

August 23, 2018

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: Approval of Capital Expenditures Supplemental to Newfoundland and Labrador
Hydro's (Hydro) 2018 Capital Budget Application – Control System Between Mary's
Harbour Diesel Plant and St. Mary's River Hydro Plant**

Please find enclosed one (1) original and nine (9) copies of Hydro's Application, plus supporting affidavit, project proposal, and draft order.

Hydro previously purchased power from the Mary's Harbour River Hydro Plant (the Hydro Plant) from 1987 to 2007 until the plant ceased operations due to technical issues with the control system. A Power Purchase Agreement was signed in September 2017 between Hydro and the new owners of the Hydro Plant, St. Mary's River Energy Limited, for the sale and purchase of energy (the PPA). This fifteen year contract will allow Hydro to purchase energy from the Hydro Plant at 90% of the fuel cost required to produce energy at the Mary's Harbour Diesel Plant (the Diesel Plant). To facilitate the safe and reliable operation of the Mary's Harbour System and maximize energy sales from the customer owned Hydro Plant, updates to the communication and protection and control systems in the Diesel Plant are required.

This project is at the request of St. Mary's River Energy Limited who will be covering all costs associated with the required scope of work. The project is estimated to cost approximately \$195,500 and it is expected to take 16 weeks to complete. Completion of this project is recommended to fulfill Hydro's obligations as per the signed PPA, and to reduce the cost of energy production in Mary's Harbour by maximizing production of hydroelectric energy at St. Mary's River Hydro Plant.

Should you have any questions, please contact the undersigned.

Yours truly,

Newfoundland & Labrador Hydro



Michael Ladha
Legal Counsel & Assistant Corporate Secretary
MSL/sk

Encl.

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey
ecc: Larry Bartlett – Teck Resources Limited
Dean Porter – Poole Althouse

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

Denis Fleming – Cox & Palmer
Sheryl Nisenbaum – Praxair Canada Inc.

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 for approval to proceed with the construction and purchase of certain improvements and additions to its property pursuant to Section 41(3) of the Act.

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

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

A. Background

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 purchased power from the Mary's Harbour River Hydro Plant (the Hydro Plant) from 1987 to 2007, until the plant ceased operations due to technical issues with the control system. A Power Purchase Agreement was signed in September 2017 between Hydro and the new owners of the Hydro Plant, St. Mary's River Energy Limited (Generator Owner), for the sale and purchase of energy. The fifteen year contract will allow Hydro to purchase energy from the St. Mary's River Energy Limited Hydro Plant at 90% of the fuel cost required to produce energy at the Mary's Harbour Diesel Plant (the Diesel Plant).

3. The Hydro Plant will consist of a 175 kW generator located approximately 2.3 km from the Diesel Plant. Power will be delivered to the system through the distribution line next to the Hydro Plant that serves the town's water supply.

B. Application

4. The proposed project will establish a communications link with the Hydro Plant and integrate it with the controls system at the Diesel Plant, allowing the Diesel Plant to receive data from the Hydro Plant, set a maximum allowable power output for the Hydro Plant, and, if necessary, send an emergency shutdown signal to the Hydro Plant. Some modifications to the Diesel Plant protection settings are also anticipated in order to coordinate with the Hydro Plant.
5. The new control system will enable maximum output from the Hydro Plant, while avoiding forcing the Diesel Plant units to operate below 30% of their capacity, as per manufacturers' recommendations.
6. Hydro is recommending the approval of this fully contributed project by the Generator Owner, at the Generator Owner's request, that will realize maximized generation for the Hydro Plant and savings for Hydro customers on every kilowatt hour purchased from the Generator Owner through the optimized operation between the two generating plants.

7. The estimated capital cost of the project is \$195,500. This is a fully contributed project by the Generator Owner. The scope of work for this project is set out in the project description and justification document attached hereto as Schedule 1.

C. Justification and Relief Requested

8. Hydro submits that the proposed capital expenditures described in paragraphs 4 through 7 hereof, are necessary to ensure that Hydro can continue to provide service which is safe and adequate and just and reasonable as required by Section 37 of the Act.
9. Hydro therefore makes Application for an Order pursuant to section 41(3) of the Act approving capital expenditures associated with the purchase and construction of a control system between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant, at an estimated capital cost of \$195,500, all as set out in this Application and in the attached project description and justification document attached hereto as Schedule 1.

DATED at St. John's in the Province of Newfoundland and Labrador this 23rd day of August 2018.



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	Electrical
	Mechanical
	Civil
	Protection & Control
	Transmission & Distribution
	Telecontrol
	System Planning

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

August 2018

A Report to the Board of Commissioners of Public Utilities

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

1 **Summary**

2 Newfoundland and Labrador Hydro (Hydro) previously purchased power from the Mary's
3 Harbour River Hydro Plant (Hydro Plant) from 1987 to 2007, when the plant ceased operations
4 due to technical issues with the control system. A Power Purchase Agreement (PPA) was signed
5 in September 2017 between Hydro and the new owners of the Hydro Plant, St. Mary's River
6 Energy Limited, for the sale and purchase of energy. This fifteen year contract will allow Hydro
7 to purchase energy from the St. Mary's River Energy Limited Hydro Plant at 90% of the fuel cost
8 required to produce energy at the Mary's Harbour Diesel Plant (Diesel Plant). To facilitate the
9 safe and reliable operation of the Mary's Harbour System and maximize energy sales from the
10 customer owned Hydro Plant, updates to the communication and protection and control
11 systems in the Diesel Plant are required.

12

13 This project is at the request of St. Mary's River Energy Limited who will be covering all costs
14 associated with the required scope of work. The project is estimated to cost approximately
15 \$195,500 and it is expected to take 16 weeks to complete. Completion of this project is
16 recommended to fulfill Hydro's obligations as per the signed PPA, and to reduce the cost of
17 energy production in Mary's Harbour by maximizing production of hydroelectric energy at St.
18 Mary's River Hydro Plant.

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

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Appendix A: Power Purchase Agreement

Appendix B: Case Study – Hydro Power

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

1 Project Description

This project will establish a communications link with the St. Mary's River Hydro Plant (Hydro Plant) and integrate it with the controls system at the Mary's Harbour Diesel Plant (Diesel Plant). The objectives of this project are to allow the Diesel Plant to receive data from the Hydro Plant, set a maximum allowable power output for the Hydro Plant, and, if necessary, send an emergency shutdown signal to the Hydro Plant. This will facilitate the safe and reliable operation of both plants and maximize generation from the Hydro Plant, thus maximizing the reduction in fuel consumption at the Diesel Plant. Some modifications to the Diesel Plant protection settings are also anticipated in order to coordinate with the Hydro Plant.

This control system will enable maximum output from the Hydro Plant, while avoiding forcing Hydro's diesel units to operate below 30% of their capacity, as per diesel manufacturers' recommendations. Operating a diesel unit below 30% of its rated capacity for extended periods of time can cause technical and maintenance issues. To avoid forcing the diesels to operate below 30% without this control system, the output of the Hydro Plant would have to be set manually based on the diesel plant's minimum loading for the day or the week, and as a result there would be less than optimal production from the Hydro Plant.

The proposed control system is a replacement of the control system in the original Mary's Harbour Hydro Facility.

The Hydro Plant will consist of a 175 kW generator located approximately 2.3 km from the Diesel Plant (refer to Appendix B¹ "*Case Study Hydro Power*" for historical information on the Mary's Harbour Hydro Electric Development). Power will be delivered to the system through the distribution line next to the Hydro Plant that serves the town's water supply. The Mary's Harbour distribution system is shown in Figure 1.

¹ It should be noted that not all data and information recorded in the case study is applicable to the current hydro plant and should be considered a historical document for information purposes only.

