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From: Cheryl Blundon
Sent: February 29, 2012 2:50 PM
To: [REDACTED]
Subject: FW: REvision 1 to presentation
Attachments: PUB Sumbission - Rev1.pdf

[REDACTED]

Sent: February-29-12 6:48 AM
To: Cheryl Blundon
Subject: REvision 1 to presentation

Ms. Blundon

As discussed yesterday please see a revision to the written presentation. The changes are as noted.

Can you please acknowledge receipt of the file.

Again I would ask that my personal information be kept confidential.

[REDACTED]

Muskrat Falls – The Benefits of a Phased Development

A Submission to the Public Utilities Board
February 29, 2012
Revision 1



Rev	Description	Date
0	First Issue to PUB	February 27, 2012
1	Slides 142,-148 added	February 29, 2012



Introduction

It has been said by many pundits that the Lower Churchill development represents the most important public policy decision in a generation. With the commencement of the Public Utilities Board (PUB) review of the project, and the subsequent release of volumes of project documentation, public interest and debate has recently begun to escalate to a level matching this claim. Considering that there has been in excess of 200 million dollars spent on the project since 2003, and a current rate of spend of 12-15 million a month, the public interest is perhaps long overdue¹.

The Author was personally called into action following Premier Dunderdale's year-end television interview. Since then I have immersed myself into the various reports and exhibits all conveniently filed within the PUB website. My initial opinions matched that of other pundits; namely the lack of a proper screening exercise by NALCOR, and the restricted terms of reference for the PUB review, has cultivated a "fait de complete" opinion of this project. However, further study has compelled the Author to generate this presentation. During my review efforts there were four basic questions which arose:

1. Do we need the additional electricity?
2. Is the Muskrat Falls the lowest cost option?
3. Considering the relative robust economic outlook for the next 4 years, why are we completing the largest public works project in our provinces history now?
4. Does the Emera partnership add value to the people of the province?



Introduction (Cont'd)

As I read through the 110 different exhibits prepared by NALCOR these fundamental questions kept returning. Yet there were several basic conclusions that I reached early in the review, which shaped how I have developed my final conclusions:

- As a province we need to make the right decision and close or convert the Holyrood facility to an alternative more environmentally responsible, and economically sustainable.
- There will eventually be a subsea electrical link between the island and mainland Canada. If not now, it will need to be built in 2035 in advance of Upper Churchill Power becoming available
- Subsea HVDC with HDD shore approaches and wet cable splices are technically challenging. This technology should be proven, and the system “shaked down” prior to the de-commissioning of Holyrood.
- NALCOR has completed a vast amount of very productive engineering, design and other works. There have been several significant milestones, and as Mr. Martin has said the stars are aligned. This work should not be shelved unless there is due reason.

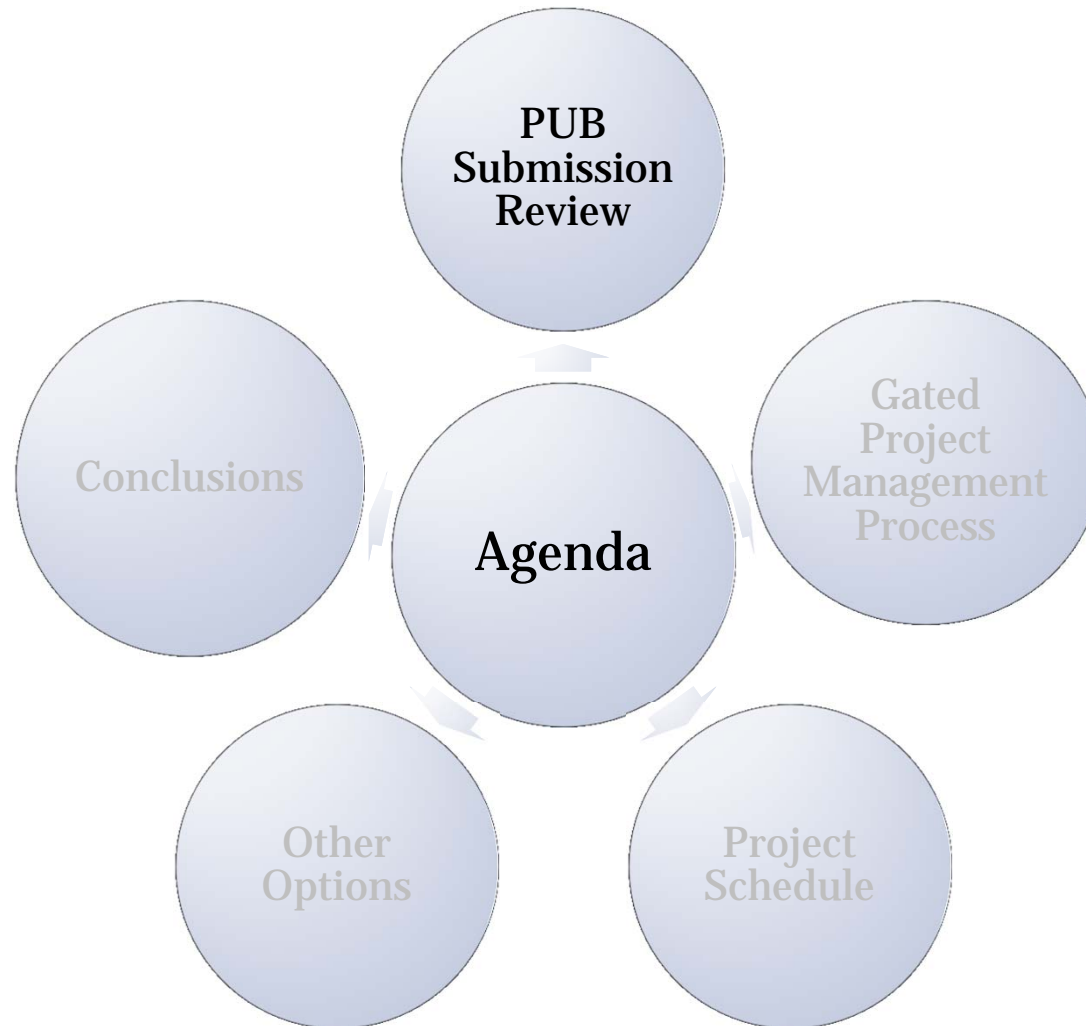


Introduction (Cont'd)

Considering these basic points, and with further investigation summarized herein, the author has reached the personal conclusion that the Labrador-Island-Link (LIL) and the Strait of Bell Island (SOBI) crossing should be completed within the current project schedule, however the Muskrat Falls Generating Facility (MFGF) should be delayed until the demand requirements are certain.

The construction of the LIL and SOBI would provide immediate access to Upper Churchill recall power, and will also provide the further advantage of greater system reliability. This should defer the capacity and energy deficiency currently predicted to be 2015 and 2019 respectively, well into the next decade. A delay to the MFGF decision will allow time to review the potential Labrador power requirements, provide further certainty concerning the Corner Brook Mill, and alternate sources of energy such as shale gas. A decision can then be made on a near term basis when this information is better known. It could be that with the additional requirements in Labrador a Gull Island First option may be ultimately preferred.

Within this presentation the Author will attempt to summarize the work completed to reach this conclusion. Where possible references have been added as appropriate.





Public Utilities Board Overview

- Nalcor has presented that Muskrat Falls and the Labrador Island Transmission Line represents the lowest cost power for the island of Newfoundland.
- The PUB has been retained on the following reference question:

“The Board shall review and report to governments on whether the Projects represent the least cost option for power to the Interconnected Island over the period to 2011 – 2067, as compared to the isolated island option”

- The 2007 Energy Plan (Page 48) clearly demonstrates the commitment of the Government of Newfoundland and Labrador to maintain least cost power as the primary rate setting objective in the province.
- The mandate of the PUB should also be extended to ensure that the MF and LIL projects represent the lowest cost, long term alternative to the people of the province.



