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November 30, 2017

Paul L. Coxworthy
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Via Electronic Mail and Courier

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

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

Dear Ms. Blundon:

Re: Application of Newfoundland and Labrador Hydro to establish customer electricity rates for 2018 and 2019 (2017 General Rate Application)

Further to the Board's correspondence dated November 29, 2017, please find enclosed the original and thirteen (13) copies of the Requests for Information IC-NLH-170 - IC-NLH-176 of the Island Industrial Customers in the above Application, in follow up to Hydro's response to IC-NLH-146.

We trust you will find the enclosed to be in order.

Yours truly,

Stewart McKelvey

Paul L. Coxworthy

PLC/kmcd

Enclosures
c: Tracey Pennell, Senior Legal Counsel, Newfoundland and Labrador Hydro
Dennis M. Brown, Q.C., Consumer Advocate
Gerard Hayes, Newfoundland Power
Dean A. Porter, Poole Althouse
Denis J. Fleming, Cox & Palmer
Van Alexopoulos, Iron Ore Company of Canada
Benoit Pepin, Rio Tinto
Senwung Luk, Labrador Interconnected Group

360880 v1

IN THE MATTER OF the *Electrical Power Control Act,* 1994, SNL 1994, Chapter E-5.1 and the *Public Utilities Act*, RSN 1990, Chapter P-47 (the Act);

AND IN THE MATTER OF a General Rate Application (the Application) by Newfoundland and Labrador Hydro to establish customer electricity rates for 2018 and 2019.

ISLAND INDUSTRIAL CUSTOMERS GROUP
REQUESTS FOR INFORMATION
IC–NLH-170 – IC-NLH-176

Issued: November 30, 2017

IN THE MATTER OF the *Electrical Power Control Act,* 1994, SNL 1994, Chapter E-5.1 and the *Public Utilities Act*, RSN 1990, Chapter P-47 (the Act);

AND IN THE MATTER OF a General Rate Application (the Application) by Newfoundland and Labrador Hydro to establish customer electricity rates for 2018 and 2019.

REQUESTS FOR INFORMATION OF THE ISLAND INDUSTRIAL CUSTOMERS GROUP IC–NLH-170 to IC-NLH-176

With reference to IC-NLH-146, Table 1, and Hydro's statement, in relation to the Expenditures "Come By Chance T1 and T2 High Voltage Bushings (H1, H2, H3)" that "At the time Hydro's response to IC-NLH-015 was filed in 2014, specific bushings for replacement were not identified", please respond to IC-NLH-170, 171 and 172:

IC–NLH-170 Had the Come By Chance T1 and T2 High Voltage Bushings (H1, H2, H3) been identified for replacement at the time Hydro filed its response to IC-NLH-008 in the 2016 Capital Budget Application? If so, why was this capital expenditure not identified in Hydro's response to IC-NLH-008 as a 2016 capital expenditure planned to be specifically assigned to NARL? If not, when did Hydro identify the Come By Chance T1 and T2 High Voltage Bushings (H1, H2, H3) for replacement?

IC–NLH-171 Please identify what Hydro considers to be the complete project description and justification filed with the Board for the replacement of the Come By Chance T1 and T2 High Voltage Bushings (H1, H2, H3), and please identify by what process Hydro considers these capital expenditures to have been approved by the Board, including the applicable reference thereto in an order of the Board. Please include with your response copies of all filings referred to in the response.

IC–NLH-172 Please confirm that the capital expenditures for the Come By Chance T1 and T2 High Voltage Bushings (H1, H2, H3) are the six (6) 2016 expenditures for "BUSHING..." listed in Table 2 of IC-NLH-103 (Revision 2), and please provide Hydro's detailed and complete justification for the proposed specific assignment of each of these capital expenditures to NARL.

With reference to IC-NLH-146, Table 1, and Hydro's statement, in relation to the Expenditures "Come By Chance T1 and T2 Upgrades" that "At the time Hydro's response to IC-NLH-015 was filed in 2014, specific protective devices for replacement were not identified", please respond to IC-NLH-173, 174 and 175:

IC–NLH-173 Had these Come By Chance T1 and T2 Upgrades been identified for replacement at the time Hydro filed its response to IC-NLH-008 in the 2016 Capital Budget Application? If so, why was this capital expenditure not identified in Hydro's response to IC-NLH-008 as a 2016 capital expenditure planned to be specifically assigned to NARL? If not, when did Hydro identify specific protective devices for Come By Chance T1 and T2 for replacement?

IC–NLH-174 Please identify what Hydro considers to be the complete project description and justification filed with the Board for the Come By Chance T1 and T2 Upgrades, and please identify by what process Hydro considers these capital expenditures to have been approved by the Board, including the applicable reference thereto in an order of the Board. Please include with your response copies of all filings referred to in the response.

IC–NLH-175 Please confirm that the capital expenditures for the Come By Chance T1 and T2 Upgrades are the two (2) 2016 expenditures for "TRF Upgrade..." listed in Table 2 of IC-NLH-103 (Revision 2), and please provide Hydro's detailed and complete justification for the proposed specific assignment of each of these capital expenditures to NARL.

IC–NLH-176 With reference to Exhibit 24 filed in the Muskrat Falls Review (copy enclosed), it is noted that there is reference to a potential system support role for the Come By Chance Terminal Station (at e.g. pages 9, 10 and 31). It is recognized that the current and currently-planned role for the Come By Chance Terminal Station may have changed since the 2010 filing of Exhibit 24. Please describe the current role played, and the currently-planned role to be played, by the Come By Chance Terminal Station in relation to the Island Interconnected Transmission System, and please identify whether any of the capital expenditures referred to in IC-NLH-170 through IC-NLH-175 proposed to be specifically assigned to NARL will contribute to the current role played, and/or the currently-planned role to be played, by the Come By Chance Terminal Station in relation to the Island Interconnected Transmission System.

DATED at St. John's, Newfoundland and Labrador, this 30th day of November, 2017.

POOLE ALTHOUSE

Per: ______________________
Dean A. Porter

STEWART MCKELVEY

Per: ______________________
Paul L. Coxworthy

COX & PALMER

Per: ______________________
Denis J. Fleming

TO: The Board of Commissioners of Public Utilities
Suite E210, Prince Charles Building
120 Torbay Road
P.O. Box 21040
St. John's, NL A1A 5B2
Attention: Board Secretary

TO: Newfoundland & Labrador Hydro
P.O. Box 12400
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Attention: Tracey L. Pennell, Legal Counsel

TO: Newfoundland Power
P.O. Box 8910
55 Kenmount Road
St. John's, NL A1B 3P6
Attention: Gerard Hayes, Legal Counsel

TO: Browne Fitzgerald Morgan & Avis
Churchill Park Law Offices
P.O. Box 23135
Terrace on the Square, Level II
St. John's, NL A1B 4J9
Attention: Dennis M. Browne Q.C., Consumer Advocate

Approved for Release

Date July 20/2011

ISLAND TRANSMISSION SYSTEM OUTLOOK

Date: December 2010

System Planning Department

REGISTERED PROFESSIONAL ENGINEER
THOMAS
SIGNATURE
PROVINCE OF NEWFOUNDLAND

newfoundland labrador hydro
a nalcor energy company

TABLE OF CONTENTS

INTRODUCTION

Newfoundland and Labrador Hydro (Hydro) owns and operates twenty five 230 kV transmission lines totaling 1608 km, sixteen 138 kV transmission lines totaling 1231 km, fifteen 66/69 kV transmission lines totaling 634 km and 52 high voltage terminal stations on its Island Interconnected Transmission System. Figure 1 provides a map of the Island Interconnected Transmission System showing the existing 230 kV transmission lines in red, 138 kV transmission lines in green and 66/69 kV transmission lines in blue.

The purpose of this report is to provide a summary of the status of the existing transmission system on the Island of Newfoundland and provide an outlook on the requirements for system additions in the five to ten year time frame.

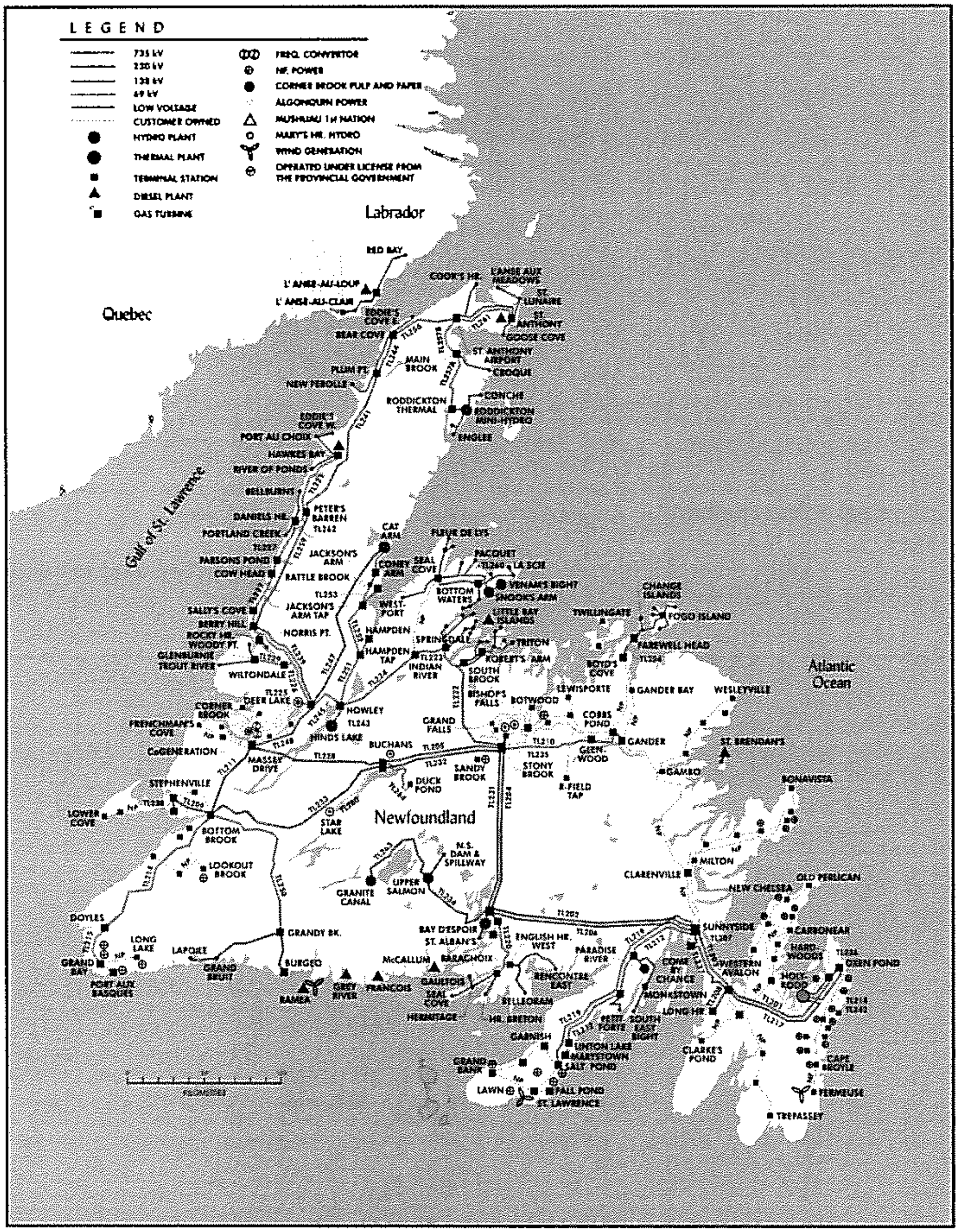

Figure 1 – Island Interconnected Transmission System

TRANSMISSION PLANNING CRITERIA

The transmission system on the Island of Newfoundland is assessed and expanded based upon a prescribed transmission planning criteria. The transmission planning criteria used by the System Planning Department of Newfoundland and Labrador Hydro and reviewed by the Public Utilities Board of Newfoundland and Labrador considers:

- NLH's bulk transmission system (i.e. 230 kV and 138 kV loops) is planned to be capable of sustaining the single contingency loss of any transmission element without loss of system stability;
- In the event a transmission element is out of service, power flow in all other elements of the power system should be at or below normal rating;
- The NLH system is planned to be able to sustain a successful single pole reclose for a line to ground fault based on the premise that all system generation is available;
- Transformer additions at all major terminal stations (i.e. two or more transformers per voltage class) are planned on the basis of being able to withstand the loss of the largest unit;
- For single transformer stations there is a back-up plan in place which utilizes NLH's and/or Newfoundland Power's mobile equipment to restore service;
- For normal operations, the system is planned on the basis that all voltages be maintained between 95% and 105%; and
- For contingency or emergency situations voltages between 90% and 110% is considered acceptable.

BULK 230 kV TRANSMISSION SYSTEM

In discussing the status and outlook for the bulk 230 kV transmission system, the system is split between the natural demarcation at Bay d'Espoir. Therefore commentary is provided on the Bay d'Espoir East and Bay d'Espoir West 230 kV transmission systems.

There are eleven 230 kV lines totaling 627 km in length connecting Bay d'Espoir Generating Station to the major load centers and generation in the eastern portion of the province. There are twelve 230 kV lines totaling 855 km in length connecting Bay d'Espoir to major load centers and generation in the central and western portion of the province. The remaining 126 km of 230 kV transmission line consists of two lines which connect the Granite Canal and Upper Salmon Generating Stations to Bay d'Espoir.

Bay d'Espoir East 230 kV Transmission System

The 230 kV transmission system east of Bay d'Espoir is characterized as being a heavily loaded system. During the peak load period a typical 230 kV system load east of Bay d'Espoir is on the order of 850 MW. The 230 kV line flows from Bay d'Espoir to the east coast total approximately 420 MW, with the remainder of the peak load being supplied by the Holyrood Thermal Generating Station.

The Bay d'Espoir – East 230 kV transmission system experiences significant voltage drop during peak load conditions. As a result this portion of the system requires voltage support in the form of MVAR injection in order to bring system voltages up to minimum acceptable levels. The Holyrood Thermal Generating Station, the Hardwoods combustion turbine operating as a synchronous condenser and shunt capacitor banks at Long Harbour, Hardwoods and Oxen Pond Terminal Stations provide the MVAR injection into the 230 kV system to counteract the voltage drop.

The voltage support equipment has been sized to provide transfer capabilities to the east coast under single equipment contingencies as follows:

- For an Avalon Peninsula load of up to 335 MW Holyrood Unit 3 operating as a synchronous condenser and no thermal generation on line;
- For an Avalon Peninsula load between 335 MW and 461 MW one unit at Holyrood on line generating plus Holyrood Unit 3 operating as a synchronous condenser;
- For an Avalon Peninsula load between 461 MW and 535 MW two units at Holyrood on line generating; and
- For an Avalon Peninsula load beyond 535 MW all three units at Holyrood on line generating.

These limits provided optimal transfers given the historical east – west load splits and available hydroelectric generating capacity. With the shut down of two paper mills in central and western Newfoundland there is additional hydroelectric generating capability that can be delivered to the Avalon Peninsula. In essence the east – west load split has changed with the loss of the two industrial customers giving a requirement to transfer more central and western hydroelectric generation to the Avalon Peninsula prior to the start up of oil fired generation at Holyrood. There are two barriers to significant increases in the Bay d'Espoir East 230 kV transfer capabilities – voltage support and transmission line thermal limits.

Bay d'Espoir East 230 kV Voltage Support

The addition of the Vale Inco processing facility in Placentia Bay requires the decommissioning of the existing Long Harbour 230/46 kV Terminal Station and construction of a new 230/13.8 kV terminal station at the Vale Inco site. Decommissioning of the Long Harbour Terminal Station will remove the Long Harbour 46 kV, 24 MVAR capacitor bank from service. As this is an important part of the voltage support system for the Avalon Peninsula load, the capabilities of this capacitor bank must be relocated elsewhere in the system.

Load flow analysis has demonstrated that the Come By Chance Terminal Station is the preferred location for relocation of the displaced Long Harbour capacitor banks. Analysis has further demonstrated that increasing the size of the Come By Chance capacitor bank from a single bank to 4 x 38.35 MVAR, 230 kV banks provides additional transfer capabilities to the Bay d'Espoir East 230 kV transmission system. These new transfer capabilities are summarized as follows:

- For an Avalon Peninsula load of up to 335 MW Holyrood Unit 3 operating as a synchronous condenser and no thermal generation on line;
- For an Avalon Peninsula load between 335 MW and 517 MW one unit at Holyrood on line generating plus Holyrood Unit 3 operating as a synchronous condenser;
- For an Avalon Peninsula load between 517 MW and 617 MW two units at Holyrood on line generating; and
- For an Avalon Peninsula load beyond 617 MW all three units at Holyrood on line generating.

These increased transfer capabilities delay the start up on the second and third units at Holyrood in the fall and advance the shut down of the second and third units in the spring. The impact of the increased transfer limits is that average unit loadings on the Holyrood generators will increase, resulting in improved operating efficiency and reduced fuel consumption.

Unfortunately, the addition of the four capacitor banks at Come By Chance Terminal Station does not change the 335 MW transfer limit for the start of the first generator at Holyrood. The reason for this situation is that the Bay d'Espoir East 230 kV transmission system is thermally constrained at this loading and not voltage constrained, as is the case for start up of the second and third units at Holyrood.

Bay d'Espoir East 230 kV Thermal Constraints

As current flows through the conductor, the conductor will begin to heat. The combined effect of increasing the conductor current (i.e. power transfer), the ambient temperature and wind will cause the conductor to heat up and expand. As the conductor gets hotter and expands, it sags closer to the ground. To ensure a safe clearance between the conductor and ground, the conductor temperature must not exceed its design temperature. The combined current, ambient temperature and wind define the maximum load the transmission line can carry safely – the thermal limit. As the ambient temperature increases the transmission line transfer capability is reduced.

The original 230 kV transmission system was designed using a maximum conductor temperature of 50 °C. The transmission lines rebuilt as part of the Avalon Peninsula Transmission Line Upgrade Project have a maximum conductor temperature of 80 °C and therefore have higher transfer capabilities. Transmission lines TL201 (Western Avalon to Hardwoods), TL202 (Bay d'Espoir to Sunnyside), TL203 (Sunnyside to Western Avalon), TL206 (Bay d'Espoir to Sunnyside) and TL218 (Holyrood to Oxen Pond) have not been upgraded and must operate at a maximum conductor temperature of 50 °C.

An Avalon Peninsula load of 335 MW can occur during ambient temperatures of 15 ^{0}C. The combined effect of this temperature and system loading is overload of transmission lines TL202, TL203 and TL206 during line out contingencies to parallel transmission line paths. The solution to this thermal constraint is to upgrade TL202 and TL206, rebuild of TL203 and construct a third 230 kV transmission line from Bay d'Espoir eastward to Western Avalon.

Status of Bay d'Espoir East 230 kV Upgrades and New Construction

The application of four 230 kV capacitor banks at Come By Chance totaling approximately 150 MVAR increases the transfer capability of the Bay d'Espoir East 230 kV transmission system by approximately 60 MW for the start of the second unit at Holyrood and approximately 100 MW for the start of the third unit. The comparison of 150 MVAR for 100 MW of transfer capability demonstrates that the capacitor bank addition has reached the point of diminishing returns. That is to say, at this level of voltage support and resultant increase in transfer capability, the existing transmission system has reached its limit without future transmission line construction. While the capacitor bank addition is very useful for future voltage support, its short lead time and ease of construction makes it a short term solution to a long term problem. This is typical within the utility industry.

Increasing the transfer capabilities of transmission lines TL202 and TL206 between Bay d'Espoir and Sunnyside can be accomplished through the addition and/or modification of a number of steel structures on each transmission line. The modifications will bring the maximum conductor temperature to 75 °C, yielding transfer limits very close to the steel transmission lines[1] rebuilt during the Avalon Upgrade Project. A detailed review of thermal uprating of TL202 and TL206 has been completed and cost estimates prepared. A cost benefit analysis is required to assess the project. It is expected that the TL202/206 thermal uprate project will be submitted as part of NLH's next capital budget and five year plan for completion in years three or four.

The existing 230 kV transmission line TL203 (Sunnyside to Western Avalon) is an H-frame wood pole line. Increasing the operating temperature (thermal limits) of this line to increase its transfer capacity is questionable as the line is near end of life. Given the original design parameters of TL203, increasing the transfer capability of this line may require a complete rebuild. A new 45 km long steel tower transmission line would be constructed.

Rather than rebuild TL203, a new steel tower transmission line between Bay d'Espoir and Western Avalon is being considered. Detailed analysis of the Island Interconnected Transmission System has revealed that a new 230 kV transmission line between Bay d'Espoir and Western Avalon whether either the HVdc transmission line is built between Labrador and the Island, or if the Island were to remain electrically isolated. In the context of the HVdc interconnection, the new line is required for power system stability reasons. In the context of a continued isolated Island, the remaining hydroelectric developments such as Portland Creek, Island Pond and Round Pond are located in central and west while the load center is located on the Avalon Peninsula. The third 230 kV transmission line from Bay d'Espoir to the Avalon Peninsula is required to increase power transfers to the load center. One benefit of the third 230 kV transmission line is that combined with thermal uprating of TL202 and TL206 there appears to be sufficient transfer capability for single transmission line contingencies without having to rebuild TL203. Further analysis is required on this point to firm up the status of TL203. It is expected that the Bay d'Espoir to Western Avalon 230 kV transmission line addition project will be submitted as part of NLH's next capital budget and five year plan for completion in year five.

The existing 230 kV transmission line TL201 (Western Avalon to Hardwoods) is an H-frame wood pole line. Analysis has indicated that increased transfer capacity for this

[1] TL207 (Sunnyside to Come By Chance), TL237 (Come By Chance to Western Avalon), TL217 (Western Avalon to Holyrood), TL242 (Holyrood to Hardwoods) and TL236 (Hardwoods to Oxen Pond)

line will be required in the 2017 time frame. The actual timing will depend upon the status of the HVdc transmission line and off Avalon Peninsula generation sources. Increasing the operating temperature (thermal limits) of this line to increase its transfer capacity is questionable as the line is nearing end of life. Given the original design parameters of TL201, increasing the transfer capability of this line may require a complete rebuild. A new 81 km long steel tower transmission line would be constructed.

Bay d'Espoir East 230 kV Power Transformers

Given the physical size of 230 kV power transformers, a mobile spare 230 kV transformer is not practical. As a result, NLH installs spare 230 kV power transformer capacity in its 230 kV terminal stations. The 2010 review of power transformer capacity revealed a need to increase power transformer capacity in the St. John's region. The Hardwoods and Oxen Pond Terminal Stations contain seven 230/66 kV power transformers with a total installed capacity of 641.8 MVA. The system is planned for the loss of one of the largest transformers in the Hardwoods – Oxen Pond loop. The St. John's region load continues to increase, resulting in the need to add a new 230/66 kV, 75/100/125 MVA power transformer at Oxen Pond Terminal Station. NLH and Newfoundland Power (NP) will be conducting a joint study this fall and winter to finalize the power transformer requirement, the impact on NP's 66 kV transmission system and the impact the transformer addition will have on power system stability for short circuits on 66 kV transmission lines in the St. John's region. The fourth transformer at Oxen Pond is included in the NLH capital budget and five year plan with an expectation that it will be installed in the fall of 2012. Figure 2 provides a simplified single line diagram of the proposed addition and indicates the addition of a 230 kV bus tie circuit breaker as was completed in Hardwoods with the addition of T4 there. Given the criticality of the load supplied and the need to be able to take 230 kV equipment out of service for regular maintenance, a fourth 230 kV circuit breaker is being considered for this station to form a 230 kV ring bus.

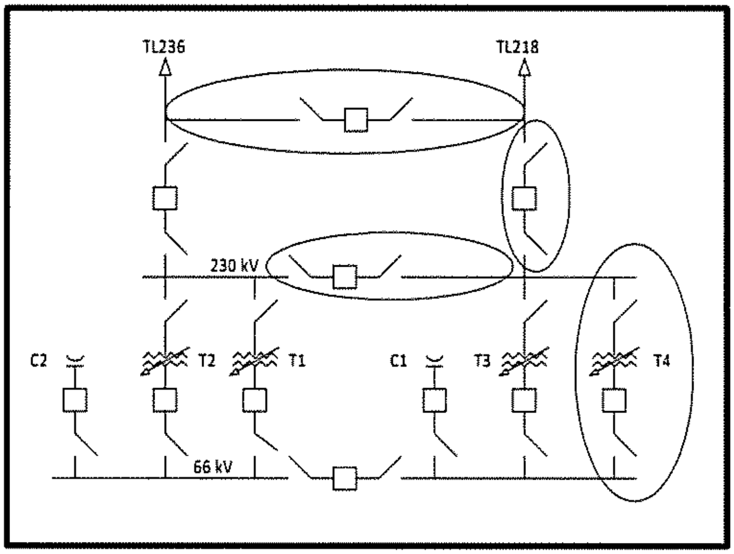

Figure 2 – Proposed Oxen Pond T4 Addition

Bay d'Espoir West 230 kV Transmission System

The 230 kV transmission system west of Bay d'Espoir is characterized as being a relatively light loaded system. During the peak load period a typical 230 kV system load west of Bay d'Espoir is on the order of 450 MW. The 230 kV line flows from Bay d'Espoir to the west total approximately 210 MW, with the remainder of the peak load being supplied by the Cat Arm and Hinds Lake Generating Stations and purchases from Non-Utility Generators. During a typical summer night, the loading on the 230 kV transmission system west of Bay d'Espoir will fall to approximately 115 MW.

The Bay d'Espoir – West 230 kV transmission system experiences significant voltage rise and subsequently high voltages during most of the year. The phenomenon of voltage rise along lightly loaded high voltage transmission lines is referred to as the "Ferranti Effect". Given the high voltages for most of the year, this portion of the 230 kV transmission system requires voltage support in the form of MVAR absorption in order to bring voltages down to a maximum acceptable level.

Voltage control equipment for voltage reduction on the Bay d'Espoir West 230 kV transmission system includes:

- Operation of the Stephenville combustion turbine in synchronous condenser mode;
- Operation of one, or both, of the Cat Arm generators in synchronous condenser mode at night; and
- Operation of Bay d'Espoir Unit 7 generator in synchronous condenser mode at night.

Bay d'Espoir West 230 kV Voltage Support

The closure of both the Stephenville and Grand Falls paper mills along with the idling of production capacity at the Kurger mill in Corner Brook has caused a reduction in the overall loadings on the Bay d'Espoir West 230 kV transmission system, particularly during the off-peak period between early spring and late fall. This reduction in loading has resulted in an increase in the number of hours that the Stephenville Gas Turbine has been required to operate as a synchronous condenser as well as the loading on the synchronous condenser when in operation. In addition to the increased operation of the synchronous condenser, beginning in April of 2009 NLH began removing 230 kV transmission line TL233 between Buchans and Bottom Brook Terminal Stations to assist with voltage reduction during light load (night time) conditions as operation of available synchronous condensers was no longer sufficient to reduce system voltages to within acceptable limits. The impact of removing TL233 from service is to, in effect, supply all load west of Buchans via a single radial 230 kV transmission system. Loss of the 230 kV transmission line TL228 between Buchans and Massey Drive Terminal Stations during this configuration would result in a loss of supply to all customers west of Buchans.

Analysis has indicated that the addition of a 230 kV, 30 MVAR shunt reactor at Bottom Brook Terminal Station will eliminate the need to remove TL233 for voltage control under normal operation and reduce the loading and operating hours on the Stephenville Gas Turbine as a synchronous condenser. The addition of the 230 kV, 30 MVAR shunt reactor for Bottom Brook Terminal Station is included in the current capital budget and five year plan.

The announcement of the HVdc Maritime Link between Newfoundland and Nova Scotia may alter the requirement for the 230 kV, 30 MVAR shunt reactor at Bottom Brook Terminal Station. With the Maritime Link completed, loading on the 230 kV transmission system west of Bay d'Espoir will be increased by as much as 500 MW. With this increased loading, existing high voltages on the west coast may be eliminated. As well, it is envisioned that the Maritime Link will utilize voltage source converter technology, which is well suited to controlling the ac system bus voltage at its connection point. AS a result further analysis is required to determine the requirement for additional voltage support equipment on the 230 kV system west of Bay d'Espoir.

Bay d'Espoir West 230 kV Thermal Constraints

There are no immediate concerns regarding the transfer capabilities of the Bay d'Espoir West 230 kV transmission system. The existing transmission system is capable of supplying west coast load during the loss of a single 230 kV transmission line.

Given the announcement of an HVdc interconnection between the west coast of Newfoundland and Nova Scotia, the Bay d'Espoir West 230 kV transmission system will require reinforcements in line with the HVdc system loading patterns. Preliminary analysis indicates that thermal overloading should not be an issue for HVdc exports on the order of 250 MW. However, depending upon loading patterns (load and time of year) potential overloads may be expected on TL211 (Massey Drive to Bottom Brook), TL228 (Buchans to Massey Drive) and TL232 (Stony Brook to Buchans) during loss of a 230 kV transmission line. Ongoing analysis will further define system constraints and requirements.

Status of Bay d'Espoir West 230 kV Upgrades and New Construction

At present there are no 230 kV line upgrades or no new 230 kV transmission line builds to increase the transfer capability of the Bay d'Espoir West 230 kV transmission system planned or budgeted.

Given the announced HVdc interconnection between the west coast of Newfoundland and Nova Scotia, the Bay d'Espoir West 230 kV transmission system will require reinforcements in line with the HVdc system loading patterns. The analysis is one of optimizing the HVdc interconnection point with the ac power system based upon the load requirements of the Maritimes. To date, with the HVdc converter station located at Bottom Brook Terminal station, a 230 kV transmission line between Granite Canal and Bottom Brook will be required. Depending upon loading patterns, upgrades to TL211, TL228 and TL232 may also be required.

Bay d'Espoir West 230 kV Power Transformers

Given the physical size of 230 kV power transformers, a mobile spare 230 kV transformer is not practical. As a result, NLH installs spare 230 kV power transformer capacity in its 230 kV terminal stations. The 2010 review of power transformer capacity revealed no immediate need for additional 230 kV transformer capacity in the Bay d'Espoir West 230 kV transmission system.

It should be noted that the Stephenville Terminal Station contains a single 230/66 kV, 40/553.3/66.6 MVA power transformer for the supply of NP customers in Stephenville and surrounding area. The terminal station itself is supplied from the Bay d'Espoir West 230 kV transmission system via a single 230 kV transmission line, TL209, from Bottom Brook. An integral part of the reliable supply to customers supplied by the Stephenville Terminal Station is the Stephenville Combustion Turbine. Under normal operation the combustion turbine is utilized in synchronous condenser mode to assist in voltage control of the Bay d'Espoir West 230 kV transmission system. For loss of the transmission line TL209 or loss of the single 230/66 kV power transformer at Stephenville Terminal Station the combustion turbine is operated in generate mode to supply the customers. The Stephenville combustion turbine is expected to reach end of life and be retired in 2024. Should the replacement combustion turbine be sited anywhere but at Stephenville, a second 230/66 kV power transformer, and possibly a second 230 kV transmission line, will be required for Stephenville Terminal Station.

Bay d'Espoir 230 kV Transmission System

The Bay d'Espoir 230 kV transmission system consists of two 230 kV transmission lines connecting up stream generating stations at Granite Canal and Upper Salmon to the Bay d'Espoir Terminal Station and bulk grid. Loss of transmission line TL234 (Upper Salmon to Bay d'Espoir) will result in loss of 124 MW of generation from the system. The existing under frequency load shedding scheme is used to rebalance the load and available generation on the Island for this event.

The proposed Island Pond development will be connected to the Bay d'Espoir 230 kV transmission system by routing existing transmission line TL263 (Granite Canal to Upper Salmon) into and out of the Island Pond Generating Station. The impact will be to increase to total generation connected to TL234 to approximately 160 MW. This would make the loss of TL234 second only to the loss of Holyrood Unit 1 or 2 as the most significant generation contingency on the Island. Detailed analysis is required prior to the commitment to build Island Pond to determine if water management and subsequent production of the combine plants up stream of Bay d'Espoir will exceed NLH's existing maximum unit loading criteria and necessitate a new 230 kV transmission line connection for the Bay d'Espoir 230 kV transmission system. Potential new lines include Granite Canal to Bottom Brook, Island Pond to Buchans or a second Upper Salmon to Bay d'Espoir line.

The proposed Round Pond development is also located in the Bay d'Espoir water system. At an 18 MW capacity it is proposed to build a 69 kV transmission line from the site to the Bay d'Espoir Terminal Station rather than grid tie at the 230 kV level.

AS noted in the Bay d'Espoir West 230 kV Transmission System section, the announced HVdc maritime Link will require the addition of a 230 kV transmission line between Granite Canal and Bottom Brook.

RADIAL SYSTEMS

Hydro operates a number of radial transmission systems at both the 138 kV and 66/69 kV voltage levels. These include:

- Great Northern Peninsula (66/69 kV and 138 kV);
- White Bay (69 kV);
- Seal Cove Road to Bottom Waters (138 kV);
- Boyd's Cove to Farewell Head (66 kV);
- Doyles – Port aux Basques (66 kV and 138 kV);
- Bottom Brook to Grandy Brook (138 kV);
- Bay d'Espoir to Barachoix (69 kV); and
- Burin Peninsula (138 kV).

Great Northern Peninsula

The Great Northern Peninsula (GNP) transmission system is the largest radial system operated by Hydro on the Island Interconnected Transmission System. The system consists of 348 km of 138 kV transmission line stretching from Deer Lake to St. Anthony Airport, an underlying 66 kV transmission system approximately 213 km in length from Deer Lake to Hawke's Bay and approximately 111 km of 69 kV transmission line connecting St. Anthony, Main Brook and Roddickton to St. Anthony Airport.

The very long 138 kV transmission system is susceptible to voltage rise under light load conditions. To this end 5 MVAR, 138 kV shunt reactors are used at Plum Point (two units) and Bear Cove (one unit) to reduce transmission voltages to within acceptable limits under light load conditions. Figure 3 provides a plot of the 138 kV shunt reactor in service times for the period December 2009 to December 2010. The graph indicates that all three reactors were in service for 92.8% of the year, two reactors were in service for 99.9% of the year and one reactor was in service for the entire year. A review of the outages to the GNP shunt reactors indicates that reactors were removed during lighter load conditions in the spring, summer and fall. These outages to shunt reactors are attributed to transmission line and terminal station equipment maintenance and not due to low voltages under heavier load conditions.

A substantial portion of the load on the GNP transmission system is located north of Hawke's Bay. Under peak load conditions there is a potential for a significant voltage drop over the length of the transmission system. To correct for low voltages on the system three 3 MVAR, 69 kV switched capacitor banks are employed at St. Anthony Airport Terminal Station. Additional voltage adjustment is provided by the On Load Tap Changers (OLTCs) on each of the 138/66 kV and 138/69 kV power transformers located in the system.

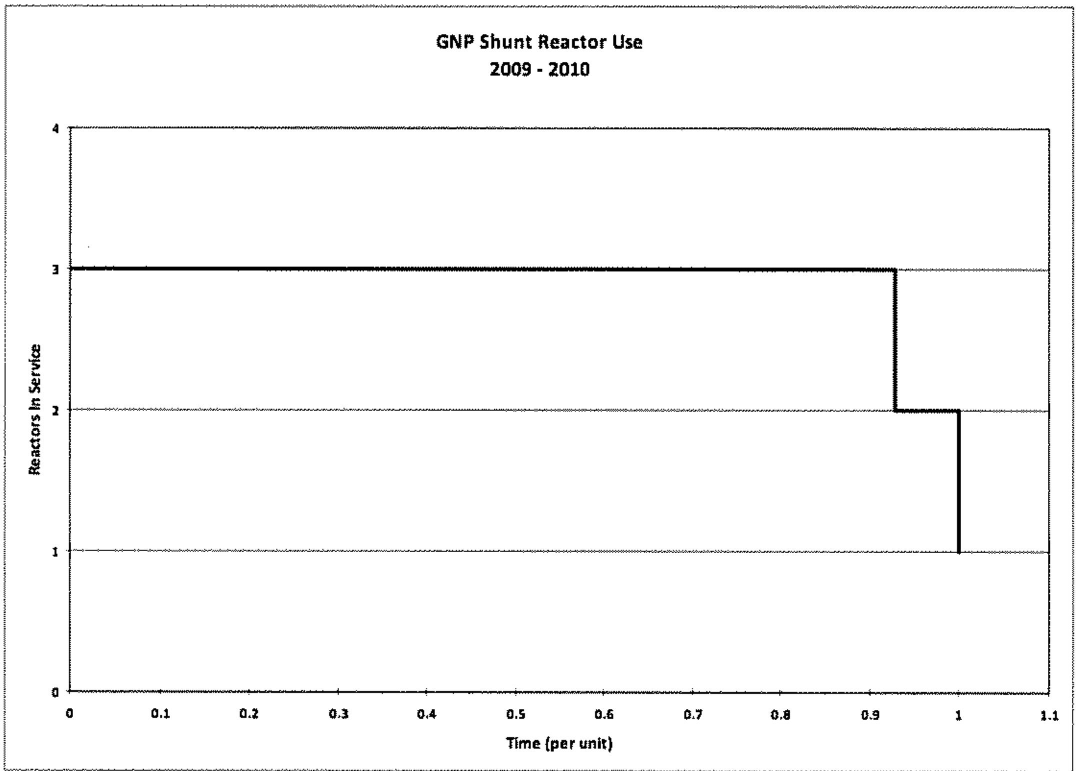

Figure 3 – GNP Shunt Reactor Use

Figure 4 provides a plot of the St. Anthony Airport shunt capacitor bank use for the period December 2009 to December 2010. The graph indicates that all three capacitor banks were in service for 5.2% of the year, two banks were in service for 58.4% of the year and at least one capacitor bank was in service for 94% of the year.

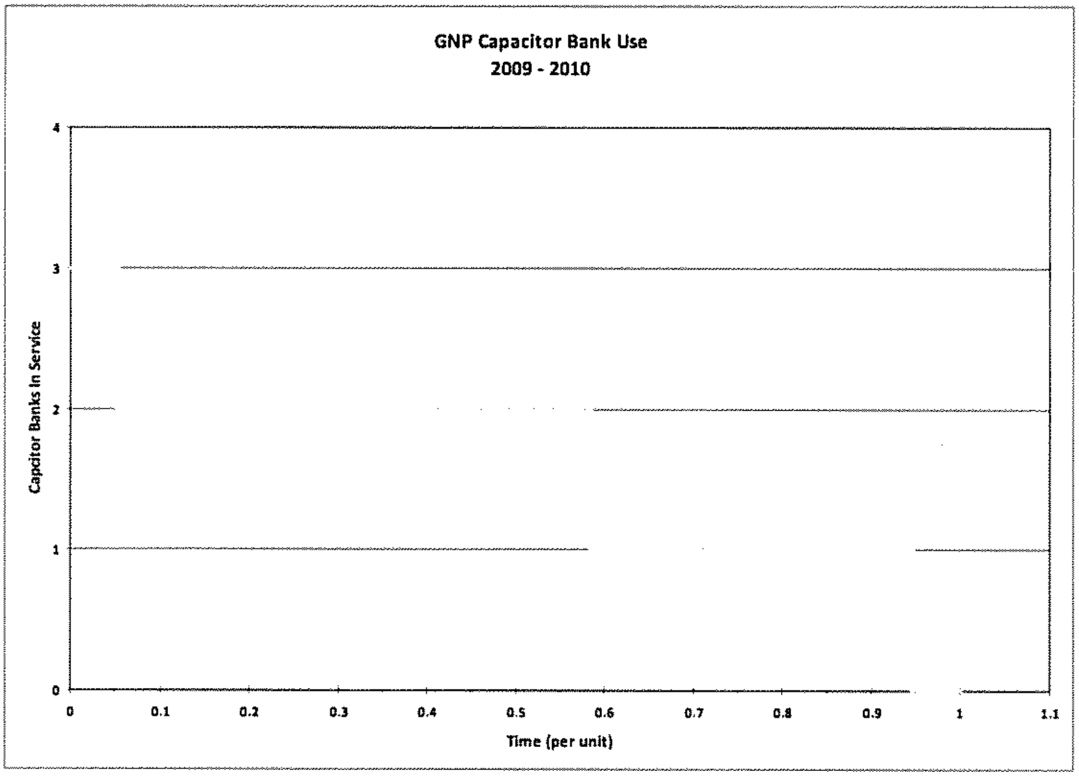

Figure 4 – GNP Shunt Capacitor Bank Use

To assess the effectiveness of the voltage control devices on the GNP, voltage duration curves for the 138 kV buses at Peter's Barren (PBN), Berry Hill (BHL), Plum Point (PPT), Bear Cove (BCV) and St. Anthony Airport (STA) Terminal Station were plotted for the period December 2009 to December 2010. Figure 5 provides the 138 kV voltage duration curves. Based upon the hourly data from the Hydro EMS, all 138 kV system voltages on the GNP fell within the transmission planning voltage criteria for normal operation during the year.

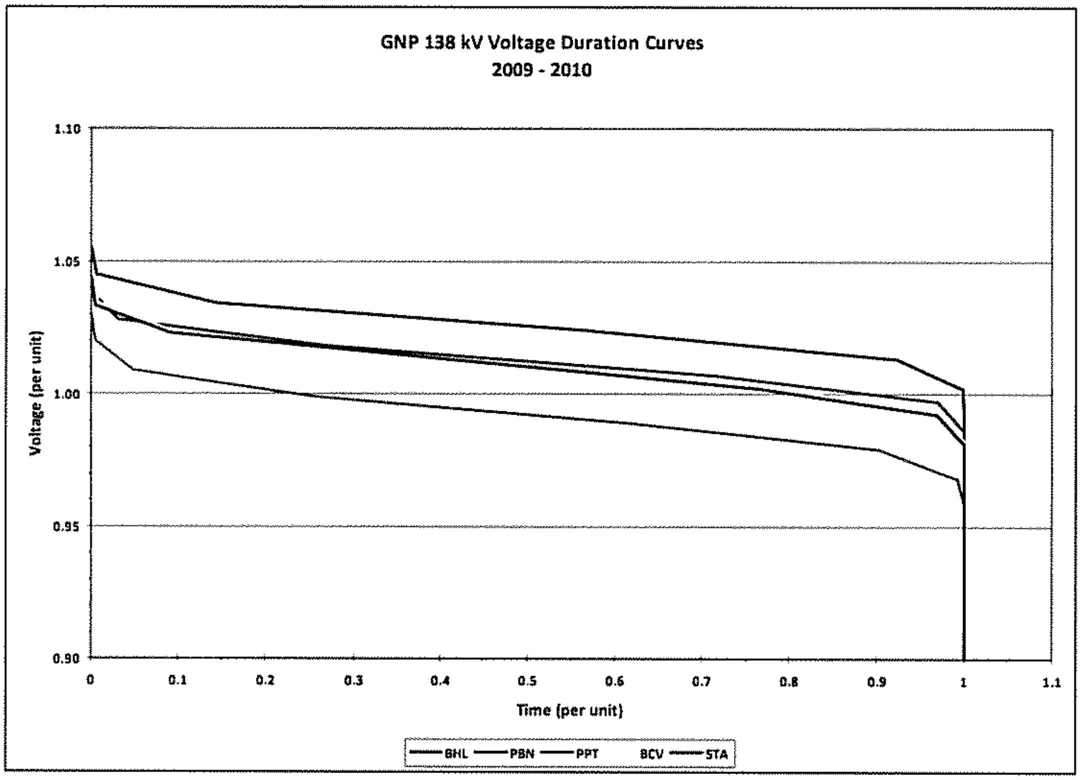

Figure 5 – GNP 138 kV Voltage Duration Curves

Based on the Market Analysis 2010 Fall Forecast, there is an expected 363 kW load growth on the GNP between 2011 and 2016. Based on this estimate of load growth and the existing voltage support usage, transmission reinforcements on the GNP are not anticipated in the foreseeable future.

White Bay

The White Bay system consists of 112.9 km of 69 kV transmission line from Howley Terminal Station to Coney Arm Terminal Station. The 69 kV system is supplied by a 138/69 kV, 7.5/10/12.5 MVA power transformer at Howley. The system also connects the 4 MW non utility generator Rattle Brook. Total peak load on the system equals 3.98 MW. The Market Analysis Fall 2010 load forecast indicates a peak load of 3,986 kW in 2011 with no increase in load forecast out to the year 2016. Based upon the transfer capacity of this system, and the lack of load growth, transmission system reinforcements for the White Bay 69 kV system are not anticipated in the foreseeable future. Figure 6 provides a load flow plot of the 2016 peak load case for White Bay with the Rattle Brook generator out of service. The case demonstrates acceptable voltages throughout the White Bay system for the year 2016.

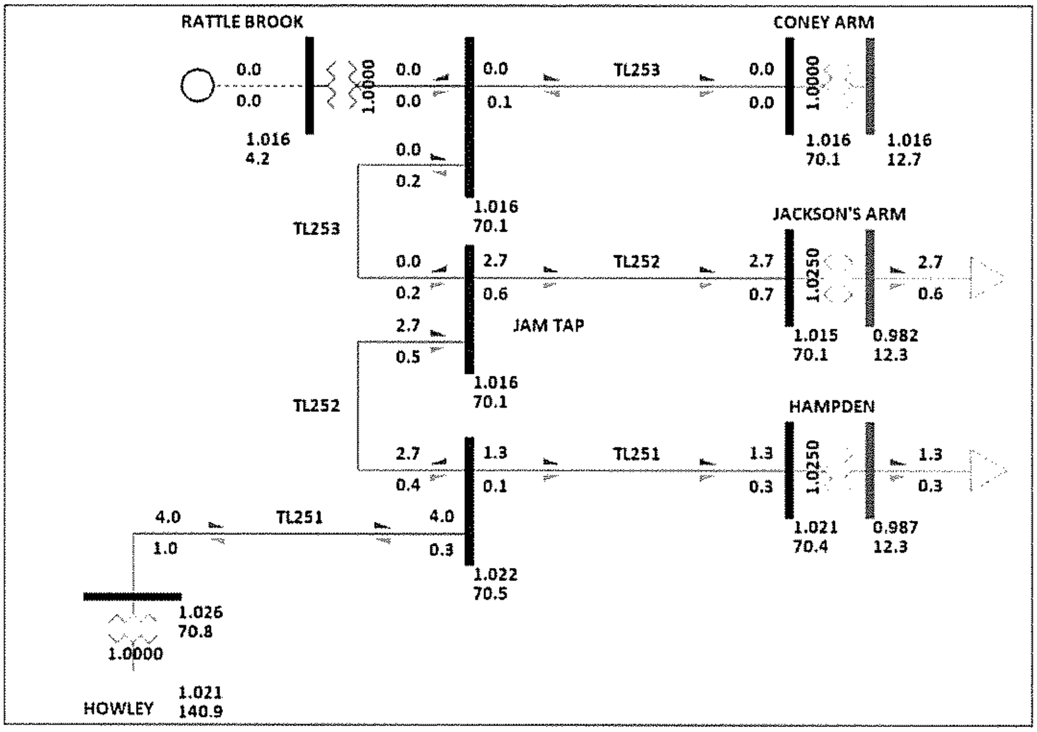

Figure 6 – White Bay System – 2016 Peak – Rattle Brook Off

Seal Cove Road to Bottom Waters

Hydro operates a 36 km long 138 kV radial transmission system from Newfoundland Power's Seal Cove Road Substation to the Hydro Bottom Waters Terminal Station on the Baie Verte Peninsula. In turn, the Seal Cove Road Substation is connected radially to the bulk system via a 62.8 km long 138 kV transmission line to Hydro's Indian River Terminal Station. The Indian River Terminal Station is situated on the Deer Lake to Stony Brook 138 kV loop.

The 2016 forecast for the Bottom Waters distribution system is 12.9 MW. The terminal station contains a 138/25 kV, 10/13.3/16.7 MVA power transformer. As a result, transformer overload is not a concern for the foreseeable future. Figure 7 provides a plot of the 2016 peak load case for the Bottom Waters system and demonstrates that there are no foreseeable voltage issues on this radial transmission system.

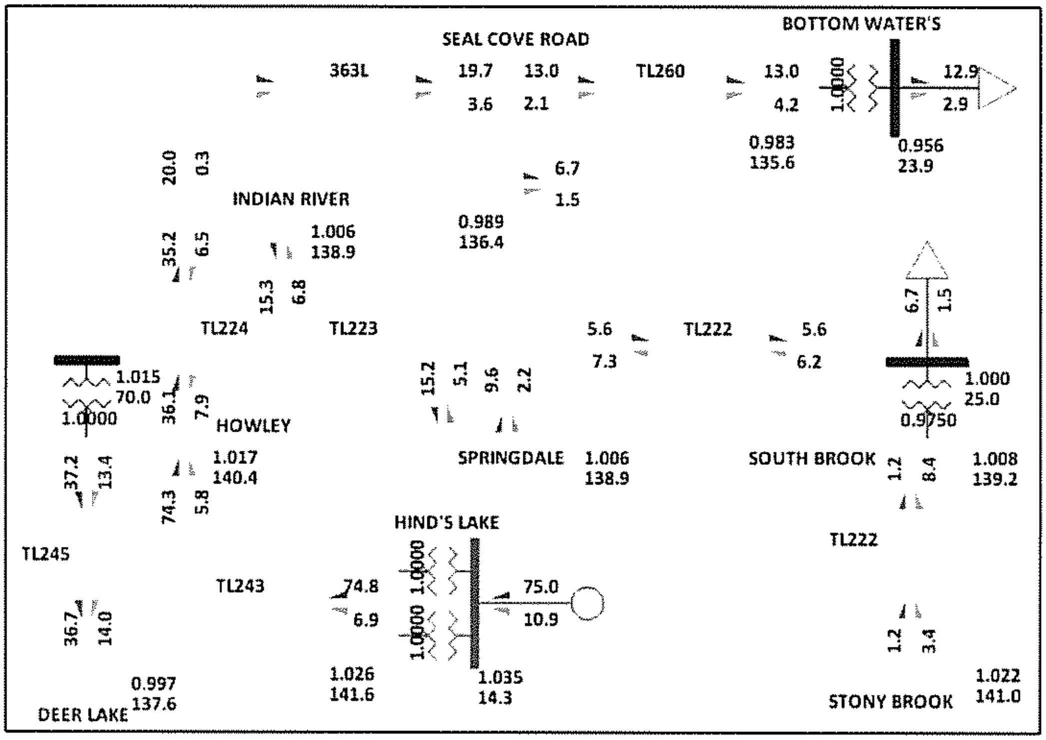

Figure 7 – Bottom Waters System – 2016 Peak

Boyd's Cove to Farewell Head

Hydro operates an 18.9 km long 66 kV radial transmission system from Newfoundland Power's Boyd's Cove Substation to the Hydro Farewell Head Terminal Station in Gander Bay. Under normal operation the Boyd's Cove Substation is connected radially via 66 kV transmission lines to Newfoundland Power's 138/66 kV Cobb's Pond Substation near the town of Gander. The Farewell Head Terminal Station is the supply point for Hydro's distribution systems on both Change Islands and Fogo Island.

The 2016 forecast for the Farewell Head distribution system is 6.3 MW. This load is well within the capacity of the 138/25 kV, 10/13/3/16.7 MVA power transformer installed at Farewell Head. Load flow analysis of ht system indicates that there are no expected transmission voltage issues within the planning horizon.

Doyles – Port Aux Basques

The Doyles – Port aux Basques system consists of a 118.3 km long 138 kV transmission line between Bottom Brook and Doyles Terminal Stations and a 27.3 km long 66 kV transmission line between Doyles Terminal Station and Newfoundland Power's Grand Bay Terminal Station. Hydro also operates a 3 MVAR, 66 kV capacitor bank at Grand Bay. Newfoundland Power maintains a 5 MW mobile combustion turbine at Grand Bay and operates a 7.6 MVA hydroelectric generator at Rose Blanche Brook.

The forecast peak for the system is 31.9 MW which is well within the capabilities of the 230.138 kV, 25/33.3/41.7 MVA supply transformer at Bottom Brook Terminal station with the Rose Blanche Brook hydro unit out of service. The expected loading on the Doyles 138/66 kV transformer equals 32.5 MVA with the Rose Blanche Brook hydro unit out of service over peak. This loading is well within the transformer rating of 25/33.3/41.7 MVA.

Hydro has been experiencing gas leakage issues on the Grand Bay 66 kV capacitor bank circuit breaker in the recent past. This gas leakage has resulted in the capacitor bank being unavailable for voltage support on the system. The Grand Bay capacitor bank was installed on the system for voltage support over peak in 1983. At that time the transformer at Doyles was a 138/66 kV, 15/20/25 MVA unit without an on load tap changer. With the change out of Dolyes T1 to a larger unit with an on load tap changer and the addition of the Rose Blanche Brook hydro plant by Newfoundland Power, the requirement for the Grand Bay capacitor bank has been greatly diminished. Consequently, a review in 2010 has indicated that the Grand Bay capacitor bank can be removed from service, rather than replace the problematic 66 kV circuit breaker. The long term plan for voltage support on the Doyles – Port Aux Basques system when load grows beyond the capabilities of the remaining voltage support equipment is to install distribution class capacitor banks on appropriate distribution feeders within Newfoundland Power's system.

Figure 8 provides a load flow plot of the Doyles – Port Aux Basques system over peak with the Rose Blanche Brook Hydro unit and the Grand Bay capacitor Bank out of service. The results indicate acceptable voltage levels and equipment loadings for the foreseeable future.

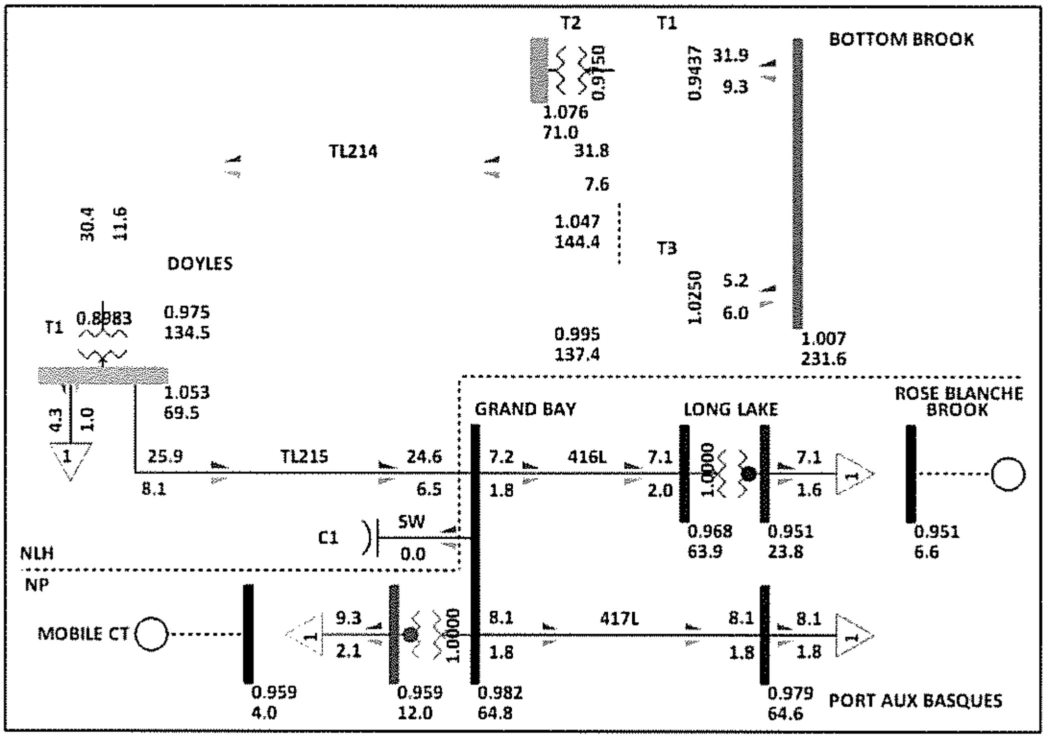

Figure 8 – Doyles – Port Aux Basques System at Peak

Bottom Brook to Grandy Brook

Originally built in 1987 as part of the 138 kV transmission system to supply the Hope Brook gold mine, the Bottom Brook to Grandy Brook system consists of a 123.2 km long 138 kV transmission line between Bottom Brook and Grandy Brook Terminal Stations. The system is supplied by a 230/138 kV, 25/33.3/41.7 MVA transformer, T3, at Bottom Brook. At Grandy Brook the distribution system is supplied by a 138/25 kV, 7.5/10/12.5 MVA transformer. The 2016 forecast load for the system is 5.16 MW, well within the capabilities of the transmission system. Analysis indicates that there are no transmission issues on this system for the foreseeable future.

Bay d'Espoir to Barachoix

The Bay d'Espoir to Barachoix system consists of 63.1 km of 69 kV transmission line and three 69 kV terminal stations at Conne River, English Harbour West and Barachoix. The system is supplied by two 230/69 kV transformers rated 15/20/25 MVA each with on load tap changers for voltage regulation. The system also contains a 69/24 kV, 10/13.3/16.6 MVA transformer which is a supply of station service for Bay d'Espoir powerhouse number one and the local distribution system.

The total system load based on the 2016 load forecast is expected to reach 23.1 MVA. This is within the rating of a single 230/69 kV transformer during a single contingency. With less than 2 MVA of spare transformer capacity by 2016, 230/69 kV transformer monitoring for replacements will be required in the 10 to 15 year planning horizon.

Figure 9 provides a 2016 peak load plot of the Bay d'Espoir to Barachoix system. No voltage violations are anticipated in the near future. The plot does note an overload of the 69/12.5 kV, 2.5 MVA transformer at Conne River Terminal Station. A set of cooling fans will be added to this transformer in 2011 to increase the transformer rating to 3.33 MVA, thereby eliminating the transformer overload.

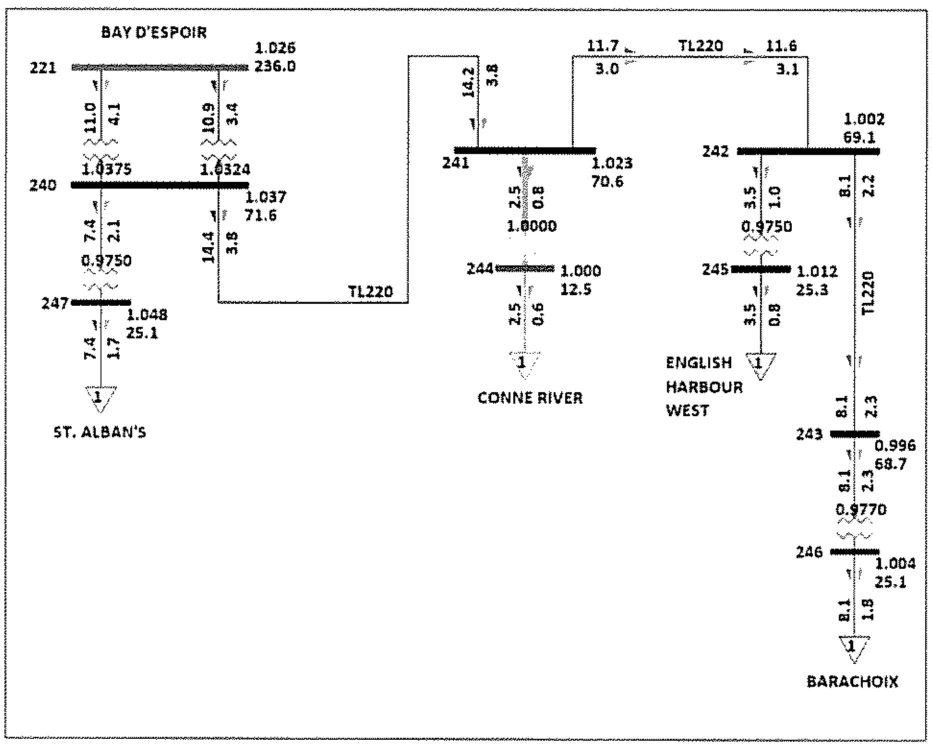

Figure 9 – Bay d'Espoir to Barachoix 2016 Peak

Burin Peninsula

Hydro operates two 138 kV transmission lines totaling approximately 294 km in length on the Burin Peninsula. In addition Hydro operates an 8 MW hydro plant at Paradise River that is connected to the 138 kV transmission system on the Burin Peninsula at Monkstown Terminal Station. The system is supplied from the Stony Brook Terminal Station via two 230/138 kV, 75/100/125 MVA transformers. These 230/138 kV transformers also supply the eastern end of the Stony Brook to Sunnyside 138 kV loop.

The forecast peak load for the system is expected to reach 73.3 MW during the five year planning horizon. This is within the thermal rating of each of Hydro's 138 kV transmission lines for the peak load period. Voltage support during 138 kV line outages during peak includes operation of the 25 MW combustion turbine at Greenhill and manual operation of the on load tap changers on the Sunnyside 230/138 kV transformers to provide maximum sending end voltages.

Figure 10 provides a load flow plot of the Burin system during the expected peak. There are no immediate issues for this system during the five year planning horizon.

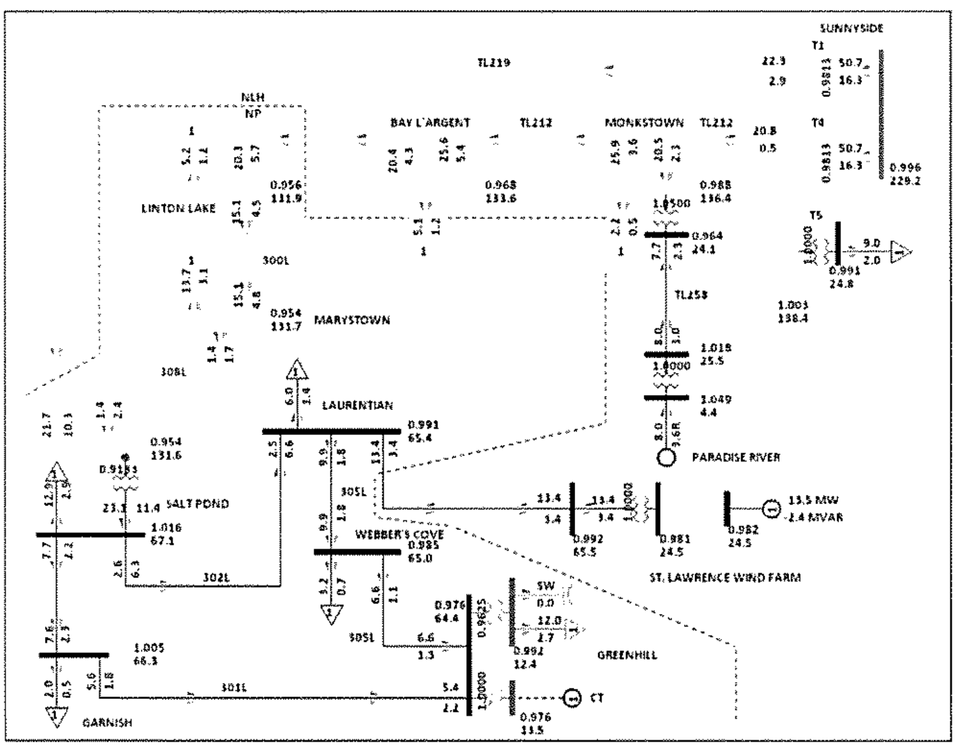

Figure 10 – Burin Peninsula System – 2016 Peak

LOOPED SYSTEMS

There are three 138 kV transmission loops within the Island Interconnected Transmission System. These 138 kV loops are connected to the 230 kV bulk system via multiple 230/138 kV transformers equipped with on load tap changers for voltage control along the 138 kV systems. The 138 kV loops include:

- Deer Lake to Stony Brook;
- Stony Brook to Sunnyside; and
- Holyrood to Western Avalon.

Deer Lake to Stony Brook

The Deer Lake to Stony Brook loop is supplied from a single 230/138 kV, 45/60/75 MVA transformer at Deer Lake and two 230/138 kV, 75/100/125 MVA transformers at Stony Brook. The 230/138 kV transformer at Deer Lake also connects the radial 138 kV transmission system on the Great Northern Peninsula to the bulk 230 kV system. The two 230/138 kV transformers at Stony Brook also supply the Stony Brook end of the Stony Brook to Sunnyside 138 kV loop. The 75 MW Hinds Lake Hydroelectric Generating Station is connected to this looped system at the Howley Terminal Station. The White Bay and Bottom Waters radial transmission systems are also connected to the Deer Lake to Stony Brook 138 kV loop. Hydro operates 224 km of 138 kV transmission line along the loop excluding the radial Bottom Waters system.

Total 2016 peak load for the Deer Lake to Stony Brook loop is expected to equal 43.1 MW. This is well within the capabilities of both the Deer Lake 230/138 kV transformer and the Hinds lake generator.

Transmission lines TL223 (Springdale to Indian River) and TL224 (Indian River to Howley) contain a relatively small conductor for 138 kV transmission. The conductor, 266.8 kcmil, 6/7 ACSR "OWL", has a 52.2 MVA thermal rating during summer time ambient temperature conditions. As a result, Hinds Lake output may have to be reduced during 138 kV line outages in the region. This is not viewed as a severe constraint given the relatively light system loading conditions during the summer months and the subsequent availability of other hydraulic resources to permit redispatch of Hinds Lake.

Stony Brook to Sunnyside

The Stony Brook to Sunnyside 138 kV loop is supplies by two 230/138 kV, 75/100/125 MVA transformers at each end. The 230/138 kV transformers at Sunnyside also supply the 138 kV system on the Burin Peninsula. Hydro operates one 138 kV transmission line, TL210, between Stony Brook Terminal Station and Newfoundland Power's Cobb's Pond Substation. The remainder of the transmission lines in the 138 kV loop are owned and operated by Newfoundland Power.

Total load in the Stony Brook to Sunnyside loop is expected to reach 243 MW by 2016. The 230/138 kV transformers within the loop are also exposed to the Burin Peninsula load of 73 MW. Netting off the St. Lawrence Wind Farm and Paradise River Hydroelectric Generating Station the 230/138 kV transformers within this loop will be required to supply a net load of 297.3 MW under normal operation by 2016.

For loss of a single 230/138 kV, 75/100/125 MVA transformer in the loop, Newfoundland Power combustion turbines at Greenhill (25 MW) and Wesleyville (12.7 MW) are started to reduce the loading on the remaining units. Analysis of the 2016 peak load case indicates that for loss of a 230/138 kV transformer at Stony Brook the remaining Stony Brook transformer will be overloaded even with both the Greenhill and Wesleyville combustion turbines in service. Opening the 138 kV loop between Cobb's Pond and Gander Substations will reduce the loading on the remaining Stony Brook transformer to 102% of its rating. However, this action will increase the loading on the Grand Falls 138/66 kV transformer to 105% of rating. The resultant 138 kV bus voltage at Gander is expected to equal 0.91 p.u., just above the minimum 0.90 p.u. voltage criteria for the contingency. As a result, modifications to the Stony Brook to Sunnyside loop can be expected in the ten year planning horizon. Discussions with Newfoundland Power on this loop are warranted in the coming year. Figure 11 provides a load flow plot of the overload case.

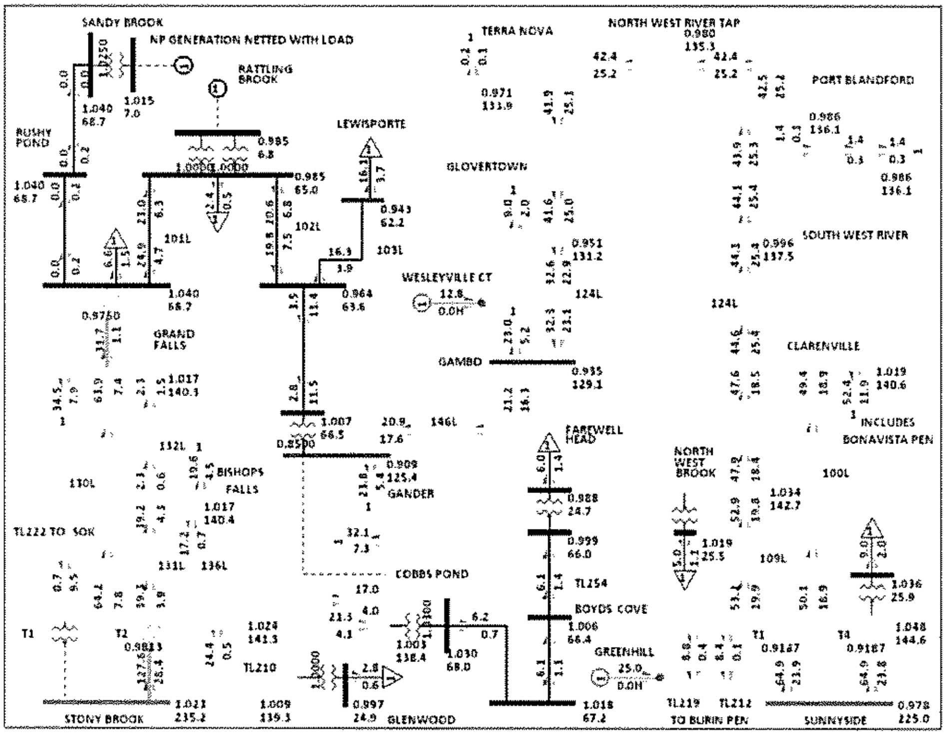

Figure 11 – Stony Brook to Sunnyside 138 kV Loop – STB T1 Out – 2016 Peak

Holyrood to Western Avalon

All transmission lines within the Holyrood to Western Avalon loop are owned by Newfoundland Power. Hydro supplies the loop from its Holyrood and Western Avalon Terminal Stations using four 230/138 kV, 25/33.3/41.7 MVA (two at each end) and two 230/138 kV, 75/100/125 MVA transformers (one at each end). The Western Avalon Terminal Station also supplies an underlying 66 kV transmission system owned by Newfoundland Power via two 230/66 kV, 15/20/25 MVA transformers.

There are no emergency generators located in the Holyrood to Western Avalon loop. Consequently, the must be sufficient installed transformer capacity to supply the load over peak with one of the largest units (i.e. 75/100/125 MVA) out of service. The 2016 forecast peak for the 138 kV loop is 119.8 MW. Given a firm 230/138 kV transformer capacity of 291.8 MVA, transformer overloading in the Holyrood to Western Avalon 138 kV loop is not anticipated in the foreseeable future.

SUMMARY

Newfoundland and Labrador Hydro owns and operates 1608 km of 230 kV transmission line, 1231 km of 138 kV transmission line, 634 km of 66/69 kV transmission line and 52 high voltage terminal stations on its Island Interconnected Transmission System.

The Bay d'Espoir East 230 kV transmission system consists of eleven 230 kV transmission lines totaling 627 km in length. This portion of the system is characterized as being a heavily loaded transmission system which experiences significant voltage drop during peak load conditions. Shunt capacitor banks at Long Harbour, Hardwoods and Oxen Pond Terminal Stations in addition to operation of the Hardwoods combustion turbine and Holyrood unit 3 in synchronous condenser mode provide the necessary voltage support to the Bay d'Espoir East 230 kV transmission system.

There are two barriers to significant increases in the transfer capabilities of the Bay d'Espoir East 230 kV transmission system including voltage support and transmission line thermal ratings.

The proposed nominal 150 MVAR, 230 kV shunt capacitor banks at Come By Chance Terminal Station not only replace the loss of the 24 MVAR shunt capacitor bank displaced with the decommissioning of the Long Harbour Terminal Station to facilitate the new Vale Inco processing facility, but also provides the necessary voltage support to defer the start up of the second and third units at Holyrood in the fall.

The requirement to start the first unit at Holyrood each fall is based upon the thermal limits of existing transmission lines in the Bay d'Espoir East 230 kV transmission system. Analysis to date indicates the viability of upgrading steel transmission lines TL202 and TL206 between Bay d'Espoir and Sunnyside to facilitate increased power transfers to the Avalon Peninsula. Further work is required to develop the cost benefit analysis of this alternate. It is expected that the thermal upgrades of TL202 and TL206 will be entered into next year's capital budget and five year plan.

Thermal upgrading of H-frame wood pole transmission line TL203 is not viewed as viable given that the line is reaching end of life and a complete rebuild to a steel tower transmission line may very well be necessary to increase its transfer capability.

The construction of a third 230 kV transmission line from Bay d'Espoir eastward to Western Avalon is necessary whether there is an HVdc link to Labrador or the Island remains electrically isolated. This third circuit shows promise of negating the need to rebuild TL203 in the near future. Further analysis is required on the specific timing of the third 230 kV transmission line. It is expected that this line will be entered into next year's capital budget and five year plan with a view to begin construction near the end of the five year plan.

Upgrading of H-frame wood pole transmission line TL201 is not viewed as viable given that the line is reaching end of life and a complete rebuild to a steel tower transmission line may very well be necessary to increase its transfer capability. Analysis indicates that rebuild of TL201 will be required in the 2017 time frame with the actual timing dependent upon the status of the HVdc transmission line and off Avalon generating resources.

A review of 230 kV power transformers in the Bay d'Espoir East 230 kV transmission system revealed a need to add a new 230/66 kV, 75/100/125 MVA power transformer at Oxen Pond Terminal Station to supply the load increases in the St. John's region. A joint review between Newfoundland and Labrador Hydro and Newfoundland Power is underway to assess need, timelines and impact on system additions and power system stability. It is expected that this new transformer will be required to be in service in the Fall of 2012.

The Bay d'Espoir West 230 kV transmission system consists of twelve 230 kV transmission lines totaling 855 km in length. This portion of the system is characterized as being a lightly loaded transmission system which experiences significant voltage rise during most load conditions. Operation of the Stephenville combustion turbine, Cat Arm generators and Bay d'Espoir Unit 7 in synchronous condenser mode has provided the necessary voltage support to the Bay d'Espoir West 230 kV transmission system.

The closure of both the Stephenville and Grand Falls paper mills along with the idling of production capacity at the Kurger mill in Corner Brook has caused a reduction in the overall loadings on the Bay d'Espoir West 230 kV transmission system, particularly during the off-peak period between early spring and late fall. This reduction in loading has resulted in an increase in voltage levels such that beginning in April of 2009 NLH began removing 230 kV transmission line TL233 between Buchans and Bottom Brook Terminal Stations to assist with voltage reduction during light load (night time) conditions as operation of available synchronous condensers was no longer sufficient to reduce system voltages to within acceptable limits. The impact of removing TL233 from service is to, in effect, supply all load west of Buchans via a single radial 230 kV transmission system. Loss of the 230 kV transmission line TL228 between Buchans and Massey Drive Terminal Stations during this configuration would result in a loss of supply to all customers west of Buchans.

Analysis has indicated that the addition of a 230 kV, 30 MVAR shunt reactor at Bottom Brook Terminal Station will eliminate the need to remove TL233 for voltage control under normal operation and reduce the loading and operating hours on the Stephenville Gas Turbine as a synchronous condenser. The addition of the 230 kV, 30 MVAR shunt reactor for Bottom Brook Terminal Station is included in the current capital budget and five year plan. The shunt reactor is scheduled to be in service in 2013. The recent announcement of an HVdc transmission link between Bottom Brook and Lingan, Nova Scotia (The maritime Link) has the potential to assist with voltage control on the west coast. As a result, should VSC based technology for the HVdc system be used, the need for a 30 MVAR shunt reactor at Bottom Brook may be eliminated. Consequently, it is recommended that the timing of the Bottom Brook shunt reactor be delayed one year to assess the impacts of the HVdc Maritime Link on west coast voltage control.

A review of 230 kV power transformers in the Bay d'Espoir West 230 kV transmission system revealed no immediate need for 230 kV transformer additions. Of note is the fact that the Stephenville Combustion Turbine provides back up to the Stephenville 230/66 kV transformer during a transformer outage. The Stephenville Combustion Turbine will reach end of life in the 2023 – 2024 time frame. A decision to locate a replacement combustion turbine at a site other than Stephenville will have to consider the addition of a second 230/66 kV power transformer for Stephenville.

The Bay d'Espoir 230 kV transmission system consists of two 230 kV transmission lines that connect up stream generating stations to the Bay d'Espoir Terminal Station and bulk grid. The proposed addition of the Island Pond development into the Bay d'Espoir 230 kV transmission system will increase the amount of generation connected to the grid via a single transmission line. A detailed assessment of the reliability impacts is required prior to the release of the Island Pond development for construction.

Hydro operates eight radial transmission systems on the Island Interconnected Transmission System. A review of these systems indicate that given changes in the Doyles-Port Aux Basques system in the past 10 to 15 years, the 3 MVAR, 66 kV capacitor bank located at Grand Bay is no longer required for voltage support on the system. Rather than replace the capacitor bank circuit breaker that has been experiencing substantial SF_6 gas leaks this past year, it is recommended that the circuit breaker and capacitor bank be removed from service. The only other issue noted on the radial systems is the overloading of the Conne River 69/12.5 kV, 2.5 MVA transformer. A budget proposal has been submitted to increase the rating of this transformer to 3.3 MVA through the addition of a set of cooling fans in 2012.

The Island Interconnected Transmission System includes three 138 kV looped systems. Hydro owns varying amounts of transmission equipment in each of these loops and is the supplier to the loops via 230/138 kV transformers. A review of the loops indicates potential overloading of the 230/138 kV transformers in the Stony Brook to Sunnyside loop in the 2016 time frame for loss of a single 230/138 kV, 75/100/125 MVA transformer. Discussions with Newfoundland Power in the coming year are warranted to address the issue and mitigation solutions.