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

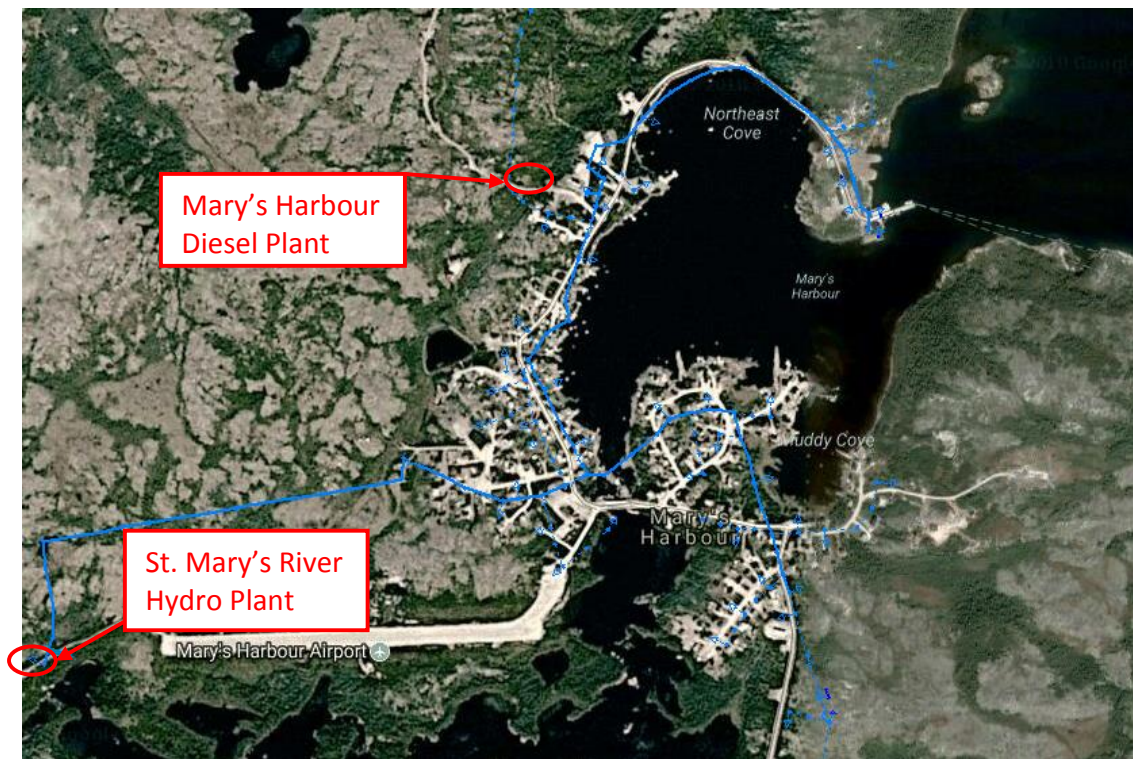


Figure 1: Mary's Harbour Distribution System

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

- 1 The estimate for this project is shown in Table 1.

Table 1: Project Estimate (\$000)

Project Cost	2019	2020	Beyond	Total
Material Supply	18.5	0.0	0.0	18.5
Labour	105.3	0.0	0.0	105.3
Consultant	24.3	0.0	0.0	24.3
Contract Work	23.2	0.0	0.0	23.2
Other Direct Costs	13.2	0.0	0.0	13.2
Interest and Escalation	0.0	0.0	0.0	0.0
Administration Fee ²	11.0	0.0	0.0	11.0
Subtotal	195.5	0.0	0.0	195.5
Cost Recoveries ³	-195.5	0.0	0.0	-195.5
Total	0.0	0.0	0.0	0.0

2 Operating Experience

- 3 The Mary's Harbour Diesel Plant supplies power to Hydro customers in the Town of Mary's
4 Harbour through a 4.16 kV distribution feeder.

5

- 6 Mary's Harbour Hydro was the first company to establish a hydroelectric plant in the town and
7 Newfoundland and Labrador Hydro purchased power from them between 1987 and 2007. The
8 original Hydro Plant was connected to the system through a customer owned underground
9 cable.

10

- 11 In 2007 Hydro ceased power purchasing from the Hydro Plant as it had become aware of a
12 technical issue with the control system and was unable to continue purchasing until the issue
13 was addressed. The Hydro Plant could not supply the entire Mary's Harbour load by itself, and
14 the control system was supposed to trip off the Hydro Plant if the Diesel Plant went offline. If
15 the Hydro Plant did not trip during a diesel plant trip, then damage to customer equipment was
16 a possible consequence. In 2007, the Diesel Plant tripped offline but the Hydro Plant failed to

² Administration Fee includes administrative overheads incurred by Supply Chain, Accounts Payable, etc.

³ As per the terms of the PPA, the Generator Owner will cover overruns up to 15% above the project estimate of \$195,500.

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant

1 trip offline, which resulted in damage to equipment for other customers in Mary's Harbour.
2 Given that no corrective action was ever taken by the Hydro Plant owner, no power has been
3 purchased since the event. Part of the requirement for the current upgrade is to correct that
4 problem.
5

6 **3 Project Justification**

7 Hydro and St. Mary's River Energy Limited (the Generator Owner) signed a Power Purchase
8 Agreement (Appendix A) in September 2017 for the sale and purchase of energy between the
9 two companies. This agreement is over a fifteen-year period and stipulates that Hydro will
10 purchase energy from the Generator Owner at ninety percent of the average cost of diesel fuel
11 to produce energy at the Diesel Plant.⁴
12

13 This is a fully contributed project by the Generator Owner, at the Generator Owner's request,
14 that will realize maximized generation for the Hydro Plant and savings for Hydro customers on
15 every kilowatt hour purchased from the Generator Owner through the optimized operation
16 between the two generating plants. Completion of a control system is recommended under the
17 conditions of the signed PPA.⁵
18

19 **4 Alternatives**

20 There are no alternatives for this project as it is required for safe and reliable operation of the
21 Hydro Plant and is proposed to fulfill the terms of the PPA between Hydro and St. Mary's River
22 Energy Limited.

⁴ Refer to "Schedule B" pages 16 and 17 in Appendix A for detailed calculation of energy payment.

⁵ Refer to Appendix A, Article A.1 Conditions of Supply

5 Conclusion

There are no alternatives for this project as it is required for safe and reliable operation of the Hydro Plant and is proposed to fulfill the terms of the PPA between Hydro and St. Mary's River Energy Limited.

6 Project Schedule

The anticipated project schedule is provided in Table 2.

Table 2: Project Schedule

Activity		Start Date	End Date
Design & Procurement	Protection & Control design, communications design, procurement of materials	Sep 2018	Sep 2018
Construction	Protection & Control wiring, controls modifications, communications installation	Sep 2018	Oct 2018
Commissioning	Verification of new protection settings, verification of communications and controls, installation of revenue metering equipment	Oct 2018	Nov 2018
Closeout	Project closeout	Dec 2018	Dec 2018

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
Appendix A

Appendix A

Power Purchase Agreement

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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AGREEMENT FOR THE PURCHASE AND SALE OF ENERGY

THIS AGREEMENT made at St. John's, in the Province of Newfoundland and Labrador on the 22 day of September, 2017 (the "Agreement")

BETWEEN: **NEWFOUNDLAND AND LABRADOR HYDRO**, a corporation and agent of the Crown constituted by statute, renamed and continued by the *Hydro Corporation Act*, 2007 Chapter H-17 of the 2007 Statutes of Newfoundland and Labrador and having its head office at St. John's, in the Province of Newfoundland and Labrador, (hereinafter referred to as "Hydro") of the first part;

AND **ST. MARY'S RIVER ENERGY LIMITED PARTNERSHIP**, a limited partnership formed under the laws of the Province of Newfoundland & Labrador, by its general partner, **ST. MARY'S RIVER ENERGY GP LTD.**, a body corporate incorporated under the laws of the Province of Newfoundland & Labrador (hereinafter referred to as the "Generator") of the second part.

WHEREAS the Generator proposes to operate a 175 kW hydro generation facility (hereinafter called "the Facility" at Mary's Harbour, Newfoundland and Labrador, aforesaid, more particularly described in Schedule C attached hereto; and

WHEREAS Hydro and the Generator wish to enter into an Agreement which sets forth the terms and conditions upon which the sale and purchase of energy will be undertaken;

NOW THEREFORE THIS AGREEMENT WITNESSETH that the parties agree as follows:

ARTICLE 1
INTERPRETATION AND TERM OF THE AGREEMENT

- 1.01 In this agreement, unless the context otherwise requires,
- a) "Agreement" means this Agreement for the Purchase and Sale of Energy, as amended, supplemented or modified from time to time in accordance with the provisions hereof;
 - b) "Commercial In-Service Date" is that date which follows the day upon which all features and equipment of the Generator's Facility are demonstrated to Hydro's satisfaction to be capable of operating simultaneously to deliver Power and Energy

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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continuously into Hydro's isolated diesel system in Mary's Harbour as provided this Agreement;

- c) "Electricity" includes Power and Energy;
- d) "Energy" means the amount of electricity generated and delivered during a given period of time and measured in kilowatt-hours ("kWh");
- e) "Facility" means all the Generator's generating, transmission plant and associated equipment located in Mary's Harbour and as described in Schedule C and connecting with Hydro's isolated diesel system in Mary's Harbour used to provide Power and Energy pursuant to this Agreement;
- f) "Good Utility Practice" means those practices, methods or acts (including but not limited to the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry in Canada) that at a particular time, in the exercise of reasonable judgment, would be expected to accomplish the desired result in a manner which is consistent with laws and regulations and due concerns for reliability, safety, environmental protection, economy and expedition;
- g) "Harmonized Sales Tax" or "HST" means all amounts eligible pursuant to Part IX of the *Excise Tax Act* (Canada), including, for greater certainty, the taxes commonly referred to as the goods and services tax ("GST") and the harmonized sales tax ("HST");
- h) "Interconnection Point" means that point where the Facility connects to the isolated diesel system in Mary's Harbour;
- i) "Month" means a calendar month;
- j) "Power" means the amount of electrical power generated and delivered at any time and is measured in kilowatts ("kW");
- k) "Point of Delivery" means the jumper connection joining the load side of the Generator's group operated disconnect switch to Hydro's system, specifically the three (3) phase 4.16 kV primary distribution line which is dead-ended on the same structure as the Generator's group operated disconnect switch. The Point of Delivery is approximately seventy (70) meters from the Generator's Facility.
- l) "Province" means the Province of Newfoundland and Labrador;
- m) "Site" means the location of the Facility and includes all land owned or leased, or to which the Generator holds an easement, for the purposes of the Facility and connected with the objects of this Agreement;