Current Status

- Nalcor has submitted a detailed submission in November 2011 to the Public Utilities Board. This is a comprehensive submission detailing decades of work on the project.
- The PUB has been directed to provide a final report for March 30, 2011.
- The Premier of Newfoundland and Labrador has welcomed public comment to the process.
- The following presents an assessment of the PUB submission by the Author.

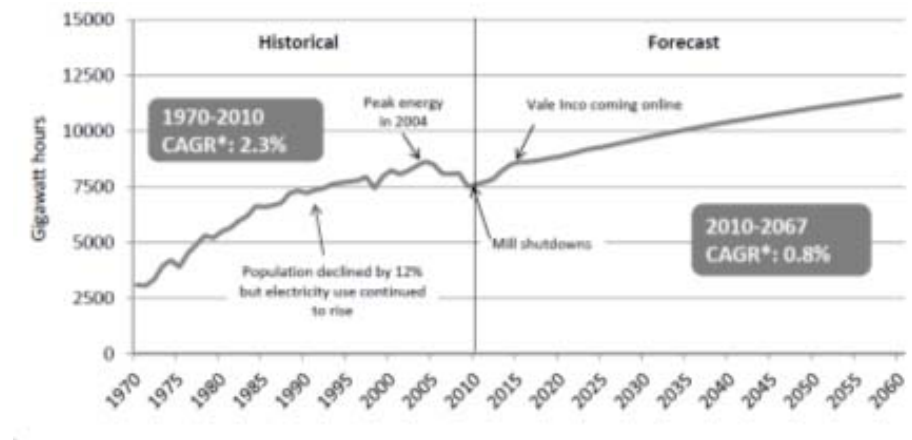


**PUB
Submission
Review**

Predictions of Demand Growth

Predicting Energy Requirements

- A primary economic driver for the MF and LIL developments is the predicted growth in power requirements for the island of Newfoundland.
- NALCOR has generated a 20 year forecast of power demands which is a econometric model based on key economic inputs.
- The 2010 – PLF covers the period from 2011-2029. This has been extended from the total project evaluation period of 2011 – 2067 based on general trends on power requirements.
- The Cumulative Present Worth (CPW) analysis (which determined that the MF and LIL as the least cost solution for the long term power requirements) is based upon the 2010 PLF.

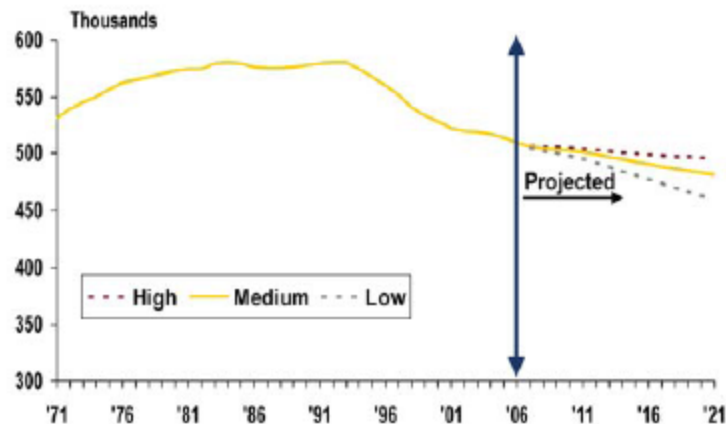


Presentation to the PUB – July 2011 (Posted on PUB Website)

The power demands are a key input into the final recommendation. It is essential that these predictions are sound.

Newfoundland's Population

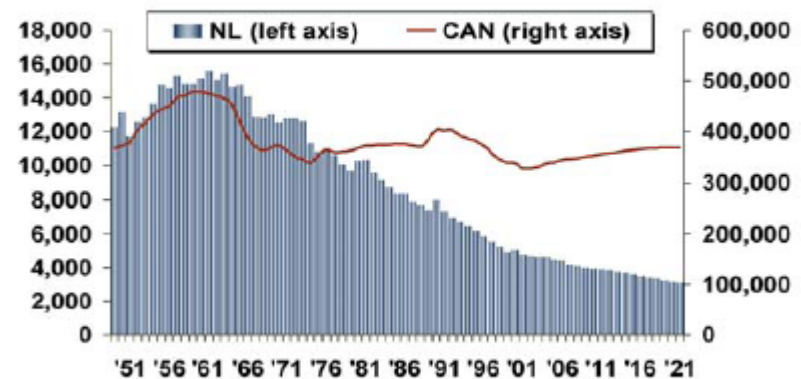
Population
Newfoundland and Labrador, 1971 to 2021p



Source: Statistics Canada; Economics and Statistics Branch, Department of Finance

Note: High, medium and low population projections vary depending on assumptions for fertility rates, net migration levels and life expectancy.

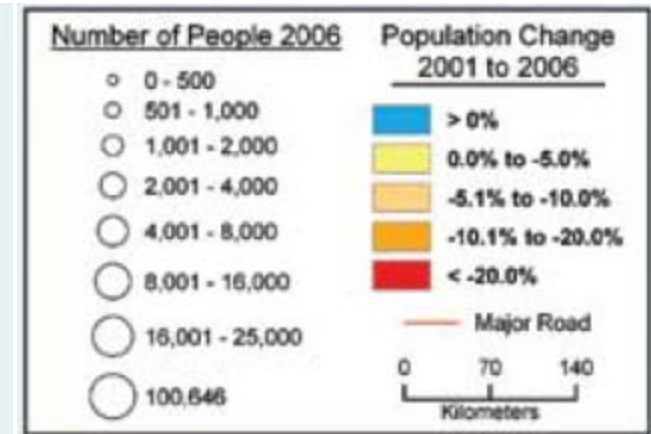
Number of Births
Canada and Province, 1949 to 2021p



Source: Statistics Canada; Economics and Statistics Branch, Department of Finance

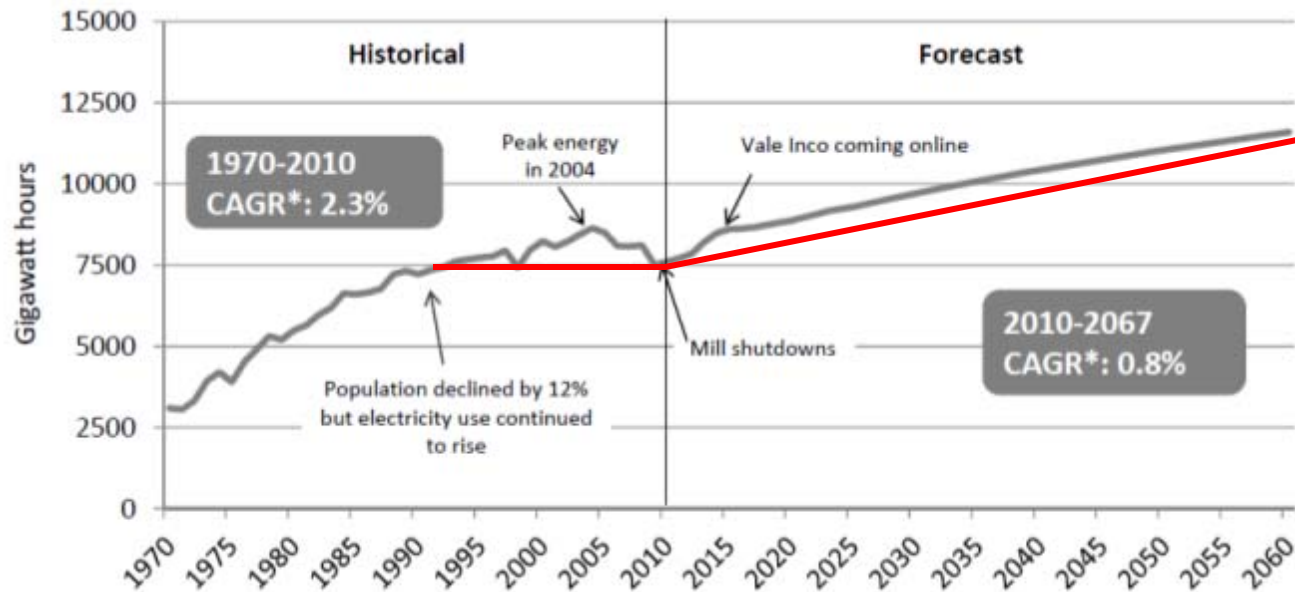
- There is a clear demographic change in Newfoundland's Population. Fewer and older.
- Since 2006 there are more deaths than births recorded in the province. There is a very clear shift in the demographics.

Newfoundland's Population (Cont'd)



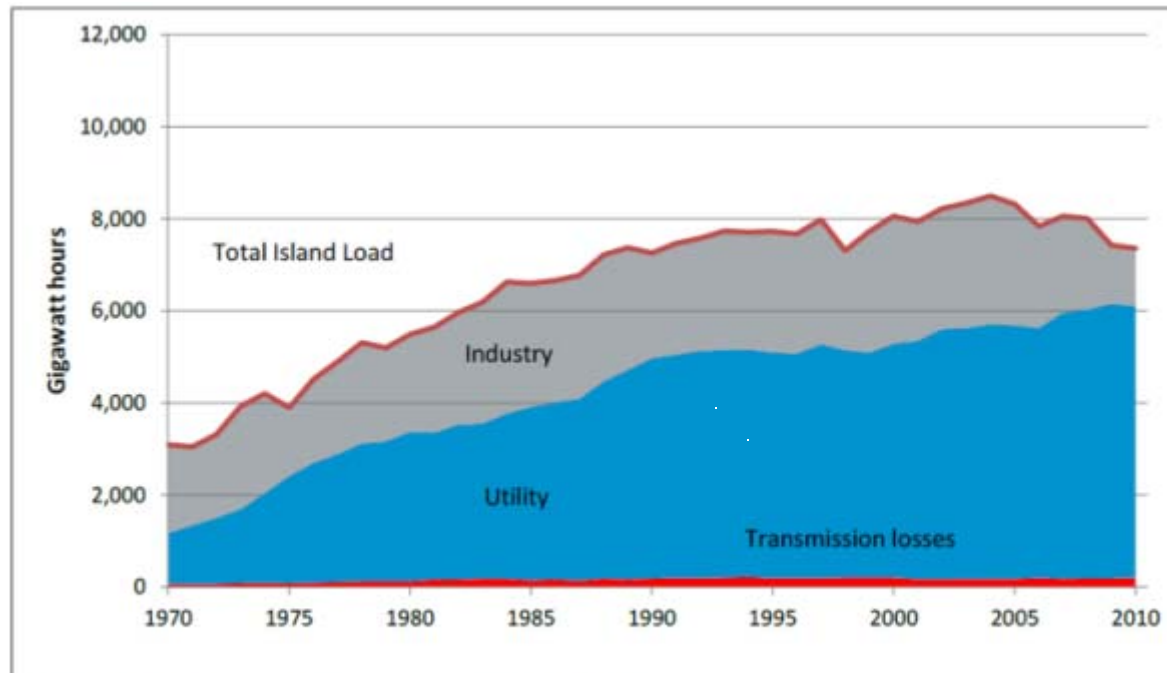
In addition to the decrease in population there has also been a clear transition to urban areas.

Sanity Check



- Does NALCOR's power consumption predictions make sense, considering the unique characteristics of Newfoundland's (island) demographic changes?
- Is it reasonable to use an econometric prediction model based on the historical growth in Newfoundland?

Sanity Check



Sources: (1) NLH, *Total Island Interconnected Load*, 2011 (Exhibit 58)
(2) NLH, *System Planning*

- Nalcor has maintained the current “industry” requirements through their analysis.
- It is the “utility” predictions which must be reviewed and understood. These have been determined from econometric modeling
- The largest component is the “domestic” use sales which is dependent upon the number of customers, and average use per customer.



What is an Econometric Model?

- When NALCOR makes reference to econometric models they are in essence correlating the predicted element to a series of fundamental economic indicators. A series of adjustments are made to fit the projection curve to historical data, this can then be used to then predict the future data set.

$$Y = (3.072308 * X1) + (7963.467 * X2) + (-524.7547 * X3) + (0.064911 * X4) + (-35.36781 * X5) + (0.008005 * X6) + (-617.9116 * X7)$$

Y=Domestic Average Use per Customer in the NP Service Area

X1=Domestic Market Share of Electric Heat *Degree Days Heating

X2=Domestic Market Share of Electric Heat

X3=Domestic Marginal Price of Electricity in the Previous Year (t-1)

X4=Personal Disposable Income per Customer in \$2002

X5=Technological Change (<1981=0, 1981=1 increasing by 1 each year, 2010=30)

X6=Population of Newfoundland

X7=Recession Dummy for 1982 (1982=1, otherwise=0)

- The above is the econometric equation to determine the average energy use per home.
- MHI noted that econometric modeling was acceptable, however end use modeling would be preferred. For example the average size of the family home being heated is a obvious input which is not included in the above equation.
- MHI also did not provide any critical assessment into the fundamental economic data which was inputted into the econometric equations. For example there was no verification of the population projections used by NALCOR.

Key Inputs into the “Utilities” Demand Profile

1. Growth Rate of Domestic customers
2. Energy consumption per household
3. Consumer wealth and disposable income
4. Method of extrapolation beyond 20 year economical period (Page 22 of November 10th, 2011 PUB submission)

Table 2: Provincial Economic Indicators - 2010 PLF

Indicator	Historical	Forecast		
	1989-2009	2009-2014	2009-2019	2009-2029
Adjusted Real GDP at Market Prices* (% Change Per Year)	1.4%	1.5%	1.0%	0.9%
Real Disposable Income (% Change Per Year)	1.2%	1.5%	1.0%	0.9%
Average Housing Starts (Number Per Year)	2,333	2,575	2,400	2,135
End of Period Population ('000s)	509	515	510	507

*Adjusted GDP excludes income that will be earned by the non-resident owners of Provincial resource developments to better reflect growth in economic activity that generates income for local residents.

Source: Government of Newfoundland and Labrador, Department of Finance

Nalcor has modeled the demands from 2010 to 2029 using their standard 20 year forecasting approach. The power requirements are then extrapolated for the economical evaluation period 2029-2067



(1) Growth Rate of Domestic Customers

- An econometric equation has been used to predict the growth in domestic customers.

