32	18.57	19.91	22.88	17.91	15.64	15.64
2033	23.40	16.60	18.87	20.23	23.24	18.19	15.84	15.84
2034	23.75	16.87	19.18	20.56	23.60	18.46	16.04	16.04
2035	24.11	17.15	19.50	20.89	23.97	18.74	16.24	16.24
2036	24.47	17.43	19.82	21.22	24.34	19.03	16.45	16.45
2037[53]	24.84	16.48	18.77	21.56	24.72	19.32	17.95	17.95
2038[54]	22.21	16.77	19.10	20.90	24.11	19.61	20.68	20.68
2039	22.58	17.06	19.43	21.25	24.49	19.90	20.94	20.94
2040	22.96	17.36	19.77	21.60	24.89	20.20	21.21	21.21

[48] 2 MVA load transfer from BCV-T1 to the new substation, 2.5 MVA from BCV-T1 to PUL, 7 MVA from RRD-T2 and RRD-T3 to the new substation, 1.5 MVA from PUL to the new substation, 4 MVA from VIR-T3 to the new substation, and 2 MVA from VIR-T1 and VIR-T2 to VIR-T3.

[49] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.

[50] 2.7 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3, 3.0 MVA from VIR-T3 to the new substation.

[51] Additional load from St. John's International Airport, Additional transformer added to the new substation, 4.0 MVA load transfer from RRD-T2 and RRD-T3 to the new substation.

[52] 5.0 MVA from VIR-T1 and VIR-T2 to the new substation.

[53] 2.6 MVA from RRD-T2 and RRD-T3 to the new substation

[54] 3.0 MVA load transfer from BCV-T1 to the new substation, 2.0 MVA load transfer from VIR-T1 and VIR-T2 to the new substation.

Alternative 2
20-Year Substation Load Forecast – Low Growth

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	NEW-T1
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**						
2020	25.41	19.73	22.30	22.77	25.44	17.20	--
2021[55]	20.75	16.26	18.46	22.28	24.94	15.09	14.50
2022	20.71	16.21	18.40	22.28	24.93	15.06	14.48
2023	20.64	16.14	18.32	22.25	24.90	15.01	14.44
2024[56]	20.74	16.19	18.38	21.61	24.28	16.57	14.50
2025	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2026[57]	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2027	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2028	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2029	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2030	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2031	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2032	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2033	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2034	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2035	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2036	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2037	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2038	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2039	20.74	16.41	18.62	21.64	24.32	16.57	14.56
2040	20.74	16.41	18.62	21.64	24.32	16.57	14.56

[55] 2 MVA load transfer from BCV-T1 to the new substation, 2.5 MVA from BCV-T1 to PUL, 7 MVA from RRD-T2 and RRD-T3 to the new substation, 1.5 MVA from PUL to the new substation, 4 MVA from VIR-T3 to the new substation, and 2 MVA from VIR-T1 and VIR-T2 to VIR-T3.

[56] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.

[57] Forecast for 2026 to 2040 applies the 0% low load growth factor.

Appendix D
Alternative 3 – 20-Year Substation Load Forecasts

Alternative 3
20-Year Substation Load Forecast – Base Case

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	NEW-T1
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**						
2020	25.41	19.73	22.30	22.77	25.44	17.20	--
2021[58]	20.64	17.64	19.98	22.28	24.94	19.19	8.60
2022	20.61	17.59	19.92	22.28	24.93	19.16	8.59
2023	20.54	17.52	19.84	22.25	24.90	19.11	8.57
2024[59]	20.63	17.57	19.90	21.61	24.28	20.67	8.60
2025[60]	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2026	20.74	16.16	18.35	21.74	24.42	20.74	12.28
2027	20.84	16.24	18.44	21.83	24.53	20.81	12.33
2028	20.94	16.32	18.53	21.92	24.63	20.88	12.38
2029	21.05	16.40	18.62	22.02	24.74	20.95	12.43
2030[61]	21.15	16.48	18.71	22.11	24.85	21.02	15.48
2031	21.25	16.56	18.80	22.21	24.95	21.10	15.54
2032[62]	21.35	16.64	18.89	21.20	23.97	23.38	15.61
2033	21.46	16.72	18.98	21.29	24.07	23.46	15.67
2034	21.56	16.80	19.07	21.39	24.18	23.55	15.73
2035	21.67	16.89	19.17	21.49	24.29	23.63	15.79
2036	21.77	16.97	19.26	21.59	24.40	23.71	15.86
2037	21.88	17.05	19.35	21.68	24.51	23.80	15.92
2038	21.98	17.13	19.44	21.78	24.62	23.88	15.98
2039	22.09	17.22	19.54	21.88	24.73	23.96	16.05
2040	22.20	17.30	19.63	21.98	24.84	24.05	16.11

[58] 4.1 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3, 4.6 MVA load transfer from BCV-T1 to the new substation, 4 MVA load transfer from VIR-T3 to the new substation, and 2 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[59] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[60] 3.6 MVA load transfer from RRD-T2 and RRD-T3 to the new substation.
[61] Additional load from St. John's International Airport.
[62] 2.2 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.