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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- n) "Term" means that period that commences on the Commercial In-Service Date and continues for a period fifteen (15) years unless otherwise terminated as per Article 3 of this Agreement.
- 1.02 In this Agreement all references to dollar amounts and all references to any other money amounts are, unless specifically otherwise provided, expressed in terms of coin or currency of Canada which at the time of payment or determination shall be legal tender herein for the payment of public and private debts.
- 1.03 Words in this Agreement importing the singular number shall include the plural and vice versa and words importing the masculine gender shall include the feminine and neuter genders.
- 1.04 Where a word is defined anywhere in this Agreement, other parts of speech and tenses of the same word have corresponding meanings.
- 1.05 Wherever in this Agreement a number of days are prescribed for any purpose, the days shall be reckoned exclusively of the first and inclusively of the last.
- 1.06 The headings of all the articles are inserted for convenience of reference only and shall not affect the construction or interpretation of this Agreement.
- 1.07 Any reference in this Agreement to an Article, a Clause, a sub-Clause or a paragraph shall, unless the context otherwise specifically requires, be taken as a reference to an article, a Clause, a sub-Clause or a paragraph of this Agreement.
- 1.08 This Agreement may be executed in two or more counterparts, each of which when so executed shall be deemed to be an original, but all of such counterparts together shall constitute one and the same instrument. Signatures delivered by facsimile or electronic mail shall be deemed for all purposes to be original counterparts of this Agreement.
- 1.09 This Agreement shall become binding upon execution and, subject to the early termination provisions contained herein, shall remain in effect for duration of the Term.

ARTICLE 2
CONDITIONS FOR THE DELIVERY OF ELECTRICITY

- 2.01 The terms and conditions detailed in Schedule A, Schedule B and Schedule C, which schedules form a part of this Agreement, shall apply to the delivery of Electricity.
- 2.02 Should there be any greenhouse gas or similar emission credits or other negotiable rights or interests arising from environmental attributes of either the ownership or the

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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operation of the Generator's Facilities, they shall be vested in Hydro to be assigned, traded, retained or otherwise dealt with in any manner as Hydro may in its sole discretion determine.

ARTICLE 3
TERM OF AGREEMENT

- 3.01 Except as otherwise provided herein, this Agreement shall continue in force for a period of fifteen (15) years commencing on the Commercial In-Service Date, and thereafter shall continue in force for an indefinite term; provided that either party may:
- (a) provide one (1) year written notice to the other party to terminate this Agreement during its original fifteen (15) year term, provided a minimum period of nine (9) years from the Commercial In-Service Date has passed; or
 - (b) provide (1) month written notice to the other party to terminate this Agreement after its original fifteen (15) year term.

ARTICLE 4
AVAILABILITY OF ELECTRICITY

- 4.01 Subject to the provisions of this Agreement, the generator shall sell Electricity exclusively to Hydro, and Hydro agrees to purchase all such Electricity delivered to the Point of Delivery; provided that Hydro has sufficient load to absorb the Electricity, subject to Clause 4.02.
- 4.02 The Generator shall put in place the appropriate controls and mechanisms to ensure that the Power produced from the Generator's Facilities does not cause the total output from Hydro's Mary's Harbour diesel generating plant to fall below thirty (30) percent of the prime power rating of the smallest diesel generating unit in service in the Mary's Harbour diesel generating plant.
- 4.03 If at such time in the future Hydro wishes to change the installed capacity of in the Mary's Harbour diesel generating plant, it shall do so at its sole and unfettered discretion. At such time, the Generator will be required to update its control system as appropriate.
- 4.04 Subject to the provisions of this Agreement, Hydro shall sell electricity to the Generator only at such times that Electricity is not being delivered to Hydro.

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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ARTICLE 5
DELIVERY OF ELECTRICITY AND METERING

- 5.01 Electricity shall be at a nominal frequency of sixty (60) hertz and at a nominal voltage as outlined in Schedule C attached hereto. The maintenance of the nominal voltage at the Point of Delivery shall constitute the supply of Electricity.
- 5.02 The metering plant to be used under this Agreement shall be furnished and installed by Hydro, at the Generator's Expense, in a suitable place to be provided by the Generator at the Site and shall be furnished and installed in such a manner as to register accurately the total amount of Power and Energy delivered to Hydro to determine the amount of Energy to be purchased by Hydro.
- 5.03 The revenue metering equipment to be purchased and installed by Hydro pursuant to Clause 5.02 shall be of a type approved for revenue metering by the Measurement Canada, a department of the Government of Canada.
- 5.04 Where practical, the metering equipment required under Clauses 5.02 will be installed at the Interconnection Point. Where necessary, adjustments will be made to all meter readings to account for transformer, transmission and distribution line losses between the metering point and the Interconnection Point.
- 5.05 Authorized employees of Hydro and officials acting on behalf of the appropriate department of the Government of Canada shall have the right of access to all meters at all reasonable times, for the purpose of reading, inspecting, testing, repairing or replacing the metering equipment installed pursuant to Clause 5.02 hereof. However, the said authorized employees shall not interfere with the operations of the Generator except to the extent such interference is required as a result of the work being performed, in which case, such interference shall be kept to the minimum amount of time necessary, all in accordance with Good Utility Practice.

ARTICLE 6
BILLINGS, RATES AND CHARGES

- 6.01 Payment for Energy made available for the Generator under this Agreement shall be subject to the provisions of Schedules A and B and to the rates outlined therein.
- 6.02 The Generator shall render its accounts monthly and Hydro will, within twenty (20) days after the date of receiving such account, make payment in lawful money of Canada at the appointed office of the Generator or by means of direct deposit into a Canadian bank account of the Generator. Any amounts in arrears or overdue to the Generator after

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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expiration of such twenty (20) days shall bear interest, before and after judgment, at the prime rate of Bank of Nova Scotia plus two percent (2%) annually until such balance is paid.

- 6.03 Payment for Energy made available by Hydro under this agreement shall be at Rates, rules and regulations regularly applied by Hydro in the Community of Mary's Harbour at the time of any such sale or sales.
- 6.04 The Generator and Hydro acknowledge that, notwithstanding any other provision of this Agreement, any amounts payable by Hydro to the Generator pursuant to this Agreement exclude HST and include all other Taxes. If the Generator is required to collect from Hydro an amount of HST with respect to the provision of any goods or services supplied pursuant to this Agreement, such amounts shall be identified separately on the invoice. All invoices shall include Generator's HST registration number.

ARTICLE 7
INSURANCE

- 7.01 The Generator shall at its own expense acquire and maintain, during the original fifteen (15) year term of this Agreement or in the absence of its termination any time thereafter, Comprehensive General Liability Insurance of not less than two million dollars (\$2,000,000.00) inclusive for any one (1) accident or occurrence (the Policy).
- 7.02 Prior to supplying Hydro with Power, the Generator shall provide Hydro a certificate of insurance that shall be updated annually.
- 7.03 The Policy shall have Hydro as additional named insureds and shall contain a cross liability clause.
- 7.04 The Policy shall not be cancelled, reduced, restricted, terminated or changed in any way or allowed to lapse without at least thirty (30) days written notice to Hydro, sent by prepaid registered mail to the head office of Hydro. In the event the Policy is cancelled, revised, restricted, terminated, changed or lapses the Generator shall immediately replace the Policy.
- 7.05 In the event that Comprehensive General Liability Insurance is not effected to the satisfaction of Hydro, Hydro may effect such insurance as described in this Article 10 and pay the premium in respect thereof. In such a case, Hydro may set off the payment of any such premium against any amounts owed by Hydro to the Generator pursuant to this Agreement. Any action in this respect shall in no way change or reduce the Generator's responsibilities and liabilities under this Agreement.

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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**ARTICLE 8
SAFETY**

8.01 The Generator and Hydro actively encourage the use of the best safety practices in the construction and operation of their respective facilities. Both parties shall ensure that all applicable safety laws and regulations are adhered to with respect to the Facility and the associated operations throughout the Term hereof. In addition to requirements elsewhere for operation of the Facility, Generator acknowledges that for construction activities Hydro endorses the Certificate of Recognition Safety Program of the Newfoundland and Labrador Construction Safety Association (NLCSA). Accordingly, Generator agrees to ensure that, prior to the commencement of performance of construction activities at the Site, the general contractor and all subcontractors obtain and deliver proof of a valid Certificate of Recognition from the NLCSA or similar accreditation/ safety program acceptable to Hydro. Where Generator performs construction activities itself it shall be considered a contractor for the purposes of this clause.

**ARTICLE 9
ENVIRONMENT**

- 9.01 Hydro, through its environmental policy, commits to compliance with legal and other requirements, to prevention of pollution, and to continual improvement.
- 9.02 Generator shall ensure protection of the environment at the Facility, and, Generator and its contractors must be aware of potential environmental impacts during construction and operation of the Facility. Generator shall ensure that its employees, agents, and its contractors and their employees and agents comply with all applicable environmental laws, regulations, permits and requirements of federal, provincial and municipal authorities and, on a best effort basis, Generator shall ensure that its contractors comply with the Hydro's aforementioned environmental policy (which is available at the website: <https://www.nlhydro.com/environment/environmental-policy/>).
- 9.03 Generator shall provide Hydro with copies of environmental permits, approvals and monitoring studies prior to commencement of the relevant work.

**ARTICLE 10
ARBITRATION**

- 10.01 Any dispute or differences between the parties hereto concerning this Agreement which cannot be resolved or settled by the said parties shall be settled by final and binding arbitration in the City of St. John's, Newfoundland, at the request of either party pursuant to the provisions of the Arbitration Act (Newfoundland and Labrador), subject to the specific terms hereof.

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- 10.02 The party desiring arbitration shall notify the other party of its intention to submit any dispute(s) or difference(s) to arbitration as well as a brief description of the matter(s) to be submitted for arbitration.
- 10.03 Should the parties fail to agree on a single arbitrator to settle the relevant dispute(s) or difference(s) within fifteen (15) days of delivery of the aforesaid notice, then each such party shall within thirty (30) days thereafter nominate an arbitrator having expertise with respect to the subject matter(s) under dispute (failing which nomination by a party, the arbitrator nominated by the other party may proceed to determine the dispute alone as he or she shall deem fit) and the two (2) arbitrators so selected shall select a chairperson of the arbitral tribunal of similar expertise to act jointly with them.
- 10.04 If said arbitrators shall be unable to agree in the selection of such chairman within thirty (30) days of the expiry of the aforesaid thirty (30) day arbitrator nomination period, the chairman shall be selected as contemplated in the *Arbitration Act* (Newfoundland and Labrador).
- 10.05 The costs of the arbitration shall be borne by the parties hereto as may be specified in the determination of the arbitrator(s). The arbitrator(s) shall further be authorized to retain such legal counsel and other professional advisors to provide any advice to the arbitrator(s) as the arbitrator(s) deem appropriate.
- 10.06 The decision of the single arbitrator or any two (2) of the three (3) arbitrators, as the case may be, shall be non-appealable, final and binding with respect to the issue(s) in dispute.

ARTICLE 11
PREVIOUS AGREEMENTS

- 11.01 This Agreement contains all the terms and conditions agreed on by the parties and no other previous Agreements, written or verbal, respecting the subject matter of this Agreement shall be deemed to exist, or to bind either party.

ARTICLE 12
PERMITS AND LAWS

- 12.01 The Generator shall obtain and pay for any and all permits, licenses or easements necessary or required for the delivery of Electricity pursuant to the provision of this Agreement. The Generator shall comply fully with all laws, regulations and ordinances of the proper public authorities in connection with the performance of its duties under this Agreement.

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ARTICLE 13
MODIFICATION OF AGREEMENT

- 13.01 If at any time during the continuance of this Agreement the parties shall deem it necessary or expedient to make any alteration or addition to this Agreement, they may do so by means of a written agreement between them which shall be supplemental to and form part of this Agreement.
- 13.02 Any amendment, change or modification of this Agreement shall be binding upon the parties hereto or either of them only if such amendment, change or modification is in writing and is executed by each of the parties to this Agreement by its duly authorized officers or agents and in accordance with its regulations or by-laws.
- 13.03 Hydro shall have the right to terminate this agreement if the Generator has not completed the interconnection to the Interconnected Grid, and delivered electricity to the Interconnection Point within two (2) years of the execution date of this Agreement.

ARTICLE 14
SUCCESSORS AND ASSIGNS

- 14.01 This Agreement shall extend to and be binding upon and enure to the benefit of Hydro and of the Generator, and to their respective successors and assigns, provided that the Generator shall not be entitled to assign its entire interest in this Agreement or any portion thereof without the written consent of Hydro.

ARTICLE 15
GOVERNING LAW AND FORUM

- 15.01 This Agreement shall be governed by and interpreted in accordance with the laws of the Province and the federal laws of Canada applicable therein and, subject to Article 10, every action or other proceeding arising hereunder shall be determined exclusively by a court of competent jurisdiction in the Province, subject to the right of appeal to the Supreme Court of Canada where such appeal lies.

ARTICLE 16
ACCESS TO INFORMATION

- 16.01 Where under the Province's *Access to Information and Protection of Privacy Act, 2015* it is permitted to maintain the confidentiality of the business terms contained within this

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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Agreement, Hydro shall maintain such confidentiality and shall not release such information to any third party.

ARTICLE 17
ADDRESS FOR SERVICE

17.01 Subject to Clauses 17.02 and 17.03, any notice, request or other instrument which is required or permitted to be given, made or served under this Agreement by either of the parties hereto shall be given, made or served in writing and shall be deemed to be properly given, made or served if personally delivered, or sent by email, or mailed by prepaid registered post, addressed, if service is to be made

(a) on Hydro, to:

Newfoundland and Labrador Hydro
Hydro Place
P.O. Box 12400
St. John's, NL
A1B 4K7

Attention: General Counsel and Corporate Secretary
Email: GYoung@nlh.nl.ca

(b) on the Generator, to:

Mary's River Energy Limited Partnership
c/o Mary's River Energy GP Ltd.
1801 Hollis St, Suite 1205
Halifax, NS
B3J 3N4

Attention: President
Fax: (902) 422-9780
Email: jbrereton@naturalforges.ca

With a copy to:

McInnes Cooper
1969 Upper Water St., Suite 1300
Purdy's Wharf Tower II
Halifax, NS
B3J 2V1

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Attention: Michael Simms
Fax: (902) 425-6350
Email : Michael.simms@mcinnescooper.com

- 17.02 Any notice, request or other instrument given, made or served as provided in Clause 17.01 shall be deemed to have been received by the party hereto to which it is addressed, if personally served on the date of delivery, or if mailed three (3) days after the time of its being so mailed, or if sent facsimile transmission, one (1) day after the date of sending.
- 17.03 Either of the parties hereto may change the address to which a notice, request or other instrument may be sent to it by giving to the other party to this Agreement notice of such change, and thereafter, every notice, request or other instrument shall be delivered or mailed in the manner prescribed in Clause 17.01 to such party at the new address.

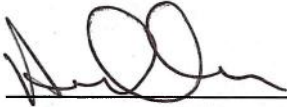
IN WITNESS WHEREOF Newfoundland and Labrador Hydro and St. Mary's River Energy Limited Partnership have each executed this Agreement by causing it to be executed in accordance with its by-laws or regulations and by its duly authorized officers or agents, the day and year first above written.

THE CORPORATE SEAL of
Newfoundland and Labrador
Hydro was hereunder affixed in
the presence of:




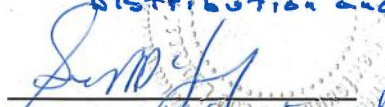
Witness

DULY EXECUTED by
St. Mary's River Energy Limited Partnership,
by its general partner,
St. Mary's River Energy GP Ltd.
in accordance with its
Regulations or By-Laws
in the presence of:




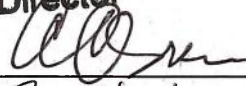
Witness
Andy MacCallum



VP, Transmission &
Distribution and NLSO


Corporate Secretary and
General Counsel



Robert Apold
Director


President

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SCHEDULE A

Terms and Conditions for Delivery of Electricity

**ARTICLE A.1
CONDITIONS OF SUPPLY**

- A.1.1 The Generator shall arrange for, at its expense, the interconnection between its facilities and Hydro's Facilities. The Generator shall be financially responsible for the necessary modifications of Hydro's Facilities to enable Hydro to utilize the delivered Electricity in circumstances and in a manner that provide for the proper protection and safe operation of Hydro's Facilities. Hydro shall provide to the Generator an estimate of all costs to be incurred by Hydro to interconnect the Generator and the Generator shall provide advance payment to Hydro for these costs. Upon the completion of the interconnection, an adjustment shall be made so that if the actual cost exceeds the estimate, the difference shall be paid by the Generator to Hydro forthwith, provided that the Generator shall not be required to pay more than fifteen percent (15%) more than the estimated cost. If the actual cost is less than the estimate, the difference shall be reimbursed to the Generator by Hydro.
- A.1.2 The Generator shall assume financial responsibility for all power system components deemed necessary by Hydro on the Generator's side of the Point of Delivery including transformation, switching and auxiliary equipment such as synchronizing and protection equipment.
- A.1.3 It is agreed that Hydro may require the Generator to follow appropriate operating procedures not substantially different from those procedures followed for Hydro's own generators. Operating procedures amongst others will provide for routine switching operations for example, for scheduled maintenance or for emergencies including forced outages and unexpected contingencies as well as a line of communication between Hydro and the Generator. These procedures are to enable Hydro to safely interrupt the flow of Electricity from the Generator. In addition, Hydro has a work protection code that has certain requirements for its contractors and their employees. Depending on system configuration, there may be periods where Hydro will not be able to purchase power from the Generator for the purpose of establishing safe work zones on Hydro's system. Hydro will provide the Generator with copies of the operating procedures with all revisions or additions and its work protection code.
- A.1.4 Except for abnormal operating conditions, variations from any nominal frequency or nominal voltage shall not exceed appropriate ranges of tolerable values. The Generator shall be responsible for installing protective equipment to protect its own property and operations from variations in frequency and voltage or from temporary delivery of other than three (3) phase power. In no event shall Hydro be liable to the Generator for any

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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- loss, damage or injury resulting directly or indirectly from variations in frequency or voltage, or for temporary delivery of other than three (3) phase power.
- A.1.5 The Generator agrees to provide suitable transforming equipment and all other electrical equipment from the Point of Delivery of the Electricity, including electrical equipment Hydro deems necessary from time to time during the continuance of this Agreement, for the safety and security of the operation of Hydro's Facilities. All of the said equipment of the Generator shall be subject to the approval of Hydro and shall be installed, maintained and operated in a manner satisfactory to Hydro. Until such approval has been given, Hydro shall not be bound to receive or supply any Electricity under this Agreement or, if receipt or supply has commenced, to continue same.
- A.1.6 The Generator shall operate in such a manner so as not to cause disturbance or fluctuations to Hydro's Facilities, or interference with communication systems or control circuits of Hydro or of any third party. The Generator shall take remedial measures at its own expense by way of installing suitable apparatus or otherwise as may be necessary to reduce any disturbance or fluctuations or any interference with the communication systems or control circuits to a tolerable level. In any event, the Generator shall indemnify Hydro from all claims and demands made against Hydro, or its officers, directors, employees or agents, by any third party in consequence of failure of the Generator to perform its obligations under this Section.
- A.1.7 Where Hydro has installed on its Facilities equipment for automatic reclosing of circuit breakers after an interruption of the supply of Electricity, it shall be the obligation of the Generator to provide at its own expense, adequate protective equipment for all its facilities that might be adversely affected by such reclosing equipment, and as well, such equipment as may be required for the prompt disconnection of any of the Generator's apparatus that might affect the proper functioning of the reclosing equipment. Hydro will co-operate with the Generator and use its best endeavours with a view to mutual agreement as to the reclosing time of the equipment, but failing such agreement, the decision of Hydro as to that time shall be final.
- A.1.8 The Generator agrees to provide free of charge or rent a convenient and safe space for the meters and other service entrance equipment of Hydro on or in the Generator's premises and further agrees that no one who is not a properly authorized agent of Hydro or otherwise lawfully entitled to do so shall be permitted or suffered to repair, remove, inspect or tamper with any of the said meters and equipment and that the properly authorized agents of Hydro shall, at all reasonable hours, have the right to read, inspect, repair, replace and remove any of the said equipment and have free access for that purpose of the said premises.
- A.1.9 Hydro may from time to time make tests to determine the electrical characteristics of the Generator's supply of Electricity and may install and use meters and equipment, which it deems necessary.

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ARTICLE A.2
CONTRACT PERFORMANCE

- A.2.1 If at any time the Generator fails to perform any of its obligations affecting operation under this Agreement including failing to operate as required by this Agreement by any operating procedures, then Hydro may give notice thereof to the Generator, which notice may be given by telephone to an employee of the Generator by an employee of Hydro and the Generator shall immediately remedy the said failure. In case of continued failure for more than fifteen (15) minutes after the notice, Hydro may discontinue the receipt of all Electricity or any part thereof and shall not be obliged to resume receipt of Electricity until the Generator has remedied the failure. The Generator shall designate in writing to Hydro the name of the employee to whom notices under this Section are to be given, and in default of such designation or in the event of said employee not being immediately available to receive any such notice, the Generator agrees the notice may be given by telephone or otherwise to any other employee of the Generator.
- A.2.2 If the Generator fails to perform any obligations under this Agreement, Hydro may give written notice to the Generator that unless the obligation is completely fulfilled within a specified period after mailing of the notice, Hydro shall discontinue the receipt of Electricity. If the Generator continues in default in respect of the obligation beyond the period specified in the notice, Hydro may discontinue the receipt of Electricity and may refuse to resume receipt of Electricity until the Generator has fulfilled its obligation. The right to discontinue the receipt of Electricity in this Section is in addition to and not in limitation of any other right provided elsewhere in this Agreement to discontinue the receipt of Power for failure of the Generator to perform a particular obligation.
- A.2.3 Notwithstanding that Hydro may have discontinued the receipt of Electricity to the Generator by reason of failure by the Generator to perform any of its obligations under this Agreement, or that Hydro has discontinued receipt of Electricity upon the request of the Generator, such discontinuance shall not be construed as a breach of contract by Hydro to receive Electricity from the Generator under this Agreement, nor shall such discontinuance relieve the Generator from its obligations to deliver Electricity in accordance with the provisions of this Agreement, and such provisions shall continue in force until termination of the Agreement, unless Hydro otherwise agrees in writing.
- A.2.4 Either party shall have the right to interrupt the supply or receipt of Electricity at any time to the extent necessary to safeguard life or property or for the purpose of construction, maintenance, operations, repair, replacement or extension of their equipment or works. Either party shall limit the duration of such interruptions as much as practicable and, except in emergencies, shall give to the other party adequate warning of its intention to interrupt the supply or receipt of Electricity.
- A.2.5 If the Generator's inability to make Electricity available or Hydro's inability to take Electricity is in either case attributable to an Uncontrollable Event or the Electricity is

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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interrupted by the Generator, or Hydro for any of the purposes described in Section A.2.4, then no party shall be liable to the other for damages or breach of contract. The term "Uncontrollable Event" shall be deemed to be a cause reasonably beyond the control of either the Generator, or Hydro which inability includes but without limitation, strike of the Generator's, or Hydro's employees, damage or destruction by the elements, fire, explosion, war, the Queen's enemies, legal acts of the public authorities, insurrection, Act of God, or inability to obtain or transport essential services, materials, products or equipment because of the effect of similar causes on the Generator's, or Hydro's suppliers or carriers, accident to the electrical generation or delivery system including Hydro's Facilities.

SCHEDULE B

Calculation of Energy Payment

Hydro agrees to pay for Energy delivered in each Month of the Term of this Agreement, an amount calculated by application of the following formula:

$$EP_{ji} = ED_{ji} \times \left(\frac{FC_{ji}}{EFF_{i-1}} \times 0.90 \right)$$

Where:

- j* is the Month for which payment is payable;
- i* is the calendar year in which Month *j* falls;
- EP_{ji}* is the total Energy payment for Energy delivered in Month *j* of calendar year *i* in Canadian Dollars;
- ED_{ji}* is the Energy delivered by the Generator to Hydro under the Terms of this Agreement in Month *j* of calendar year *i* in kWh;
- FC_{ji}* is the average fuel cost for diesel fuel consumed in Hydro's diesel generating plant serving the community of Mary's Harbour in Month *j* of calendar year *i* in Canadian Dollars; per litre and
- EFF_{i-1}* is the average plant efficiency of Hydro's diesel generating plant serving the community of Mary's Harbour as determined below.

EFF_{i-1} is the greater of either:

- (a) 3.245 kWh/litre of fuel, which is the average plant efficiency of Hydro's Mary's Harbour diesel generating plant for the years 2014, 2015 and 2016;

or

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$$(b) \frac{KWH_{i-1}}{FUEL_{i-1}}$$

Where:

KWH_{i-1} is the total Energy produced at Hydro's diesel generating plant serving the community of Mary's Harbour in the calendar year immediately preceding the year for which payment is due, in kWh;

$FUEL_{i-1}$ is the total number of litres of diesel fuel consumed in Hydro's diesel generating plant serving the community of Mary's Harbour in the calendar year immediately preceding the year for which payment is due;

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SCHEDULE "C"

Generation Characteristics

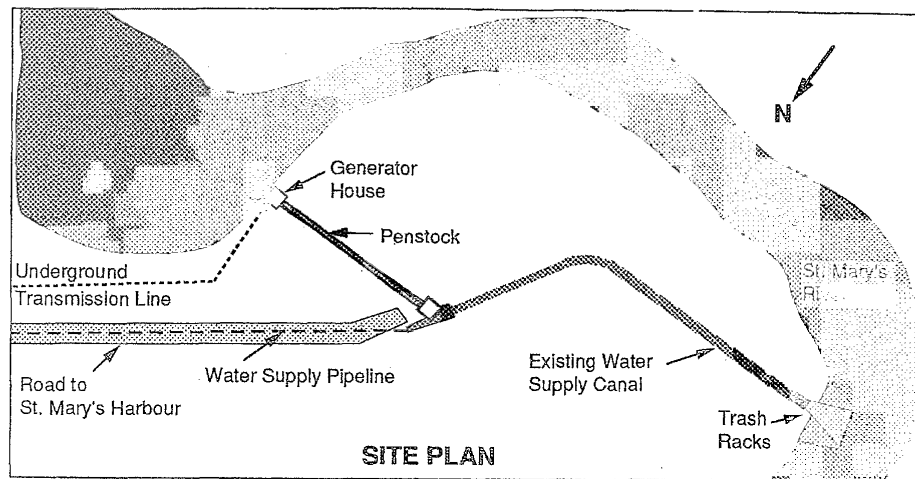
Generator:	Canadian Hydro Components 900mm Kaplan
Location:	Mary's Harbour, Newfoundland
Nominal Voltage at Delivery Point:	4160 V
Type of Generator:	Kaplan, Axial Flow
Generator Nameplate Rating:	175 kW

Appendix B

Case Study – Hydro Power

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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CASE STUDY HYDRO POWER



Private power development in Mary's Harbour, Labrador

Mary's Harbour Hydro Electric Development

The term 'innovation' naturally calls to mind the image of new equipment and technology. But innovation isn't restricted to the technical side of demonstration projects. Installing a small hydro system at Mary's Harbour in Labrador involved setting up the first private hydro company in Newfoundland (created specifically to sell power to Newfoundland and Labrador Hydro), changing provincial legislation, and sharing facilities with the provincial Department of Municipal Affairs. Everyone of the eight organizations involved in the project was breaking new ground.