$$Y = (0.480831 * X1) + (0.037441 * X2) + (3802.905 * X3) + (-1768.742 * X4) + (-364.1837 * X5) + -2029.571$$

Y=Number of Domestic Customer Additions in the NP Service Area

X1=Housing Starts & Completions

X2=Personal Income per Customer in \$2002

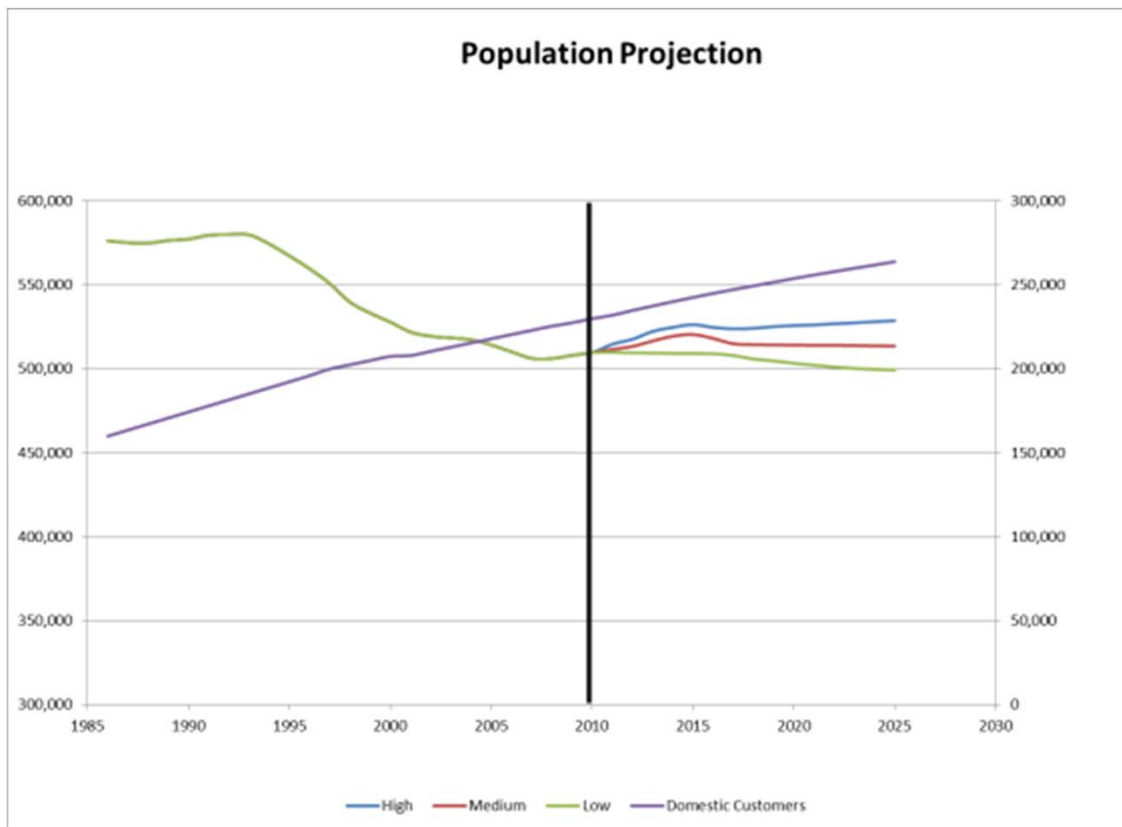
X3=Dummy Variable (1972=1, otherwise=0)

X4=Dummy Variable (1976=1, otherwise=0)

X5=Economy Shift Change Variable (<1995=0, 1995 and on=1)

- The econometric model has been fitted to both the number of housing starts and the personal income per customer.
- The model has predicted a clear increase in domestic customers from 229,000 in 2010 to 271,000 in 2029.
- Does this use of this model for a 50 year period make sense considering the unique demographic changes within the island?

(1) Growth Rate of Domestic Customers

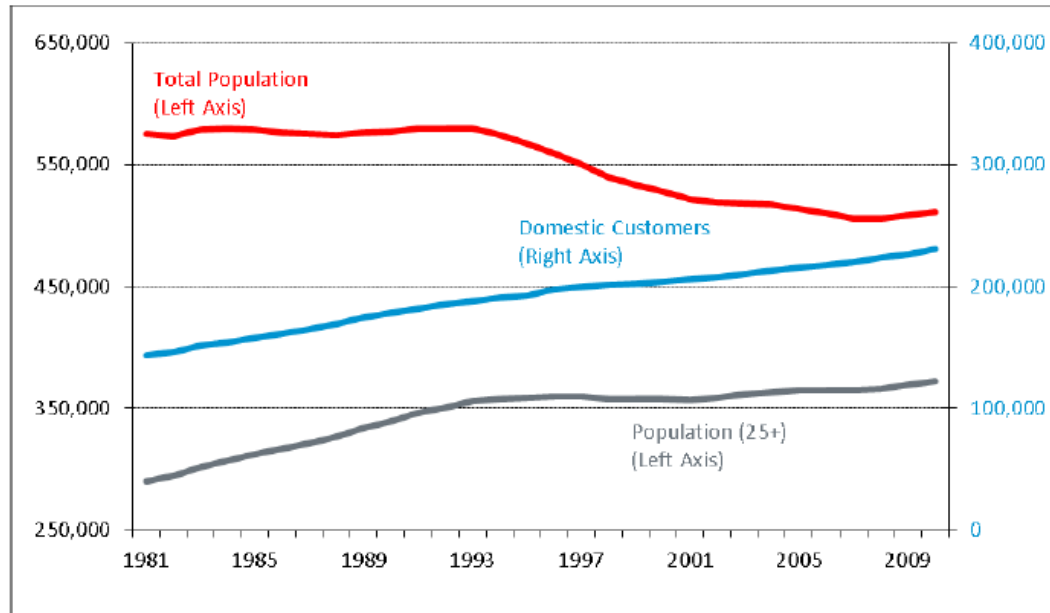


- Nalcor have assumed a relatively flat population growth with an end of period population of 507,000 in 2029.
- The Statistics Agency of Newfoundland and Labrador have produced estimates for population growth (Low, Medium and High Scenario). This is shown within the attached graph for 2010 census results.
- NALCOR Customer estimates (Shown Left) continue to rise in a near linear fashion.

- ***Population Statistics from Government of Newfoundland Dept. of Statistics Website***
- ***Domestic customer data come from Figure 4 of the main submission, and Exhibit 27.***

(1) Growth Rate of Domestic Customers

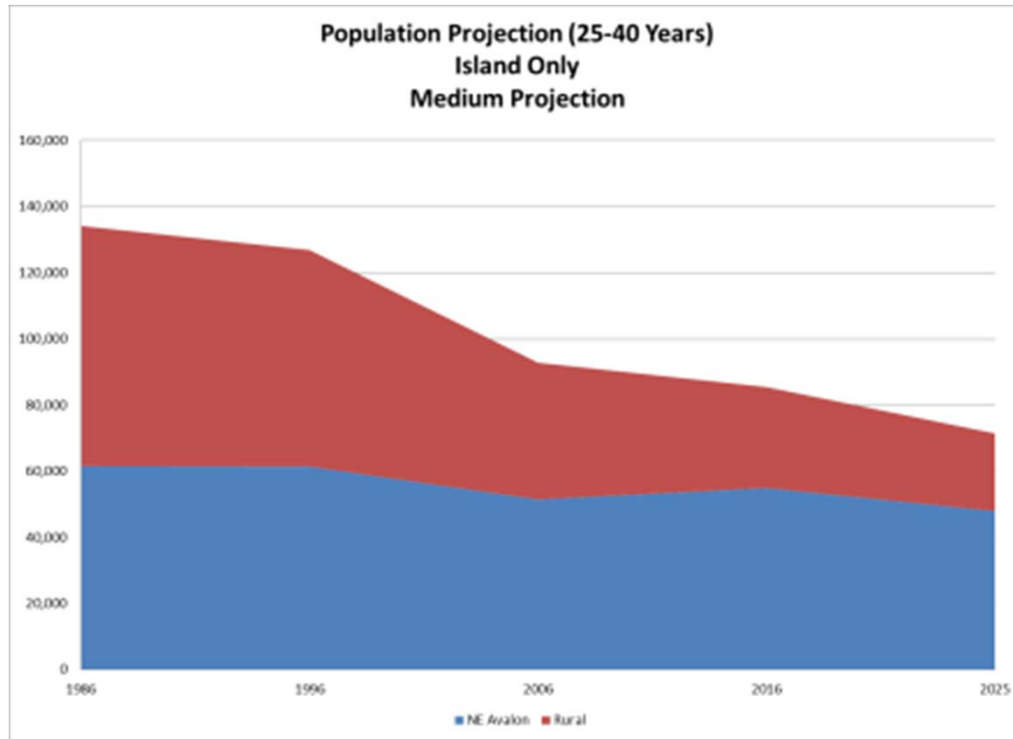
Figure 4: Provincial Population and Island Interconnected Domestic Customers



Sources: (1) Government of Newfoundland and Labrador, Department of Finance
(2) Newfoundland Power, year-end customer data
(3) NLH, System Operations, Customer Service Group

- Nalcor have provided a summary of the domestic customers from a historical (above) and from a projected basis (previous slide)
- Within the period of 1990-2005 there was a consistent linear increase in customer base, even with a decrease in the population.
- The main submission to the PUB explains this increase due to a strong economy and the increased number of the population above 25 years old (Page 24, main submission)

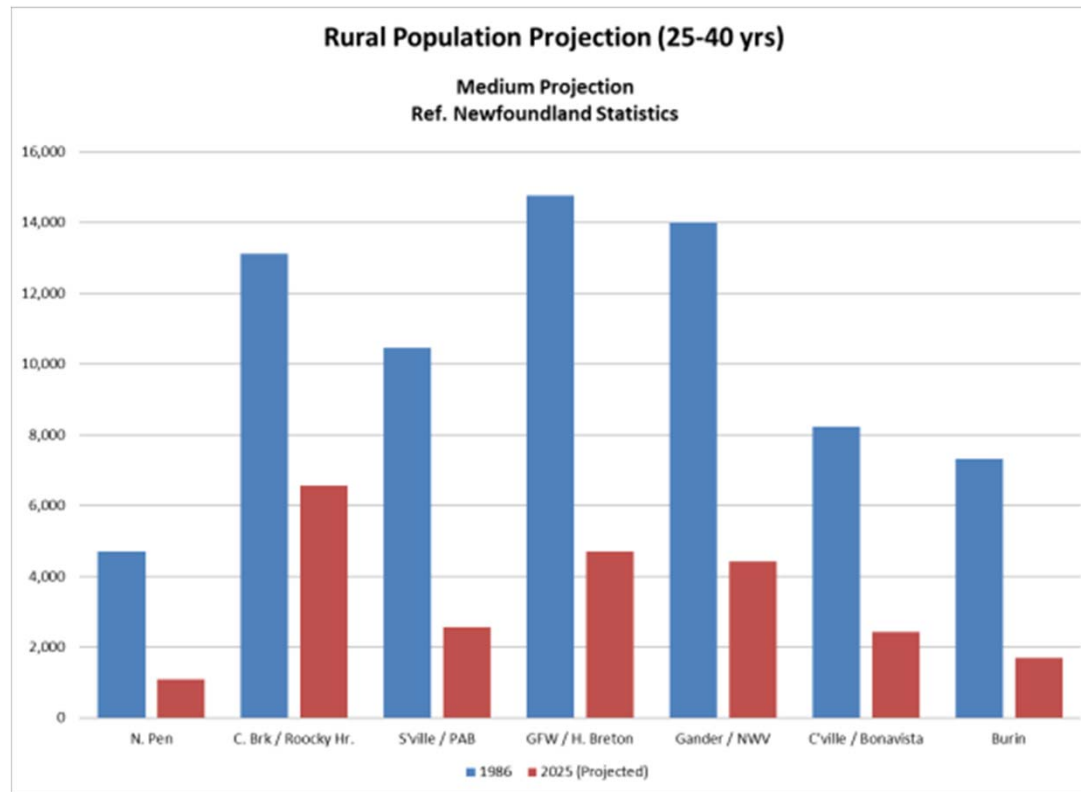
(1) Growth Rate of Domestic Customers



Newfoundland Statistics Population Projections - 2010

- Although there are many factors which contribute to the domestic customer basis, a key input should be the population within the 25-40 year old age group who are moving into the real estate market.
- The following chart shows the projections of people within the age group, separated by rural / urban
- There is a clear reduction of this indicator. This is especially true for rural areas (as classified as any area outside the NE Avalon rural secretariat region).

(1) Growth Rate of Domestic Customers



- The long term impacts of the structural changes in the fishery in the 1990's are having a permanent impact on the rural population profile.
- Unless there is a fundamental change to the provincial economic outlook the majority of population, housing and economic growth will be in the NE Avalon.
- Are the housing projections used in the econometric equation sensible?

(1) Growth Rate of Domestic Customers – New Housing Starts



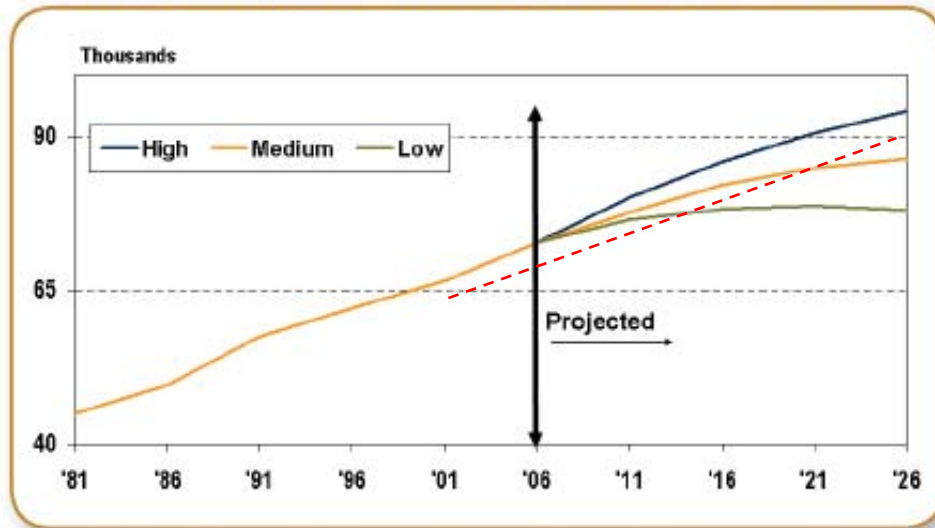
- Nalcor have taken an average of 2135 annual housing starts from 2009-2021.
- This seems reasonable based on the historical housing growth (attached)

However

- The population demographics within the province means that closer scrutiny should be applied to all projections for housing starts.
- Considering the rural shift there should also be a consideration for housing “abandonments” which does not seem to be tracked within the PLF projections. This will likely be a growing statistic in rural areas.

(1) Growth Rate of Domestic Customers – New Housing Starts

Total Households Northeast Avalon, 1981 to 2026p



Statistics Canada; Economic Research and Analysis Division, Department of Finance

- The provincial department of statistics have produced “Population and Household Projections for the North East Avalon” which predicts the total number of households (2008).
 - [http://www.economics.gov.nl.ca/pdf2008/Population%20and%20Household%20Projections_2008%20\(web\).pdf](http://www.economics.gov.nl.ca/pdf2008/Population%20and%20Household%20Projections_2008%20(web).pdf)
 - There is a estimate of households which is provided (left).
- Considering the above projections for the North East Avalon, and the general aging of rural regions the NALCOR estimates for new home construction appear to be the HIGH range. As a reference the red dashed line represents 1000 new homes per year. The reader should note the LOW projection, which has a leveling of homes on the NE Avalon.
 - It would be prudent for NALCOR to build a “bottom up” assessment on a regional basis. As evident the “LOW” prediction from 2008 indicates that there would be virtually zero growth in households. **This would have a pronounced impact on the economics of the MF + LIL project.**



(1) Growth Rate of Domestic Customers – Conclusions

- The major contributing element of the total predicted energy consumption on the island is the number of domestic customers, and the increase in energy consumption.
- Econometric modeling has been used to calculate the expected energy consumption.
- NALCOR has not taken a probabilistic approach to predicting growth in the numbers of domestic customers. This is despite the department of Finance generating a long term view of household projections for the North East Avalon, which had a LOW, MEDIUM and HIGH assessment.
- NALCOR should verify the housing starts used in the analysis conform with the likely or MEDIUM demand projections.
- A probabilistic assessment should be considered, as will be discussed later within this presentation.

(2) Energy Use Per Household

- NALCOR in their demand predictions have assumed a nearly consistent energy consumption per household. (Exhibit 46)
- The energy use per household has been based on the following econometric equation

$$Y = (3.072308 * X1) + (7963.467 * X2) + (-524.7547 * X3) + (0.064911 * X4) + (-35.36781 * X5) + (0.008005 * X6) + (-617.9116 * X7)$$

Y=Domestic Average Use per Customer in the NP Service Area
X1=Domestic Market Share of Electric Heat *Degree Days Heating
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X4=Personal Disposable Income per Customer in \$2002
X5=Technological Change (<1981=0, 1981=1 increasing by 1 each year, 2010=30)
X6=Population of Newfoundland
X7=Recession Dummy for 1982 (1982=1, otherwise=0)

- Following the increase in power rates in 2016/2017 there is 3% reduction in energy usage per household.

Energy Use Per Household (kwhr)
Exhibit 46



(2) Energy Use Per Household

Figure 28: Average Real Rate per MWh

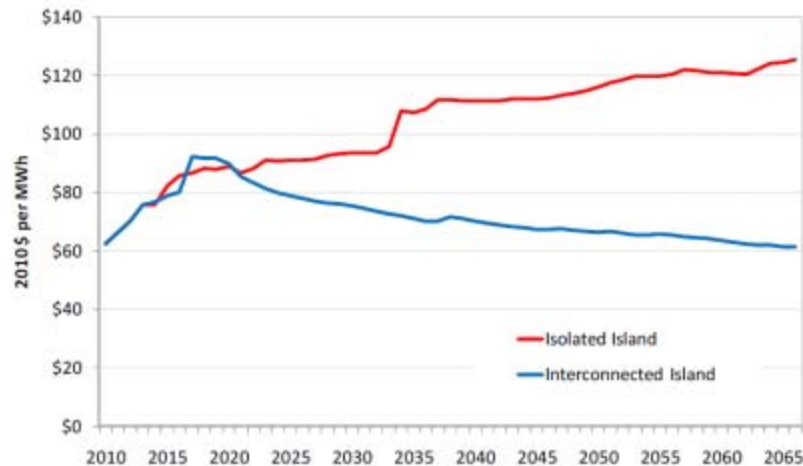
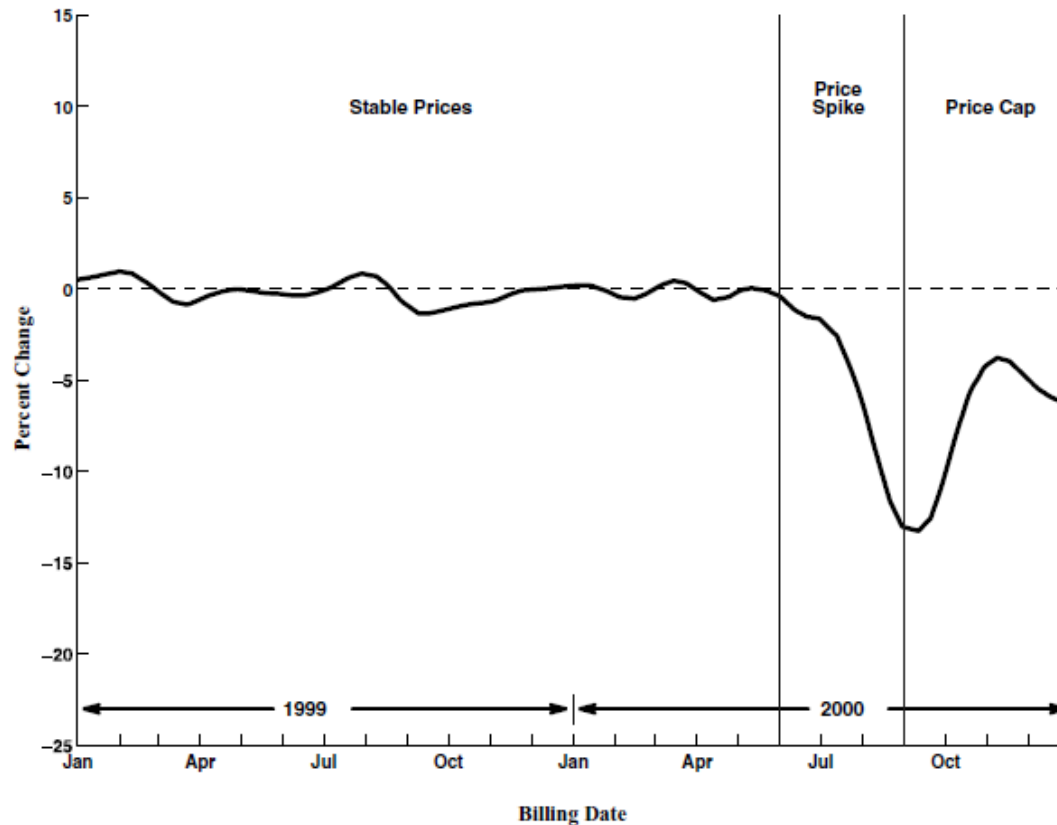


Exhibit 101

- As demonstrated within Figure 28 of Exhibit 101 electrical prices will increase by >50% from 2010 to 2017. This is irrespective of the option.
- Is a 3% reduction in household energy use reasonable? Is the model accurate for this type of change in price?
- Will the increase in energy cost drive consumers to more energy efficient means such as heat pumps, or return them to traditional sources of heat such as wood stoves.
- This 3% reduction does not seem reasonable, and NALCOR should complete the end use model, as recommended by MHI in their report.

(2) Energy Use Per Household

AVERAGE WITHIN-HOUSEHOLD CONSUMPTION CHANGES DURING THE 2000 PRICE SPIKE AND PRICE CAP



Source:

“What Changes Energy Consumption Rates and Public Pressure”, Reiss and White, Rand Journal of Economics, Autumn 2008.

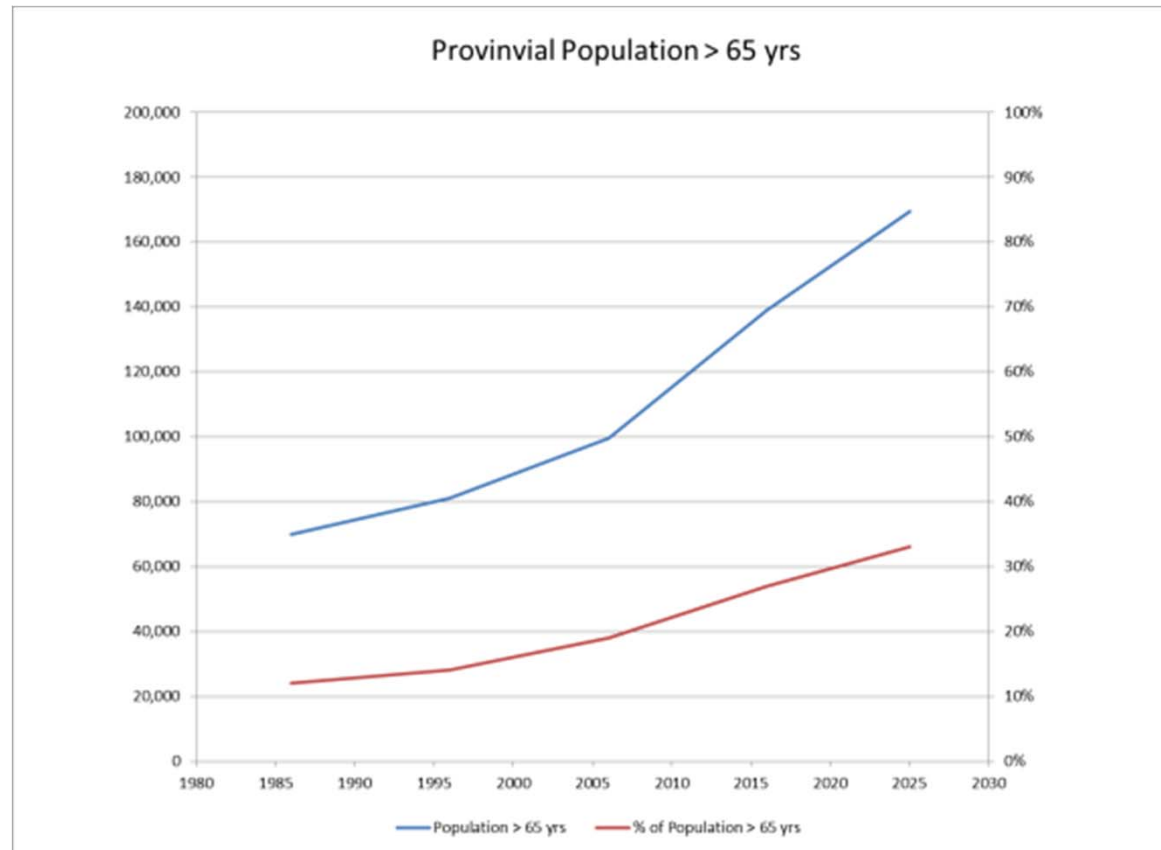
- For comparative purposes a 2008 study from the RAND Journal of Economics reviewed that the changes in energy consumption following a rapid increase in electricity cost in California. It confirmed the fundamental principal of economics “Prices do effect consumption”.



(3) Personal and Disposal Income

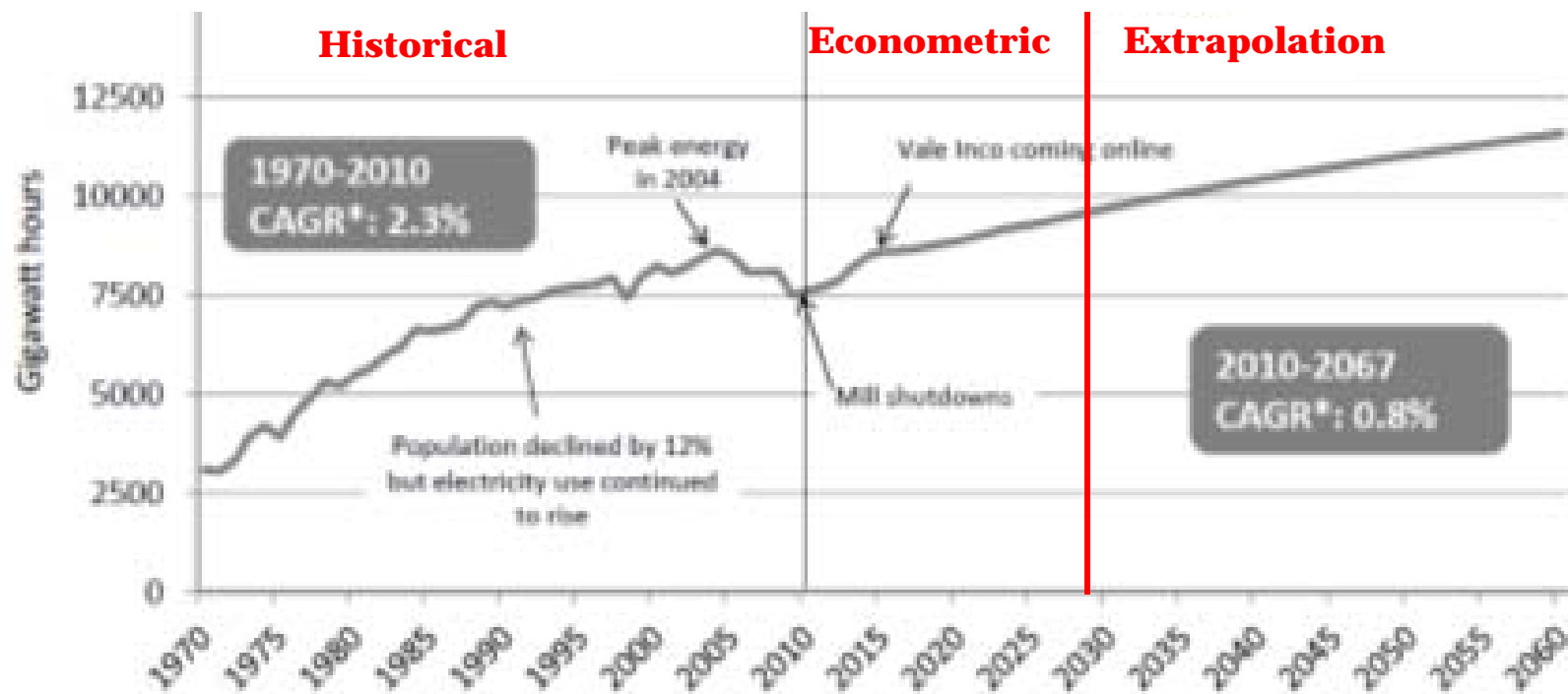
- Many of the econometric models use personal and disposable income as a variable into the analysis.
- Exhibit 27 contains the disposable income assumed by NALCOR. There is an increase in 11,487 CAD in 2010 to 13,695 CAD in 2029.
- Considering the relative economic robustness of the economy over the past 6 years is it reasonable to assume that this key parameter will continue to increase?
- This should also consider the effects of the population changes will have on this.

(3) Personal and Disposal Income



- The graying of the population will have a substantial impact on the economy of the island. By 2025 - 33% of the population will be above 65 years old. Has the “retirement income” factored into the disposal income projections used within the PLF model? *[Source: Government of NL Population Projections]*

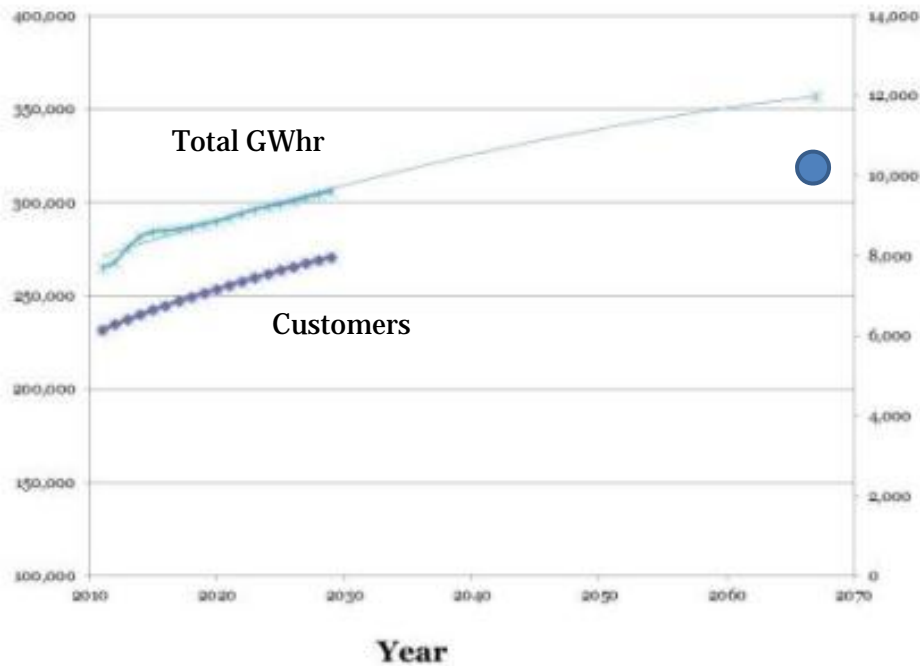
(4) Demand Extrapolation



Date	Energy (GWhrs)	Model	Reference
2010	7585	Actual	11-10-11 Submission
2029	9626	2010 PLF	Pg. 27 Exhibit 27
2067	~12000	Extrapolation	Pg. 34, Navigant Review

(4) Demand Extrapolation

For the 2010 PLF, the island load forecast was extended beyond the 20-year econometric forecast period, based initially on the average gigawatt hour (GWh) growth in energy for the last five years in the forecast. This is the period from 2024 to 2029. The annual GWh growth in energy was subsequently reduced in five to 10 year intervals to reflect the growing yet maturing market saturation for electricity in heating markets, while maintaining an annual load increment to reflect basic underlying provincial economic growth. The impacts of material reductions in future load expectations are addressed through discrete load sensitivity cases. Sensitivity analyses are discussed in Section 7.2.



- There would be in excess of ~320,000 customers to meet the extended demand requirements. Assuming a population of 510,000 this would equate to 1.6 people per household.
- Considering the population projections for the province is this realistic?



NALCOR Demand Projections:

- The Energy Demand Forecast produced by NALCOR is the critical factor in driving the requirement and economic preference for the LIL + MF project.
- It would be recommended that NALCOR take a regional bottom up assessment for the projected demand profiles for energy, which considers the aging of the population and the movement from rural to urban.
- It is recommended power predictions from 2029 – 2067 be based on more than extrapolation of the period from 2025-2029. This is considered essential based on the noted demographic changes.
- It is recommended that NALCOR provide a HIGH, MEDIUM and LOW demand model which is consistent, and based on the models developed by the Government of Newfoundland Department of Statistics.
- The associated cost of power on a kw/hr basis should be made for each of the HIGH, LOW and MEDIUM projections. *(More to follow on this)*



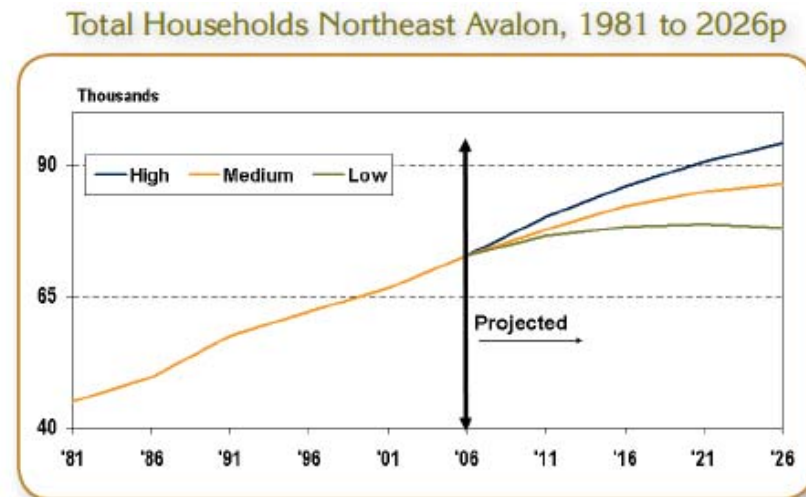
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Predictions of Demand Growth

A Probabilistic Approach

Predicting Demand - A Probabilistic Approach

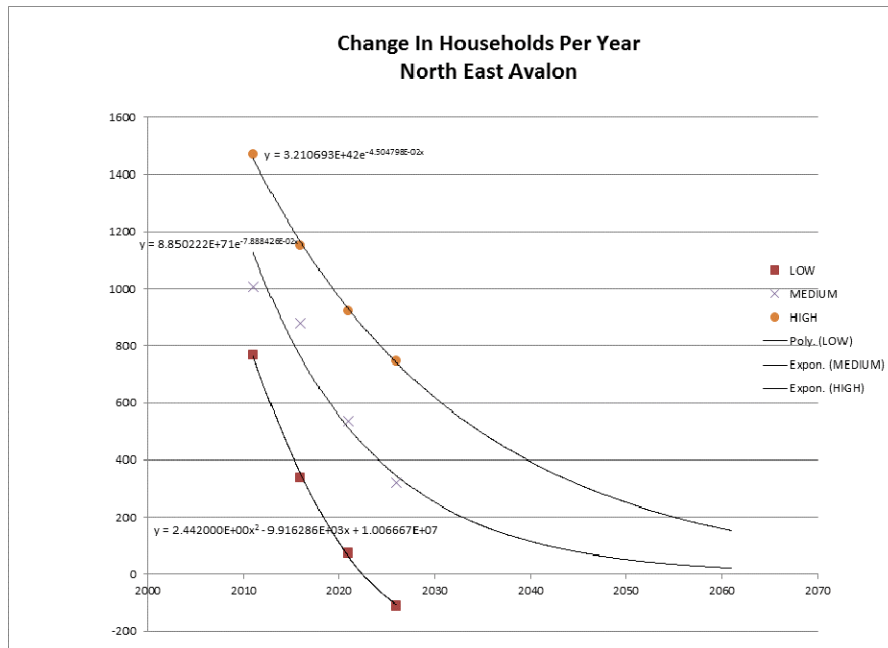
- NALCOR has taken a deterministic method of determining the CPW for the interconnected and isolated options.
- During the panel hearings there has been a commitment by NALCOR to complete a Monte Carlo, or probabilistic view of the project costs. (Page 110, February 13 proceedings)
- It must be asked why not complete a probability assessment of the demand? The basic approach adopted by the Department of Finance for a HIGH, MEDIUM and LOW projection would serve as a reasonable starting point.
- The Author has attempted to undertake such an assessment, routed by the Household Predictions from the Department of Finance.
- The following is a very approximate model, however it serves to provide a general view on the sensitivities in the demand projections.



Statistics Canada; Economic Research and Analysis Division, Department of Finance

Predicting Demand - A Probabilistic Approach

- The author has analyzed the data provided within the June 2008 document entitled “Population and Household Projections – North East Avalon.
- This document contained projections for households in the NE Avalon as summarized on the following table.
- From this data the Author has produced a profile for the “change in households per year”, which has been fitted with the noted regression formulae.



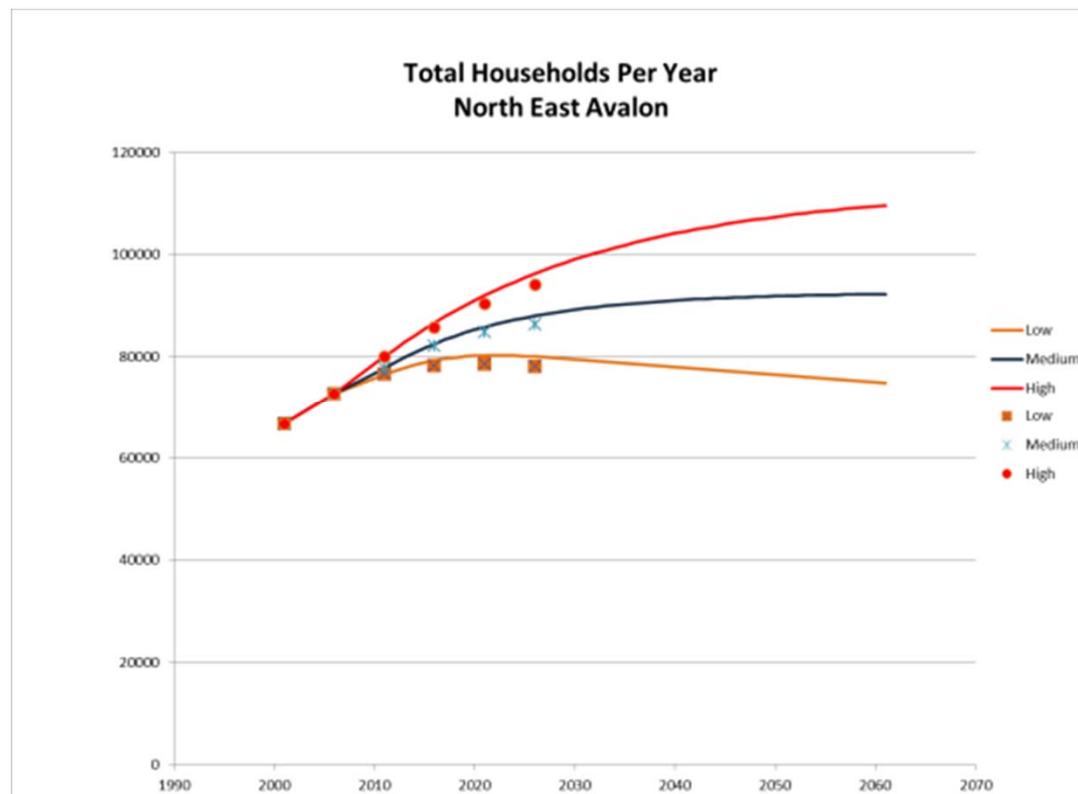
Scenario 1 - Low								
Household Projections - