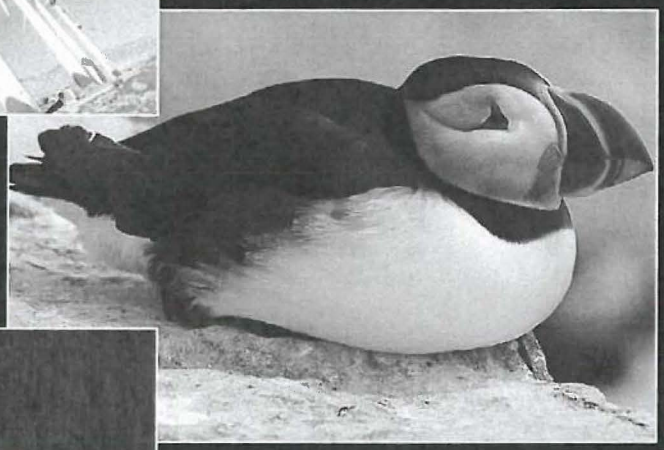
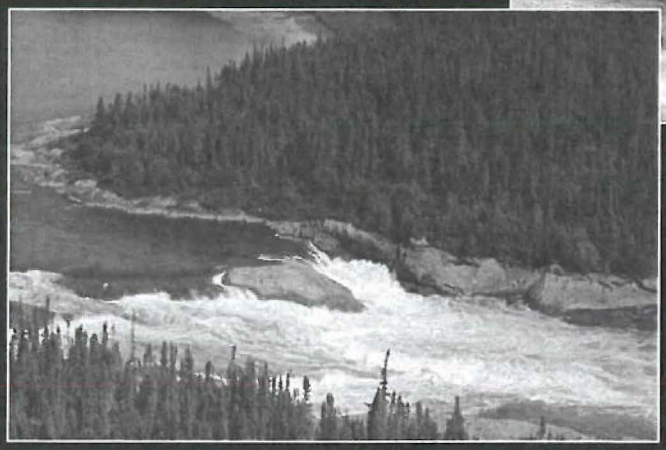
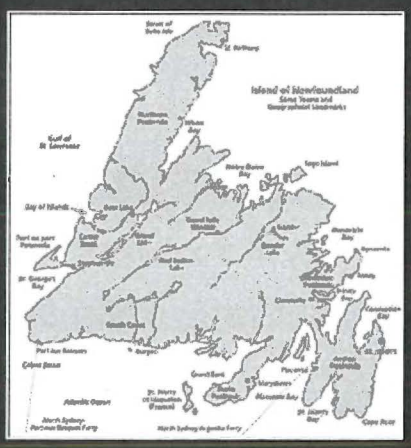
# CONSUMER ADVOCATE FOR NEFWOUNDLAND AND LABRADOR
# TWO GENERATION EXPANSION OPTIONS

## HIGH LEVEL REVIEW REPORT







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Knight Piésold
CONSULTING

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# CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR TWO GENERATION EXPANSION OPTIONS

## HIGH LEVEL REVIEW REPORT (REF. NO. VA1103-365/2-1)

| Rev | Description | Date | Approved |
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| A | Issued in Draft (Prior to Manitoba Hydro Review) | November 2, 2011 | SRM |
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**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION OPTIONS**

**HIGH LEVEL REVIEW REPORT**
**(REF. NO. VA103-365/2-1)**

## EXECUTIVE SUMMARY

The Government of the Province of Newfoundland and Labrador is proposing to develop the Lower Churchill hydro resource as the preferred long-term power supply for the island of Newfoundland. The Board of Commissioners of Public Utilities is an independent, quasi-judicial tribunal responsible for, amongst other things, the regulation of and general supervision of public utilities in the Province.

The government has made a reference to the Board, in which it is stated: *"In the Energy Plan, 2007, Government committed to the development of the Lower Churchill hydro resource. It has been determined that the least-cost option for the supply of power to the Island interconnected system over the period of 2011-2067 is the development of the Muskrat Falls generation facility and the Labrador-Island Link transmission line (the "Projects")…as compared to the isolated Island development scenario (the "Isolated Island Option")…both of which shall be outlined further in a submission made by Nalcor Energy ("Nalcor") to the Board of Commissioners of Public Utilities) the ("Board")*, and the Board has been directed to: *"review and report to Government on whether the Projects represent the least-cost option for the supply of power to Island Interconnected Customers over the period of 2011-2067, as compared to the Isolated Island Option, this being the "Reference Question".*



Providing an answer to the "Reference Question" is the focus of this High Level Review Report.

Knight Piésold Ltd. has performed this high level review of the information provided by Nalcor on behalf of the Consumer Advocate of Newfoundland and Labrador. The information provided to date by Nalcor, has been delivered in a piecemeal fashion, with a number of key documents still being withheld from the Public by Nalcor, as they are considered "Confidential". Due to the lack of available detailed costing information, Knight Piésold has completed this High Level Review Report based on its own recent and relevant experience with regards to project costs associated with each of the proposed development options.

This review is limited to the comparison of the Two Generations Options presented to the Board by Nalcor as follows:

- Interconnected Island Option:
  - 824 MW Muskrat Falls Hydro (MF) plus 50 MW CT on Island (Generation).
  - 900 MW HVDC Labrador Island Link (LIL) (Transmission).
- Isolated Island Option:
  - 25 MW Wind.
  - 36 MW Island Pond, 23 MW Portland Creek and 18 MW Round Pond Hydro.
  - Holyrood Upgrades.
  - 170 MW CCGT, and incremental 50 MW CT additions.
  - Holyrood Replacement post 2030 with additional Thermal Generation.

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Based on the information available at the time of writing this report, Knight Piesold is in general agreement with Nalcor assessment that the Interconnected Island Option represents the least-cost option for the supply of power to Island Interconnected Customers over the period of 2011-2067. However, it should be noted that the projections on fuel price increases over the next 50 years have a significant impact on these findings, and if the fuel prices do not increase at the rates projected, then the difference between the two generations options is significantly reduced.

Knight Piésold has further found that:

- The demand projections methodologies presented are reasonable, and have been accepted for the analysis presented in this report.
- Demand side management results were not included and could have a measurable impact, its bearing on the overall supply selection needs to be demonstrated. (The Navigant Report indicated it did not have an impact.)
- The Isolated Island Option does not integrate as much wind or small hydro into consideration as was possible; however the development of these renewable resources would not alleviate the requirement for the development of firm thermal resources in the future under the Isolated Island Option. The projected ratio of Island renewable resources to overall oil based thermal resources is insufficient to compete with the interconnected island option.
- Nalcor and Navigant excluded natural gas generation in the generation expansion alternatives on the basis that natural gas was not yet available on the island and there was no firm plans to bring natural gas to the island, however natural gas within a larger development plan of Newfoundland and Labrador at current projected market rates could be very cost competitive with MF and the LIL.
- The targeted online date of the Isolated Island Options is suspect as Portland Creek project appears more financially attractive than the Island Pond and a Wind Power Project.
- The cost of the Churchill Falls-Muskrat Falls transmission line has been included in the Muskrat Falls capital cost; while this was done to alleviate and reduce the supply risk should Muskrat Falls fail to commission on time, it is likely that that the line would be utilized to export power in the early stages when the power may not be required. The inclusion or non-inclusion may warrant a separate review if the cost is to be borne by NL customers.
- The optimization of the Muskrat Falls project has not been reviewed since 1998, in light of new project configurations and energy valuations a revision may be warranted (both in terms of installed capacity and height of infrastructure and assuming no development of Gull Island).
- Delaying the development of the Muskrat Falls (MF) and Labrador-Island Link (LIL) was not considered in the Navigant summary report on Decision Gate 2.

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**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**(REF. NO. VA103-365/2-1)**

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**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**(REF. NO. VA103-365/2-1)**

## SECTION 1.0 - INTRODUCTION

### 1.1 BACKGROUND

The Government of the Province of Newfoundland and Labrador is proposing to develop the Muskrat Falls (MF) and Labrador-Island Link (LIL) projects as the preferred long-term power supply for the island of Newfoundland. This report will provide a high-level review of the information used to arrive at this recommendation.



### 1.2 ENTITIES INVOLVED

#### 1.2.1 Nalcor Energy

Nalcor Energy was created in 2007 to manage the energy resources of the provinces of Newfoundland and Labrador. Nalcor Energy is a provincial Crown corporation under the Government of Newfoundland and Labrador. There are five lines of business under Nalcor Energy which include: Newfoundland and Labrador Hydro, the Churchill Falls Generating Station, The Lower Churchill Project, Oil and Gas and the Bull Arm Fabrication Site.

Nalcor Energy has provided the documentation reviewed herein to describe the process used to arrive at the decision to develop the Muskrat Falls (MF) and Labrador-Island Link (LIL) projects.

#### 1.2.2 Board of Commissioners of Public Utilities

The PUB is an independent, quasi-judicial regulatory body appointed by the Lieutenant Governor in Council, and operates primarily under the authority of the Public Utilities Act. The Board is responsible for the regulation of the electric utilities in the province to ensure that the rates charged are just and reasonable, and that the service provided is safe and reliable.

The Provincial Government of Labrador and Newfoundland has asked the Board of Commissioners of Public Utilities (PUB) to provide an additional review of the process used to determine that Muskrat Falls represents the least-cost option for the supply of power to Island Interconnected Customers compared to an Isolated Island development option.

#### 1.2.3 Manitoba Hydro International Ltd.

Manitoba Hydro International Ltd. is a wholly-owned subsidiary of the Manitoba electric power utilities. Manitoba Hydro International Ltd. (MHI) has been engaged by the PUB to perform a review of the Nalcor analysis.

### 1.2.4 Consumer Advocate

The Consumer Advocate ensures the effective representation of domestic and general service electricity customers in response to applications from public utilities and is appointed by the Government of Newfoundland and Labrador. Consumer advocate Tom Johnson has been appointed to represent consumer interests during the PUB review.

The Consumer Advocate takes part in the public consultation process organized by the PUB.

### 1.2.5 Knight Piésold Ltd.

Knight Piésold Ltd. (KP) is an independent, international consulting company specialising in power supply developments. The company was incorporated federally in Canada in 1975, and has had no prior involvement in any energy studies in the Province of Newfoundland and Labrador and bring an independent review role to this assignment.

Knight Piésold has been involved in hydropower projects for over 80 years and has recent, relevant experience in design and construction of new hydropower generating capacity in Canada. Knight Piésold also has in-house capabilities in wind power, thermal power and transmission.



Knight Piésold Ltd. has been asked by the Consumer Advocate to provide an independent high-level review of the assessments by Nalcor and MHI.

### 1.2.6 Navigant

The Muskrat Falls with the Labrador-Island Link was chosen as the preferred alternative to meet future energy needs during Decision Gate 2 (DG2).

Navigant, a consulting services firm, was retained by Nalcor to perform and report on the DG2 estimates. To prepare their findings, Navigant built and managed financial screening tools that allowed for rapid turn-around in the review of different planning scenarios, assessed and implemented methodologies for comparing resource options of different lives and sizes, and calculating the revenue requirement impacts of each resource option considered. Subsequent to their review Navigant prepared the "Independent Supply Decision Review."

### 1.2.7 Independent Project Review Team

The Independent Project Review (IPR) Team consisted of a small team of experts in project management, engineering, construction & commissioning. They were asked to perform a high-level independent expert assessment to ensure that decision-makers understand the completeness and issues associated with the deliverables on which they will base their decisions. The review focused on the Muskrat Falls Generation and Labrador island Link.

### 1.2.8 Churchill Falls Labrador Corporation

The Churchill Falls facilities are owned and operated by the Churchill Falls (Labrador) Corporation, CFLCo. It is owned by two shareholders: the Newfoundland and Labrador Hydro Corporation (65.8%), and Hydro-Quebec. CFLCo has a 99-year lease on the Churchill River watershed with the government of Newfoundland and Labrador. It was signed in 1961 and is renewable for a further 99 years. Based on those rights, CFLCo developed the site, which now produces approximately 34,000 GWh annually.

Under a 1969 contract, CFLCo sells the bulk of that power, about 30,000 MWh, to Hydro-Quebec. The remainder is sold to the iron-ore mines in western Labrador and to Newfoundland and Labrador Hydro. Regarding sales to Hydro-Quebec, the 1969 contract sets the price at $2.50 per MWh which yields about $75 million annually. Both the amount of power that must be sold to Hydro-Quebec and the price are points of contention.

## 1.3 SCOPE AND OBJECTIVES



The Board of Commissioners of Public Utilities (PUB) has been asked to review and report to Government on whether the Muskrat Falls (MF) and Labrador-Island Link (LIL) projects represent the least–cost option for the supply of power to Island Interconnected Customers over the period of 2011-2067, as compared to the Isolated Island Option. Nalcor Energy has provided the Newfoundland and Labrador PUB a series of documents and references to summarise the process used in their evaluation.

This review is limited to the comparison of the Two Generations Options presented to the Board by Nalcor as follows:

- Interconnected Island Option (Alternative 1):
  - 824 MW Muskrat Falls Hydro (MF) plus 50 MW CT on Island (Generation).
  - 900 MW HVDC Labrador Island Link (LIL) (Transmission).
- Isolated Island Option (Alternative 2):
  - 25 MW Wind Power Purchase Agreement.
  - 36 MW Island Pond, 23 MW Portland Creek and 18 MW Round Pond Hydro Facilities.
  - Holyrood Upgrades.
  - 170 MW CCGT, and incremental 50 MW CT additions.
  - Holyrood Replacement post 2030 with additional Thermal Generation added as the load grows.

### 1.3.1 Cumulative Present Worth

The culmination of the presented generation planning analysis by Nalcor is the comparison of the Cumulative Present Worth (CPW). The CPW is the present value of all incremental utility capital and operating costs incurred to reliably meet a specific load forecast given a prescribed set of reliability criteria. Nalcor's documentation shows that the Interconnected Island Option has a lower CPW than the Isolated Island Option, and is thus Nalcor's recommended Option, consistent with the provision of mandated least cost electricity services.

### 1.3.2 High Level Review

For the purpose of this review, information was looked at broadly honing in on the aspects or components that were most likely to affect to overall outcome and decision. For example the exact capital cost of each of the potential island options does not have as much repercussions as the single cost of the LIL.

### 1.3.3 Limitations

Beyond expressing our opinion of the information provided, Knight Piésold did not have access to the detailed costing information and other "confidential" information to develop the same system wide risk based planning tools developed by Newfoundland and Labrador Hydro (Strategist model) and Navigant, and to be developed by Manitoba Hydro International. Thus our numerical analysis was simplified to incorporate a review of payments for average annual energy.

This high level review does not constitute an audit or validation of Nalcor's work. However, it will provide the Consumer Advocate with a document that highlights the high risk areas and components of the two generations options that have the greatest impacts on the CPW.



### 1.3.4 Not Considered

This report did NOT review:

- The environmental implications of the alternatives
- The retrieval of energy from Churchill Falls
- The use of renewable vs. non-renewable resources
- The legislated requirements, or
- The value and potential of electricity exports.

It is expected that any of the above aspects, if taken into account, could provide a different set of conclusions when the two generation expansion options are compared, as compared to limiting the selection criteria to the CPW Analysis.

### 1.3.5 Two Generation Expansion Alternatives

The major components and time-frames for the **Two Generation Expansion Alternatives** as put forward by Nalcor are as follows:

Alternative 1: (the "Projects")

- Installation of a 50 MW combustion turbine in 2014.
- Development of the 824 MW hydroelectric potential at Muskrat Falls on the Lower Churchill River in Labrador and completion of a nominal 900 MW HVDC link, including submarine cables across the Strait of Belle Isle, to the Island of Newfoundland in 2016. Coincident with this, the nominal 500 MW oil-fired Holyrood Thermal Generating Station (HTGS) on the Island would be placed on standby.
- Retirement of the HTGS in 2021.

- Installation of primarily thermal capacity in the 2030 to 2067 timeframe.

Alternative 2: (Isolated Island Option):

- Installation of a 25 MW wind farm in 2014.
- Completion of the 36 MW Island Pond hydroelectric plant on the Island in 2015.
- Upgrades to the HTGS including the addition of electrostatic precipitators, scrubbers and NOX burners in the 2015 to 2017 timeframe.
- Completion of the 23 MW Portland Creek hydroelectric plant on the Island in 2018.
- Completion of the 18 MW Round Pond hydroelectric plant on the Island in 2020.
- Installation of a 170 MW combined cycle combustion turbine in 2022.
- Installation of 50 MW combustion turbines in 2024 and 2027.
- Installation of 50 MW of wind capacity in 2029.
- Replacement of the HTGS and the addition of more thermal capacity in the 2030 to 2067 timeframe.

## 1.4 REFERENCE DOCUMENTS



Documents provided by Nalcor energy to the Newfoundland and Labrador Board of Commissioners of Public Utilities:

- Synopsis of 2010 Generation Expansion Decision, Nalcor Energy, July 2011.
- Exhibits 1 through 101.
- RFI Responses Batch 01 through Batch 32; including MHI-Nalcor, PUB-Nalcor, and Response to Board Question 3-4.
- Muskrat Falls Development, Presentation to the PUB, July 2011.

Supplemental Documentation:

- Report of the Joint Review Panel established by Canada's Minister of the Environment, the Minister of Environment and Conservation for Newfoundland and Labrador, and the Minister for Intergovernmental Affairs for Newfoundland and Labrador, Lower Churchill Hydroelectric Generation Project, Nalcor Energy, Newfoundland and Labrador, August 2011. CEAA Reference No. 07-05-26178. Department of Environment and Conservation Registration No.: 1305.
- Focusing Our Energy, Newfoundland and Labrador Energy Plan, September 2007.
- Independent Supply Decision Review prepared for Nalcor Energy by Navigant Consulting Ltd, September 14, 2011.
- LNG related Documents:
  - Order Granting Long-Term Multi-contract Authorization to Export LNG by Vessel from the Cove Point LNG Terminal.
  - Dominion Cove Point LNG, Application for Long-Term Authorization to Export LNG to the USA Department of Energy.
  - Response to Newfoundland and Labrador Energy Plan Discussion Paper by the Canadian Association of Petroleum Producers.

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## SECTION 2.0 - DOCUMENT REVIEWS AND SUMMARY

The purpose of this section is the identification of any gaps in the data provided by existing reports and recent studies that could have a bearing on the analysis and recommendations.

### 2.1 COMPREHENSIVENESS

Given the limited time available for the review of the information and sheer volume of information it is unfortunate that it was not presented in a more comprehensive fashion. The number of subsequent key questions by MHI and PUB reflects that the documentation was, generally speaking, not packaged in an effective manner or with the most relevant material presented clearly upfront. The recently released "Independent Supply Decision Review" prepared by Navigant Consulting was instrumental in understanding the process used to arrive at the proposed recommendation and the sensitivity of the recommendation to a number of factors.

The IPR Team noted that the processes and methods used for Risk Analysis, Estimating and Economic analysis complied with appropriate standards and best practices and they observed a good association between the Economics, Estimating and Finance teams. While Knight Piésold trusts the methodologies and rigor of the work undertaken, summarized findings with the clear reference to the supporting material was not often present.



### 2.2 DOCUMENT REVIEW

Table 2.1 presents a list of all the documents made available to Knight Piésold as of: October 7, 2011. A one line comment about the various documents has also been included in Table 2.1.

### 2.3 CRITERIA SELECTION

Two aspects of the planning criteria have been generally accepted, but no particular sensitivity analysis was presented surrounding these criteria, which themselves have a bearing on the overall supply selection. The criteria are: Capacity and Energy.

Section 3 of the Nalcor's Synopsis defines the terms:

- "Energy: The Island Interconnected System should have sufficient generating capability to supply all of its firm energy requirements with firm system capability."
- "Capacity: The Island Interconnected System should have sufficient generating capacity to satisfy a Loss of Load Hours (LOLH) expectation target of not more than 2.8 hours per year."

#### 2.3.1 Energy Criteria

Despite the term "firm demand" and "firm capability" having varying definitions from jurisdiction to jurisdiction the energy criteria is a sensible criterion from an energy quantity perspective. If this criterion forms the basis for the decision making then the terms should be clearly defined; i.e. firm annual supply, firm seasonal supply, etc.

While the reliability of the system should be evaluated, the economic basis could be evaluated on an average basis or some other statistical basis. However, from a cost analysis perspective the soul use of firm supply would tend to be a conservative estimate of the renewable energy supplied and therefore increase the average amount of thermal supplement required, it appears from Exhibit 100 that the average was used.

### 2.3.2 Capacity Criteria

The capacity criteria have an implication affecting the preferred supply option. Generally speaking, if the customers of N&L were willing to accept a less reliable electrical supply source or on the contrary required a more reliable network, then this criterion would change. We can only assume that this criterion was derived as an optimal target, but it is was not possible to ascertain if it was biased towards the Interconnected Island Option (Alternative 1) in the first place.

This high level review has not reviewed whether or not the proposed alternatives achieve the given LOLH Criteria.



## 2.4 PROJECT COMPONENT DESCRIPTIONS

Our understandings of the proposed developments are as follows:

### 2.4.1 Muskrat Falls Hydroelectric Project (Variant 10)

Muskrat Falls Design Basis is shown in Muskrat Falls Project - Exhibit 30 Page 13 of 24. The Muskrat Falls facility would consist of two dams, a reservoir and a generation facility having a total capacity of 824 MW. The two dams would be constructed of roller compacted concrete. The north dam with crest at 39.5 masl and 430 metres in length, and the south dam with crest at 45.5 masl and 325 m in length. The powerhouse would be an above-ground structure that would house four Kaplan turbines, each with a capacity of 206 MW giving a total installed capacity of 824 MW. The project indicative gross head is 35.5 m (39 masl – 3.5 masl) . Water for each turbine would be delvered to the generating units via 9-metre diameter penstocks. The total discharge from the powerhouse would be 2,660 $m^3/s$. The spillway would accommodate a probable maximum flood of 22,420 $m^3/s$. The long term average flow at Muskrat Falls is 1,841 $m^3/s$ (2,026 $m^3/s$ with the Romaine and St-Jean diversions). The facility will be capable of generating 4,900 GWh annually, according to Appendix B, p 37.

| Parameter | DG2 Design |
|---|---|
| Layout | Variant 10, Scheme 3b |
| Power Generation Capacity | 824 MW |
| Annual Energy Production | 4,900 GWh |
| Turbines | 4 x 216 MW Kaplan |
| Main Dam | RCC |
| Temporary Diversion Scheme | Spillway |
| Spillway | 4 radial gates |
| Access | South Side Access Road |

| | |
|---|---|
| Camp | 1,500 people |

Based on the documentation reviewed in this report it appears that:

- The Muskrat Falls Hydroelectric Development is technically feasible.
- Continued studies are underway to reduce risks and contingencies in the cost estimates.
- Previous and recent geotechnical investigations indicate foundations are suitable for the given structures.
- Proposed structures and electrical and mechanical equipment are conventional.
- The North spur stabilization layout is technically feasible.
- The project construction schedule is aggressive.

