newfoundland labrador hydro
a nalcor energy company

Hydro Place. 500 Columbus Drive.
P.O. Box 12400. St. John's. NL
Canada A1B 4K7
t. 709.737.1400 f. 709.737.1800
www.nlh.nl.ca

October 22, 2013

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

ATTENTION: Ms. Cheryl Blundon
Director of Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: An Application by Newfoundland and Labrador Hydro (Hydro) pursuant to Subsection 41 (3) of the Act for the approval of the replacement of a generator main breaker at Hinds Lake.

Please find enclosed the original and eight copies of the above-noted Application, plus supporting affidavit, project proposal, and draft order.

The work was initiated as an operating project, and identified as capital once the work was under way. The work consists of replacing the original air blast 13.8KV, 4000A 60Hz generator main breaker. The main unit breaker at Hinds Lake is critical to the operation of the generating unit, and required either overhaul or replacement. Replacement is the least cost option, as identified in the attached report.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Geoffrey P. Young
Legal Counsel

GPY/jc

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Thomas Johnson – Consumer Advocate
Thomas O'Reilly, Q.C. - Cox & Palmer

IN THE MATTER OF the *Electrical Power Control Act,* R.S.N.L. 1994, Chapter E-5.1 (the EPCA) and the *Public Utilities Act*, R.S.N.L. 1990, Chapter P-47 (the Act), and regulations thereunder;

AND IN THE MATTER OF an Application by Newfoundland and Labrador Hydro (Hydro) pursuant to Subsection 41(3) of the *Act*, for the approval of the replacement of a generator main breaker at Hinds Lake.

TO: The Board of Commissioners of Public Utilities (the Board)

THE APPLICATION OF NEWFOUNDLAND AND LABRADOR HYDRO (Hydro) STATES THAT:

1. Hydro is a corporation continued and existing under the *Hydro Corporation Act, 2007*, is a public utility within the meaning of the Act and is subject to the provisions of the *Electrical Power Control Act, 1994*.

2. Hydro's fleet of hydraulic generating units includes 75 MW of generation at Hinds Lake. The Hinds Lake generating station is an essential part of the Island Interconnected System. A critical component of the Hinds Lake generating station is the generator main breaker, which electrically connects the Hinds Lake hydraulic generator to the transmission system.

3. The main unit breaker has developed several worn and deteriorated parts, requiring overhaul or replacement to ensure system reliability. Failure of the

breaker to trip upon unit shut down or when a trip pulse is issued poses a major hazard to personnel and equipment. Hydro is recommending replacement of the breaker as this is the least cost option over the long term. Details regarding Hydro's proposal to replace the breaker are contained in the attached project proposal document.

4. The completion of this breaker replacement at Hinds Lake is required to ensure that Hydro can continue to provide safe, reliable and adequate service from this essential facility.

5. The estimated cost of this project is $388,700.

6. The Applicant submits that the proposed capital works and expenditures are necessary to ensure that this generation facility can continue to provide service which is reasonable safe and adequate and just and reasonable as required by Section 37 of the *Act*.

7. Therefore, Hydro makes Application that the Board make an Order approving, pursuant to Subsection 41(3) of the *Act*, the capital expenditure of $388,700 for the replacement of a breaker at Hinds Lake as set out in this Application and in the attached project description and justification document.

DATED at St. John's, in the Province of Newfoundland and Labrador, this 22nd day of October, 2013.

Geoffrey P. Young
Counsel for the Applicant
Newfoundland and Labrador Hydro
500 Columbus Drive P.O. Box 12400
St. John's, Newfoundland and Labrador
A1B 4K7
Telephone: (709) 737-1277
Facsimile: (709) 737-1782

Project Title: Replace Generator Main Breaker

Location: Hinds Lake

Category: Generation - Hydraulic

Type: Other

Classification: Normal

Project Description:

This project is to replace the original air blast 13.8 kV, 4000A 60Hz generator main breaker. The generator main breaker connects the Hinds Lake generator to the Island Interconnected transmission system. The breaker is operated every time the unit is turned on or off. This breaker is also a critical device for both the protection of the generator step-up transformer in the event of a generator-fed short-circuit current and for the generator in the event of a system-fed short circuit current during starting, synchronization and normal operation. The breaker is used to interrupt extremely high current flows in the event of an electrical fault. There is no redundancy for the main generator breaker and it is essential for the operation of the Hinds Lake hydraulic unit.

The existing breaker consists of three separate air blast breakers (one per phase) and will be replaced with one three-phase vacuum breaker. This breaker will be located inside the existing cabinet. Due to the change from three single phase breakers to one three-phase breaker, modifications need to be made to the cabinet and electrical bus bars to install the new breaker.

Originally, this project was considered a 2013 operating project. During an internal operating projects audit, it was identified that this project meets the guidelines for a capital project, thus requiring this supplemental capital budget application. Given that it was an operating project, work is in progress, and the contract to purchase and install the breaker was awarded earlier in the year. The long lead items have been manufactured with scheduled installation to occur during the Hinds Lake annual outage in November 2013. This

project needs to happen at this time to ensure reliable generation through the upcoming winter operating season. The two failures in 2011 that are described below illustrate the risks associated with continuing to operate the Hinds Lake hydraulic generating unit with the existing breaker.

Project Cost:*($ x1,000)*	2013	2014	Beyond	Total
Material Supply	321.3	0.0	0.0	321.3
Labour	37.3	0.0	0.0	37.3
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	11.6	0.0	0.0	11.6
Interest and Escalation	0.0	0.0	0.0	0.0
Contingency	18.5	0.0	0.0	18.5
TOTAL	**388.7**	**0.0**	**0.0**	**388.7**

JUSTIFICATION

The main unit breaker at Hinds Lake is a critical component for supplying generation to the Island Interconnected System. Extended outage time and system reliability (particularly during the winter operating season) would be experienced when problems are experienced with this breaker. The existing air blast unit breaker at Hinds Lake has reached its reliable operational life. Over time, due to the high number of annual operations, this breaker has developed several worn and deteriorated parts. The Hinds Lake unit averaged 234 starts annually between 2008 and 2012. This is only 15 starts per year less than the highest of all of Hydro's fleet of hydraulic generating units which average 134 starts per year. It has experienced recent failures which have highlighted the deteriorated state. In addition, an inspection report by the Original Equipment Manufacturer (OEM) in November 2011 identified 140 parts that required replacement to refurbish this breaker.

The main unit breaker at Hinds Lake is critical to the operation of the unit. It is operated to turn the unit on or off, as well as to isolate the unit from the system to prevent further damage in the event of an electrical fault on the generator or on the electricity grid. Failure of the breaker to trip upon unit shut down or when a trip is initiated from protection

devices poses a hazard to personnel and equipment.

Existing System

The existing breaker is original equipment and has been in service since the plant was commissioned in 1980. This hydraulic generating unit experiences a very high cycle rate, averaging 234 starts annually in the past five years. This generator main breaker operates every time the unit starts or stops. The average number of starts for the 13 major hydraulic units on the System is 134, with one unit averaging only four starts annually.

There have been no major upgrades or refurbishment of this breaker, however there was corrective repair work following equipment failures in 2012 and 2011, and there was a significant inspection by the OEM technician in 2011.

Table 1: Major Work or Upgrades

Year	Major Work/Upgrade	Comments
2011	Breaker major inspection by ABB (OEM)	Hydro was informed by the service technician that the breaker is about to enter the obsolete phase of its life-cycle, and required extensive parts replacement to operate reliably. Service and parts for this breaker would be discontinued by the OEM in the following year. It was decided to delay the parts replacement at that time for a planned project.

The Hinds Lake unit is cycled (on and off) to meet system generation and manage reservoir water levels. There were 1,174 unit starts from Jan 1, 2008 to Dec 31, 2012. This results in 468 breaker operations (open or close) in an average year.

Reliability Performance

Outage Statistics

There were two forced outages of the Hinds Lake generating unit in the past five years due to failures experienced with this breaker. The first was in April of 2010, and the second in

February of 2011. Both of these failures were the result of the breaker failing to open and the unit was forced off-line for multiple days each time for repairs. When the breaker fails to open, the transmission line is isolated at the Howley Terminal Station until the breaker can be manually opened. Over the past five years, all hydraulic generating units in Hydro's fleet averaged 2.54 forced outages annually.

Legislative or Regulatory Requirements

Legislative and regulatory requirements are not a factor in this application.

Safety Performance

Safety performance is not a factor in this application.

Environmental Performance

Environmental performance is not a factor in this application.

Industry Experience

Industry experience is not a factor in this application. This application is based on the condition of the existing equipment and its importance to the island electricity system.

Vendor Recommendations

During the 2011 inspection, the vendor technician recommended an extensive overhaul to the existing breaker. He provided a quotation for 140 (41 different) replacement parts at a combined cost of $101,780. The inspector informed Hydro that he could not guarantee the availability of these parts beyond a year as this breaker model was entering the obsolete phase of its life-cycle. He also indicated that the cost of these parts is approximately the same as a new breaker. This is supported by a spare parts price list from the supplier of the new breaker that quoted a spare breaker assembly for $97,750. These prices do not include project management, engineering, modification parts, or construction labour costs. These costs were initially estimated by Hydro to be similar.

Maintenance or Support Arrangements

Existing maintenance performed on the Hinds Lake main breaker is performed primarily by Hydro personnel. Significant inspections and overhauls are performed by manufacturer technicians.

Maintenance History

The five-year maintenance history for the Hinds Lake Main Generator breaker is shown in the following table:

Table 2: Five-Year Maintenance History

Year	Preventive Maintenance ($000)	Corrective Maintenance ($000)	Total Maintenance ($ 000)
2008	0.4	0.0	0.4
2009	0.1	0.0	0.1
2010	0.2	7.3	7.5
2011	0.3	26.2	26.5
2012	1.0	0.0	1.0

In 2010, there was one maintenance issue relating to the breaker failing to open. In 2011, there were two maintenance issues including the breaker failing to open, and the close indication malfunctioning. The OEM was also on site in 2011 to perform a major inspection on the breaker.

Historical Information

Hydro has no history with replacing 13.8 kV circuit breakers. The only two other similar breakers in the Hydro Fleet are located at Upper Salmon and Granite Canal. Both are younger plants that see significantly fewer operations annually.

Anticipated Useful Life

The anticipated useful life of a high voltage circuit breaker is 40 Years. The Hinds Lake unit experiences a high number of operations annually; therefore its useful life is less than the

useful life of the typical high voltage circuit breaker.

Forecast Customer Growth

Forecasted customer load growth is not a factor in this application.

Development of Alternatives

The alternatives were to replace the circuit breaker, or to overhaul the existing circuit breaker. Operating with the existing circuit breaker in its current condition was not considered for reliability reasons.

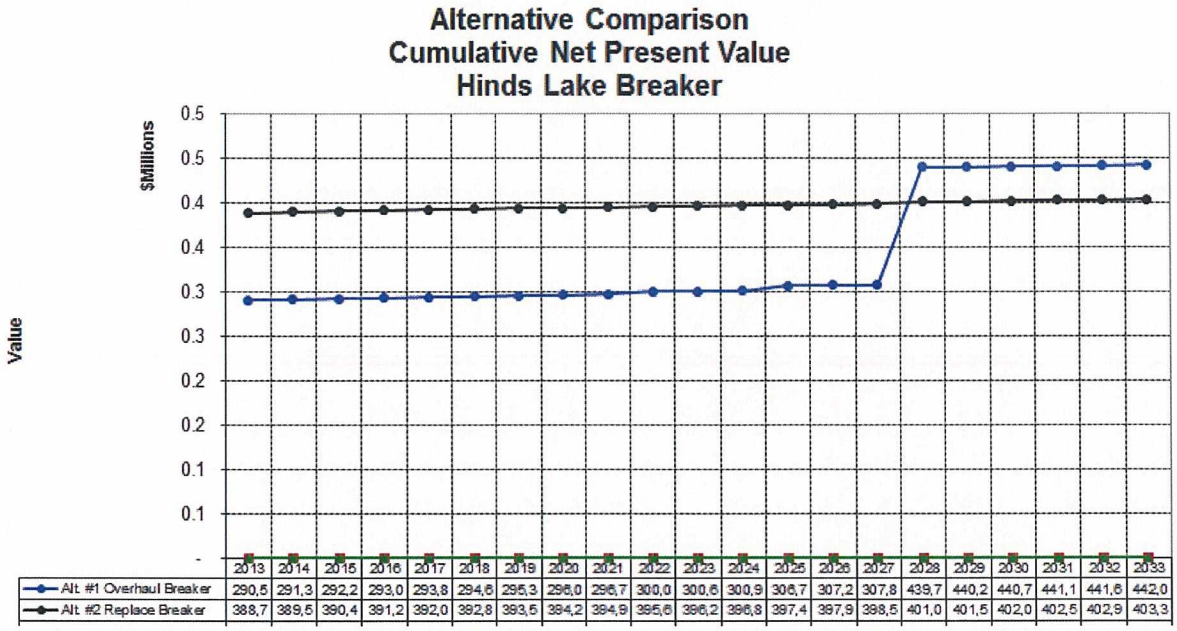
Evaluation of Alternatives

A Cost Benefit analysis was performed to compare overhauling with replacing the existing breaker. This analysis shows that when comparing these two alternatives over the 40 year service life that replacing the breaker is the least cost alternative.

Although the materials costs of both alternatives are similar, the estimated cost of the overhaul is lower than the cost of the replacement.

Table 3: Alternative Comparison – Cumulative Net Present Value

Replace Generator Main Breaker - Hinds Lake		
Alternative Comparison *Cumulative Net Present Value* *To The Year* 2053		
Alternatives	**Cumulative Net Present Value (CPW)**	**CPW Difference between Alternative and the Least Cost Alternative**
Alt. #1 Overahul Breaker	449,614	36,529
Alt. #2 Replace Breaker	413,085	0
Alt. #3 Description - Summary Table		
Alt. #4 Description - Summary Table		



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Alt #1 Overhaul Breaker	290,5	291,3	292,2	293,0	293,8	294,6	295,3	296,0	296,7	300,0	300,6	300,9	306,7	307,2	307,8	439,7	440,2	440,7	441,1	441,6	442,0
Alt #2 Replace Breaker	388,7	389,5	390,4	391,2	392,0	392,8	393,5	394,2	394,9	395,6	396,2	396,8	397,4	397,9	398,5	401,0	401,5	402,0	402,5	402,9	403,3

Energy Efficiency Benefits

Energy efficiency benefits are not a factor in this application.

CONCLUSION

The main unit breaker at Hinds Lake is a critical component for supplying generation to the Island Interconnected System. Extended outage time and system reliability (particularly during the winter operating season) have been experienced in the past when issues were experienced with this breaker. The existing air blast unit breaker at Hinds Lake has reached its reliable operational life and is worn due to the high number of operations. Replacing this breaker is more cost effective than overhauling the existing obsolete breaker when considering cost and remaining service life. Failure of the breaker to trip upon unit shut down or when a trip pulse is issued, poses a major hazard to personnel and equipment and hence, the breaker must be replaced.

Project Schedule

Table 4: Project Schedule

Activity		Start Date	End Date
Planning	Planning	January 2013	March 2013
Design	Design	February 2013	June 2013
Procurement	Breaker Procurement	April 2013	June 2013
Construction	Installation	October 2013	November 2013
Commissioning	Commissioning	November 2013	November 2013
Closeout	Project Closeout	November 2013	December 2013

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

AND IN THE MATTER OF an Application by Newfoundland and Labrador Hydro pursuant to Subsection 41(3) of the *Act*, for the approval of the replacement of a generator main breaker at Hinds Lake.

AFFIDAVIT

I, Robert J. Henderson, Professional Engineer, of St. John's in the Province of Newfoundland and Labrador, make oath and say as follows:

1. I am Vice-President of Newfoundland and Labrador Hydro, the Applicant named in the attached Application.

2. I have read and understand the foregoing Application.

3. I have personal knowledge of the facts contained therein, except where otherwise indicated, and they are true to the best of my knowledge, information and belief.

SWORN at St. John's in the Province of Newfoundland and Labrador this 22nd day of October 2013, before me:

Barrister – Newfoundland and Labrador

Robert J. Henderson

(DRAFT ORDER)
NEWFOUNDLAND AND LABRADOR
BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

AN ORDER OF THE BOARD

NO. P.U. __ (2013)

IN THE MATTER OF the *Electrical Power Control Act,* R.S.N.L. 1994, Chapter E-5.1 (the "EPCA") and the *Public Utilities Act*, R.S.N.L. 1990, Chapter P-47 (the *"Act"*), and regulations thereunder;

AND

IN THE MATTER OF an application by Newfoundland and Labrador Hydro for approval of the replacement of a generator main breaker at Hinds Lake pursuant to Subsection 41(3) of the Act.

WHEREAS Newfoundland and Labrador Hydro ("Hydro") is a corporation continued and existing under the *Hydro Corporation Act, 2007*, is a public utility within the meaning of the Act, and is subject to the provisions of the *EPCA;* and

WHEREAS Subsection 41(3) of the Act requires that a public utility not proceed with the construction, purchase or lease of improvements or additions to its property where:

a) the cost of construction or purchase is in excess of $50,000; or
b) the cost of the lease is in excess of $5,000 in a year of the lease,

without prior approval of the Board; and

WHEREAS in Order Nos. P.U. 2(2013) and P.U. 4(2013) the Board approved Hydro's 2013 Capital Budget; and

WHERAS the Board approved supplementary 2013 capital expenditures in:

(i) Order No. P.U. 1(2013) in the amount of $284,100 for the refurbishment of the stop logs at the Burnt Dam Spillway; and
(ii) Order No. P.U. 12(2013) in the amount of $5,198,000 for the refurbishment of the marine terminal at the Holyrood Thermal Generating Station; and
(iii) Order No. P.U. 14(2013) in the amount of $12,809,700 for the refurbishment and repairs to Unit 1 at the Holyrood Thermal Generating Station; and
(iv) Order No. P.U. 15(2013) in the amount of $3,823,600 for 2013 and $15,310,400 for 2014 to install additional 230 kV transformer capacity at the Oxen Pond Terminal Station; and

(v) Order No. P.U. 20(2013) in the amount of $8,015,800 for the replacement of the alternator on the Hardwoods Gas Turbine; and

WHEREAS on October 22, 2013 Hydro applied to the Board for approval to replace a generator main breaker at Hinds Lake Generating Station (the "Application"); and

WHEREAS the Board is satisfied that the 2013 supplemental capital expenditure for the replacement of a generator main breaker at Hinds Lake is necessary to allow Hydro to provide service and facilities which are reasonably safe and adequate and just and reasonable.

IT IS THEREFORE ORDERED THAT:

1. The proposed capital expenditure of $388,700 the replacement of a generator main breaker at Hinds Lake is approved.

2. Hydro shall pay all expenses of the Board arising from this Application.

DATED at St. John's, Newfoundland and Labrador, this day of , .

_____

_____

_____ _____