REMOTE COMMUNITY DEMONSTRATION PROGRAM



Energy, Mines and
Resources Canada

Énergie, Mines et
Ressources Canada

Canada

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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HYDRO POWER

Description of Project

The hydro electric generating plant which serves Mary's Harbour is located at a natural falls just 1.0 km upstream of the townsite on the St. Mary's River. The hydro plant was built in 1987 and generates about 135 kilowatts of power for the 650 residents of Mary's Harbour and the neighbouring community of Lodge Bay. Built at a cost of approximately \$625 000, the plant is the first private small hydro development built solely to sell power to Newfoundland and Labrador Hydro (NLH).

Rationale

Financing the plant and putting it into operation involved a number of individuals and organizations, from the Council at Mary's Harbour to the provincial and federal governments. The benefits are equally wide-ranging.

In a direct way, the plant offers security of electricity supply and economy. As in many remote communities, electricity at Mary's Harbour is produced by a diesel-fuelled generating plant. While the capacity of the hydro plant isn't sufficient to meet all of the town's electrical needs, it will displace approximately 270 000 litres of diesel fuel per year – about 50% of the town's current electrical demand.

Indirectly, the installation has demonstrated the feasibility of small hydro projects in Newfoundland and Labrador and it has resulted in new provincial legislation and regulations which will clear the way for future projects of a similar nature. At the federal level, staff at Energy Mines and Resources Canada see a number of additional benefits coming from the project. The Mary's Harbour installation demonstrates small hydro technology that can be used as an alternative energy source in many communities across the country. But more importantly, the Mary's Harbour experience demonstrates the steps required to bring about a venture which involves the co-operation of many different organizations. Also, the project demonstrates a successful combination of private initiative and public administration.

Organization and management

The consulting engineers who worked with the town council to study the feasibility of the project formed a private company to develop the site. The new company, Mary's Harbour Hydro, owns the hydro plant, and sells the hydro power to Newfoundland and Labrador Hydro Power Distribution District which operates the diesel plants and provides electricity to remote communities. This branch of NLH then resells the hydro power to the town's residents.

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HYDRO POWER

The Players

Energy, Mines and Resources Canada (EMR) - maintains a regional EMR Programs Office (P.O.) which played a key role in identifying the concept of shared facilities and in bringing the players together. EMR also financially contributed to construction, monitoring, and information transfer through their Remote Community Demonstration Program.

Mary's Harbour Council - supported the project and rents the canal and access road to Mary's Harbour Hydro.

Mary's Harbour Hydro - a private company formed by the partners of Sheppard, Hedges and Green, which developed the site and owns the hydro plant.

Newfoundland Board of Commissioners of Public Utilities (PUB) - regulates the sale of electricity in the province.

Newfoundland Department of Energy - provided a contribution toward the cost of the project's construction.

Newfoundland Department of Municipal Affairs - developed the town's water supply with provision for a future hydro plant.

Newfoundland and Labrador Development Corporation - a government-backed lending agency. The Corporation provided a mortgage for the project.

Newfoundland and Labrador Hydro (NLH) - operates the diesel plant and the local distribution grid. NLH purchases the hydro electric power from Mary's Harbour Hydro and sells it to consumers.

How the Project was Implemented

It's hard to pinpoint who first had the idea of a hydro plant at Mary's Harbour. But one thing is clear – many different individuals and organizations were instrumental in setting the stage for the project's development.

Pre-planning and project design – setting the stage

As background to the project, the regional EMR Programs Office had identified small hydro as a potential way to reduce oil consumption in Newfoundland's remote communities. The EMR Programs Office had also funded some studies concerning shared facilities for both water supply and hydro electric production. Sheppard, Hedges and Green (SHG) had been involved in one of these early studies for a shared system in Rigolet, Labrador.

EMR's interest led to a Phase I feasibility study investigating the hydro potential of shared facilities at Mary's Harbour. The study was carried out by Newfoundland and Labrador Hydro and funded jointly by NLH, the Remote Community Demonstration Program (RCDP) of EMR, and the Department of Municipal Affairs. The study suggested a joint venture between Municipal Affairs and NLH

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HYDRO POWER

which would involve an underground pipeline from the natural falls that would divert water for both the town's water supply and a hydro plant. Based on the pipeline idea, the study suggested that the project would cost \$3 million and produce 280 kW. However, it concluded that the project, as defined by NLH, was not feasible due to the high capital cost of the pipeline and a mismatch of energy potential and community demand.

In the meantime, Sheppard, Hedges and Green Ltd. was hired by Municipal Affairs to design the town's water supply system. With an interest in small hydro, due to its work at Rigolet, Sheppard, Hedges and Green decided to explore the idea further at Mary's Harbour. They determined that a canal could be constructed to serve the water supply system and, with little or no additional cost, it could also serve a small hydro plant. With the canal already in place, a hydro system could be developed at one-quarter of the cost of the pipeline project. However, the canal would reduce the generation potential to around 135 kW from the 280 kW originally identified by the NLH study.

Municipal Affairs was in favour of this idea as a shared canal would cost no more than their proposed buried pipeline and it left the door open for a hydro system to be developed at a later date. The municipality was quite interested in the idea of a hydro plant, provided that the project was economically attractive.

Unfortunately, it was discovered that, according to the Provincial Municipalities Act, the municipality could not own an energy project or utility. The town formed a co-operative to implement the design but it was difficult to sustain interest and the group disbanded. At this point, SHG decided to take the initiative and formed a private company, Mary's Harbour Hydro, to develop and manage the hydro development.

Approvals and regulations – clearing the way

With solid information on the site's feasibility and a company to develop the site, the project was now at first base. The next step was to remove the organizational and legal hurdles in the way of such a project and to arrange financing.

As a result of this project, the way was cleared for future small hydro developments in Newfoundland and Labrador and several changes to provincial legislation and regulations were initiated. Firstly, NLH had to waive its right of first refusal in order to permit a private company to use the water rights to the river for power generation. Secondly, initiatives were taken to have Newfoundland and Labrador Hydro and the Public Utilities Board request Cabinet to exempt projects of less than one megawatt from the Board's regulatory hearings. The Public Utilities Board sets hydro rates, and the exemption was needed in order to save the cost of hearings, which can amount to tens of thousands of dollars. Thirdly, since NLH had never participated in parallel generation or purchased power from a private supplier, the utility had to develop a set of procedures and

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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HYDRO POWER

policies for these new activities. Fourthly, on the local level, the private company, Mary's Harbour Hydro, had to seek approval from the municipality for an easement for their transmission lines and arrange for rental of the canal and use of the access road.

Financing arrangements

Three types of funds went into the financing package. The developer, Mary's Harbour Hydro, provided equity financing; Energy, Mines and Resources Canada and the Newfoundland and Labrador Department of Energy provided demonstration contributions; and the Newfoundland and Labrador Development Corporation provided a loan.

EMR was very supportive of the project, even contributing (with Municipal Affairs) to the initial feasibility study done by Newfoundland and Labrador Hydro. And with a commitment from EMR for a contribution through their Remote Community Demonstration Program, it was possible to obtain a further contribution from the provincial Department of Energy. The project broke new ground in the financing area as well, since it was the first renewable energy project to negotiate a loan with the provincial Development Corporation.

EMR Remote Community Demonstration Program	\$ 270 000.
Newfoundland and Labrador Department of Energy	60 000.
Mary's Harbour Hydro	80 000.
Newfoundland and Labrador Development Corporation loan	<u>215 000.</u>
TOTAL	\$ 625 000.

(EMR provided an additional \$81 000 for monitoring and information transfer.)

Design, construction and commissioning

The design of the plant is unique in two ways. The town's water supply facilities had been built with provision for the hydro plant to be added at a later date. With the canal and its intake structure already in place, the hydro design actually started at a second intake structure, where water was diverted from the canal to the penstock. However, since the water supply system and the hydro plant shared the canal, the water control strategy had to include provision to maintain minimum levels in the water supply and in the river.

Secondly, as part of the planning process a basic operating strategy for the plant had to be formulated between the developer, Newfoundland and Labrador Hydro and SEA Ltd. (which did the system controls). This strategy had to take into account some of the constraints of the site and, at the same time, make the maximum possible use of the hydro plant's potential. The constraints on the system were as follows: at a maximum output of 135 kW, the hydro plant could not meet the town's daytime demand or full nighttime load, and the diesel plant would therefore still be required on a 24-hour basis. Also, the diesel plant could

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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HYDRO POWER

not be permitted to run below a pre-determined minimum (approximately 25% of rated capacity). To further complicate the operation, the diesel plant would be unattended from midnight to 8:00 A.M. each day.

More savings would occur if the hydro system was always used to its fullest capacity, but initially the town's nighttime load was not large enough to allow the diesel plant to operate at minimum and to make use of the full capacity of the hydro plant.

As a result of these concerns, a control strategy was developed whereby the hydro plant would automatically run up to capacity before the diesel plant started to increase above its minimum setting. This would also work in reverse – the diesel plant would drop the load first until it reached its minimum setting, and only then would the hydro plant start to shed load. This control system was unique to the project and constitutes one of the technical aspects of the demonstration.

The final design called for a penstock 1070 mm in diameter, to carry water 70 metres from the supply canal to the powerhouse. (The penstock was purchased as used steel piping, which resulted in significant cost savings.) The wood frame powerhouse is set on a concrete foundation built at the river's edge. It houses the turbine, the generator, control panels, load governing equipment, the butterfly valve which controls water flow and the transition piping. The propeller-type Kaplan turbine, manufactured by Howden-Galt Inc., is designed for an average head of 7.3 m and a rated flow of 2.5 m³/S. It's capable of producing 135 kW at average head and rated flow.

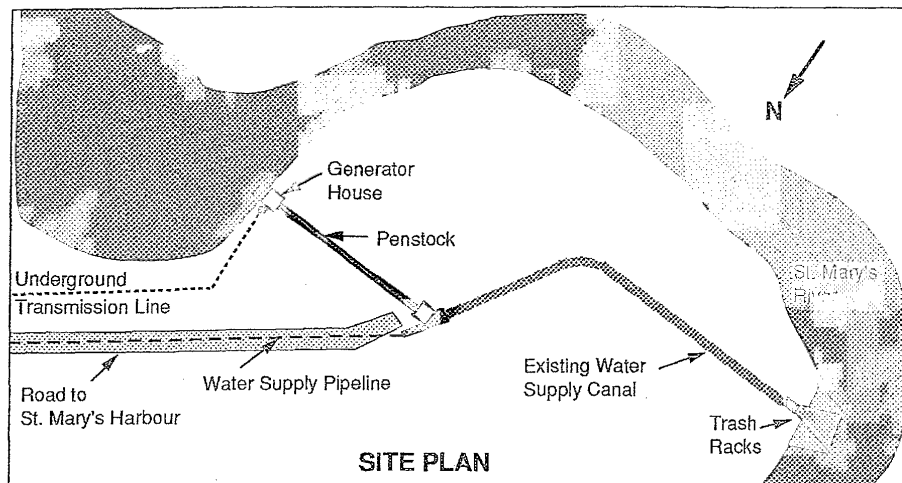
It should be noted that costs at Mary's Harbour are not typical. Because the site is at a natural falls there was no need to construct a dam or create a headpond. Also, the canal to bring the water from the falls to the penstock was already in place, having been built to serve the municipal water system. This provided considerable cost savings in the plant construction. While expenses were lower at the supply end, however, the control costs were higher because of the unique control strategy that integrated the hydro plant with the diesel system.

Commissioning

The initial commissioning went smoothly, with the plant going on-line in November of 1987.

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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HYDRO POWER



Specifications

Intake Structure	concrete structure with weir controlling flow into an intake equipped with a trash rack	
Penstock	buried steel pipe, 1070 mm diameter, 70 m long	
Powerhouse	wood frame construction with a concrete foundation	
Turbine	<p>Howden-Galt Inc.</p> <p>Horizontal, foot-mounted, single-regulated Kaplan turbine with manually adjusted blade pitch, model LH767M05. Design speed 450 RPM, increased to 1200 RPM at the gearbox. This turbine is designed for an average head of 7.3 m and a rated flow of 2.5 m³/S. At average head and rated flow it is capable of producing 135 kW.</p>	
Electrical Equipment	Speed Decreaser	Hansen
	Generator	Kato 175 KW, 3 phase, 600 volt, 1200 RPM, 60 cycle synchronous generator
	Load Shunt Governor	Thompson and Howe
	Voltage Control Breakers	Basler Klockner Moeller
Controls and Monitoring	Programmable Controller	Gould Electronics
	Data Link	Data Radio
	Computer System	Zenith
	Protection	Crompton and Klockner Moeller
	Metering	Power Measurement
	Controls and Indicator Control Panels	Telemecanique SEA Ltd.
Power Transmission	buried teck cable, 1 km	

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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HYDRO POWER

System Operation

Water entering the system is controlled by a weir at the concrete intake structure. The weir maintains minimum required water levels in the river for fish passage and in the canal for water supply to the community. Flow from the canal into the penstock is controlled by stop logs and an intake gate at a second intake structure.

The thrust block located on the penstock, upstream of the powerhouse, is required to resist the forces caused by shut-down. Because of electronic load governing, no hydraulic transients are introduced during normal operation due to load governing.

Water enters the powerhouse from the penstock through a butterfly valve. Valve opening and closing is accomplished by means of an electrically operated hydraulic pump, single acting cylinder and counterweight. Under normal operation the butterfly valve is held fully open by the pressure on the cylinder created by the pump. For shut-down, the hydraulic pressure on the cylinder is released, causing the butterfly valve to be closed by the counterweight. The speed of closure is controlled by an adjustable flow restrictor at the pump.

Power is generated by the turbine and generator at 600 volts and is transformed at the power house to 4160 volts using three 75 KVA pole-mounted transformers. Import and export metering takes place at the powerhouse and electricity is transmitted by buried cable to the edge of town. (Because the meters are at the powerhouse, it was necessary to calculate the transmission losses and factor these into the pricing agreement with NLH; transmission losses of 2% were agreed on.)

Water leaves the turbine through a discharge cone. The end of the cone is immersed in the tailrace waters to take advantage of the available suction head.

The system controls are governed by a computer located in the diesel generating plant.

Description of Project Results

Operation experience

Some problems with the control system and with large head losses were experienced in the first few months of operation. These have been partially resolved and the system has since been performing close to expectations.

An inability to control frequency was traced to the failure of a silicone chip in the control system. The hydro plant had to be taken off-line until the problem was diagnosed and the part could be replaced. Since the system was installed, the

Control System between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant
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HYDRO POWER

community has grown and demand for electricity has increased. Now that the load is large enough, the hydro plant can operate at full capacity at all times, subject to available water. This will simplify operation as the complex controls will no longer be required.

The initial period of operation was characterized by exceptionally high head losses in the concrete control structure at the entrance to the canal. These were traced to excessive turbulence, caused by a sediment pit in the centre of the structure, mid-way between the river gate and the canal gate. The turbulence was reduced by filling in the 200 mm-deep pit with concrete blocks to create a smooth passage for the water.

A large head loss was also experienced in the canal during the first winter of operation. It was found that the weight of accumulated snow, (as much as 2.4 m deep at some points) had caused the ice on the canal to collapse, blocking the channel. To solve the problem the flow to the turbine was decreased (by adjusting blades to their minimum setting). This promoted the freezing together of the surface ice chunks that were causing the restriction. Sufficient flow remained to also erode any submerged ice.

In the second winter of operation the opposite problem was encountered. After one of the driest summer and fall seasons on record, water levels in the river were at a record low. To maintain adequate flows for the town water supply, flow to the hydro plant had to be shut off. The developers are now considering building a small dam to ensure against dry periods.

Monitoring

Arrangements were made to monitor the first year's operation. However, due to difficulties with the monitoring equipment and to system downtime in the first few months, the monitoring program was delayed. Results for May '88 to February '89 will be available in April of '89. (For further information contact the EMR Programs Office — St. John's.)

Economics

It was expected that the hydro plant would generate 800 000 kWh of electricity per year. Based on the formula worked out with Newfoundland and Labrador Hydro, it was estimated that this would produce an annual income of \$ 60 000, sufficient to meet the capital and operating costs of the project. Under the formula, NLH pays Mary's Harbour Hydro "the average of actual *operating costs* of the small hydro plant and 90% of *avoidance cost*". The operating costs were defined to include all regular operating costs as well as retirement of the mortgage. Avoidance cost is defined as cost of fuel only, not including cost of installation, operation or maintenance of the diesel plant. Because of the site's limited hydro capacity, all the diesel generators would still be needed and none of the capital costs of the diesel plant would be avoided by the hydro operation.

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Newfoundland and Labrador Hydro has a two-tier pricing structure in the remote communities served by diesel power plants. Consumers are charged the same rates as residents in St. John's for the first 750 kWh. Above that, the electricity rates are more closely tied to production costs, but they are still subsidized about 50% by the government. NLH uses the savings from Mary's Harbour to reduce the government subsidy and make the remote communities' operation more self-sufficient.

Income and Expenses 1988		Projected	Actual
Income:	sale of power to NLH	\$ 59 184.	\$ 35 057.
Expenses:	interest on long-term debt	\$ 24 096.	\$ 23 593.
	depreciation	7 380.	12 591.
	property tax & canal rental	2 818.	4 606.
	insurance, legal & accounting	5 276.	6 085.
	casual labour	3 500.	3 835.
	management fee	4 900.	2 454.
	bank charges & interest	1 000.	1 669.
	repairs, maintenance & operating	2 500.	1 159.
	advertising	0.	432.
Total Expenses		\$ 51 470.	\$ 56 424.
Net Income (Loss)		\$ 7 714.	\$ (21 367.)

A comparison of the projected and actual statements highlights the difficulties encountered in the first year of operation. Considerable downtime was experienced, reflected in the lower sales of electricity (only 60% of what was projected). However, with most hydro plants, once initial commissioning problems are resolved, maintenance is low and it is expected that downtime and maintenance costs will even out in the long run.

Potential for Replication

Several of the parties involved in Mary's Harbour were interested in whether the project could be replicated at other remote sites and at sites on the power grid. Could Mary's Harbour serve as a model for the development of small hydro systems for other communities?

The answer to this question must be a qualified "Yes". Certainly Mary's Harbour proved that it can be done, but the natural advantages which made the project economically feasible may not be found at other sites. Also, at Mary's Harbour the payback period was reduced and financing was easier to obtain because of the large EMR contribution. Finally, lending agencies generally require between 10% and 20% equity. Raising the required equity would be a concern for any site which is to be developed by the private sector, especially in large projects e.g. over \$1 million. At Mary's Harbour the savings in capital costs and the EMR contribution reduced the size of mortgage needed and brought the amount of equity required to within reach of the developer's resources. Plans for sale of shares to

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community residents were postponed until the operation becomes profitable. The eventual success at selling shares and raising equity for other projects will depend on the financial viability of the project and on available tax incentives.

Along with these considerations the Mary's Harbour project provided some valuable lessons for other communities interested in developing their hydro potential. Firstly, the experience at Mary's Harbour proved that although certain things may be technically possible – they may not prove worthwhile when economics and other factors are also considered. For instance, developing a control system that enabled the plant to operate in conjunction with the diesel system at times of low loads added greatly to the complexity of the system and the costs of the installation. While this project demonstrated that such a system is technically possible, the extra costs involved indicate that base load operation should be a prerequisite for development of other sites. However, as more systems are designed and installed, the costs should begin to decrease.

Secondly, the Mary's Harbour project developers discovered the importance of keeping the control system simple, considering the costs and downtime involved in servicing remote sites. They also suggest that the first year's operation be considered an extended commissioning period; in this way the costs of 'debugging' the system would be built into the development costs.

Thirdly, the installation has shown that it's important to err on the conservative side when estimating flow rates and the capacity of a site. Small sites may not warrant extended studies to discover the exact factors affecting the flow rate, but allowances for periodic lower flows must be built into the projections.

Finally, Mary's Harbour showed that in a complex project requiring the co-operation and active support of many players, getting everyone on board is really a matter of building confidence. Using this approach, the developers of Mary's Harbour were able to create a snowball effect, persuading some agencies to break new ground in their operations and others to provide financial support.

What made Mary's Harbour Hydro possible?

- There was no need to build a dam or create a headpond.
- Sharing civil works with the water supply system cut costs drastically.
- Using an open canal instead of a buried pipeline also cut costs.
- Municipal Affairs was solidly behind the project; the department went ahead and built the water supply to accommodate a later hydro project.
- EMR support of the project built confidence at the provincial level and made it easier to get financing and other approvals.
- The engineering firm was prepared to develop the project when the municipality could not.
- Since the project was developed by a private company rather than Newfoundland and Labrador Hydro, it was eligible for the government contributions which made it more economically viable.
- The size of project and government financial support made private equity financing possible.

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Conclusions

Going into the project, each of the various participants had their own expectations. The town of Mary's Harbour was looking for a water supply system and more economical electricity. Municipal Affairs was interested in developing the town's water supply, while Newfoundland and Labrador Hydro wanted to save on diesel fuel. The Department of Energy and EMR were interested in demonstrating the potential of small hydro systems and the institutional arrangements. The provincial Development Corporation was looking for return on its investment, while the developer, Mary's Harbour Hydro, hoped to meet its expenses and mortgage payment and pay back the equity investment of its shareholders.

During the development and start-up phase the big question was, "Will it work?" Now that the initial bugs have been worked out, that question has been answered with a definite "Yes". The Mary's Harbour installation does work as planned and it will meet all these expectations.

Not only has the project demonstrated the technical feasibility of the site, it has also demonstrated how several government departments and agencies can work together with the private sector to provide a needed service in a cost-effective, innovative manner. Along the way, the project participants also developed new legislation and cleared the way for future projects of a similar nature.

For further information on the Mary's Harbour Hydro Electric Development Project, contact the following Energy, Mines and Resources Canada Program Office.

EMR Programs Office – St. John's
Box 65
Atlantic Place
3rd Floor, Suite 301
215 Water Street
St. John's, Newfoundland
A1C 6C9
(709) 772-5464 Toll Free 1-800-563-5910



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 for approval to proceed with the construction and purchase of certain improvements and additions to its property pursuant to Section 41(3) of the *Act*.


AFFIDAVIT

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

1. I am the Sr. Manager - Rural Planning, 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 23rd day of August)
2018, before me:)


Barrister – Newfoundland and Labrador

 P. Eng.
Bob Moulton, P. Eng.

1 (DRAFT ORDER)
2 NEWFOUNDLAND AND LABRADOR
3 BOARD OF COMMISSIONERS OF PUBLIC UTILITIES
4

5 AN ORDER OF THE BOARD
6

7 NO. P.U. __ (2018)
8

9 **IN THE MATTER OF** the *Electrical Power*
10 *Control Act*, RSNL 1994, Chapter E-5.1 (the
11 *EPCA*) and the *Public Utilities Act*, RSNL 1990,
12 Chapter P-47 (the Act), and regulations thereunder;
13

14 **AND IN THE MATTER OF** an Application
15 by Newfoundland and Labrador Hydro
16 for approval to proceed with the construction
17 and purchase of certain improvements and
18 additions to its property pursuant to
19 Section 41(3) of the Act.
20

21 **WHEREAS** Newfoundland and Labrador Hydro (Hydro) is a corporation continued and existing
22 under the *Hydro Corporation Act, 2007*, is a public utility within the meaning of the Act, and is
23 subject to the provisions of the *Electrical Power Control Act*, RSNL 1994; and
24

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

- 27 a) the cost of construction or purchase is in excess of \$50,000; or
28 b) the cost of the lease is in excess of \$5,000 in a year of the lease,
29 without prior approval of the Board; and
30

31 **WHEREAS** in Order No. P.U. 43(2017) the Board approved Hydro's 2018 Capital Budget in
32 the amount of \$170,868,300; and
33

34 **WHEREAS** in Order No. P.U. 5(2018) the Board approved additional 2018 capital expenditures
35 and an amended 2018 Capital Budget for Hydro in the amount of \$181,193,700; and
36

37 **WHEREAS** the Board approved supplementary 2018 capital expenditures:

- 38 (i) in Order No. P.U. 6(2018) in the amount of \$719,400 to complete voltage
39 conversion of the Labrador City Feeder VA26;
40 (ii) in Order No. P.U. 19(2018) in the amount of \$1,000,000 to be added to the
41 Allowance for Unforeseen Items;
42 (iii) in Order No. P.U. 23(2018) in the amount of \$1,120,600 to complete Level
43 2 condition assessments on penstocks at Bay d'Espoir; and
44 (iv) in Order No. P.U. 25(2018) in the amount of \$2,560,500 to restore the design
45 performance of the air heaters to increase the generating capacity of Units 1, 2 and 3
46 at the Holyrood Thermal Generating Station, including the replacement of the hot end

air heater baskets in the boilers on each unit and replacement of worn air heater sector plate liners and seals on Unit 3; and

WHEREAS on August 23, 2018, Hydro applied to the Board for approval to proceed with capital expenditures of approximately \$195,500 associated with the purchase and construction of a control system between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant;

WHEREAS the Board is satisfied that the proposed 2018 supplemental capital expenditure of approximately \$195,500 associated with the purchase and construction of a control system between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant is necessary to ensure the continued provision of a safe and reliable electricity supply to Hydro's customers.

IT IS THEREFORE ORDERED THAT:

1. The proposed capital expenditures of approximately \$195,500 associated with the purchase and construction of a control system between Mary's Harbour Diesel Plant and St. Mary's River Hydro Plant 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 , 2018.