### 2.4.2 Muskrat Falls to Churchill Fall Transmission Line

The capital cost estimate for Muskrat Falls to Churchill Falls transmission line was lumped in with the Muskrat Falls Project cost, a description is provided p. 5 of Exhibit 59: "For project costing it is recommended that two 345 kV transmission lines with a two conductor bundle of 795 MCM 26/7 ACSR "DRAKE" per phase be assumed. In addition, to ensure acceptable voltage control on line open end conditions, four 345 kV, 45 MVAR shunt reactors (one per each transmission line end) be included." This line is principally presented as a reliability component.



| Parameter | DG2 Design |
|---|---|
| Operating Voltage | 2 x 345 kV |
| Overall Transmission Length | 245 km |

### 2.4.3 Labrador Island Link

The Labrador Island Link consists of a 320 kV high voltage direct current (HVdc) transmission line, approximately 1,100 km long.

| Parameter | DG2 Design |
|---|---|
| Operating Voltage | 320 kV |
| System Capacity | 900 MW |
| Number of Submarine Cables | 3 off |
| Overall Transmission Length | 1,050 km |
| Submarine Cable Route | 35 km |

Analysis carried out in June and July of 2010 confirmed that a 900 MW HVdc link between Labrador and the Island would require a minimum operating voltage of ±320 kV to ensure that transmission losses for the proposed HVdc system would be in the order of 10% over peak periods.

### 2.4.4 Wind Power Facilities

Newfoundland has an abundant wind resource with a significant potential for wind-power development. There are operational constraints that limit the amount of additional

non-dispatchable generation that can be added to the system. A nominal 25 MW wind farm is reportedly expected to generate a reported estimated annual firm and a reported average energy capability of approximately 70 and 110 GWh, respectively; yielding respective capacity factor equivalents of 32% and 50%. The given capacity factors appear high and will need to be confirmed with the long term data from the existing wind farms of Fermeuse and St. Lawrence.

### 2.4.5 Island Pond Hydroelectric Facility

Island Pond is a proposed 36 MW hydroelectric facility located on the North Salmon River, within the watershed of the existing Bay d'Éspoir development. The project would use roughly 25 m of net head between the existing Meelpaeg Reservoir and Crooked Lake to produce an annual firm and average energy capability of 172 GWh and 186 GWh, respectively; yielding respective capacity factor equivalents of 54% and 59%.

The development would include a 3 km diversion canal between Meelpaeg Reservoir and Island Pond, which would raise the water level in Island Pond to that of the Meelpaeg Reservoir. Also, approximately 3.4 km of channel improvements would be constructed in the area. At the south end of Island Pond, a 750 m long forebay would pass water to the 23 m high earth dam, and then onto the intake and powerhouse housing a single Kaplan turbine generator with a full load flow of 182 $m^3/s$, and finally discharging it into Crooked Lake via a 550 m long tailrace.

The facility would be connected to TL263, a nearby 230 kV transmission line connecting the Granite Canal Generating Station with the Upper Salmon Generating Station.



### 2.4.6 Portland Creek Hydroelectric Facility

Portland Creek is a proposed 23 MW hydroelectric facility located on Main Port Brook, near Daniel's Harbour, on the Northern Peninsula. The project would utilize 395 m of net head between the head pond and outlet of Main Port Brook to produce an annual firm and average energy capability of 99 GWh and 142 GWh, respectively; yielding respective capacity factor equivalents of 49% and 70%.

The project would require: a 320 m long diversion canal; three concrete dams; a 2,900 m long penstock and a powerhouse housing two Pelton turbine generators, a 27 km 66 kV transmission line from the project site to Peter's Barren Terminal Station; and the construction of access roads.

### 2.4.7 Round Pond Hydroelectric Facility

Round Pond is a proposed 18 MW hydroelectric facility located within the watershed of the existing Bay d'Éspoir development. The facility would utilize the available head between the existing Godaleich Pond and Long Pond Reservoir (approximately 11 m) to produce an annual firm and average energy capability of 109 GWh and 132 GWh, respectively; yielding respective capacity factor equivalents of 69% and 83%. Flows are regulated by the Upper Salmon Generating Station, in addition to the natural drainage from Round Pond basin itself.

The plant design flow is around 193 $m^3/s$. (A design factor of 1.2 considering a Mean Annual Discharge of 163 $m^3/s$.) The facility includes large pieces of infrastructure: a 800 m earth fill dam, a 1,050 m saddle dam, a spillway dam, a 290 m power canal, an 80 m fish passage facility.

### 2.4.8 Combined Cycle Combustion Turbine Facility

The combined cycle facility, also known as a combined-cycle combustion turbine (CCCT) facility, consists of a combustion turbine fired on light oil (in the absence of natural gas), a heat recovery steam generator, and a steam turbine generator.

Two sites have been considered by Nalcor: one alternative for a proposed combined cycle plant located at the existing HTGS to take advantage of the operational and capital cost savings associated with the existing facilities. The other alternative is to develop a greenfield site at a location yet to be determined. The greenfield alternative may be preferred due to environmental constraints that may be placed on any new developments at Holyrood and reduce the risk of loss of multiple generation sources in the event of major events.

The power ratings being considered herein were for a 170 MW CCCT facility, capable of generating approximately 1,340 GWh annually.



### 2.4.9 Combustion Turbines

Combustion turbines (CTs) are designed to start quickly to meet the demand for electricity during peak operating periods. The proposed CTs are fired on light oil. These simple-cycle combustion turbines nominally rated at 50 MW (net), would be located either adjacent to similar existing units at Hydro's Hardwoods and Stephenville Terminal Stations, at the Holyrood site or at greenfield locations. If required, they can be utilized to provide an annual firm energy capability of 394 GWh each (a 90% Capacity Factor).

### 2.4.10 Holyrood Ugrades

Newfoundland and Labrador Hydro (Hydra) operates a 500-MW heavy oil fired generating plant at Holyrood on Conception Bay. The plant consists of three units. Units 1 and 2 were commissioned as 150 MW units in 1969, and Unit 3 was commissioned as a 150 MW unit in 1980. In the late 1980s, Units 1 and 2 were uprated to 175 MW each, bringing the total capacity to 500 MW. No air emissions control equipment exists on any of the units. Upgrades are required for continued use of the facility.

## SECTION 3.0 - LOAD AND GENERATION FORECAST REVIEWS

### 3.1 LOAD FORECASTS REVIEW

#### 3.1.1 Load Forecast

The load forecasts (from 2010) were provided in Exhibit 1, the numbers provided are developed by the Market Analysis Section, System Planning Department of Newfoundland and Labrador Hydro.

The numbers supplied have been well accepted during the planning phase and the methods employed are consistent with standard utility practice, therefore are accepted as presented. Navigant has noted that the projected growth is comparable (slightly less than) to the electrical energy growth rates in Canada overall.



#### 3.1.2 Provincial Energy Plan

The Provincial Energy Plan outlines the long-term vision for developing Newfoundland and Labrador. The relevant Energy Plan objectives are meeting the provincial electricity needs, re-investing wealth from non-renewable oil resources into renewable projects, and replacing Holyrood Thermal generating Station (HTGS) with non-emitting alternative, or installing scrubbers and electrostatic precipitators.

The Energy Plan confirms broadly the projected continued increase in demand and capacity requirement reflected in these numbers through 2067. The switch to electric heat is cited as the primary driver of the increase in electricity demand. Additional accepted assumptions in the forecast include:

- Continued operations of the Island newsprint mill and oil refinery
- Continued operations of the Teck mine through 2013
- Full production of the Vale Nickel processing facility by 2015, and
- Continued growth led by the development of the Hebron oil field.

#### 3.1.3 Load Shape

The load shape shared in Exhibit 2, indicates that the hourly peak demand rises to 30% over average annual energy requirement. In the load forecast the peak energy requirement is roughly 72-75% over the average energy requirement.

### 3.2 DEMAND SIDE MANAGEMENT

Whether it is expected to count as a supply or a reduced load, no quantification of demand side management (DSM) was provided. Exhibit 16 – Generation Planning Issues mentions a number of energy conservation programs and states their success, yet no metric of the impact is indicated. It further states:

"The impact of energy conservation measures resulting from the Five-Year Energy Conservation Plan will need to be evaluated to determine what, if any impact, it has on the decision for the next

source. At this time, it is expected that the principal benefits will be the economic and environmental benefits of the reduced reliance on HTGS produced electricity and that the timing for the next decision will be unaffected."

Navigants "Assumptions for Island Demand and Supply" indicate that a realistic level of DSM could yield an annual savings of 750 GWh at the end of a 20 year period of aggressive DSM programs, regulations, codes and standards. "Realizing this level of saving would require investing approximately $400 million in energy efficiency over 20 years." Even at these costs the returns far exceed what can be achieved by traditional supply means. It is therefore recommended that DSM be presented as a viable supply that could meet a measurable portion of the forecasted demand growth.

Furthermore, if aggressive demand side management is pursued independently then the forecasted energy demand from the Muskrat Falls (MF) generation facility may be impacted, and since the MF project is amortized over the projected energy consumption, there may be a resulting impact on the cost per unit energy of MF.



## 3.3 GENERATION FORECASTS

Figures 3.1 and 3.2 illustrate the forecasted demand and average means of meeting that demand as provided by Nalcor in Exhibit 100 (released October 4, 2011) in both the Interconnected Island Scenario and the Isolated Island Scenario. Visually one can observe the small role played by average non Labrador Island Link supplies in the Interconnected Option, and the relatively small proportion of the renewable component in the Isolated Island Scenario.

The general makeup of the supply is reasonable with renewable sources taking precedent over thermal sources.

## 3.4 CAPACITY FACTOR ESTIMATES REVIEW

Firm capability for the hydroelectric resources is the firm energy capability of those resources under the most adverse three-year sequence of reservoir inflows occurring within the historical record. Firm capability for the thermal resources (HTGS) is based on energy capability adjusted for maintenance and forced outages.

The overall rates are reasonable in each case, with exception of the high wind capacity factor, but it is not significant overall.

## SECTION 4.0 - OPTIMIZATION REVIEW

It is debatable as to whether the two options as presented by Nalcor were indeed the optimal options to compare. Particularly in the Isolated Island scenario, while the Navigant report did breach some of the information gaps, the full spectrum of isolated island options was not shared.

### 4.1 OPTIMIZATION OF THE INTERCONNECTED ISLAND OPTION (ALTERNATIVE 1)

The Muskrat Falls project has been repeatedly shown as a fixed 824 MW facility, but there may be options surrounding the development. Any improvement in the optimization of Muskrat Fall should only help lean the selection towards the interconnected option.

#### 4.1.1 Hydrology of Muskrat Falls

A flow duration curve for Muskrat Falls is presented in the 1999 Feasibility Study (pdf p. 545, 1999 Feasibility Study.) It shows an exceedance probability over 80% for a flow of 1,600 $m^3/s$ and 15% for a flow of 2,400 $m^3/s$. With roughly 35 m of net head this bracket corresponds very roughly to 500 - 750 MW of installed capacity. Given the indicated exceedance probability curve a 500 MW plant would have a very firm energy profile capable of generating over 4,000 GWh annually. Note: it is unclear whether this curve includes the Romaine and St-Jean diversions. Section 5.3 of the 1999 Feasibility Study indicates that the potential size of the Muskrat Falls project could vary from 618 MW to 1,236 MW.



With a reported 824 MW installed capacity, 2,660 $m^3/s$ design flow, 4,900 GWh of annual generation, there is some capacity valuation to the final recommended installed capacity over an energy valuation or logical development economies associated with sunk development costs.

#### 4.1.2 Increased Head at Muskrat Falls

Increasing the impoundment elevation at Muskrat Falls would limit any future development of Gull Island, but allow for more energy to be produced at Muskrat Falls. In RFI Response MHI-Nalcor 74, Nalcor states that it does not intend to develop Muskrat Falls in isolation of Gull Island. A configuration of Muskrat Falls may therefore exist that is more optimal to the consumer if the consumer is to bear the development cost.

#### 4.1.3 Optimization of Muskrat Falls Installed Capacity

According to Section 5.3 of the 1999 Feasibility Study the project was optimized on the basis of capital costs for varying sizes and economic factors assumed for evaluating energy and capacity benefits, as supplied by Newfoundland and Labrador Hydro were:

- "Present value of 1 TWh per year for fifty year project life and 10% interest rate = $225,000,000"
- "Value of 1 MW capacity = $550,000"

While the metric for the recommended installed capacity has most likely changed since the 1998 studies, the optimization of the projects installed capacity has not been revised since. Assuming

a unit rate of 75 $/MWh, at 2% escalation, for 50 years at 10% interest puts the NPV in excess of $1 billion.

The report further refers to "Acres International Ltd., (1998), Churchill River Complex - Optimization Study, (In progress), P12859.00." not provided or reviewed herein.

According to the IPR Team Muskrat Falls has been optimized within the overall development plan of the river, it did not indicate whether Muskrat Falls was optimized in the context of providing power to Newfoundland. The end difference could be that the Newfoundland consumers would be paying for a larger or smaller piece of infrastructure than specifically necessary to meet their demand in an optimal way.

4.1.4 Phased Development

The proposed Muskrat Falls Development has not been optioned as a phased development where all turbine generators are not installed on the onset. There are undoubtedly large economies in terms of installation costs and mobilization for installing all equipment during the initial development however the turbine generators are also large ticket items and differing the installation of one or two of the turbines could differ the expenditures in excess of $100 to $200 million in initial capital.



4.1.5 Upper Churchill Improvements Opportunities

The system model schematic (pdf p.93 – 1999 Muskrat Falls Feasibility Study) shows the complexity of the Upper Churchill Falls system upstream of Muskrat Falls. There may be a number of system upgrades or capital improvement projects that could be expanded to provide generation beyond the current capability. While it is understood that this consideration was not covered under the current mandate, the question is posed since the current Muskrat Falls and LIL option already extend from Muskrat Falls to the Upper Churchill system.

## 4.2 TRANSMISSION OPTIMIZATION

The available transmission options have been studied (e.g., transmission to the island, transmission through Quebec to US, transmission thru Newfoundland to the Maritimes). The only option that warrants consideration for supply power to Newfoundland is the Labrador Island Link (LIL) and the alignment, voltage and channel crossing designs have been further optimized by Nalcor over the last decade. There appears to be room for further optimization of the Muskrat Falls to Churchill Falls transmission line, and there is obviously a benefit to exporting any excess energy from the system, but this has not been evaluated as part of this study.

## 4.3 OPTIMIZATION OF THE ISOLATED ISLAND OPTIONS

While reviewing the information provided by Nalcor, the question of whether the Isolated Island Option put forth was indeed the optimal and least cost option for an Isolated Island development was nagging. The recently released Navigant Report outlines the parameters leading to the proposed option and reinforces the options recommended by Nalcor.

It was noted that the mandate of the Independent Project review, performed by a team of four independent experts was to focus on the Muskrat Falls Generation and Island Link and not the Isolated Island Options; as such the Isolated Island Option may not have undergone the same level of scrutiny.

While Knight Piésold concurs with the dismissal of Solar and Nuclear sources on the basis stated by Navigant, there are still outstanding questions with regards to the on Island hydropower and gas (LNG) generation opportunities.

### 4.3.1 Wind Power Integration

Navigant's assessment and Exhibit 61's both indicate that a larger amount of Wind Power can be integrated in the generation mix, particularly in instances where supplemental capacity has been added to the system. As wind power is competitive versus the thermal alternatives it is expected that the presented option may be slightly sub-optimal (i.e. additional wind power integrations could be considered).



### 4.3.2 Hydropower Resources

It may be worth revisiting the 1986 Study performed by Shawmont Newfoundland that identified 196 potential hydro sites to ensure there are no hidden assets. Furthermore, it has been Knight Piésold's experience that older hydroelectric studies typically limited themselves to a traditional vision of firm hydropower as opposed to a renewable vision of intermittent run-of-river hydropower with larger energy generation capabilities. KP has not had access to this 1986 study to review.

Navigant indicated that seven proposals were received for selection in response to a 1992/93 hydroelectric procurement process with average bid prices of 102$/MWh (in today's prices, as updated by Navigant). This immediately raises the query as to why only three on island hydroelectric projects are considered in Alternative 2 (i.e. Isolated Island Option)?

### 4.3.3 Optimization in Light of Thermal Offsets

The indicated capacity factors for the 3 proposed hydroelectric facilities are generally high indicating that they are either on highly regulated systems (Round Pond, Island Pond) or optimized with a firmer yield in mind. If the individual facilities are designed on the basis of their individual cost benefit ratios there is could be an opportunity to significantly increase their energy generation potential and thereby offset expensive thermal generation. Simply put, it is likely that the proposed hydroelectric facilities could have larger installed capacities than those indicated, though the amount is probably not significant when compared to the total increase in demand to 2067, but still worth consideration.

## 4.4 NATURAL GAS

Newfoundland and Labrador has witnessed strong growth in its oil and gas sector and Nalcor has an active role in the exploration and development of oil and gas resources both offshore and onshore. Natural gas is produced in Newfoundland and Labradors offshore areas and could be transported to

Newfoundland, either as gas in a pipeline or in a Liquefied Natural Gas (LNG) tanker. Once onshore, gas could be used to generate electricity through CTs, a significantly more efficient method than fuel oil and producing far less GHGs and other emissions. While there is significant gas resource offshore of Newfoundland, a majority of the resource occurs as solution gas in an oil pool or as a "gas cap." The development and availability of this resource will depend on oil development and will generally occur only after an oil resource has been depleted.

As a result, a provincial plan for gas development may be feasible. Hibernia, Terra Nova, and White Rose have the potential to contribute reserves. Within a decade these oilfields may have surplus gas available for export. As stated explicitly in the Newfoundland and Labrador Energy Plan: "The economic feasibility of gas-to-wire will depend on a variety of factors, such as the total cost of producing, delivering and converting gas to electricity, compared to the current market value of electricity in the targeted marketplace."

A series of articles forwarded to Knight Piésold by the Consumer Advocate point out that Dominion Cove Point LNG is poising to export LNG out of the US. Projected costs for LNG are low and bearing the appropriate infrastructure could be very cost competitive. If LNG was available at projected competitive market rates then gas fired generation could most likely be developed at a cost much less than Muskrat Falls, especially in the short term.



The economic feasibility of gas-to-wire will depend on the total cost of producing, delivering and converting gas to electricity, as compared to the current market value of electricity in the Newfoundland. Conditions necessary for gas to wire development are:

- Gas Resources must be accessible either through the ability to import LNG or through offshore development and supporting infrastructure (a pipeline)
- Available Gas Handling Capacity
- Compatibility with Oil Developments, and
- Compelling Economics.

There are a number of long term policy items here that go far beyond the scope of this review: what resource does the province wish to pursue, does pursuing Muskrat Falls hinder the development of gas resources, what are the resource sector risks, what is the cost of the loss of gas sales, etc. Nalcor and Navigant both indicated correctly that there was no immediate firm development plan to bring natural gas to the Island, and assumed it was sufficient for their consideration.

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## SECTION 5.0 - COSTS, DEVELOPMENT SCHEDULES AND FINANCIAL ANALYSES

### 5.1 COST ESTIMATE REVIEWS

Knight Piésold has reviewed the overall costs of MF and LIL with extremely limited access to layouts, bill of quantities or breakdowns of the project costs. A very cursory review of the isolated island option was also undertaken. Table 5.1 contains a summary of the projects cost shared by Nalcor and Navigant.

#### 5.1.1 Muskrat Falls

Very broadly speaking, investment costs of large hydropower plants range from $2 million/MW to $10 million/MW. It is very site-sensitive, with a typical figure of about $4 million/MW. Operation and maintenance (O&M) costs of hydropower are between 1.5% and 2.5% of investment cost per year. The Muskrat Falls Facility fits within this bracket at around $3 million/MW without the LIL, and $6 million/MW with the LIL.

The cost estimate for Muskrat Falls is in the right order of magnitude and generally appears adequate without access to the details. Two components appear conservative: the intake and powerhouse component and the development costs. A review of a Bill of Quantities could help ascertain their appropriateness. The Muskrat Falls to Churchill Falls Transmission Line based on lineal unit costs over the two x 245 km lines appears largely underestimated.



| Item | Nalcor | KP Order of Magnitude Review | Impression of Cost Estimate |
|---|---|---|---|
| Site | 373 M$ | 290 M$ | Adequate |
| • Site Preparation | | Guess = 50 M$ | |
| • Access | | 375 km of new or upgrades at 100$/m = 37 M$ | Depends largely on clearing access. |
| • Site Services, Accommodations Complex and Catering | | 1,500 pers x 30,000$ pers/yr x 4 years = 180 M$ | |
| • Reservoir Clearing | | 390,000 $m^3$ of timber at 50$/$m^3$ = 20 M$ | Recovery Value? |
| Power | 923 M$ | 660 M$ | Adequate |
| • Intake | | 0.2 M$/MW x 824MW = 165 M$ | TBD, No General Arrangements |
| • Powerhouse | | 0.2 M$/MW x 824MW = 165 M$ | TBD, No General Arrangements |
| • Turbine Generator | | 0.4 M$/MW x 824MW = 330 M$ | Adequate |
| Dams | 274 M$ | 275 M$ | Adequate |
| • Spillway Structure | | Guess = 50 M$ | |
| • RCC Dams | | 2.5 M $m^3$ x 50$/$m^3$ = 125 M$ | |

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| | | | |
|---|---|---|---|
| • Cofferdams | | Guess = 50 M$ | |
| • North Spur Stabilization | | Guess = 50 M$ | |
| **Interconnection** | 261 M$ | **400 M$** | **Low!** |
| • Switchyards | | 30 M$ | |
| • MF to CF Transmission Lines | | 2 x 245 km 345 kV x 0.75 M$/km = 370 M$ | |
| **Development Costs** | 375 M$ | 14% of 1,831 M$ = 256 M$ | High |
| • Feasibility Studies | | 1% | |
| • EA | | 1% | |
| • Insurance | | 2% | |
| • Engineering and Design | | 8% | |
| • Project Management | | 2% | |
| **Escalation Allowance** | 335 M$ | | Adequate |
| **Estimate Contingency** | 328 M$ | | Adequate 15% of Cost |
| **Total** | **2,369 M$** | | Reasonable |



The IPR team noted that while there was no defined estimating process for NALCOR mega-projects, but that the Gate 2 estimate was planned and carried out in accordance with a project-specific process. The IPR team noted that the change to "MF first" placed time pressures on the estimating process documentation, but that the methodology used was consistent with best practice for this type of project at Gate 2. It is KPs view that this "documentation", is vital in the proper review of the costs of the Muskrats Falls development, and reiterate the IPR teams comment that considerable work to complete the Gate 2 estimating package needs to be completed.

### 5.1.2 Labrador Island Link

HVDC has been used in transmission since 1954, and is presented by vendors (ABB) as a competitive economic choice for distances over 800 km. Again the cost per km of the HVdc Overland Transmission appears low.

| Item | Nalcor | KP Order of Magnitude Review | Impression of Cost Estimate |
|---|---|---|---|
| • Converter Stations, Electrodes, and Switchyards | 466 M$ | | Adequate |
| • SOBI Cable Crossing Land Sites, and Transition Compounds | 324 M$ | 35 km x 10 M$/km = 350 M$ | Adequate |
| • HVdc Overland Transmission | 400 M$ | 1,050 km x 0.75 M$/km = 790 M$ | **Low!** |

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| | | | |
|---|---|---|---|
| • Island System Upgrades | 194 M$ | | |
| • **Development Costs** | 232 M$ | 16% of 1,384 M$ = 221 M$ | Adequate |
| • **Escalation Allowance** | 208 M$ | | Adequate |
| • **Estimate Contingency** | 236 M$ | | Adequate 15% of Cost |
| **Total** | **2,060 M$** | | A little Low |

5.1.3 Small Hydro

As expressed in RFI #4, "given the findings by Nalcor... the Interconnected Scenario holds a $2.2 billion dollar CPW advantage over the Isolated Scenario, and is therefore the preferred solution; no action has been taken to update the cost estimates for these projects, except to escalate them annually. Nalcor does not believe that further study beyond that undertaken would reduce the costs of these projects. To the extent that any increase in costs would only increase the preference of the Interconnected Scenario, further efforts to update these cost estimates are not warranted."