Alternative 3
20-Year Substation Load Forecast – High Growth

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	NEW-T1	NEW-T2
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73	--	--
Year	**Forecasted Undiversified Peak (MVA)**							
2020	25.41	19.73	22.30	22.77	25.44	17.20	--	--
2021[63]	20.64	17.64	19.98	22.28	24.94	19.19	8.60	--
2022	20.61	17.59	19.92	22.28	24.93	19.16	8.59	--
2023	20.54	17.52	19.84	22.25	24.90	19.11	8.57	--
2024[64]	20.63	17.57	19.90	21.61	24.28	20.67	8.60	--
2025[65]	20.64	16.08	18.26	21.64	24.32	20.67	12.24	--
2026	20.96	16.33	18.54	21.94	24.65	20.89	12.39	--
2027	21.28	16.58	18.82	22.24	24.98	21.11	12.55	--
2028[66]	21.61	16.93	19.22	20.02	22.83	21.33	17.50	--
2029	21.94	17.19	19.51	20.33	23.18	21.55	17.72	--
2030[67]	22.27	17.45	19.80	20.64	23.52	21.78	20.95	--
2031[68]	22.61	17.72	20.10	20.95	23.87	22.04	21.21	--
2032	22.96	17.99	20.40	21.27	24.22	22.31	21.48	--
2033	23.30	18.26	20.71	21.59	24.58	22.59	21.75	--
2034	23.65	18.53	21.02	21.92	24.95	22.86	22.02	--
2035[69]	24.01	18.81	21.34	21.14	24.22	23.14	24.20	--
2036	24.37	19.09	21.66	21.48	24.59	23.43	24.51	--
2037	24.74	19.38	21.98	21.81	24.97	23.72	24.82	--
2038[70]	22.11	19.67	22.30	20.95	24.16	24.31	15.11	15.11
2039	22.48	19.96	22.63	21.30	24.54	24.60	15.30	15.30
2040[71]	22.86	19.97	22.65	21.65	24.94	24.90	15.80	15.80

[63] 4.1 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3, 4.6 MVA load transfer from BCV-T1 to the new substation, 4 MVA load transfer from VIR-T3 to the new substation, and 2 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[64] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.
[65] 3.6 MVA load transfer from RRD-T2 and RRD-T3 to the new substation.
[66] 5.0 MVA load transfer from VIR-T1 and VIR-T2 to RRD-T2 and RRD-T3, 4.8 MVA from RRD-T2 and RRD-T3 to the new substation.
[67] Additional load from St. John's International Airport
[68] RRD-T3 replaced with a 25 MVA transformer.
[69] 2.2 MVA load transfer from VIR-T1 and VIR-T2 to RRD-T2 and RRD-T3.
[70] Additional transformer added to the new substation, 2.4 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3, 2.1 MVA from VIR-T3 to the new substation, 3.0 MVA load transfer from BCV-T1 to the new substation.
[71] 0.6 MVA load transfer from RRD-T2 and RRD-T3 to the new substation.

Alternative 3
20-Year Substation Load Forecast – Low Growth

Device	BCV-T1	RRD-T2	RRD-T3	VIR-T1	VIR-T2	VIR-T3	NEW-T1
Sec. Voltage (kV)	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Rating (MVA)	25	20	20	25	25	25	25
2019 Peak (MVA)	23.23	18.06	20.41	20.22	22.66	15.73	--
Year	**Forecasted Undiversified Peak (MVA)**						
2020	25.41	19.73	22.30	22.77	25.44	17.20	--
2021[72]	20.65	17.64	19.98	22.28	24.94	19.19	8.60
2022	20.61	17.59	19.92	22.28	24.93	19.16	8.59
2023	20.54	17.52	19.84	22.25	24.90	19.11	8.57
2024[73]	20.64	17.57	19.90	21.61	24.28	20.67	8.60
2025[74]	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2026[75]	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2027	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2028	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2029	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2030	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2031	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2032	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2033	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2034	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2035	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2036	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2037	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2038	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2039	20.64	16.08	18.26	21.64	24.32	20.67	12.24
2040	20.64	16.08	18.26	21.64	24.32	20.67	12.24

[72] 4.1 MVA load transfer from RRD-T2 and RRD-T3 to VIR-T3, 4.6 MVA load transfer from BCV-T1 to the new substation, 4 MVA load transfer from VIR-T3 to the new substation, and 2 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.

[73] 1.5 MVA load transfer from VIR-T1 and VIR-T2 to VIR-T3.

[74] 3.6 MVA load transfer from RRD-T2 and RRD-T3 to the new substation.

[75] Forecast for 2026 to 2040 applies the 0% low load growth factor.