It is Knight Piésold's opinion that the following key aspects of the project should and could easily be updated to ensure an apples to apples comparison of the two options:

- Installed Capacities and Energy Generation Potential.
- Capital and Operating Cost Estimates.



5.1.4 Wind

Costs presented were generally conservative, but acceptable.

5.1.5 CCCT

The capital cost estimate for the Holyrood Combined Cycle Plant is based on the Combined Cycle Plant Study Update, Supplementary Report which was completed in 2001, with a review by Hydro's Mechanical Engineering Department in 2009 and updated to 2010.

5.1.6 CT

The capital cost estimate for these units was reviewed in 2009, by Hydro's Mechanical Engineering Department and updated in 2010. Approximately 90 percent of the direct cost is for the gas turbine package and due to recent fluctuations in demand for gas turbines; prices remain volatile. Hydro should continue to monitor turbine prices to determine when a further in-depth review of the capital cost estimates becomes necessary.

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## 5.2 UNIT COST OF ENERGY

Using the material provided by Nalcor and Navigant, Knight Piésold calculated the expected development cost for the various supply sources are as follows:

**Unit Cost of Energy (2010 $/MWh) escalated at 2%**

| | 6% IRR | 8% IRR | 10% IRR | 15% IRR |
|---|---|---|---|---|
| • Muskrat Falls and LIL (Sale as Needed) | 88 | **131** | 183 | 357 |
| • Muskrat Falls and LIL (Full Sale) | | 79 | 104 | 181 |
| • 170 MW CCCT (90% C.F.) | | 228 | 231 | 239 |
| • 170 MW CCCT (60% C.F.) | | 239 | **243** | 255 |
| • 50 MW CT (90% C.F.) | | 273 | 276 | 283 |
| • 25 MW Wind | | 70 | 80 | 110 |
| • 36 MW Island Pond | | 68 | 85 | 138 |
| • 23 MW Portland | | 47 | 58 | 90 |
| • 18 MW Round Pond | | 79 | 99 | 160 |
| • Average 75 MW Wind – 77 MW Hydro | | 67 | **81** | 123 |
| • Conservation | | 32 | 40 | 60 |



Tables 5.2 through 5.10 present the assumptions and calculations for the various power supply options. Figure 5.1, shows that the time of development has very little influence on the bearing of the 2010 unit cost of energy escalated at 2%. In the case of thermal supplies, development is slightly cheaper in the earlier decades. The results are summarized in Table 5.1 as well.

It is interesting to note that on a mix basis to achieve the unit cost of energy of Muskrat Falls and the Labrador Island Link requires an Isolated Island option that includes an energy supply with about 70% from renewables, which is not available in the current options.

### 5.2.1 Federal Load Guarantee

In August 2011, Canada's federal government pledged to cover the $6.2 billion cost of the first phase of the Lower Churchill Project, the construction of the Muskrat Falls plant, with Federal Loan guarantees, which will lower borrowing costs by 2%.

## 5.3 SIMPLIFIED CPW ANALYSIS

A simplified CPW analysis was conducted using the projected energy balance and unit rates for energy (escalated at 2% annually) of:

- 131 $/MWh for Muskrat Falls and the Labrador Island Link
- 81 $/MWh for renewable energy (Hydro or Wind), and
- 243 $/MWh for thermal energy (corresponding to a CCCT at 60% capacity factor).

The results are presented in Table 5.11:

- A CPW of the Interconnected Island Scenario of: $6.8 billion CAD.
- A CPW of the Isolated Island Scenario of: $9.5 billion CAD.
- A difference of: $2.7 billion CAD in favour of the Interconnected Island Option.

The Nalcor studies showed CPWs of $6.7 and $8.8 billion CAD for a delta of $2.1 billion CAD in favour of the Interconnected Island Option.

### 5.3.1 Sensitivity Analysis of CPW

The Navigant report has conducted an in depth sensitivity analysis indicating the CPW based selection would not change under a large range of scenarios. These are illustrated in Figure 5.2.

Using the simplified approach the following sensitivity analysis was completed:

| Scenario | **Interconnected Island Scenario** | **Isolated Island Scenario** | **Difference** |
|---|---|---|---|
| Base Case | 6.8 B$ | 9.5 B$ | 2.7 B$ |
| Fuel at growth rate 50% of expected increase -> unit cost of Thermal of 170$/MWh | 6.2 B$ | 6.9 B$ | 0.7 B$ |
| Fuel at growth rate 150% of expected increase -> unit cost of Thermal of 355$/MWh | 13.5 B$ | 7.8 B$ | 5.7 B$ |
| +20% to Capital Cost of Muskrat Falls and LIL -> unit cost 155$/MWh | 7.6B$ | 9.5B$ | 1.9 B$ |
| With Energy Conservation for Isolated Option (750 GWh at 40$/MWh) | 6.8 B$ | 7.9 B$ | 1.1 B$ |
| With Energy Conservation for Isolated Option (750 GWh at 40$/MWh) and Thermal Cost of 185 $/MWh | 7.2 B$ | 7.2 B$ | 0 B$ |



The analysis shows that the preference is not particularly sensitive to an increase in Muskrat Falls and LIL project costs, but relatively sensitive to projected fuel costs. Aggressive conservation can play a very significant role in bridging the gap between the two options as well.

**Notes:**

- The CPW analysis is slightly biased in that a number of thermal resources are put on line in the later years when their cost cannot be fully amortized, reversely the study duration coincides exactly with the Labrador Transmission Link design life.
- If gas generation was developed at substantially less cost than 185 $/MWh, which is very likely, then the Interconnected Island Scenario would be much more competitive.

## 5.4 SCHEDULE

### 5.4.1 Timing of Project Development

It was not possible to verify the timing of the inclusion of various capacity based assets since a review of the Loss of Load Hours (LOLH) cannot be performed. It is presumed that the timing of the asset deployment is adequate. MHI-Nalcor-13 illustrates this balance.

### 5.4.2 Individual Project Development Schedule

The indicated development times:

| Facility | Development time from release date to in-service date (months) |
|---|---|
| Muskrat Falls HEF | |
| Labrador Island Link | 60 |
| Wind Farm | 30 |
| Island Pond HEF | 42 |
| Portland Creek HEF | 32 |
| Round Pond HEF | 33 |
| CCCT | 36 |
| CT | 36 |



One of the major unknowns in the case of the isolated island projects is the permitting time frame which may increase the development durations suggested by Nalcor. For example the Round Pond schedule estimate comes directly out of the 1989 report, and it is doubtful the same allowance for environmental reviews was allotted two decades ago. A development in less than 3 years from initiation, including permitting and construction is extremely aggressive.

### 5.4.3 IPR Team Review

The IPR Team was of the opinion "that the Project Schedule has been developed in accordance to an agreed process and identifies the critical path and the correct sequence of key events." The schedule documentation indicates a quality of planning and scheduling appropriate for Gate 2. The IPR Team noted a number of schedule concerns such as the duration of Phase 3, the potential delays in EA release, and a significant level of time-risk exposure. However, they also indicated schedule risk mitigation steps had been taken, such as early turbine model tests and aggressive early construction programs. Again the IPR Teams focus was on the interconnected island option.

### 5.4.4 Environmental Assessment

The environmental assessment process is a key schedule item for which a sufficient schedule allowance should be made regardless of the option pursued. The permitting time frame remains an area of significant risk & uncertainty. Clarity in the project definition is of the utmost

importance to avoid long permitting delays. It is believed that the inclusion or non-inclusion of Gull Island renders the project's environmental impact assessment more difficult.

The clarity of information as the project progresses through the EA process is paramount.

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## SECTION 6.0 - CONCLUSION AND RECOMMENDATIONS

### 6.1 CONCLUSIONS

The study performed by Navigant Consulting for Nalcor Energy, found that the Muskrat Falls (MF) and Labrador-Island Link (LIL) option represents the lowest-cost option for consumers in Newfoundland. Knight Piésold Ltd. has performed a high level review and generally agrees with Navigant Consulting's findings and those presented by Nalcor Energy. However, there are large gaps in the information supplied that would temper that recommendation, in some instances the options compared may be sub-optimal. Furthermore there may be a larger role for gas within Newfoundland; and any readily accessible gas resource on the island could tip the CPW balance in favour of an isolated island scenario.

Knight Piésold has found that:

- The demand projections methodologies are reasonable and the results have been accepted as presented.
- Demand side management results were not included and could have a measurable impact. Its bearing on the overall supply selection should be to be demonstrated by Nalcor.
- The Isolated Island Option does not integrate as much wind or small hydro into consideration as may be possible; however the development of these renewable resources would not alleviate the requirement for the development of firm thermal resources in the future under the Isolated Island Option. The projected ratio of island renewable resources to overall thermal based generation resources is insufficient to compete with the interconnected island option.
- Nalcor and Navigant excluded natural gas generation in the generation expansion alternatives on the basis that natural gas was not yet available on the island and there were no firm plans to bring natural gas to the island. However, natural gas within a larger development plan of Newfoundland and Labrador at current projected market rates could be cost competitive with MF and the LIL (i.e. the Interconnected Island Option).



### 6.2 RECOMMENDATIONS

#### 6.2.1 Criteria Definition

It would be helpful to develop a less succinct definition of the criteria that addresses the temporal or probabilistic aspect of the energy criteria and the basis for the selected LOLH capacity criteria.

#### 6.2.2 Less Information, but More Clarity in Project Definitions

There is a need to provide a clear description of the proposed infrastructure without references to outdated reports or notification about innumerable changes, the material drowns out what is truly been proposed. In the case of the LIL almost no information has been provided about what exactly has been proposed and costed out. A summary list of the infrastructure components and the rough associated cost will give confidence of what was accounted for and a better understanding of the appropriateness.

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6.2.3 Comprehensive documentation

Comprehensive documentation should be prepared covering:

- The overall economic evaluation, and
- The isolated island resource options.

6.2.4 Bearing the Cost of the MF and LIL Development (i.e. Alternative 1 – Interconnected Island Option)

There are a number of costs that could be borne by the consumer that are carried in the current MF and LIL proposals. The weight of these costs and how they are carried forward to the consumer will need to be closely monitored. For example:

- The cost of the Churchill Falls-Muskrat Falls transmission line has been included in the Muskrat Falls capital cost; while this was done to alleviate and reduce the supply risk should Muskrat Falls fail to commission on time, it is likely that that the line would be utilized to export power in the early stages when all the power generated at the site may not be required by the Newfoundland consumers. The inclusion or non-inclusion may warrant a separate review if the cost is to be borne by Newfoundland customers.
- The optimization of the Muskrat Falls project has not been reviewed since 1998, in light of new project configurations and energy valuations a revision may be warranted (both in terms of installed capacity and height of infrastructure and assuming no development of Gull Island).
- Delaying the development of the Muskrat Falls (MF) and Labrador-Island Link (LIL) was not considered in the Navigant summary report on Decision Gate 2, a phased development of MF may also be worth considering, if exports are not permitted. Obviously, if exports of excess power are permitted and viable then the MF and LIL option will look even more attractive if these benefits trickle down to the Newfoundland consumer in terms of reduced electricity rates.

This report has been prepared with very limited access to the latest costing information, which is still classified as "confidential" by Nalcor. It is strongly recommended that this report be updated once this "classified" information is released to the public, and when the Manitoba Hydro International Report is made public by the Board.

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## SECTION 7.0 - CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.

Prepared:

Boris Fichot, P.Eng.
Senior Engineer



Reviewed:

Sam Mottram, P.Eng.
Manager - Power Services

Approved:

Jeremy Haile, P.Eng.
President

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**TABLE 2.1**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**PROJECT NAME**

**TWO GENERATION EXPANSION ALTERNATIVES - HIGHLEVEL REVIEW**
**DOCUMENT REVIEW**

Print Oct/13/11 10:50:40

| | Relevance | Reviewed | Notes: |
|---|---|---|---|
| **Nalcor Main Submission** | | | |
| Synopsis of 2010 Generation Expansion Decision | High | Yes | |
| Introduction | | | Does not cover all material |
| Generation Expansion Analysis | | | Strategist is industry standard |
| Reliability Criteria | | | Selected without sensitivity analysis presented |
| Generation Expansion Inputs | | | Does not cover all material |
| Generation Expansion Plans | | | Timeline framework biased towards LIL |
| Appendix A: Natural Resources News Release | | | Reference Question |
| Appendix B: MF Technical Note | | | Design history & specific Technical Information and Study References |
| Appendix C: LIL Technical Note | | | Design History and some Specific Technical Information and Study References |
| **Nalcor Exhibits** | | | |
| Exhibit 01 - Planning Load Forecasts | High | Yes | Accepted in Energy Plan, Consistent with Canadian Forecasts |
| Exhibit 02 - Load Shape | Medium | Yes | Based on Historical |
| Exhibit 03 - Nalcor Inflation Escalation Forecast | High | Yes | Close to 2% Overall, Resource selection ranking not particularly affected |
| Exhibit 04 - Nalcor Fuel Oil Price Forecast | High | Yes | Consistent with |
| Exhibit 05 - Capital Costs | High | Yes | Reviewed in KP Report |
| Exhibit 06 - Hydro PPA + HVDC Analysis | High | Yes | Basis for energy of infeed? (average, firm, statistical) |
| Exhibit 07 - Service Life Retirement | High | Yes | Industry standard |
| Exhibit 08 - Opex Costs | High | Yes | Generally High in Ratio to Capital |
| Exhibit 09 - Thermal Units Heat Rates | Medium | Yes | Industry standard |
| Exhibit 10 - Energy Forecasts Hydro Wind | Low | Yes | No background, pattern useful, winter generation thermal component. |
| Exhibit 11 - Asset Maintenance | Low | Yes | |
| Exhibit 12 - Forced Outage Rates | Medium | Yes | Reflected in Capacity Factors |
| Exhibit 13 - Unit Capacities | High | Yes | Existing resources, control over non-Nalcor assets unclear |
| Exhibit 14 - Generation Expansion Plan_2010 PLF | High | Yes | Schedule of strategies, balance of energy demand unclear (firm, average, statistical) |
| Exhibit 15 - PWC Finance Summary | Medium | Yes | No inclusion of LIL |
| Exhibit 16 - Generation Planning Issues 2010 | High | Yes | Summary of projects, delay of MF impact on LIL for reliability |
| Exhibit 17 - Water Management Agreement 2009 | Low | No | Energy Calculation Elsewhere |
| Exhibit 18 - HVDC Interconnection 1998 | High | Yes | From 1998 |
| Exhibit 19 - Muscrat Falls Feasibility 1999 | High | Yes | Not final arrangement, focus on Variant 7 (diversion tunnels, north variant), covers hydrology. Project optimization was carried over from previous study despite separate configuration. North Spur Stabilization |
| Exhibit 20 - Independent Analysis 2010 | Low | Yes | "team misaligned on several key project elements which presents risks", labour shortages |
| Exhibit 21 - Project Review (Summary)_Gate 2 | Low | Yes | labour and staffing plan, governance |
| Exhibit 22 - Project Review (Detailed)_Gate 2 | Medium | Yes | Acceptance of optimization parameters, governance issues |
| Exhibit 23 - HVDC Link History | Medium | Yes | History |
| Exhibit 24 - Island Transmission Outlook | Low | Yes | |
| Exhibit 25 - Letter to Board July 12_2011 | Low | Yes | Wind power PPA structure, replacement cost |
| Exhibit 26 - NLH Outage Rates Schedule | Low | Yes | % reflected in capacity factors |
| Exhibit 27 - PLF Summary 2010 | Medium | Yes | Basis for load forecast |
| Exhibit 28 - PUB Letter July 12_2011 | Medium | Yes | Report on Holyrood refurbishment |
| Exhibit 29 - Cost Effectiveness of supply power from LB to Island | Low | Yes | December 1980 Report on Cost Effectiveness, Scheduling Criteria |
| Exhibit 30 - LCP Design Progress | Medium | Yes | |
| Exhibit 31 - LPC Cost Progress | High | Yes | Variant 10, Class 4 Cost Estimate |
| Exhibit 32 - Financial Model Input 2011 | Low | Yes | |
| Exhibit 33 - Ocean Currents | Low | No | |
| Exhibit 34 - Review of Fishing Equipment | Low | No | |
| Exhibit 35 - Iceberg Cable Risk | Low | No | |
| Exhibit 36 - Response to PUB Letter Muskrat Price | High | Yes | Basis for Cost of Service Price |
| Exhibit 37 - SOBI Decision Recommendation | High | Yes | Seabed Crossing vs. Tunnel / Conduit Crossing, Have Technical Uncertainties, Potential Cost Increases 80 M$ |
| Exhibit 38 - Muskrat Falls North Spur | Medium | Yes | |
| Exhibit 39 - Muskrat Piezometers | Low | No | |
| Exhibit 40 - Muskrat Piesometers2 | Low | No | |
| Exhibit 41 - Muskrat Piesometers3 | Low | No | |
| Exhibit 42 - 2009 Planning Review | High | No | 2009, System, Does not discuss criteria |
| Exhibit 45 - Load Forecast Regressions | Medium | No | Too Cryptic |
| Exhibit 46 - PLF Key Forecast Units | Medium | No | |
| Exhibit 47 - Island Link Overview | High | Yes | History |
| Exhibit 48 - HVDC Link Reliability Study | Low | No | 1981 Reliability Study |
| Exhibit 49 - Estimating Process Overview | Medium | No | |

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| | | | |
|---|---|---|---|
| Exhibit 50 - PMF Estimate | Low | No | 1999 - 21,900 m3/s + 5,000 with Upper Basin Discharge |
| Exhibit 51 - PMF Report 2 | Low | No | |
| Exhibit 52 - Island Pond-Granite Canal Cost Update | Low | No | 1997 - Cost |
| Exhibit 53 - Island Pond Feasibility 1988 | Low | No | |
| Exhibit 54 - Bay D'Espoir Flood Analysis | Low | No | 1985 - System |
| Exhibit 55 - Turbines and Transformers | Low | Yes | 4 Kaplan, Less Complex |
| Exhibit 56 - New Dawn Agreement | Medium | Yes | Province - Nalcor - Innu Nation, payment terms to Innu Nation |
| Exhibit 57 - HVDC Cable Reliability | Low | Yes | 1985 - Reliability, PDF for Failures |
| Exhibit 58 - Total Island interconnected Load | Medium | Yes | Historical Island Load |
| Exhibit 59 - Preliminary Transmission System Analysis | High | Yes | Muskrat Falls to Churchill Falls |
| Exhibit 60 - Island Pond Hydro Pre-Feasibility Study | Medium | Yes | 1986, Regulated system |
| Exhibit 61 - Wind Integration into the Island System | Medium | Yes | 2004 - water management, frequency considerations and transmission limitations, 80 MW cap no spill, 130 no technical repercussions |
| Exhibit 62 - Key Regression Equations | Low | No | Too Cryptic |
| Exhibit 63 - Provincial Economic Data | Medium | No | |
| Exhibit 64 - Rural Island Interconnected Loads | Low | No | |
| Exhibit 65 - Hollyrood Life Extension Study | Medium | No | Hatch, 2011 Marine Terminal |
| Exhibit 66 - Hollyrood Emissions Reduction Study | Low | No | Alstom, 2002, Description, Fuels |
| Exhibit 67 - Hollyrood MCC Assessment | Low | No | Stantec, 2009 Arc-Flash Hazard Analysis |
| Exhibit 68 - Hollyrood Air Emissions | Medium | Yes | Acres 2004, Cost Comparison |
| Exhibit 69 - Island Pond Hydro - Geotech | Low | No | |
| Exhibit 70 - NLD Hydro 2010 Expansion Analysis | Medium | Yes | To Check Balance |
| Exhibit 71 - Transmission Line Meteorological Study | Low | No | 1973 |
| Exhibit 72 - Transmission Line Meteorological Study 2 | Low | No | 1975 |
| Exhibit 73 - Transmission Line Ice and Wind Loading | Low | No | 1974 |
| Exhibit 74 - Transmission Line Meteorological Evaluation 1974 | Low | No | |
| Exhibit 75 - Weather Study 1977-78 | Low | No | |
| Exhibit 76 - Weather Study 1978-79 | Low | No | |
| Exhibit 77 - Weather Study 1979-80 | Low | No | |
| Exhibit 78 - Weather Study 1980-81 | Low | No | |
| Exhibit 79 - Weather Study 1981-82 | Low | No | |
| Exhibit 80 - Weather Study 1982-83 | Low | No | |
| Exhibit 81 - Weather Study 1983-84 | Low | No | |
| Exhibit 82 - Weather Study 1984-85 | Low | No | |
| Exhibit 83 - Weather Study 1985-86 | Low | No | |
| Exhibit 84 - Weather Study 1986-87 | Low | No | |
| Exhibit 85 - Transmission Line Reliability Study | Low | No | 1996, Avalon and Connaigre Peninsulas |
| Exhibit 86 - Transmission Line Ice Monitoring | Low | No | Ice monitoring |
| Exhibit 87 - Transmission Climate Loadings | Low | No | |
| Exhibit 88 - Transmission Atmospheric Icing | Low | No | |
| Exhibit 89 - Transmission upgrading of 230 kV lines | Low | No | |
| Exhibit 90 - Transmission Wind and Ice Loading | Low | No | |
| Exhibit 91 - HVDC In-Cloud Icing | Low | No | |
| Exhibit 92 - Meteorological Load Review 2008 | Medium | Yes | 2008 Summary, from Gull Island |
| Exhibit 93 - Transmission Icing Models | Low | No | |
| Exhibit 94 - HVDC Ice Loadings | Low | No | |
| Exhibit 95 - Transmission In-Cloud Icing in Mountains | Low | No | |
| Exhibit 96 - Transmission Line Freezing Rain | Low | No | |
| Exhibit 97 - Transmission Line Weather 2011 | Low | No | |
| Exhibit 99 - NLD Hydro Generation Expansion Analysis | High | Yes | to Check Balance |
| Exhibit 100 - Output from Isolated and Interconnected Facilities | High | Yes | to Check Balance |
| Exhibit 101 - Independent Supply Decision Review | High | Yes | Navigant Report Executive summary |
| **Nalcor Responses to RFIs** | | | |
| MHI-Nalcor - 005 - Batch 01 RFI Responses July 26-11 | Medium | Yes | AFUDC |
| MHI-Nalcor - 010 - Batch 01 RFI Responses July 26-11 | Low | Yes | No obligation to renew Wind PPA |
| MHI-Nalcor - 022 - Batch 01 RFI Responses July 26-11 | Low | Yes | |
| MHI-Nalcor - 024 - Batch 01 RFI Responses July 26-11 | Low | Yes | Reliability concerns of HVDC |
| MHI-Nalcor - 026 - Batch 01 RFI Responses July 26-11 | Low | Yes | Cost of public consultation not material |
| MHI-Nalcor - 029 - Batch 01 RFI Responses July 26-11 | Low | Yes | Immaterial |
| MHI-Nalcor - 031 - Batch 01 RFI Responses July 26-11 | Low | Yes | Global Insight revised reports for DG 3 |
| MHI-Nalcor - 032 - Batch 01 RFI Responses July 26-11 | Low | Yes | 10% ROR Basis |
| MHI-Nalcor - 033 - Batch 01 RFI Responses July 26-11 | Low | Yes | Royalty to Innu and Water Power royalty included |
| MHI-Nalcor - 007 - Batch 02 RFI Responses July 27-11 | High | Yes | HVDC Capital Cost Composition |
| MHI-Nalcor - 014 - Batch 02 RFI Responses July 27-11 | Medium | Yes | HVDC, All hardware included |
| MHI-Nalcor - 023 - Batch 02 RFI Responses July 27-11 | Low | Yes | Further optimization in Phase 3 |
| MHI-Nalcor - 025 - Batch 02 RFI Responses July 27-11 | Medium | Yes | O&M estimates by Nalcor not in DC1010 |
| MHI-Nalcor - 027 - Batch 02 RFI Responses July 27-11 | Low | Yes | EA costs of HVDC |
| MHI-Nalcor - 030 - Batch 02 RFI Responses July 27-11 | Medium | Yes | MF1010 quantities, unit costs and schedule by Nalcor |
| MHI-Nalcor - 034 - Batch 02 RFI Responses July 27-11 | Low | Yes | Owner's cost fixed percentage for Island Pond |

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|---|---|---|---|
| MHI-Nalcor - 008 - Batch 03 RFI Responses and Exhibits 38-41 | Medium | Yes | Exchange Rates |
| MHI-Nalcor - 018 - Batch 03 RFI Responses and Exhibits 38-41 | Medium | Yes | Cost of Service vs. PPA |
| MHI-Nalcor - 019 - Batch 03 RFI Responses and Exhibits 38-41 | High | Yes | No definitive design report |
| MHI-Nalcor - 020 - Batch 03 RFI Responses and Exhibits 38-41 | High | Yes | Effectiveness of sump pump system, Exhibit 19, 38, 39, 40, 41 |
| MHI-Nalcor - 021 - Batch 03 RFI Responses and Exhibits 38-41 | Medium | Yes | No provision for future capacity. |
| MHI-Nalcor - 035 - Batch 03 RFI Responses and Exhibits 38-41 | Low | Yes | Cost of Service vs. PPA |
| MHI-Nalcor - 004 - Batch 04 RFI Responses August 5-11 | Low | Yes | No update to Island, Portland, Round Cost Estimate |
| MHI-Nalcor - 006 - Batch 04 RFI Responses August 5-11 | Low | Yes | Cost Estimate Level of Detail Appropriate |
| MHI-Nalcor - 009 - Batch 04 RFI Responses August 5-11 | Low | Yes | Holyrood consideration not further lower cost of isolated island options |
| MHI-Nalcor - 011 - Batch 04 RFI Responses August 5-11 | Low | Yes | Retirement of Holyrood site. Estimated at 7 M$ for conversion to synchronous condenser. |
| MHI-Nalcor - 048 - Batch 04 RFI Responses August 5-11 | Low | Yes | MF1330 not included |
| MHI-Nalcor - 053 - Batch 04 RFI Responses August 5-11 | Low | Yes | HVDC design voltage 320 kV |
| MHI-Nalcor - 054 - Batch 04 RFI Responses August 5-11 | Low | Yes | 100 % of Capital Allocated to CPW |
| PUB-Nalcor - 001 - Batch 04 RFI Responses August 5-11 | Low | Yes | Exhibit 37 |
| PUB-Nalcor - 002 - Batch 04 RFI Responses August 5-11 | Low | Yes | Exhibit 35 |
| PUB-Nalcor - 003 - Batch 04 RFI Responses August 5-11 | Low | Yes | July 18, 2011 Presentation Questions |
| PUB-Nalcor - 004 - Batch 04 RFI Responses August 5-11 | Low | Yes | July 18, 2011 Presentation Questions |
| MHI-Nalcor - 028 - Batch 05 RFI Responses August 8-11 | Medium | Yes | DG2 9.5 M$ for land owner easements, expropriations, land use royalties |
| MHI-Nalcor - 037 - Batch 05 RFI Responses August 8-11 | Medium | Yes | Planning Criteria Exhibit 42 |
| MHI-Nalcor - 040 - Batch 05 RFI Responses August 8-11 | High | Yes | AC Power system integration, isolated island option, Exhibit 24. |
| MHI-Nalcor - 049 - Batch 06 RFI Responses Aug 9-11 | High | Yes | Fuel cost, operating cost, ppas, AFUDC rate used is 7.53% |
| MHI-Nalcor - 049 - Batch 06 MHI-Nalcor-49.1 FuelCosts.xls | High | Yes | |
| MHI-Nalcor - 049 - Batch 06 MHI-Nalcor-49.2 OperatingandPPACosts.xl | High | Yes | |
| MHI-Nalcor - 049 - Batch 06 MHI-Nalcor-49.3 AFUDC and Escalation.xls | High | Yes | |
| MHI-Nalcor - 015 - Batch 07 RFI Responses August 10-11 | Low | Yes | HVDC plant performance criteria not defined, reliability in Exhibit 29 |
| MHI-Nalcor - 017 - Batch 07 RFI Responses August 10-11 | Low | Yes | Synchronous condenser operation for 2 units when soldierd Pond commissioned. |
| MHI-Nalcor - 027 - Batch 07 RFI Responses August 10-11 | Low | Yes | EA costs (23 M$, 15 spent) |
| MHI-Nalcor - 039 - Batch 07 RFI Responses August 10-11 | Medium | Yes | AC integration studies for HVDC underway. Objectives listed. |
| MHI-Nalcor - 046 - Batch 07 RFI Responses August 10-11 | Low | Yes | Wind integration - Exhibit 25. |
| MHI-Nalcor - 050 - Batch 07 RFI Responses August 10-11 | Medium | Yes | Escalators Exhibit 3 Description |
| PUB-Nalcor - 005 - Batch 07 RFI Responses August 10-11 | High | Yes | Island Average Domestic Rate Projections (Slide 26) |
| Response to Board - Question 4 - Batch 07 RFI Responses August 10-1 | High | Yes | Combustion Turbine Data and Cost Estimate, Note Exchange Rate. CCCT $1,325 2008 USD per kW and CT $1,286 2010 USD per kW |
| MHI-Nalcor - 001 - Batch 08 RFI Responses August 10-11 | Medium | Yes | CPW composit costs Excel file Exhibit 14. |
| MHI-Nalcor - 038 - Batch 08 RFI Responses August 10-11 | Low | Yes | HVDC Converter Station specifications section 6 Exhibit 30. |
| MHI-Nalcor - 043 - Batch 08 RFI Responses August 10-11 | Medium | Yes | SOBI Feasibility - Exhibits 33-35, CE-40-44. |
| MHI-Nalcor - 044 - Batch 08 RFI Responses August 10-11 | Low | Yes | Power system reliability study, use traditional system planning procedures. Exhibit 24. |
| MHI-Nalcor - 047 - Batch 08 RFI Responses August 10-11 | Low | Yes | CT and CCCT feasibility, See Q4. |
| MHI-Nalcor - 051 - Batch 08 RFI Responses August 10-11 | Low | Yes | Projected GWh/yr and $CAD(2010)/yr by fuel type |
| MHI-Nalcor - 055 - Batch 08 RFI Responses August 10-11 | Low | Yes | Newfoundland and Labrador Hydro 2010 Long Term Planning Forecast Exhbit 27, 45, 46 |
| MHI-Nalcor - 056 - Batch 08 RFI Responses August 10-11 | Low | Yes | Historic sales and generation, MHI-Nalcor 55 |
| MHI-Nalcor - 057 - Batch 08 RFI Responses August 10-11 | Low | Yes | Thermal Generation life extensions at Holyrood Exhibit 43 |
| PUB-Nalcor - 006 - Batch 08 RFI Responses August 10-11 | Medium | Yes | Public policy initiatives list that influence two alternatives |
| MHI-Nalcor - 041 - Batch 09 RFI Responses August 11-11 | Low | Yes | CPW derived in Strategist: modules, objective function: 100% "minimization of utility cost." Fuel cost sensitivity 4 scenarios. |
| MHI-Nalcor - 042 - Batch 09 RFI Responses August 11-11 | Low | Yes | Strategist Inputs List of References |
| MHI-Nalcor - 060 - Batch 09 RFI Responses August 11-11 | Low | Yes | MHI-Nalcor-41 |
| Response to Board - Question 4 - Batch 09 RFI Responses August 11-1 | Medium | Yes | PPA vs COS |
| MHI-Nalcor - 013 - Batch 10 RFI Response August 11-11 | Medium | Yes | Load balance MHI-Nalcor-13a and MHI-Nalcor-13b |
| MHI-Nalcor - 016 - Batch 11 RIF Responses August 12-11 | Low | Yes | Selection based on constraint violation. |
| MHI-Nalcor - 045 - Batch 11 RIF Responses August 12-11 | Low | Yes | MHI-Nalcor-44 |
| MHI-Nalcor - 036 - Batch 12 RFI Responses August 16-11 | Low | Yes | Unredacted costs CE44, CE 48, CE-49 |
| MHI-Nalcor - 059 - Batch 12 RFI Responses August 16-11 | Low | Yes | Insurance based on replacement of assets, TL self insured. 0.03 per 100$. |
| MHI-Nalcor - 052 - Batch 13 RFI Responses August 17-11 | Low | Yes | Environmental mitigation costs (Lists Categories not $) |
| Response to Board - Question 3 - Batch 13 RFI Responses August 17-1 | Medium | Yes | Risk Analysis, Confidential Exhibit - 52 |
| MHI-Nalcor - 058 - Batch 14 RFI Responses August 19 | Low | Yes | Exhibit 15 clarifications |
| MHI-Nalcor - 012 - Batch 15 RFI Responses August 24-11 | Medium | Yes | Operating costs for Labrador Island Link |
| MHI-Nalcor - 069 - Batch 15 RFI Responses August 24-11 | Low | Yes | Refurbishment provisions of LIL over 50 years. |
| MHI-Nalcor - 073 - Batch 15 RFI Responses August 24-11 | High | Yes | Benchmark cost estimates - Confidential Exhibit 51 |
| MHI-Nalcor - 077 - Batch 15 RFI Responses August 24-11 | Low | Yes | Confidential Exhibit CE-54, Floods |
| MHI-Nalcor - 094 - Batch 15 RFI Responses August 24-11 | Low | Yes | SOBI Reliability Exhibit 57, 1985 Report |
| MHI-Nalcor - 010 - Batch 15 RFI Responses August 24-11 | Low | Yes | Exhibit 47 |
| MHI-Nalcor - 018 - Batch 16 RFI Responses August 26-11 | Low | Yes | Government's 25,000 tons per year not exceeded with Holyrood at 100% |
| MHI-Nalcor - 019 - Batch 16 RFI Responses August 26-11 | Low | Yes | Government's 25,000 tons per year not exceeded with Holyrood at 100% |
| MHI-Nalcor - 063 - Batch 17 RFI Responses August 29-11 | Low | Yes | Churchill to MF optimized at 345 kV, Exhibit 59 |
| MHI-Nalcor - 070 - Batch 17 RFI Responses August 29-11 | Medium | Yes | Custom indices for converter and equipments not provided. |
| MHI-Nalcor - 076 - Batch 17 RFI Responses August 29-11 | Medium | Yes | Pumpwell for 10 year, no failure provisions. Final design to determine. |
| MHI-Nalcor - 090 - Batch 17 RFI Responses August 29-11 | Low | Yes | Historical Sales - Exhibit 58 |
| MHI-Nalcor - 091 - Batch 17 RFI Responses August 29-11 | Low | Yes | Historical Sales - Exhibit 58 |

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|---|---|---|---|
| MHI-Nalcor - 093 - Batch 17 RFI Responses August 29-11 | Low | Yes | Forcast Information - Exhibit 45 |
| MHI-Nalcor - 095 - Batch 17 RFI Responses August 29-11 | Low | Yes | Confidential Exhibit CE-55, RFP on Submarine Cable Design |
| PUB-Nalcor - 016 - Batch 17 RFI Responses August 29-11 | Low | Yes | Rio Tinto increase production 100%, Increase in Labrador Load |
| MHI-Nalcor - 065 - Batch 18 RFI Responses September 1-11 | Low | Yes | Single Line Diagram (Soldiers Pond) |
| MHI-Nalcor - 066 - Batch 18 RFI Responses September 1-11 | Low | Yes | Technical requirements for the 3 – 300 MVar Synchronous Condensers CE-10 |
| MHI-Nalcor - 068 - Batch 18 RFI Responses September 1-11 | Low | Yes | CE-04 synchronous condenser requirments |
| MHI-Nalcor - 061 - Batch 19 RFI Responses 02-September-11 | Low | Yes | No operational based reliability report, forced outage rate of 0.89% |
| MHI-Nalcor - 072 - Batch 19 RFI Responses 02-September-11 | Low | Yes | No mechanical fuse. |
| MHI-Nalcor - 078 - Batch 19 RFI Responses 02-September-11 | Low | Yes | Hydrology for Round Pond |
| MHI-Nalcor - 087 - Batch 19 RFI Responses 02-September-11 | Low | Yes | 40% CF for wind basis. |
| MHI-Nalcor - 092 - Batch 19 RFI Responses 02-September-11 | Low | Yes | historical demand information |
| PUB-Nalcor - 017 - Batch 19 RFI Responses 02-September-11 | Low | Yes | 1989 Exceedance of emissions cap. |
| MHI-Nalcor - 074 - Batch 20 RFI Responses 6-11 | High | Yes | 4.870 TWh. Installed capcity differ after Gull Island, Quebec River Diversion, and CF2. Nalcor does not intend to develop Muskrat Falls in isolation of Gull Island. 824MW design for Muskrat Falls optimum. No Quebec river diversion included. |
| MHI-Nalcor - 088 - Batch 20 RFI Responses 6-11 | Low | Yes | Wind integration, Exhibit 61. |
| MHI-Nalcor - 103 - Batch 20 RFI Responses 6-11 | Low | Yes | Synchronous condenser conversion at Holyrood in CE-61 |
| MHI-Nalcor - 112 - Batch 20 RFI Responses 6-11 | Low | Yes | Validation of iceberg risks |
| MHI-Nalcor - 113 - Batch 20 RFI Responses 6-11 | Low | Yes | Impact energyof iceberg risks |
| MHI-Nalcor - 082 - Batch 21 RFI Responses September 7-11 | Low | Yes | Detail on Round Pond HEP, none |
| MHI-Nalcor - 062 - Batch 22 RFI Responses September 9-11 | Low | Yes | Calc of 320 kV minimum, maximum HVdc system losses has been set at 10% |
| MHI-Nalcor - 064 - Batch 22 RFI Responses September 9-11 | Low | Yes | Single line diagram for Muskrat Falls is under development. Simplified attached. |
| MHI-Nalcor - 115 - Batch 22 RFI Responses September 9-11 | Low | Yes | Regression equations for load forcast Exhbit 62 |
| MHI-Nalcor - 079 - Batch 23 RFI Responses September 14-11 | Low | Yes | CE-57 Island Pond Cost |
| MHI-Nalcor - 081 - Batch 23 RFI Responses September 14-11 | Low | Yes | CE-58 Portland Creek Cost Backup |
| MHI-Nalcor - 114 - Batch 24 15 September 2011 | Low | Yes | Exhibit 64, 46 and MHI-Nalcor 92 |
| MHI-Nalcor - 116 - Batch 24 15 September 2011 | Low | Yes | Exhibit 63 |
| MHI-Nalcor - 109 - Batch 25 - 16 September 2011 | Low | Yes | Exhibit 65, marine terminal life extensions would be substantially larger |
| MHI-Nalcor - 111 - Batch 25 - 16 September 2011 | Low | Yes | Exhibit 67 |
| MHI-Nalcor - 110 - Batch 26 - 16 September 11 | Low | Yes | Exhibits 66 & 68 |
| MHI-Nalcor - 080 - Batch 27 - RFI Responses - 20 September 2011 | Low | Yes | Exhibit 69 |
| MHI-Nalcor - 098 - Batch 27 - RFI Responses - 20 September 2011 | Low | Yes | Exhibit 70, Corner Brook Co-Gen as Thermal Source |
| MHI-Nalcor - 104 - Batch 27 - RFI Responses - 20 September 2011 | Low | Yes | kWh/bbl vs unit load (MW) for Holyrood |
| MHI-Nalcor - 075 - Batch 28 RFI Responses 21 September 2011 | Low | Yes | CF interconnection has no impact |
| MHI-Nalcor - 108 - Batch 28 RFI Responses 21 September 2011 | Low | Yes | Summary of starts per year for each Holyrood Unit |
| MHI-Nalcor - 089 - Batch 29 RFI Responses 23 September 2011 | Medium | Yes | Wind penetration, Exhibit 61, 80 MW no spill, 130 MW spill. +100 MW by 2025. |
| MHI-Nalcor - 099 - Batch 29 RFI Responses 23 September 2011 | Low | Yes | PPA Energy Tariff of $75.82 /MWh in 2010$ escalating at 2% annually |
| MHI-Nalcor - 101 - Batch 29 RFI Responses 23 September 2011 | Low | Yes | ESP and FGD installations in their report are totaled at $450 million. $582 is 2010 |
| MHI-Nalcor - 081 - Batch 29 RFI Responses 23 September 2011 | Low | Yes | Navigant Report available |
| MHI-Nalcor - 082 - Batch 29 RFI Responses 23 September 2011 | Low | Yes | Navigant Report available |
| PUB-Nalcor - 080 - Batch 30 RFI Responses 26 September 2011 | Low | Yes | Navigant TOR |
| MHI-Nalcor - 002 - Batch 31 RFI Responses 27 September 2011 | High | Yes | Sensitivity to reduced time frame. CPW preference of the Interconnected Scenario over the Isolated Island Scenario is $1,058 million. |
| MHI-Nalcor - 003 - Batch 31 RFI Responses 27 September 2011 | High | Yes | Upper Churchill Power after 2041. Deferral of the interconnection would result in significantly higher rates for Island consumers between now and 2041. High risk and uncertainty. |
| MHI-Nalcor - 071 - Batch 31 RFI Responses 27 September 2011 | Medium | Yes | Appendix A of Exhibit 97 loadings by area, design details not available |
| MHI-Nalcor - 080 - Batch 31 RFI Responses 27 September 2011 | Low | Yes | Exhibit 98 - Studies for Island Pond Hydroelectric Project |
| MHI-Nalcor - 083 - Batch 32 RFI Responses 04 October 2011 | Low | Yes | DC1210 – "HVDC Sensitivity Studies" |

## Other Resources

| | | | |
|---|---|---|---|
| Report of the Joint Review Panel | High | Partial | Environmental Impact |
| Focusing Our Energy | Medium | Yes | 2007 Energy Plan |
| Independent Supply Decision Review | High | Yes | Review of Options and Sensitivity Analysis |

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| 0 | 18OCT'11 | ISSUED WITH REPORT | BXF | SRM | JPH |
|---|---|---|---|---|---|
| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |

TABLE 5.1

## CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR
## TWO GENERATION EXPANSION ALTERNATIVES

## HIGH LEVEL REVIEW REPORT
## GENERATION PORTFOLIO SUMMARY

Print: 10/14/11 8:14

| Resource | Design Life (years) | 2010 Capital Cost (M$) | Capacity (MW) | Firm Generation (GWh) | Average Generation (GWh) | Capacity Factor | Capital Cost to Capacity Ratio (M$/MW) | Capital Cost to Firm Generation Ratio (M$/GWh) | Capital Cost to Average Generation Ratio ($/GWh) | Estimated 2010 Energy Price on Sales Basis ($/MWh) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hydropower Project** | | | | | | | | | | |
| Muskrat Falls and Labrador Island Link | 50 | 4,929 | 824 | 4,470 | 4,580 | 63% | 5.98 | 1.10 | 1.08 | **131*** |
| Island Pond Development | 50 | 166.2 | 36 | 179 | 188 | 60% | 4.62 | 0.93 | 0.88 | 85* |
| Round Pond Development | 50 | 142.2 | 18 | 108 | 132 | 84% | 7.90 | 1.32 | 1.08 | 99* |
| Portland Creek | 50 | 89.9 | 23 | 99 | 142 | 70% | 3.91 | 0.91 | 0.63 | 58* |
| Other Small Hydro | 50 | | | | | | | | | 102** |
| **Wind Power** | | | | | | | | | | |
| 25 MW Wind Farm | 20 | 58.1 | 25 | NA | 88 | 40% | 2.32 | NA | 0.66 | 80* |
| **Renewable Average** | | | | | | | | | | |
| Island Renewable Portfolio | | | 152 | 386 | 725 | 54% | | | | **81** |
| **Thermal** | | | | | | | | | | |
| CCCT 170 | 30 | 206.2 | 170 | 1,340 | 1,340 | 90% | 1.21 | 0.15 | 0.15 | 231* |
| | | | | | 894 | 60% | | | | **243*** |
| | | | | | 447 | 30% | | | | 271* |
| GT 50 | 25 | 65.1 | 50 | 394 | 329 | 90% | 1.30 | 0.17 | 0.20 | 276* |
| GT 50 - Capacity Payment | | | 50 | 394 | | 2% | | | | 130,000$/MW |
| **DSM** | | | | | | | | | | |
| Aggressive Agregated Strategies | NA | 200 | 90 | 750 | 750 | 95% | 2.22 | 0.27 | 0.27 | 40** |
| 1/2 Aggressive Agregated Strategies | NA | 100 | 45 | 375 | 375 | 95% | 2.22 | 0.27 | 0.27 | 40** |

Notes:
* KP Simplified Financial Analysis
** Navigant Report

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 09SEP'11 | ISSUED WITH REPORT 303-112/1-1 | BXF | SRM | JPH |

TABLE 5.2

CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR
TWO GENERATION EXPANSION ALTERNATIVES

HIGH LEVEL REVIEW REPORT
BASIC FINANCIAL ANALYSIS - MF & LIL

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| Year of Development | 2017 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 0.0% | Internal Rate of Return | 8.0% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 130.7 $/MWh | | |
| Energy Sale Escalation | 2.0% | | |
| **Asset** | **Greenfield CCCT** | | |
| Installed Capacity | 824 MW | | |
| Capacity Factor | 67.6% | | |
| Average Available Gene | 4900.0 GWh | | |
| Life of Infrastructure | 50 Years | | |
| **Capital Cost** | | | |
| 2010 Capital Cost | $ 4,974,531,656 | | |

| Cost | | Distribution | LIL | LIL AFUDC | MF | MF AFUDC | TOTAL |
|---|---|---|---|---|---|---|---|
| Year -7 | 2010 | 3.3% | $ 108,892,854 | $ 753,465 | $ 56,448,952 | | $ 166,095,270 |
| Year -6 | 2011 | 2.9% | $ 19,106,627 | $ 1,191,996 | $ 125,789,166 | | $ 146,087,789 |
| Year -5 | 2012 | 13.4% | $ 216,580,120 | $ 2,382,350 | $ 451,626,159 | | $ 670,588,629 |
| Year -4 | 2013 | 26.1% | $ 506,473,481 | $ 55,615,766 | $ 792,206,676 | | $ 1,354,295,922 |
| Year -3 | 2014 | 24.0% | $ 544,807,024 | $ 97,913,375 | $ 649,259,465 | | $ 1,291,979,864 |
| Year -2 | 2015 | 18.3% | $ 426,213,841 | $ 142,120,932 | $ 482,150,585 | | $ 1,050,485,359 |
| Year -1 | 2016 | 11.3% | $ 251,094,350 | $ 180,088,870 | $ 309,803,801 | | $ 740,987,021 |
| Year 0 | 2017 | 0.7% | | | $ 34,078,555 | | $ 34,078,555 |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | 166,095,270 | | | | | -166,095,270 | -166,095,270 |
| 2011 | | 146,087,789 | | | | | -146,087,789 | -312,183,059 |
| 2012 | | 670,588,629 | | | | | -670,588,629 | -982,771,688 |
| 2013 | | 1,354,295,922 | | | | | -1,354,295,922 | -2,337,067,610 |
| 2014 | | 1,291,979,864 | | | | | -1,291,979,864 | -3,629,047,474 |
| 2015 | | 1,050,485,359 | | | | | -1,050,485,359 | -4,679,532,833 |
| 2016 | | 740,987,021 | | | | | -740,987,021 | -5,420,519,855 |
| 2017 | 0 | 34,078,555 | 272,103,707 | 20,316,000 | | | 217,709,152 | -5,202,810,703 |
| 2018 | 1 | | 288,157,015 | 27,592,084 | | | 260,564,931 | -4,942,245,772 |
| 2019 | 2 | | 304,977,887 | 33,822,950 | | | 271,154,937 | -4,671,090,835 |
| 2020 | 3 | | 321,623,523 | 29,117,021 | | | 292,506,502 | -4,378,584,333 |
| 2021 | 4 | | 343,622,770 | 35,710,298 | | | 307,912,472 | -4,070,671,860 |
| 2022 | 5 | | 366,605,376 | 30,770,402 | | | 335,834,974 | -3,734,836,886 |
| 2023 | 6 | | 402,051,686 | 31,631,973 | | | 370,419,713 | -3,364,417,174 |
| 2024 | 7 | | 421,990,961 | 32,517,668 | | | 389,473,292 | -2,974,943,881 |
| 2025 | 8 | | 440,649,817 | 33,428,163 | | | 407,221,654 | -2,567,722,227 |
| 2026 | 9 | | 464,209,887 | 40,901,152 | | | 423,308,736 | -2,144,413,491 |
| 2027 | 10 | | 489,707,254 | 35,326,348 | | | 454,380,907 | -1,690,032,585 |
| 2028 | 11 | | 524,363,545 | 36,315,486 | | | 488,048,059 | -1,201,984,526 |
| 2029 | 12 | | 575,878,954 | 37,332,319 | | | 538,546,635 | -663,437,891 |
| 2030 | 13 | | 602,504,789 | 38,377,624 | | | 564,127,165 | -99,310,726 |
| 2031 | 14 | | 629,985,113 | 46,848,198 | | | 583,136,915 | 483,826,189 |
| 2032 | 15 | | 658,263,036 | 40,556,859 | | | 617,706,176 | 1,101,532,365 |
| 2033 | 16 | | 687,440,690 | 41,692,451 | | | 645,748,238 | 1,747,280,604 |
| 2034 | 17 | | 717,543,165 | 42,859,840 | | | 674,683,325 | 2,421,963,928 |
| 2035 | 18 | | 746,859,520 | 44,059,915 | | | 702,799,605 | 3,124,763,533 |
| 2036 | 19 | | 775,268,226 | 53,661,593 | | | 721,606,633 | 3,846,370,166 |
| 2037 | 20 | | 776,809,577 | 46,561,814 | | | 730,247,764 | 4,576,617,930 |
| 2038 | 21 | | 807,362,660 | 47,865,544 | | | 759,497,115 | 5,336,115,045 |
| 2039 | 22 | | 839,662,627 | 49,205,780 | | | 790,456,847 | 6,126,571,892 |
| 2040 | 23 | | 871,179,914 | 50,583,542 | | | 820,596,372 | 6,947,168,264 |
| 2041 | 24 | | 903,477,154 | 61,466,881 | | | 842,010,273 | 7,789,178,537 |
| 2042 | 25 | | 936,767,068 | 53,455,877 | | | 883,311,191 | 8,672,489,728 |
| 2043 | 26 | | 970,976,946 | 54,952,642 | | | 916,024,304 | 9,588,514,032 |
| 2044 | 27 | | 1,006,283,006 | 56,491,316 | | | 949,791,691 | 10,538,305,723 |
| 2045 | 28 | | 1,042,534,511 | 58,073,073 | | | 984,461,438 | 11,522,767,161 |
| 2046 | 29 | | 1,079,860,220 | 70,410,119 | | | 1,009,450,102 | 12,532,217,262 |
| 2047 | 30 | | 1,118,071,602 | 61,370,694 | | | 1,056,700,908 | 13,588,918,171 |
| 2048 | 31 | | 1,157,545,909 | 63,089,073 | | | 1,094,456,836 | 14,683,375,006 |
| 2049 | 32 | | 1,198,123,669 | 64,855,568 | | | 1,133,268,102 | 15,816,643,108 |
| 2050 | 33 | | 1,237,639,599 | 66,671,523 | | | 1,170,968,075 | 16,987,611,183 |
| 2051 | 34 | | 1,278,168,617 | 80,657,326 | | | 1,197,511,290 | 18,185,122,473 |
| 2052 | 35 | | 1,319,853,761 | 70,457,399 | | | 1,249,396,362 | 19,434,518,835 |
| 2053 | 36 | | 1,362,695,044 | 72,430,206 | | | 1,290,264,837 | 20,724,783,673 |
| 2054 | 37 | | 1,405,503,879 | 74,458,252 | | | 1,331,045,627 | 22,055,829,300 |
| 2055 | 38 | | 1,449,511,849 | 76,543,083 | | | 1,372,968,766 | 23,428,798,065 |
| 2056 | 39 | | 1,494,717,936 | 92,397,290 | | | 1,402,320,647 | 24,831,118,712 |
| 2057 | 40 | | 1,541,086,169 | 80,889,506 | | | 1,460,196,663 | 26,291,315,375 |
| 2058 | 41 | | 1,588,609,815 | 83,154,412 | | | 1,505,455,403 | 27,796,770,779 |
| 2059 | 42 | | 1,637,486,944 | 85,482,735 | | | 1,552,004,209 | 29,348,774,988 |
| 2060 | 43 | | 1,687,824,417 | 87,876,252 | | | 1,599,948,165 | 30,948,723,153 |
| 2061 | 44 | | 1,739,197,482 | 105,849,787 | | | 1,633,347,695 | 32,582,070,848 |
| 2062 | 45 | | 1,792,096,727 | 92,866,217 | | | 1,699,230,510 | 34,281,301,357 |
| 2063 | 46 | | 1,846,378,934 | 95,466,471 | | | 1,750,912,463 | 36,032,213,820 |
| 2064 | 47 | | 1,902,191,740 | 98,139,532 | | | 1,804,052,208 | 37,836,266,028 |
| 2065 | 48 | | 1,957,750,863 | 100,887,439 | | | 1,856,863,423 | 39,693,129,451 |
| 2066 | 49 | | 2,013,424,621 | 121,264,288 | | | 1,892,160,334 | 41,585,289,785 |
| 2067 | 50 | | 2,069,249,252 | 106,616,232 | | | 1,962,633,020 | 43,547,922,805 |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]MF and LIL

Notes:
1. LIL costs and AFUDC and MF Cost as reflected in Nalcor Exhibit 5e and 5f
2. Energy Demand over Link as Forecasted in Exhibit 100
3. Operating cost from Exhibit 8

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 14OCT11 | ISSUED WITH REPORT | BXF | BRM | JPM |

**TABLE 5.3**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 170 MW CCCT (90% CF)**

Print: 11/1/11 16:52

| | | | | |
|---|---|---|---|---|
| **Year of Development** | 2025 | | | |
| **Financial** | | | **Analysis** | |
| Interest Rate | 8.0% | | Internal Rate of Return | 10.0% |
| Discount rate | 8.0% | | | |
| 2010 Energy Sale | 231.0 | $/MWh | | |
| Energy Sale Escalation | 2.0% | | | |
| **Asset** | **Greenfield CCCT** | | | |
| Installed Capacity | 170 | MW | | |
| Capacity Factor | 90.0% | | | |
| Average Available Gen | 1340.3 | GWh | | |
| Generation Assumed | 1340.3 | GWh | | |
| Life of Infrastructure | 30 | Years | | |
| **Capital Cost** | | | | |
| 2010 Capital Cost | $ 206,187,000 | | | |
| Relevant Index | *CCCT Plant Construction* | | | |
| AFUDC | 7.52% | | | |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | 13.7% | $ 28,326,821 | $ 35,436,853 | $ 1,334,198 | $ 36,771,051 |
| Year -1 | 2024 | 53.9% | $ 110,860,926 | $ 141,458,542 | $ 8,094,774 | $ 149,553,316 |
| Year 0 | 2025 | 32.5% | $ 66,999,152 | $ 87,232,896 | $ 17,314,543 | $ 104,547,440 |

| **O&M Cost** | | 2010 | 2010 |
|---|---|---|---|
| | Fixed | 9,220 $/MW | |
| | | | 1,567,400 |
| | Variable | 5.32 $/MWh | |
| | | | 7,130,290 |
| | Escalation | 2.8% | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | 36,771,051 | | | | 0 | -36,771,051 | -36,771,051 |
| 2024 | | 149,553,316 | | | | 0 | -149,553,316 | -186,324,367 |
| 2025 | 0 | 104,547,440 | | | | 0 | -104,547,440 | -290,871,807 |
| 2026 | 1 | | 425,020,879 | 13,529,874 | 382,207,703 | 0 | 29,283,302 | -261,588,505 |
| 2027 | 2 | | 433,521,297 | 13,908,710 | 389,338,444 | 0 | 30,274,143 | -231,314,362 |
| 2028 | 3 | | 442,191,722 | 14,298,154 | 397,895,332 | 0 | 29,998,236 | -201,316,126 |
| 2029 | 4 | | 451,035,557 | 14,698,502 | 406,452,221 | 0 | 29,884,833 | -171,431,292 |
| 2030 | 5 | | 460,056,268 | 15,110,060 | 413,582,962 | 0 | 31,363,246 | -140,068,047 |
| 2031 | 6 | | 469,257,393 | 15,533,142 | 422,139,851 | 0 | 31,584,400 | -108,483,646 |
| 2032 | 7 | | 478,642,541 | 15,968,070 | 430,696,740 | 0 | 31,977,732 | -76,505,915 |
| 2033 | 8 | | 488,215,392 | 16,415,176 | 439,253,629 | 0 | 32,546,588 | -43,959,327 |
| 2034 | 9 | | 497,979,700 | 16,874,801 | 447,810,518 | 0 | 33,294,382 | -10,664,945 |
| 2035 | 10 | | 507,939,294 | 17,347,295 | 456,367,406 | 0 | 34,224,592 | 23,559,647 |
| 2036 | 11 | | 518,098,080 | 17,833,020 | 466,350,443 | 0 | 33,914,617 | 57,474,264 |
| 2037 | 12 | | 528,460,041 | 18,332,344 | 474,907,332 | 0 | 35,220,365 | 92,694,629 |
| 2038 | 13 | | 539,029,242 | 18,845,660 | 484,890,369 | 0 | 35,293,223 | 127,987,852 |
| 2039 | 14 | | 549,809,827 | 19,373,328 | 494,873,406 | 0 | 35,563,093 | 163,550,945 |
| 2040 | 15 | | 560,806,024 | 19,915,781 | 504,856,443 | 0 | 36,033,799 | 199,584,744 |
| 2041 | 16 | | 572,022,144 | 20,473,423 | 514,839,480 | 0 | 36,709,241 | 236,293,985 |
| 2042 | 17 | | 583,462,587 | 21,046,679 | 524,822,517 | 0 | 37,593,391 | 273,887,376 |
| 2043 | 18 | | 595,131,839 | 21,635,986 | 534,805,554 | 0 | 38,690,299 | 312,577,674 |
| 2044 | 19 | | 607,034,475 | 22,241,793 | 546,214,740 | 0 | 38,577,943 | 351,155,617 |
| 2045 | 20 | | 619,175,165 | 22,864,564 | 557,623,925 | 0 | 38,686,677 | 389,842,293 |
| 2046 | 21 | | 631,558,668 | 23,504,771 | 569,033,110 | 0 | 39,020,787 | 428,863,080 |
| 2047 | 22 | | 644,189,842 | 24,162,905 | 580,442,295 | 0 | 39,584,642 | 468,447,722 |
| 2048 | 23 | | 657,073,638 | 24,839,466 | 591,851,480 | 0 | 40,382,692 | 508,830,414 |
| 2049 | 24 | | 670,215,111 | 25,534,971 | 603,260,665 | 0 | 41,419,475 | 550,249,888 |
| 2050 | 25 | | 683,619,413 | 26,249,951 | 614,669,850 | 0 | 42,699,612 | 592,949,501 |
| 2051 | 26 | | 697,291,802 | 26,984,949 | 627,505,184 | 0 | 42,801,669 | 635,751,169 |
| 2052 | 27 | | 711,237,638 | 27,740,528 | 640,340,517 | 0 | 43,156,593 | 678,907,762 |
| 2053 | 28 | | 725,462,391 | 28,517,263 | 653,175,850 | 0 | 43,769,278 | 722,677,040 |
| 2054 | 29 | | 739,971,638 | 29,315,748 | 666,011,184 | 0 | 44,644,709 | 767,321,749 |
| 2055 | 30 | | 754,771,071 | 30,136,587 | 678,846,517 | 0 | 45,787,967 | 813,109,716 |
| 2056 | | | | | | 0 | 0 | 813,109,716 |
| 2057 | | | | | | 0 | 0 | 813,109,716 |
| 2058 | | | | | | 0 | 0 | 813,109,716 |
| 2059 | | | | | | 0 | 0 | 813,109,716 |
| 2060 | | | | | | 0 | 0 | 813,109,716 |
| 2061 | | | | | | 0 | 0 | 813,109,716 |
| 2062 | | | | | | 0 | 0 | 813,109,716 |
| 2063 | | | | | | 0 | 0 | 813,109,716 |
| 2064 | | | | | | 0 | 0 | 813,109,716 |
| 2065 | | | | | | 0 | 0 | 813,109,716 |
| 2066 | | | | | | 0 | 0 | 813,109,716 |
| 2067 | | | | | | 0 | 0 | 813,109,716 |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]170MW CCCT (90% CF)

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 09SEP'11 | ISSUED WITH REPORT 303-11/91-1 | BXF | BRM | JPH |

**TABLE 5.4**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 170 MW CCCT (60%CF)**

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| **Year of Development** | 2025 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 0.0% | Internal Rate of Return | 10.1% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 243.0 $/MWh | | |
| Energy Sale Escalation | 2.0% | | |
| **Asset** | **Greenfield CCCT** | | |
| Installed Capacity | 170 MW | | |
| Capacity Factor | 60.0% | | |
| Average Available Gen | 1340.3 GWh | | |
| Generation Assumed | 893.5 GWh | | |
| Life of Infrastructure | 30 Years | | |
| **Capital Cost** | | | |
| 2010 Capital Cost | $ 206,197,000 | | |
| Relevant Index | *CCCT Plant Construction* | | |
| AFUDC | 7.52% | | |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | 13.7% | $ 28,326,821 | $ 35,436,853 | $ 1,334,198 | $ 36,771,051 |
| Year -1 | 2024 | 53.8% | $ 110,860,926 | $ 141,458,542 | $ 8,094,774 | $ 149,553,316 |
| Year 0 | 2025 | 32.5% | $ 66,999,152 | $ 87,232,896 | $ 17,314,543 | $ 104,547,440 |

| **O&M Cost** | 2010 | 2010 |
|---|---|---|
| Fixed | 9,220 $/MW | 1,567,400 |
| Variable | 5.32 $/MWh | 4,753,526 |
| Escalation | 2.8% | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | 36,771,051 | | | | 0 | -36,771,051 | -36,771,051 |
| 2024 | | 149,553,316 | | | | 0 | -149,553,316 | -186,324,367 |
| 2025 | 0 | 104,547,440 | | | | 0 | -104,547,440 | -290,871,807 |
| 2026 | 1 | | 298,056,590 | 9,832,650 | 259,184,642 | 0 | 29,049,299 | -261,822,508 |
| 2027 | 2 | | 304,027,922 | 10,107,964 | 264,020,176 | 0 | 29,899,782 | -231,922,726 |
| 2028 | 3 | | 310,108,481 | 10,390,987 | 269,822,817 | 0 | 29,894,677 | -202,028,049 |
| 2029 | 4 | | 316,310,650 | 10,681,935 | 275,825,458 | 0 | 30,003,257 | -172,024,792 |
| 2030 | 5 | | 322,636,863 | 10,981,029 | 280,460,993 | 0 | 31,194,842 | -140,829,950 |
| 2031 | 6 | | 329,089,601 | 11,288,498 | 286,263,634 | 0 | 31,537,469 | -109,292,481 |
| 2032 | 7 | | 335,671,393 | 11,604,575 | 292,068,275 | 0 | 32,000,542 | -77,291,939 |
| 2033 | 8 | | 342,384,820 | 11,929,504 | 297,868,916 | 0 | 32,586,400 | -44,705,538 |
| 2034 | 9 | | 349,232,517 | 12,263,530 | 303,671,558 | 0 | 33,297,430 | -11,408,109 |
| 2035 | 10 | | 356,217,167 | 12,606,908 | 309,474,199 | 0 | 34,136,060 | 22,727,951 |
| 2036 | 11 | | 363,341,511 | 12,959,902 | 316,243,947 | 0 | 34,137,662 | 56,865,613 |
| 2037 | 12 | | 370,608,341 | 13,322,779 | 322,046,588 | 0 | 35,238,973 | 92,104,586 |
| 2038 | 13 | | 378,020,508 | 13,695,817 | 328,816,336 | 0 | 35,508,354 | 127,612,940 |
| 2039 | 14 | | 385,580,918 | 14,079,300 | 335,586,084 | 0 | 35,915,533 | 163,528,474 |
| 2040 | 15 | | 393,292,536 | 14,473,520 | 342,355,833 | 0 | 36,463,183 | 199,991,657 |
| 2041 | 16 | | 401,158,387 | 14,878,779 | 349,125,581 | 0 | 37,154,027 | 237,145,684 |
| 2042 | 17 | | 409,181,554 | 15,295,385 | 355,895,329 | 0 | 37,990,841 | 275,136,525 |
| 2043 | 18 | | 417,365,186 | 15,723,655 | 362,665,077 | 0 | 38,976,453 | 314,112,979 |
| 2044 | 19 | | 425,712,489 | 16,163,918 | 370,401,932 | 0 | 39,146,640 | 353,259,618 |
| 2045 | 20 | | 434,226,739 | 16,616,507 | 378,138,787 | 0 | 39,471,445 | 392,731,063 |
| 2046 | 21 | | 442,911,274 | 17,081,770 | 385,876,642 | 0 | 39,953,862 | 432,684,926 |
| 2047 | 22 | | 451,769,499 | 17,560,059 | 393,612,497 | 0 | 40,596,943 | 473,281,869 |
| 2048 | 23 | | 460,804,889 | 18,051,741 | 401,349,352 | 0 | 41,403,797 | 514,685,666 |
| 2049 | 24 | | 470,020,987 | 18,557,190 | 409,086,207 | 0 | 42,377,591 | 557,063,257 |
| 2050 | 25 | | 479,421,407 | 19,076,791 | 416,823,062 | 0 | 43,521,554 | 600,584,811 |
| 2051 | 26 | | 489,009,835 | 19,610,941 | 425,527,023 | 0 | 43,871,870 | 644,456,681 |
| 2052 | 27 | | 498,790,032 | 20,160,047 | 434,230,985 | 0 | 44,398,999 | 688,855,680 |
| 2053 | 28 | | 508,765,832 | 20,724,529 | 442,934,947 | 0 | 45,106,356 | 733,962,037 |
| 2054 | 29 | | 518,941,149 | 21,304,816 | 451,638,909 | 0 | 45,097,424 | 779,959,461 |
| 2055 | 30 | | 529,319,972 | 21,901,350 | 460,342,871 | 0 | 47,075,751 | 827,035,212 |
| 2056 | | | | | | 0 | 0 | 827,035,212 |
| 2057 | | | | | | 0 | 0 | 827,035,212 |
| 2058 | | | | | | 0 | 0 | 827,035,212 |
| 2059 | | | | | | 0 | 0 | 827,035,212 |
| 2060 | | | | | | 0 | 0 | 827,035,212 |
| 2061 | | | | | | 0 | 0 | 827,035,212 |
| 2062 | | | | | | 0 | 0 | 827,035,212 |
| 2063 | | | | | | 0 | 0 | 827,035,212 |
| 2064 | | | | | | 0 | 0 | 827,035,212 |
| 2065 | | | | | | 0 | 0 | 827,035,212 |
| 2066 | | | | | | 0 | 0 | 827,035,212 |
| 2067 | | | | | | 0 | 0 | 827,035,212 |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]170MW CCCT (60%CF)

| REV | DATE | DESCRIPTION | PREPD | CHKD | APPD |
|---|---|---|---|---|---|
| 0 | 09SEP11 | ISSUED WITH REPORT 303-119/1-1 | BXF | SRM | JPH |

**TABLE 5.5**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 50 MW CT**

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| **Year of Development** | 2025 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 0.0% | Internal Rate of Return | 10.5% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 270.0 $/MWh | | |
| Energy Sale Escalation | 2.0% | | |
| **Asset** | **Greenfield CCCT** | | |
| Installed Capacity | 50 MW | | |
| Capacity Factor | 90.0% | | |
| Average Available Gen | 394.2 GWh | | |
| Generation Assumed | 394.2 GWh | | |
| Life of Infrastructure | 25 Years | | |

**Capital Cost**

| | |
|---|---|
| 2010 Capital Cost | $ 65,127,000 |
| Relevant Index | *Combustion Turbine Plant Construction* |
| AFUDC | 7.53% |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | 1.0% | $ 682,351 | $ 858,397 | $ 32,319 | $ 890,716 |
| Year -1 | 2024 | 26.7% | $ 17,418,566 | $ 22,348,020 | $ 908,474 | $ 23,256,494 |
| Year 0 | 2025 | 72.2% | $ 47,036,083 | $ 61,570,233 | $ 4,136,404 | $ 65,706,637 |

**O&M Cost**

| | | 2010 | 2010 |
|---|---|---|---|
| Fixed | 9,220 $/MW | | 461,000 |
| Variable | 5.32 $/MWh | | 2,097,144 |
| Escalation | 2.8% | | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | 890,716 | | | | 0 | -890,716 | -890,716 |
| 2024 | | 23,256,494 | | | | 0 | -23,256,494 | -24,147,210 |
| 2025 | 0 | 65,706,637 | | | | 0 | -65,706,637 | -89,853,847 |
| 2026 | 1 | | 149,357,986 | 3,979,375 | 135,999,665 | 0 | 9,378,947 | -80,474,900 |
| 2027 | 2 | | 152,345,146 | 4,090,797 | 138,536,972 | 0 | 9,717,377 | -70,757,523 |
| 2028 | 3 | | 155,392,049 | 4,205,338 | 141,581,740 | 0 | 9,604,969 | -61,152,553 |
| 2029 | 4 | | 158,499,890 | 4,323,089 | 144,626,509 | 0 | 9,550,292 | -51,602,261 |
| 2030 | 5 | | 161,669,888 | 4,444,135 | 147,183,816 | 0 | 10,061,938 | -41,540,325 |
| 2031 | 6 | | 164,903,286 | 4,568,571 | 150,208,585 | 0 | 10,126,130 | -31,414,195 |
| 2032 | 7 | | 168,201,351 | 4,696,491 | 153,253,354 | 0 | 10,251,507 | -21,162,689 |
| 2033 | 8 | | 171,565,378 | 4,827,993 | 156,298,122 | 0 | 10,439,263 | -10,723,425 |
| 2034 | 9 | | 174,996,686 | 4,963,177 | 159,342,891 | 0 | 10,690,619 | -32,807 |
| 2035 | 10 | | 178,496,620 | 5,102,146 | 162,387,659 | 0 | 11,006,815 | 10,974,008 |
| 2036 | 11 | | 182,066,552 | 5,245,006 | 165,939,889 | 0 | 10,881,657 | 21,855,665 |
| 2037 | 12 | | 185,707,883 | 5,391,866 | 168,984,658 | 0 | 11,331,359 | 33,187,024 |
| 2038 | 13 | | 189,422,041 | 5,542,838 | 172,536,888 | 0 | 11,342,315 | 44,529,339 |
| 2039 | 14 | | 193,210,482 | 5,698,038 | 176,089,118 | 0 | 11,423,326 | 55,952,665 |
| 2040 | 15 | | 197,074,691 | 5,857,583 | 179,641,348 | 0 | 11,575,760 | 67,528,425 |
| 2041 | 16 | | 201,016,185 | 6,021,595 | 183,193,578 | 0 | 11,801,012 | 79,329,437 |
| 2042 | 17 | | 205,036,509 | 6,190,200 | 186,745,808 | 0 | 12,100,501 | 91,429,938 |
| 2043 | 18 | | 209,137,239 | 6,363,525 | 190,298,038 | 0 | 12,475,675 | 103,905,613 |
| 2044 | 19 | | 213,319,984 | 6,541,704 | 194,357,730 | 0 | 12,420,550 | 116,326,163 |
| 2045 | 20 | | 217,586,383 | 6,724,872 | 198,417,421 | 0 | 12,444,090 | 128,770,254 |
| 2046 | 21 | | 221,938,111 | 6,913,168 | 202,477,113 | 0 | 12,547,830 | 141,318,084 |
| 2047 | 22 | | 226,376,873 | 7,106,737 | 206,536,804 | 0 | 12,733,332 | 154,051,416 |
| 2048 | 23 | | 230,904,411 | 7,305,725 | 210,596,496 | 0 | 13,002,190 | 167,053,606 |
| 2049 | 24 | | 235,522,499 | 7,510,285 | 214,656,187 | 0 | 13,356,026 | 180,409,632 |
| 2050 | 25 | | 240,232,949 | 7,720,574 | 218,715,879 | 0 | 13,796,497 | 194,206,129 |
| 2051 | | | | | | 0 | 0 | 194,206,129 |
| 2052 | | | | | | 0 | 0 | 194,206,129 |
| 2053 | | | | | | 0 | 0 | 194,206,129 |
| 2054 | | | | | | 0 | 0 | 194,206,129 |
| 2055 | | | | | | 0 | 0 | 194,206,129 |
| 2056 | | | | | | 0 | 0 | 194,206,129 |
| 2057 | | | | | | 0 | 0 | 194,206,129 |
| 2058 | | | | | | 0 | 0 | 194,206,129 |
| 2059 | | | | | | 0 | 0 | 194,206,129 |
| 2060 | | | | | | 0 | 0 | 194,206,129 |
| 2061 | | | | | | 0 | 0 | 194,206,129 |
| 2062 | | | | | | 0 | 0 | 194,206,129 |
| 2063 | | | | | | 0 | 0 | 194,206,129 |
| 2064 | | | | | | 0 | 0 | 194,206,129 |
| 2065 | | | | | | 0 | 0 | 194,206,129 |
| 2066 | | | | | | 0 | 0 | 194,206,129 |
| 2067 | | | | | | 0 | 0 | 194,206,129 |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]50MW CT

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 06SEP'11 | ISSUED WITH REPORT 363-112/1-1 | BXF | SRM | JPH |

TABLE 5.6

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 50 MW CT - CAPACITY PAYMENT**

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| **Year of Development** | 2025 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 0.0% | Internal Rate of Return | 9.9% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 300.0 $/MWh | | |
| Capcity Payment | 130,000 $/MW | | |
| Energy Sale Escalation I | 2.0% | | |
| **Asset** | **Greenfield CCCT** | | |
| Installed Capacity | 50 MW | | |
| Capacity Factor | 2.0% | | |
| Average Available Gene | 394.2 GWh | | |
| Generation Assumed | 8.8 GWh | | |
| Life of Infrastructure | 25 Years | | |

**Capital Cost**

| | | | | | | |
|---|---|---|---|---|---|---|
| 2010 Capital Cost | $ 65,137,000 | | | | | |
| Relevant Index | *Combustion Turbine Plant Construction* | | | | | |
| AFUDC | 7.53% | | | | | |
| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | 1.0% | $ 682,351 | $ 858,397 | $ 32,319 | $ 890,716 |
| Year -1 | 2024 | 26.7% | $ 17,418,566 | $ 22,348,020 | $ 908,474 | $ 23,256,494 |
| Year 0 | 2025 | 72.2% | $ 47,036,083 | $ 61,670,233 | $ 4,138,404 | $ 65,706,637 |

**O&M Cost**

| | 2010 | 2010 |
|---|---|---|
| Fixed | 9,220 $/MW | 461,000 |
| Variable | 5.32 $/MWh | 46,603 |
| Escalation | 2.5% | |

| Year | Life Year | Investment ($) | Energy and Capacity Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | 890,716 | | | | 0 | -890,716 | -890,716 |
| 2024 | | 23,256,494 | | | | 0 | -23,256,494 | -24,147,210 |
| 2025 | 0 | 65,706,637 | | | | 0 | -65,706,637 | -89,853,847 |
| 2026 | 1 | | 12,530,788 | 789,613 | 3,022,215 | 0 | 8,718,960 | -81,134,887 |
| 2027 | 2 | | 12,781,404 | 811,722 | 3,078,599 | 0 | 8,891,082 | -72,243,804 |
| 2028 | 3 | | 13,037,032 | 834,450 | 3,146,261 | 0 | 9,056,321 | -63,187,484 |
| 2029 | 4 | | 13,297,772 | 857,815 | 3,213,922 | 0 | 9,226,035 | -53,961,449 |
| 2030 | 5 | | 13,563,728 | 881,834 | 3,270,307 | 0 | 9,411,587 | -44,549,861 |
| 2031 | 6 | | 13,835,002 | 906,525 | 3,337,989 | 0 | 9,590,509 | -34,959,353 |
| 2032 | 7 | | 14,111,702 | 931,908 | 3,405,630 | 0 | 9,774,165 | -25,185,188 |
| 2033 | 8 | | 14,393,936 | 958,001 | 3,473,292 | 0 | 9,962,644 | -15,222,544 |
| 2034 | 9 | | 14,681,815 | 984,825 | 3,540,953 | 0 | 10,156,037 | -5,066,507 |
| 2035 | 10 | | 14,975,452 | 1,012,400 | 3,608,615 | 0 | 10,354,437 | 5,287,930 |
| 2036 | 11 | | 15,274,961 | 1,040,747 | 3,687,553 | 0 | 10,546,660 | 15,834,590 |
| 2037 | 12 | | 15,580,460 | 1,069,888 | 3,755,215 | 0 | 10,755,357 | 26,589,947 |
| 2038 | 13 | | 15,892,069 | 1,099,845 | 3,834,153 | 0 | 10,958,071 | 37,548,017 |
| 2039 | 14 | | 16,209,910 | 1,130,641 | 3,913,092 | 0 | 11,166,178 | 48,714,195 |
| 2040 | 15 | | 16,534,109 | 1,162,299 | 3,992,030 | 0 | 11,379,780 | 60,093,975 |
| 2041 | 16 | | 16,864,791 | 1,194,843 | 4,070,968 | 0 | 11,598,979 | 71,692,954 |
| 2042 | 17 | | 17,202,087 | 1,228,299 | 4,149,907 | 0 | 11,823,881 | 83,516,835 |
| 2043 | 18 | | 17,546,128 | 1,262,691 | 4,228,845 | 0 | 12,054,592 | 95,571,427 |
| 2044 | 19 | | 17,897,051 | 1,298,046 | 4,319,061 | 0 | 12,279,944 | 107,851,370 |
| 2045 | 20 | | 18,254,992 | 1,334,392 | 4,409,276 | 0 | 12,511,324 | 120,362,694 |
| 2046 | 21 | | 18,620,092 | 1,371,755 | 4,499,491 | 0 | 12,748,846 | 133,111,540 |
| 2047 | 22 | | 18,992,494 | 1,410,164 | 4,589,707 | 0 | 12,992,623 | 146,104,163 |
| 2048 | 23 | | 19,372,343 | 1,449,648 | 4,679,922 | 0 | 13,242,773 | 159,346,936 |
| 2049 | 24 | | 19,759,790 | 1,490,239 | 4,770,137 | 0 | 13,499,414 | 172,846,350 |
| 2050 | 25 | | 20,154,986 | 1,531,965 | 4,860,353 | 0 | 13,762,668 | 186,609,018 |
| 2051 | | | | | | 0 | 0 | 186,609,018 |
| 2052 | | | | | | 0 | 0 | 186,609,018 |
| 2053 | | | | | | 0 | 0 | 186,609,018 |
| 2054 | | | | | | 0 | 0 | 186,609,018 |
| 2055 | | | | | | 0 | 0 | 186,609,018 |
| 2056 | | | | | | 0 | 0 | 186,609,018 |
| 2057 | | | | | | 0 | 0 | 186,609,018 |
| 2058 | | | | | | 0 | 0 | 186,609,018 |
| 2059 | | | | | | 0 | 0 | 186,609,018 |
| 2060 | | | | | | 0 | 0 | 186,609,018 |
| 2061 | | | | | | 0 | 0 | 186,609,018 |
| 2062 | | | | | | 0 | 0 | 186,609,018 |
| 2063 | | | | | | 0 | 0 | 186,609,018 |
| 2064 | | | | | | 0 | 0 | 186,609,018 |
| 2065 | | | | | | 0 | 0 | 186,609,018 |
| 2066 | | | | | | 0 | 0 | 186,609,018 |
| 2067 | | | | | | 0 | 0 | 186,609,018 |

M:\11\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]50MW CT Capacity

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 06SEP'11 | ISSUED WITH REPORT 309-11/01-1 | BXF | BRM | JPH |

**TABLE 5.7**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 25 MW WIND**

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| **Year of Development** | 2025 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 0.0% | Internal Rate of Return | 10.0% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 60.0 $/MWh | | |
| Energy Sale Escalation | 2.0% | | |
| **Asset** | **Greenfield CCGT** | | |
| Installed Capacity | 25 MW | | |
| Capacity Factor | 40.0% | | |
| Average Available Gen | 87.6 GWh | | |
| Generation Assumed | 87.6 GWh | | |
| Life of Infrastructure | 20 Years | | |
| **Capital Cost** | | | |
| 2010 Capital Cost | $ 58,082,000 | | |
| Relevant Index | *Increased at 2%* | | |
| AFUDC | 7.53% | | |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | | | | | |
| Year -1 | 2024 | 33.3% | $ 19,341,306 | $ 25,520,443 | $ 960,845 | $ 26,481,287 |
| Year 0 | 2025 | 66.7% | $ 38,740,694 | $ 52,139,873 | $ 3,957,107 | $ 56,096,981 |

| **O&M Cost** | 2010 | 2010 |
|---|---|---|
| Fixed | 0 $/MW | 0 |
| Variable | 5.90 $/MWh | 516,840 |
| Escalation | 2.5% | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | | | | | 0 | 0 | 0 |
| 2024 | | 26,481,287 | | | | 0 | -26,481,287 | -26,481,287 |
| 2025 | 0 | 56,096,981 | | | | 0 | -56,096,981 | -82,578,268 |
| 2026 | 1 | | 9,620,482 | 803,981 | 0 | 0 | 8,816,501 | -73,761,767 |
| 2027 | 2 | | 9,812,892 | 826,493 | 0 | 0 | 8,986,399 | -64,775,368 |
| 2028 | 3 | | 10,009,150 | 849,635 | 0 | 0 | 9,159,515 | -55,615,853 |
| 2029 | 4 | | 10,209,333 | 873,424 | 0 | 0 | 9,335,908 | -46,279,944 |
| 2030 | 5 | | 10,413,519 | 897,880 | 0 | 0 | 9,515,639 | -36,764,305 |
| 2031 | 6 | | 10,621,790 | 923,021 | 0 | 0 | 9,698,769 | -27,065,536 |
| 2032 | 7 | | 10,834,226 | 948,865 | 0 | 0 | 9,885,360 | -17,180,176 |
| 2033 | 8 | | 11,050,910 | 975,434 | 0 | 0 | 10,075,476 | -7,104,700 |
| 2034 | 9 | | 11,271,928 | 1,002,746 | 0 | 0 | 10,269,182 | 3,164,482 |
| 2035 | 10 | | 11,497,367 | 1,030,823 | 0 | 0 | 10,466,544 | 13,631,027 |
| 2036 | 11 | | 11,727,314 | 1,059,686 | 0 | 0 | 10,667,628 | 24,298,655 |
| 2037 | 12 | | 11,961,860 | 1,089,357 | 0 | 0 | 10,872,503 | 35,171,158 |
| 2038 | 13 | | 12,201,098 | 1,119,859 | 0 | 0 | 11,081,239 | 46,252,397 |
| 2039 | 14 | | 12,445,120 | 1,151,215 | 0 | 0 | 11,293,905 | 57,546,302 |
| 2040 | 15 | | 12,694,022 | 1,183,449 | 0 | 0 | 11,510,573 | 69,056,875 |
| 2041 | 16 | | 12,947,902 | 1,216,586 | 0 | 0 | 11,731,317 | 80,788,191 |
| 2042 | 17 | | 13,206,860 | 1,250,650 | 0 | 0 | 11,956,210 | 92,744,402 |
| 2043 | 18 | | 13,470,998 | 1,285,668 | 0 | 0 | 12,185,329 | 104,929,731 |
| 2044 | 19 | | 13,740,418 | 1,321,667 | 0 | 0 | 12,418,751 | 117,348,482 |
| 2045 | 20 | | 14,015,226 | 1,358,674 | 0 | 0 | 12,656,552 | 130,005,034 |
| 2046 | | | | | | 0 | 0 | 130,005,034 |
| 2047 | | | | | | 0 | 0 | 130,005,034 |
| 2048 | | | | | | 0 | 0 | 130,005,034 |
| 2049 | | | | | | 0 | 0 | 130,005,034 |
| 2050 | | | | | | 0 | 0 | 130,005,034 |
| 2051 | | | | | | 0 | 0 | 130,005,034 |
| 2052 | | | | | | 0 | 0 | 130,005,034 |
| 2053 | | | | | | 0 | 0 | 130,005,034 |
| 2054 | | | | | | 0 | 0 | 130,005,034 |
| 2055 | | | | | | 0 | 0 | 130,005,034 |
| 2056 | | | | | | 0 | 0 | 130,005,034 |
| 2057 | | | | | | 0 | 0 | 130,005,034 |
| 2058 | | | | | | 0 | 0 | 130,005,034 |
| 2059 | | | | | | 0 | 0 | 130,005,034 |
| 2060 | | | | | | 0 | 0 | 130,005,034 |
| 2061 | | | | | | 0 | 0 | 130,005,034 |
| 2062 | | | | | | 0 | 0 | 130,005,034 |
| 2063 | | | | | | 0 | 0 | 130,005,034 |
| 2064 | | | | | | 0 | 0 | 130,005,034 |
| 2065 | | | | | | 0 | 0 | 130,005,034 |
| 2066 | | | | | | 0 | 0 | 130,005,034 |
| 2067 | | | | | | 0 | 0 | 130,005,034 |

M:\11\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]25MW Wind

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 08SEP11 | ISSUED WITH REPORT 303-11271-1 | BXF | SRM | JPH |

**TABLE 5.8**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 36 MW ISLAND POND HYDRO**

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| **Year of Development** | 2025 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 0.0% | Internal Rate of Return | 9.9% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 85.0 $/MWh | | |
| Energy Sale Escalation | 2.0% | | |
| **Asset** | **Greenfield CCCT** | | |
| Installed Capacity | 36 MW | | |
| Capacity Factor | 60.0% | | |
| Average Available Gen | 189.2 GWh | | |
| Generation Assumed | 189.2 GWh | | |
| Life of Infrastructure | 55 Years | | |
| **Capital Cost** | | | |
| 2010 Capital Cost | $ 166,220,000 | | |
| Relevant Index | *Hydraulic Plant Construction* | | |
| AFUDC | 7.33% | | |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | 3.0% | $ 4,906,671 | $ 6,000,859 | $ 225,932 | $ 6,226,791 |
| Year -2 | 2023 | 24.6% | $ 40,898,895 | $ 51,000,922 | $ 2,389,062 | $ 53,389,984 |
| Year -1 | 2024 | 32.9% | $ 54,653,299 | $ 69,518,996 | $ 7,106,533 | $ 76,625,530 |
| Year 0 | 2025 | 39.6% | $ 65,761,135 | $ 85,292,192 | $ 13,470,297 | $ 98,762,489 |

| **O&M Cost** | 2010 | 2010 |
|---|---|---|
| Fixed | 15,790 $/MW | 568,440 |
| Variable | 0.00 $/MWh | 0 |
| Escalation | 2.8% | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | 6,226,791 | | | | 0 | -6,226,791 | -6,226,791 |
| 2023 | | 53,389,984 | | | | 0 | -53,389,984 | -59,616,775 |
| 2024 | | 76,625,530 | | | | 0 | -76,625,530 | -136,242,305 |
| 2025 | 0 | 98,762,489 | | | | 0 | -98,762,489 | -235,004,794 |
| 2026 | 1 | | 22,079,007 | 884,249 | 0 | 0 | 21,194,758 | -213,810,036 |
| 2027 | 2 | | 22,520,587 | 909,008 | 0 | 0 | 21,611,579 | -192,198,457 |
| 2028 | 3 | | 22,970,999 | 934,460 | 0 | 0 | 22,036,539 | -170,161,918 |
| 2029 | 4 | | 23,430,419 | 960,625 | 0 | 0 | 22,469,794 | -147,692,124 |
| 2030 | 5 | | 23,899,027 | 987,522 | 0 | 0 | 22,911,505 | -124,780,620 |
| 2031 | 6 | | 24,377,007 | 1,015,173 | 0 | 0 | 23,361,834 | -101,418,785 |
| 2032 | 7 | | 24,864,548 | 1,043,598 | 0 | 0 | 23,820,950 | -77,597,835 |
| 2033 | 8 | | 25,361,839 | 1,072,819 | 0 | 0 | 24,289,020 | -53,308,815 |
| 2034 | 9 | | 25,869,075 | 1,102,857 | 0 | 0 | 24,766,218 | -28,542,597 |
| 2035 | 10 | | 26,386,457 | 1,133,737 | 0 | 0 | 25,252,719 | -3,289,878 |
| 2036 | 11 | | 26,914,186 | 1,165,482 | 0 | 0 | 25,748,704 | 22,458,826 |
| 2037 | 12 | | 27,452,470 | 1,198,116 | 0 | 0 | 26,254,354 | 48,713,180 |
| 2038 | 13 | | 28,001,519 | 1,231,663 | 0 | 0 | 26,769,856 | 75,483,036 |
| 2039 | 14 | | 28,561,549 | 1,266,149 | 0 | 0 | 27,295,400 | 102,778,436 |
| 2040 | 15 | | 29,132,780 | 1,301,602 | 0 | 0 | 27,831,179 | 130,609,615 |
| 2041 | 16 | | 29,715,436 | 1,338,046 | 0 | 0 | 28,377,390 | 158,987,005 |
| 2042 | 17 | | 30,309,745 | 1,375,512 | 0 | 0 | 28,934,233 | 187,921,238 |
| 2043 | 18 | | 30,915,940 | 1,414,026 | 0 | 0 | 29,501,914 | 217,423,151 |
| 2044 | 19 | | 31,534,258 | 1,453,619 | 0 | 0 | 30,080,640 | 247,503,791 |
| 2045 | 20 | | 32,164,944 | 1,494,320 | 0 | 0 | 30,670,624 | 278,174,414 |
| 2046 | 21 | | 32,808,243 | 1,536,161 | 0 | 0 | 31,272,081 | 309,446,496 |
| 2047 | 22 | | 33,464,407 | 1,579,174 | 0 | 0 | 31,885,234 | 341,331,730 |
| 2048 | 23 | | 34,133,696 | 1,623,390 | 0 | 0 | 32,510,305 | 373,842,035 |
| 2049 | 24 | | 34,816,369 | 1,668,845 | 0 | 0 | 33,147,524 | 406,989,559 |
| 2050 | 25 | | 35,512,697 | 1,715,573 | 0 | 0 | 33,797,124 | 440,786,682 |
| 2051 | 26 | | 36,222,951 | 1,763,609 | 0 | 0 | 34,459,342 | 475,246,024 |
| 2052 | 27 | | 36,947,410 | 1,812,990 | 0 | 0 | 35,134,420 | 510,380,444 |
| 2053 | 28 | | 37,686,358 | 1,863,754 | 0 | 0 | 35,822,604 | 546,203,048 |
| 2054 | 29 | | 38,440,085 | 1,915,939 | 0 | 0 | 36,524,146 | 582,727,194 |
| 2055 | 30 | | 39,208,887 | 1,969,585 | 0 | 0 | 37,239,302 | 619,966,495 |
| 2056 | 31 | | 39,993,065 | 2,024,734 | 0 | 0 | 37,968,331 | 657,934,826 |
| 2057 | 32 | | 40,792,926 | 2,081,426 | 0 | 0 | 38,711,500 | 696,646,326 |
| 2058 | 33 | | 41,608,784 | 2,139,706 | 0 | 0 | 39,469,078 | 736,115,404 |
| 2059 | 34 | | 42,440,960 | 2,199,618 | 0 | 0 | 40,241,342 | 776,356,746 |
| 2060 | 35 | | 43,289,779 | 2,261,207 | 0 | 0 | 41,028,572 | 817,385,318 |
| 2061 | 36 | | 44,155,575 | 2,324,521 | 0 | 0 | 41,831,054 | 859,216,372 |
| 2062 | 37 | | 45,038,686 | 2,389,608 | 0 | 0 | 42,649,079 | 901,865,451 |
| 2063 | 38 | | 45,939,460 | 2,456,517 | 0 | 0 | 43,482,943 | 945,348,394 |
| 2064 | 39 | | 46,858,249 | 2,525,299 | 0 | 0 | 44,332,950 | 989,681,344 |
| 2065 | 40 | | 47,795,414 | 2,596,007 | 0 | 0 | 45,199,407 | 1,034,880,751 |
| 2066 | 41 | | 48,751,323 | 2,668,696 | 0 | 0 | 46,082,627 | 1,080,963,378 |
| 2067 | 42 | | 49,726,349 | 2,743,419 | 0 | 0 | 46,982,930 | 1,127,946,308 |

M:\1\03\C0365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]36MW Hydro

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 09SEP11 | ISSUED WITH REPORT 365-112/1-1 | BXF | SRM | JPH |

**TABLE 5.9**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 23 MW PORTLAND CREEK HYDRO**

Print 11/1/11 16:52

| | | | | |
|---|---|---|---|---|
| **Year of Development** | 2025 | | | |
| **Financial** | | | **Analysis** | |
| Interest Rate | 8.0% | | Internal Rate of Return | 10.0% |
| Discount rate | 8.0% | | | |
| 2010 Energy Sale | 58.0 | $/MWh | | |
| Energy Sale Escalation | 2.0% | | | |
| **Asset** | **Greenfield CCCT** | | | |
| Installed Capacity | 23 | MW | | |
| Capacity Factor | 70.0% | | | |
| Average Available Gen | 141.0 | GWh | | |
| Generation Assumed | 141.0 | GWh | | |
| Life of Infrastructure | 55 | Years | | |
| **Capital Cost** | | | | |
| 2010 Capital Cost | $ 89,908,800 | | | |
| Relevant Index | *Hydraulic Plant Construction* | | | |
| AFUDC | 7.33% | | | |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | 4.3% | $ 3,863,469 | $ 4,842,686 | $ 182,327 | $ 5,025,013 |
| Year -1 | 2024 | 22.2% | $ 19,959,946 | $ 25,389,052 | $ 1,334,281 | $ 26,723,333 |
| Year 0 | 2025 | 73.5% | $ 66,085,484 | $ 85,686,933 | $ 5,616,764 | $ 91,303,697 |

| **O&M Cost** | | 2010 | 2010 |
|---|---|---|---|
| | Fixed | 15,790 $/MW | 363,170 |
| | Variable | 0.00 $/MWh | 0 |
| | Escalation | 2.9% | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | 5,025,013 | | | | 0 | -5,025,013 | -5,025,013 |
| 2024 | | 26,723,333 | | | | 0 | -26,723,333 | -31,748,346 |
| 2025 | 0 | 91,303,697 | | | | 0 | -91,303,697 | -123,052,043 |
| 2026 | 1 | | 11,229,508 | 564,937 | 0 | 0 | 10,664,571 | -112,387,472 |
| 2027 | 2 | | 11,454,098 | 580,755 | 0 | 0 | 10,873,343 | -101,514,129 |
| 2028 | 3 | | 11,683,180 | 597,016 | 0 | 0 | 11,086,164 | -90,427,965 |
| 2029 | 4 | | 11,916,844 | 613,733 | 0 | 0 | 11,303,111 | -79,124,854 |
| 2030 | 5 | | 12,155,180 | 630,917 | 0 | 0 | 11,524,263 | -67,600,590 |
| 2031 | 6 | | 12,398,284 | 648,583 | 0 | 0 | 11,749,701 | -55,850,889 |
| 2032 | 7 | | 12,646,250 | 666,743 | 0 | 0 | 11,979,507 | -43,871,382 |
| 2033 | 8 | | 12,899,175 | 685,412 | 0 | 0 | 12,213,763 | -31,657,620 |
| 2034 | 9 | | 13,157,158 | 704,603 | 0 | 0 | 12,452,555 | -19,205,065 |
| 2035 | 10 | | 13,420,301 | 724,332 | 0 | 0 | 12,695,969 | -6,509,095 |
| 2036 | 11 | | 13,688,707 | 744,614 | 0 | 0 | 12,944,094 | 6,434,998 |
| 2037 | 12 | | 13,962,482 | 765,463 | 0 | 0 | 13,197,019 | 19,632,017 |
| 2038 | 13 | | 14,241,731 | 786,896 | 0 | 0 | 13,454,836 | 33,086,853 |
| 2039 | 14 | | 14,526,566 | 808,929 | 0 | 0 | 13,717,637 | 46,804,490 |
| 2040 | 15 | | 14,817,097 | 831,579 | 0 | 0 | 13,985,518 | 60,790,008 |
| 2041 | 16 | | 15,113,439 | 854,863 | 0 | 0 | 14,258,576 | 75,048,584 |
| 2042 | 17 | | 15,415,708 | 878,799 | 0 | 0 | 14,536,909 | 89,585,493 |
| 2043 | 18 | | 15,724,022 | 903,406 | 0 | 0 | 14,820,616 | 104,406,109 |
| 2044 | 19 | | 16,038,502 | 928,701 | 0 | 0 | 15,109,802 | 119,515,911 |
| 2045 | 20 | | 16,359,273 | 954,705 | 0 | 0 | 15,404,568 | 134,920,479 |
| 2046 | 21 | | 16,686,458 | 981,436 | 0 | 0 | 15,705,022 | 150,625,501 |
| 2047 | 22 | | 17,020,187 | 1,008,916 | 0 | 0 | 16,011,271 | 166,636,771 |
| 2048 | 23 | | 17,360,591 | 1,037,166 | 0 | 0 | 16,323,425 | 182,960,196 |
| 2049 | 24 | | 17,707,803 | 1,066,207 | 0 | 0 | 16,641,596 | 199,601,792 |
| 2050 | 25 | | 18,061,959 | 1,096,061 | 0 | 0 | 16,965,898 | 216,567,690 |
| 2051 | 26 | | 18,423,198 | 1,126,750 | 0 | 0 | 17,296,448 | 233,864,138 |
| 2052 | 27 | | 18,791,662 | 1,158,299 | 0 | 0 | 17,633,363 | 251,497,501 |
| 2053 | 28 | | 19,167,495 | 1,190,732 | 0 | 0 | 17,976,763 | 269,474,264 |
| 2054 | 29 | | 19,550,845 | 1,224,072 | 0 | 0 | 18,326,773 | 287,801,037 |
| 2055 | 30 | | 19,941,862 | 1,258,346 | 0 | 0 | 18,683,516 | 306,484,553 |
| 2056 | 31 | | 20,340,699 | 1,293,580 | 0 | 0 | 19,047,119 | 325,531,672 |
| 2057 | 32 | | 20,747,513 | 1,329,800 | 0 | 0 | 19,417,713 | 344,949,385 |
| 2058 | 33 | | 21,162,463 | 1,367,034 | 0 | 0 | 19,795,429 | 364,744,814 |
| 2059 | 34 | | 21,585,713 | 1,405,311 | 0 | 0 | 20,180,401 | 384,925,215 |
| 2060 | 35 | | 22,017,427 | 1,444,660 | 0 | 0 | 20,572,767 | 405,497,982 |
| 2061 | 36 | | 22,457,775 | 1,485,111 | 0 | 0 | 20,972,665 | 426,470,647 |
| 2062 | 37 | | 22,906,931 | 1,526,694 | 0 | 0 | 21,380,237 | 447,850,884 |
| 2063 | 38 | | 23,365,070 | 1,569,441 | 0 | 0 | 21,795,628 | 469,646,513 |
| 2064 | 39 | | 23,832,371 | 1,613,386 | 0 | 0 | 22,218,985 | 491,865,498 |
| 2065 | 40 | | 24,309,018 | 1,658,560 | 0 | 0 | 22,650,458 | 514,515,956 |
| 2066 | 41 | | 24,795,199 | 1,705,000 | 0 | 0 | 23,090,199 | 537,606,155 |
| 2067 | 42 | | 25,291,103 | 1,752,740 | 0 | 0 | 23,538,363 | 561,144,518 |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]23MW Hydro

| REV | DATE | DESCRIPTION | PREPD | CHKD | APP'D |
|---|---|---|---|---|---|
| 0 | 09SEP'11 | ISSUED WITH REPORT 303-11371-1 | BXF | BRM | JPH |

**TABLE 5.10**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**BASIC FINANCIAL ANALYSIS - 18 MW ROUND POND HYDRO**

Print: 11/1/11 16:52

| | | | |
|---|---|---|---|
| **Year of Development** | 2025 | | |
| **Financial** | | **Analysis** | |
| Interest Rate | 8.0% | Internal Rate of Return | 10.0% |
| Discount rate | 8.0% | | |
| 2010 Energy Sale | 99.0 $/MWh | | |
| Energy Sale Escalation | 2.0% | | |
| **Asset** | **Greenfield CCGT** | | |
| Installed Capacity | 18 MW | | |
| Capacity Factor | 94.0% | | |
| Average Available Gene | 132.5 GWh | | |
| Generation Assumed | 132.5 GWh | | |
| Life of Infrastructure | 55 Years | | |
| **Capital Cost** | | | |
| 2010 Capital Cost | $ 142,192,354 | | |
| Relevant Index | *Hydraulic Plant Construction* | | |
| AFUDC | 7.53% | | |

| Cost | | Distribution | 2010 | 2025 | AFUDC | Total |
|---|---|---|---|---|---|---|
| Year -4 | 2021 | | | | | |
| Year -3 | 2022 | | | | | |
| Year -2 | 2023 | 8.5% | $ 12,070,094 | $ 15,051,408 | $ 566,885 | $ 15,618,093 |
| Year -1 | 2024 | 47.3% | $ 67,270,289 | $ 85,567,808 | $ 4,397,670 | $ 89,965,479 |
| Year 0 | 2025 | 44.2% | $ 62,851,971 | $ 81,519,006 | $ 11,019,634 | $ 92,538,639 |

| **O&M Cost** | 2010 | 2010 |
|---|---|---|
| Fixed | 15,790 $/MW | 284,220 |
| Variable | 0.00 $/MWh | 0 |
| Escalation | 2.8% | |

| Year | Life Year | Investment ($) | Energy Sales ($) | Operating Cost ($) | Fuel Cost ($) | Interest ($) | Cash Flow ($) | Cumulative Cash Flow ($) |
|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | 0 | 0 | 0 |
| 2011 | | | | | | 0 | 0 | 0 |
| 2012 | | | | | | 0 | 0 | 0 |
| 2013 | | | | | | 0 | 0 | 0 |
| 2014 | | | | | | 0 | 0 | 0 |
| 2015 | | | | | | 0 | 0 | 0 |
| 2016 | | | | | | 0 | 0 | 0 |
| 2017 | | | | | | 0 | 0 | 0 |
| 2018 | | | | | | 0 | 0 | 0 |
| 2019 | | | | | | 0 | 0 | 0 |
| 2020 | | | | | | 0 | 0 | 0 |
| 2021 | | | | | | 0 | 0 | 0 |
| 2022 | | | | | | 0 | 0 | 0 |
| 2023 | | 15,618,093 | | | | 0 | -15,618,093 | -15,618,093 |
| 2024 | | 89,965,479 | | | | 0 | -89,965,479 | -105,583,572 |
| 2025 | 0 | 92,538,639 | | | | 0 | -92,538,639 | -198,122,211 |
| 2026 | 1 | | 18,000,884 | 442,124 | 0 | 0 | 17,558,760 | -180,563,451 |
| 2027 | 2 | | 18,360,902 | 454,504 | 0 | 0 | 17,906,398 | -162,657,053 |
| 2028 | 3 | | 18,728,120 | 467,230 | 0 | 0 | 18,260,890 | -144,396,163 |
| 2029 | 4 | | 19,102,682 | 480,312 | 0 | 0 | 18,622,370 | -125,773,793 |
| 2030 | 5 | | 19,484,736 | 493,761 | 0 | 0 | 18,990,975 | -106,782,818 |
| 2031 | 6 | | 19,874,431 | 507,586 | 0 | 0 | 19,366,844 | -87,415,974 |
| 2032 | 7 | | 20,271,919 | 521,799 | 0 | 0 | 19,750,120 | -67,665,853 |
| 2033 | 8 | | 20,677,358 | 536,409 | 0 | 0 | 20,140,949 | -47,524,905 |
| 2034 | 9 | | 21,090,905 | 551,429 | 0 | 0 | 20,539,476 | -26,985,428 |
| 2035 | 10 | | 21,512,723 | 566,869 | 0 | 0 | 20,945,854 | -6,039,574 |
| 2036 | 11 | | 21,942,977 | 582,741 | 0 | 0 | 21,360,236 | 15,320,662 |
| 2037 | 12 | | 22,381,837 | 599,058 | 0 | 0 | 21,782,779 | 37,103,442 |
| 2038 | 13 | | 22,829,474 | 615,831 | 0 | 0 | 22,213,642 | 59,317,084 |
| 2039 | 14 | | 23,286,063 | 633,075 | 0 | 0 | 22,652,889 | 81,970,073 |
| 2040 | 15 | | 23,751,785 | 650,801 | 0 | 0 | 23,100,984 | 105,071,056 |
| 2041 | 16 | | 24,226,820 | 669,023 | 0 | 0 | 23,557,797 | 128,628,853 |
| 2042 | 17 | | 24,711,357 | 687,756 | 0 | 0 | 24,023,601 | 152,652,454 |
| 2043 | 18 | | 25,205,584 | 707,013 | 0 | 0 | 24,498,571 | 177,151,025 |
| 2044 | 19 | | 25,709,695 | 726,809 | 0 | 0 | 24,982,886 | 202,133,911 |
| 2045 | 20 | | 26,223,889 | 747,160 | 0 | 0 | 25,476,729 | 227,610,640 |
| 2046 | 21 | | 26,748,367 | 768,081 | 0 | 0 | 25,980,287 | 253,590,927 |
| 2047 | 22 | | 27,283,334 | 789,587 | 0 | 0 | 26,493,748 | 280,084,674 |
| 2048 | 23 | | 27,829,001 | 811,695 | 0 | 0 | 27,017,306 | 307,101,980 |
| 2049 | 24 | | 28,385,581 | 834,423 | 0 | 0 | 27,551,158 | 334,653,139 |
| 2050 | 25 | | 28,953,293 | 857,787 | 0 | 0 | 28,095,506 | 362,748,645 |
| 2051 | 26 | | 29,532,359 | 881,805 | 0 | 0 | 28,650,554 | 391,399,199 |
| 2052 | 27 | | 30,123,006 | 906,495 | 0 | 0 | 29,216,511 | 420,615,710 |
| 2053 | 28 | | 30,725,466 | 931,877 | 0 | 0 | 29,793,589 | 450,409,299 |
| 2054 | 29 | | 31,339,975 | 957,969 | 0 | 0 | 30,382,006 | 480,791,305 |
| 2055 | 30 | | 31,966,775 | 984,793 | 0 | 0 | 30,981,982 | 511,773,287 |
| 2056 | 31 | | 32,606,110 | 1,012,367 | 0 | 0 | 31,593,743 | 543,367,030 |
| 2057 | 32 | | 33,258,232 | 1,040,713 | 0 | 0 | 32,217,519 | 575,584,550 |
| 2058 | 33 | | 33,923,397 | 1,069,853 | 0 | 0 | 32,853,544 | 608,438,094 |
| 2059 | 34 | | 34,601,865 | 1,099,809 | 0 | 0 | 33,502,056 | 641,940,150 |
| 2060 | 35 | | 35,293,902 | 1,130,604 | 0 | 0 | 34,163,299 | 676,103,449 |
| 2061 | 36 | | 35,999,780 | 1,162,261 | 0 | 0 | 34,837,520 | 710,940,969 |
| 2062 | 37 | | 36,719,776 | 1,194,804 | 0 | 0 | 35,524,972 | 746,465,941 |
| 2063 | 38 | | 37,454,172 | 1,228,258 | 0 | 0 | 36,225,913 | 782,691,854 |
| 2064 | 39 | | 38,203,255 | 1,262,650 | 0 | 0 | 36,940,605 | 819,632,459 |
| 2065 | 40 | | 38,967,320 | 1,298,004 | 0 | 0 | 37,669,316 | 857,301,776 |
| 2066 | 41 | | 39,746,666 | 1,334,348 | 0 | 0 | 38,412,319 | 895,714,094 |
| 2067 | 42 | | 40,541,600 | 1,371,710 | 0 | 0 | 39,169,890 | 934,883,985 |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-11-01.xlsm]18MW Hydro

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| B | 09SEP11 | ISSUED WITH REPORT 303-112/1-1 | BXF | SRM | JPH |

**TABLE 5.11**

**CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR**
**TWO GENERATION EXPANSION ALTERNATIVES**

**HIGH LEVEL REVIEW REPORT**
**SIMPLIFIED CPW ANALYSIS**

Weighted Average Cost Of Capital 8.0%

Print 11/1/11 16:59

Delta 2,723,872,478

| | Isolated Island | | Labrador Infeed | |
|---|---|---|---|---|
| NPV | 9,481,197,482 | $ | 6,757,325,004 | $ |
| Unit Cost of Renewable Energy | 81.0 | 2010 $/MWh | *(10% IRR)* | |
| Unit Cost of Thermal Energy | 213.0 | 2010 $/MWh | *(10% IRR)* | |
| Unit Cost of MF and LIL Energy | 130.0 | 2010 $/MWh | *(8% IRR)* | |
| Energy Cost Escalation | 2% | | | |

| | Isolated Island | | | | | | Labrador Infeed | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Renewable Energy (GWh) | Thermal Energy (GWh) | Total (GWh) | Renewable Energy Cost ($000) | Thermal Energy Cost ($000) | Total Cost ($000) | Renewable Energy (GWh) | Thermal Energy (GWh) | LIL Energy (GWh) | Total (GWh) | Renewable Energy Cost ($000) | Thermal Energy Cost ($000) | LIL Costs ($000) | Total ($000) |
| 2010 | 189 | 1,104 | 1,293 | 15,325 | 268,321 | 286,233 | 189 | 1,104 | 0 | 1,293 | 15,325 | 268,321 | 0 | 286,233 |
| 2011 | 189 | 1,023 | 1,212 | 15,632 | 253,437 | 271,492 | 189 | 1,023 | 0 | 1,212 | 15,632 | 253,437 | 0 | 271,492 |
| 2012 | 189 | 1,068 | 1,257 | 15,944 | 269,933 | 288,391 | 189 | 1,068 | 0 | 1,257 | 15,944 | 269,933 | 0 | 288,391 |
| 2013 | 189 | 1,428 | 1,617 | 16,263 | 368,218 | 387,715 | 189 | 1,428 | 0 | 1,617 | 16,263 | 368,218 | 0 | 387,715 |
| 2014 | 213 | 1,678 | 1,891 | 18,710 | 441,366 | 463,859 | 189 | 1,702 | 0 | 1,892 | 16,588 | 447,758 | 0 | 468,129 |
| 2015 | 309 | 1,703 | 2,012 | 27,616 | 457,008 | 488,649 | 189 | 1,823 | 0 | 2,012 | 16,920 | 489,042 | 0 | 509,986 |
| 2016 | 465 | 1,565 | 2,030 | 42,399 | 428,192 | 474,650 | 189 | 1,840 | 0 | 2,029 | 17,259 | 503,584 | 0 | 524,902 |
| 2017 | 465 | 1,604 | 2,069 | 43,247 | 447,837 | 495,222 | 189 | 67 | 1,813 | 2,069 | 17,604 | 18,813 | 270,674 | 311,230 |
| 2018 | 473 | 1,665 | 2,139 | 44,909 | 474,161 | 523,347 | 189 | 68 | 1,882 | 2,139 | 17,956 | 19,247 | 286,643 | 328,123 |
| 2019 | 606 | 1,603 | 2,209 | 58,691 | 465,523 | 528,633 | 189 | 67 | 1,953 | 2,209 | 18,315 | 19,573 | 303,375 | 345,683 |
| 2020 | 619 | 1,657 | 2,276 | 61,080 | 490,859 | 556,490 | 189 | 68 | 2,019 | 2,276 | 18,681 | 20,083 | 319,934 | 363,250 |
| 2021 | 745 | 1,626 | 2,371 | 75,062 | 491,159 | 570,962 | 189 | 67 | 2,115 | 2,371 | 19,055 | 20,304 | 341,817 | 385,918 |
| 2022 | 745 | 1,723 | 2,468 | 76,563 | 530,999 | 612,498 | 189 | 67 | 2,212 | 2,468 | 19,436 | 20,741 | 364,679 | 409,793 |
| 2023 | 745 | 1,830 | 2,575 | 78,094 | 575,191 | 658,435 | 189 | 8 | 2,378 | 2,575 | 19,825 | 2,389 | 399,939 | 427,303 |
| 2024 | 745 | 1,893 | 2,638 | 79,656 | 606,959 | 691,892 | 189 | 2 | 2,447 | 2,638 | 20,221 | 641 | 419,774 | 445,913 |
| 2025 | 745 | 1,951 | 2,696 | 81,249 | 638,034 | 724,676 | 189 | 2 | 2,505 | 2,696 | 20,626 | 621 | 438,335 | 464,974 |
| 2026 | 745 | 2,033 | 2,779 | 82,874 | 678,316 | 766,747 | 189 | 2 | 2,588 | 2,779 | 21,038 | 701 | 461,771 | 489,067 |
| 2027 | 745 | 2,122 | 2,868 | 84,532 | 722,131 | 812,398 | 189 | 2 | 2,676 | 2,868 | 21,459 | 749 | 487,134 | 515,077 |
| 2028 | 745 | 2,204 | 2,949 | 86,234 | 764,825 | 856,957 | 137 | 3 | 2,809 | 2,949 | 15,838 | 972 | 521,608 | 544,316 |
| 2029 | 745 | 2,284 | 3,029 | 87,947 | 808,477 | 902,482 | 0 | 4 | 3,025 | 3,029 | 0 | 1,558 | 572,853 | 580,469 |
| 2030 | 745 | 2,362 | 3,107 | 89,706 | 852,919 | 948,840 | 0 | 5 | 3,103 | 3,107 | 0 | 1,733 | 599,339 | 607,287 |
| 2031 | 745 | 2,440 | 3,186 | 91,500 | 898,779 | 996,650 | 0 | 5 | 3,181 | 3,185 | 0 | 1,805 | 626,675 | 634,850 |
| 2032 | 745 | 2,518 | 3,264 | 93,330 | 946,057 | 1,045,914 | 0 | 6 | 3,258 | 3,264 | 0 | 2,066 | 654,804 | 663,398 |
| 2033 | 745 | 2,596 | 3,342 | 95,196 | 994,905 | 1,096,785 | 0 | 6 | 3,336 | 3,342 | 0 | 2,261 | 683,829 | 692,773 |
| 2034 | 745 | 2,675 | 3,420 | 97,100 | 1,045,485 | 1,149,426 | 0 | 7 | 3,414 | 3,420 | 0 | 2,541 | 713,773 | 723,154 |
| 2035 | 745 | 2,745 | 3,490 | 99,042 | 1,094,381 | 1,200,405 | 0 | 7 | 3,483 | 3,490 | 0 | 2,751 | 742,935 | 752,667 |
| 2036 | 745 | 2,816 | 3,561 | 101,023 | 1,144,978 | 1,253,123 | 8 | 7 | 3,545 | 3,561 | 1,139 | 2,928 | 771,195 | 782,382 |
| 2037 | 745 | 2,886 | 3,631 | 103,044 | 1,196,995 | 1,307,301 | 142 | 7 | 3,482 | 3,631 | 19,563 | 2,986 | 772,728 | 802,540 |
| 2038 | 745 | 2,956 | 3,702 | 105,104 | 1,250,676 | 1,363,184 | 142 | 12 | 3,548 | 3,702 | 19,955 | 4,908 | 803,121 | 835,386 |
| 2039 | 745 | 3,027 | 3,772 | 107,207 | 1,306,113 | 1,420,863 | 142 | 13 | 3,618 | 3,772 | 20,354 | 5,394 | 835,251 | 868,543 |
| 2040 | 745 | 3,089 | 3,834 | 109,351 | 1,359,701 | 1,476,720 | 142 | 13 | 3,680 | 3,834 | 20,761 | 5,546 | 866,602 | 900,578 |
| 2041 | 745 | 3,152 | 3,897 | 111,538 | 1,414,910 | 1,534,242 | 142 | 14 | 3,742 | 3,897 | 21,176 | 6,061 | 898,730 | 933,761 |
| 2042 | 745 | 3,214 | 3,959 | 113,768 | 1,471,876 | 1,593,563 | 142 | 14 | 3,804 | 3,960 | 21,600 | 6,594 | 931,845 | 967,958 |
| 2043 | 745 | 3,277 | 4,022 | 116,044 | 1,530,647 | 1,654,735 | 142 | 15 | 3,865 | 4,022 | 22,032 | 7,053 | 965,875 | 1,003,004 |
| 2044 | 745 | 3,339 | 4,085 | 118,365 | 1,591,038 | 1,717,572 | 142 | 16 | 3,927 | 4,085 | 22,472 | 7,528 | 1,000,996 | 1,039,165 |
| 2045 | 745 | 3,402 | 4,147 | 120,732 | 1,653,232 | 1,782,258 | 142 | 17 | 3,989 | 4,147 | 22,922 | 8,067 | 1,037,057 | 1,076,340 |
| 2046 | 745 | 3,464 | 4,210 | 123,147 | 1,717,278 | 1,848,843 | 142 | 17 | 4,051 | 4,210 | 23,380 | 8,575 | 1,074,186 | 1,114,561 |
| 2047 | 745 | 3,527 | 4,272 | 125,610 | 1,783,325 | 1,917,479 | 142 | 19 | 4,112 | 4,272 | 23,848 | 9,505 | 1,112,197 | 1,154,094 |
| 2048 | 745 | 3,589 | 4,335 | 128,139 | 1,851,069 | 1,987,877 | 142 | 20 | 4,174 | 4,335 | 24,325 | 10,160 | 1,151,464 | 1,194,618 |
| 2049 | 745 | 3,652 | 4,397 | 130,684 | 1,921,020 | 2,060,498 | 142 | 20 | 4,235 | 4,397 | 24,811 | 10,731 | 1,191,828 | 1,236,165 |
| 2050 | 745 | 3,707 | 4,452 | 133,298 | 1,988,897 | 2,131,099 | 142 | 21 | 4,289 | 4,452 | 25,307 | 11,429 | 1,231,137 | 1,276,776 |
| 2051 | 745 | 3,761 | 4,507 | 135,964 | 2,058,557 | 2,203,534 | 142 | 23 | 4,343 | 4,507 | 25,814 | 12,369 | 1,271,453 | 1,318,648 |
| 2052 | 745 | 3,816 | 4,562 | 138,683 | 2,130,319 | 2,278,125 | 142 | 24 | 4,396 | 4,561 | 26,330 | 13,174 | 1,312,919 | 1,361,546 |
| 2053 | 745 | 3,871 | 4,616 | 141,457 | 2,204,128 | 2,354,817 | 142 | 25 | 4,450 | 4,616 | 26,856 | 14,007 | 1,355,535 | 1,405,631 |
| 2054 | 745 | 3,926 | 4,671 | 144,286 | 2,279,863 | 2,433,491 | 142 | 30 | 4,500 | 4,671 | 27,394 | 17,133 | 1,398,119 | 1,451,987 |
| 2055 | 745 | 3,980 | 4,726 | 147,172 | 2,357,924 | 2,514,547 | 142 | 35 | 4,550 | 4,726 | 27,941 | 20,438 | 1,441,896 | 1,499,726 |
| 2056 | 745 | 4,035 | 4,780 | 150,115 | 2,438,195 | 2,597,871 | 142 | 39 | 4,600 | 4,780 | 28,500 | 23,626 | 1,486,864 | 1,548,551 |
| 2057 | 745 | 4,090 | 4,835 | 153,117 | 2,520,672 | 2,683,460 | 142 | 44 | 4,649 | 4,835 | 29,070 | 27,242 | 1,532,989 | 1,598,971 |
| 2058 | 745 | 4,144 | 4,890 | 156,180 | 2,605,411 | 2,771,370 | 142 | 50 | 4,699 | 4,890 | 29,652 | 31,119 | 1,580,263 | 1,650,812 |
| 2059 | 745 | 4,199 | 4,945 | 159,303 | 2,692,658 | 2,861,851 | 142 | 55 | 4,748 | 4,944 | 30,245 | 35,011 | 1,628,883 | 1,704,028 |
| 2060 | 745 | 4,254 | 4,999 | 162,489 | 2,782,288 | 2,954,776 | 142 | 59 | 4,798 | 4,999 | 30,850 | 38,786 | 1,678,956 | 1,758,589 |
| 2061 | 745 | 4,309 | 5,054 | 165,739 | 2,874,560 | 3,050,407 | 142 | 65 | 4,847 | 5,054 | 31,467 | 43,364 | 1,730,059 | 1,814,998 |
| 2062 | 745 | 4,363 | 5,109 | 169,054 | 2,969,205 | 3,148,477 | 142 | 70 | 4,897 | 5,109 | 32,096 | 47,838 | 1,782,681 | 1,872,832 |
| 2063 | 745 | 4,418 | 5,163 | 172,435 | 3,066,556 | 3,249,318 | 142 | 76 | 4,946 | 5,163 | 32,738 | 52,473 | 1,836,678 | 1,932,215 |
| 2064 | 745 | 4,473 | 5,218 | 175,884 | 3,166,542 | 3,352,862 | 142 | 81 | 4,996 | 5,218 | 33,393 | 57,062 | 1,892,197 | 1,993,088 |
| 2065 | 745 | 4,528 | 5,273 | 179,401 | 3,269,518 | 3,459,465 | 142 | 90 | 5,041 | 5,273 | 34,060 | 65,208 | 1,947,464 | 2,057,279 |
| 2066 | 745 | 4,582 | 5,328 | 182,989 | 3,375,126 | 3,568,770 | 142 | 103 | 5,083 | 5,328 | 34,742 | 76,088 | 2,002,845 | 2,124,330 |
| 2067 | 745 | 4,637 | 5,382 | 186,649 | 3,483,875 | 3,681,289 | 142 | 120 | 5,121 | 5,382 | 35,437 | 89,781 | 2,058,377 | 2,194,359 |

M:\1\03\00365\02\A\Data\Cost Tables\[CPW9.xlsx]NPV Analysis (Simplified)

NOTES:

Notes: 1. Energy distribution from Nalcor Exhibit 100

| REV | DATE | DESCRIPTION | PREPD | CHKD | APP'D |
|---|---|---|---|---|---|
| 0 | 14OCT'11 | ISSUED WITH REPORT | BXF | SRM | JPH |

M:\1\03\00365\02\A\Data\Boris Notes\[CPW8.xls]Supply Graph - Isolated (2)

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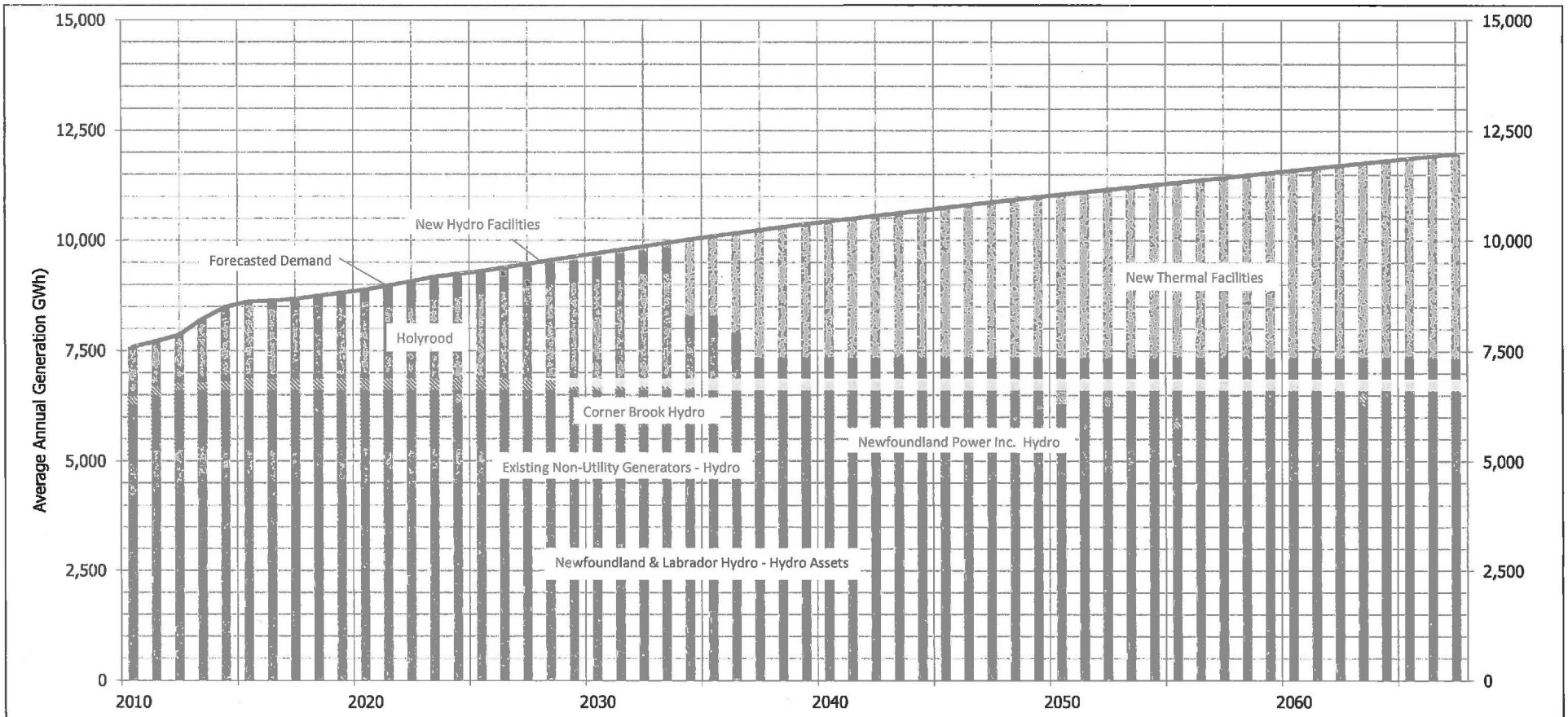


**NOTES:**
1. VALUES FROM NALCOR EXHIBIT 100

CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR

TWO GENERATION EXPANSION ALTERNATIVES

PROJECTED DEMAND AND CORRESPONDING SUPPLY
ISOLATED ISLAND OPTION

Knight Piésold CONSULTING

PIA NO. VA103-365/2

REF. NO. 1

FIGURE 3.1

REV 0

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 11OCT'11 | ISSUED WITH REPORT | BXF | SRM | JPH |

M:\1\03\00365\02\A\Data\Boris Notes\[CPW8.xls]Supply Graph -LIL

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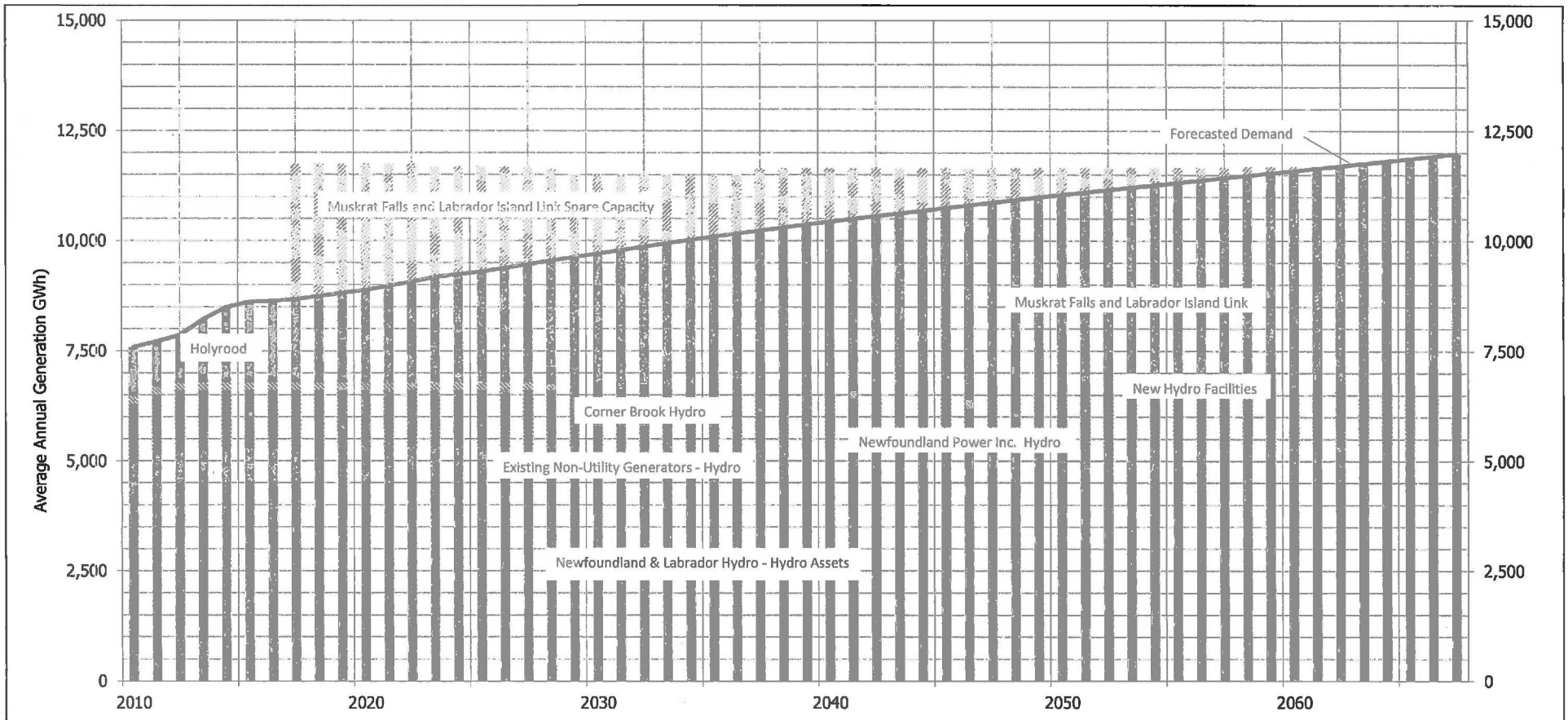


**NOTES:**
1. VALUES FROM NALCOR EXHIBIT 100

CONSUMER ADVOCATE FOR NEWFOUNDLAND AND LABRADOR

TWO GENERATION EXPANSION ALTERNATIVES

**PROJECTED DEMAND AND CORRESPONDING SUPPLY INTERCONNECTED ISLAND OPTION**

Knight Piésold CONSULTING

P/A NO. VA103-365/2

REF. NO. 1

**FIGURE 3.2**

REV 0

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 11OCT'11 | ISSUED WITH REPORT | BXF | SRM | JPH |

M:\1\03\00365\02\A\Data\Cost Tables\[Financial Analysis - BXF2011-10-13.xls]Figure 6.1

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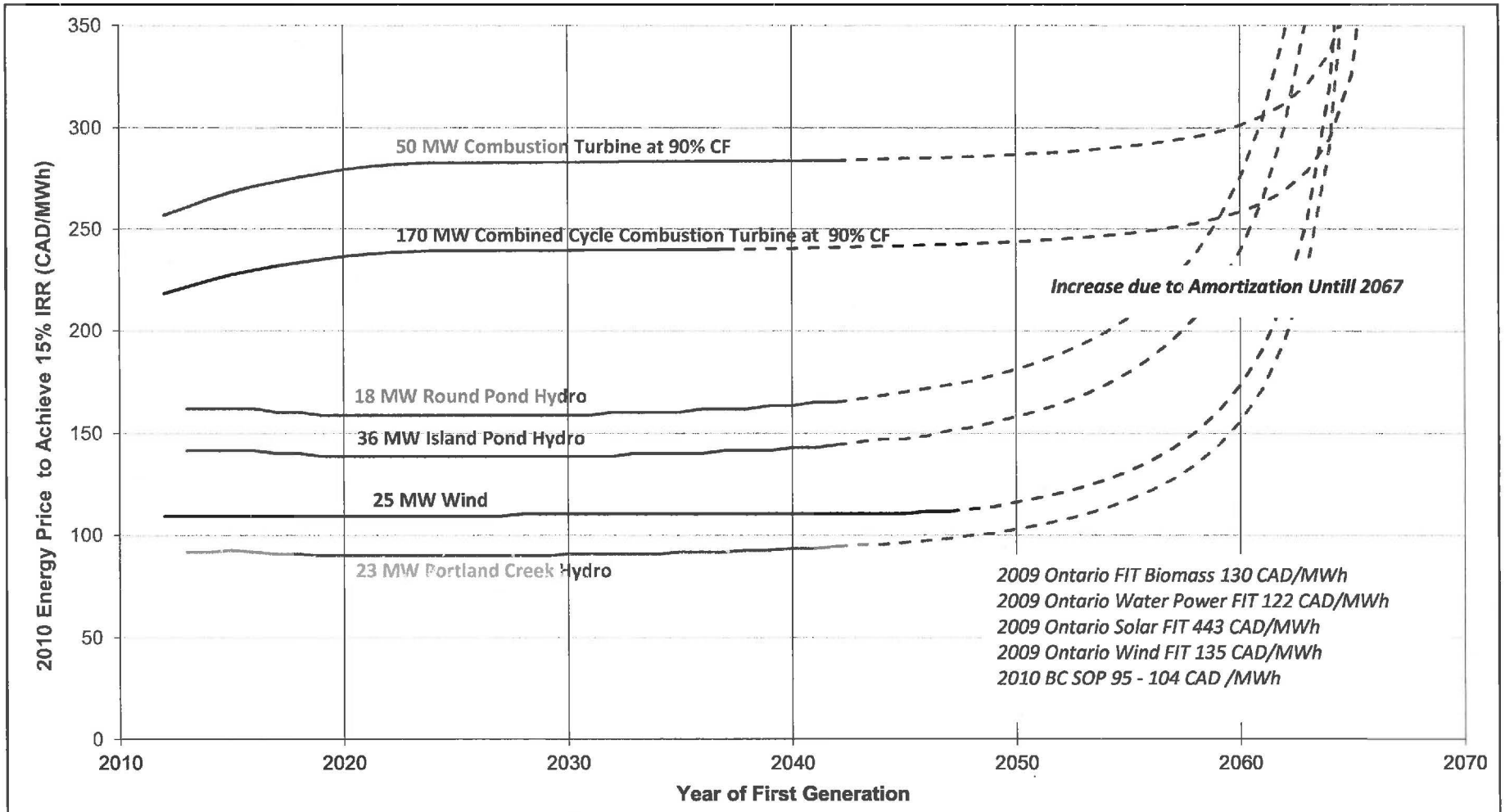


**NOTES:**
1. AFUDC included, but no interest on Capital.
2. 2010 Energy Price Escalated at 2% Annually

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 09SEP'11 | ISSUED WITH REPORT VA303-112/4-1 | BXF | SRM | JPH |

CONSUMER ADVOCATE FOR NL

TWO GENERATION EXPANSION ALTERNATIVES

**HIGH LEVEL REVIEW**
**ENERGY COST VS. DEVELOPMENT YEAR**

Knight Piésold CONSULTING

P/A NO. VA303-112/4-1

REF. NO. 1

**FIGURE 5.1**

REV 0

M:\1\03\00365\02\A\Data\Cost Tables\[Fuel Sensitivity.xls]Figure 5.2

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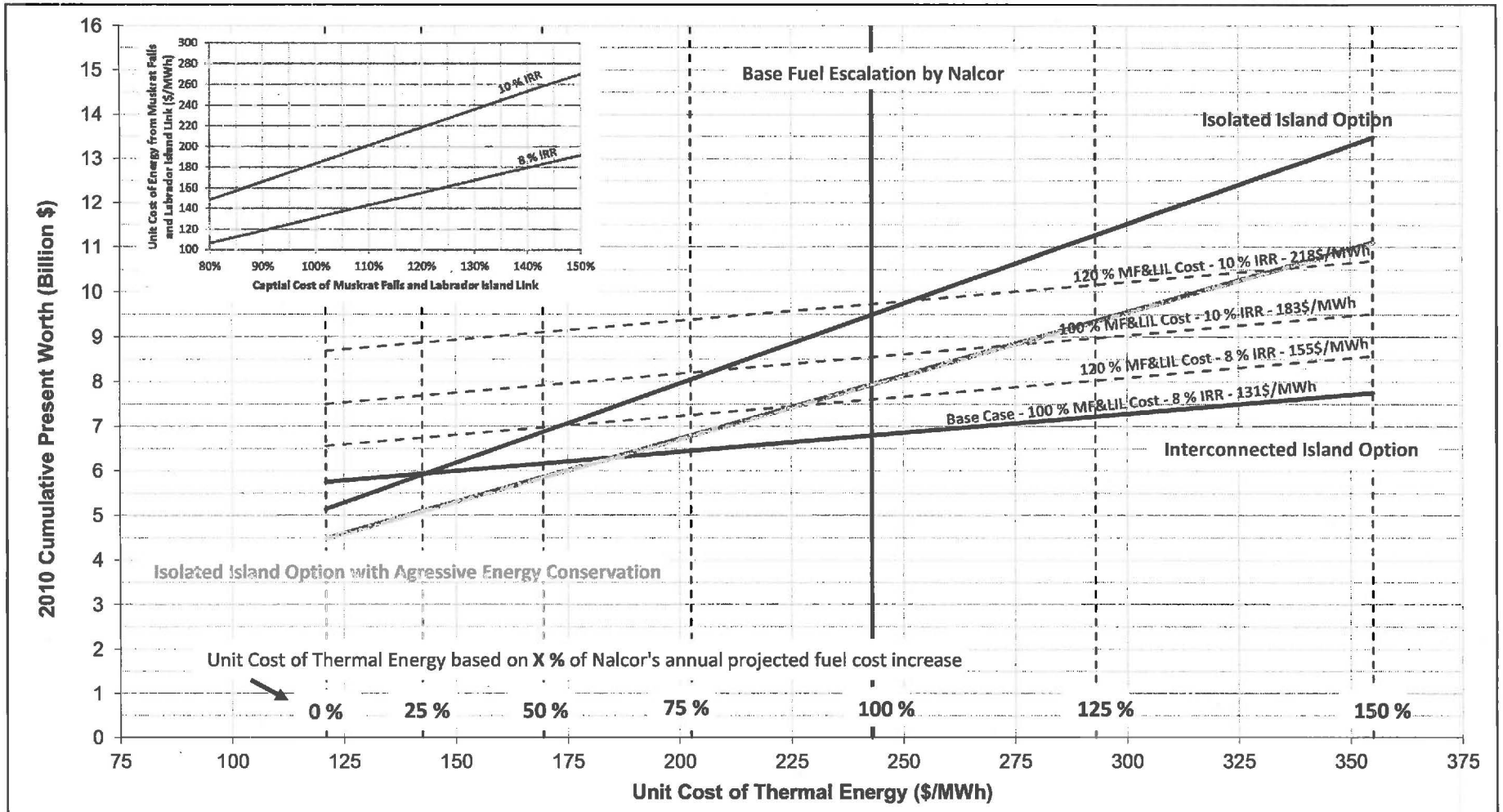


**NOTES:**

1. Interest during construction included, but no interest on Capital.
2. Weighted Average Cost of Capital 8%.
3. 2010 Energy Price Escalated at 2% Annually.
4. Thermal Energy Cost based on a 170 MW CCCT with 60% Capacity Factor and 2025 Inservice Date and a 10% IRR.
5. Renewable energy cost based on a hydro and wind and 2025 Inservice Date and a 10% IRR.
6. All Capital Cost and Price Escalators as provided by Nalcor.
7. MF and LIL Cost amortized over projected MF and LIL energy consumption.

| REV | DATE | DESCRIPTION | PREP'D | CHK'D | APP'D |
|---|---|---|---|---|---|
| 0 | 27OCT'11 | ISSUED FOR REPORT 303-112/1-1 | BXF | SRM | JPH |

CONSUMER ADVOCATE FOR NL

TWO GENERATION EXPANSION ALTERNATIVES

**CUMULATIVE PRESENT WORTH SENSITIVITY ANALYSIS**

Knight Piésold CONSULTING

P/A NO. VA103-365/2-1

REF. NO. 1

**FIGURE 5.2**

REV 0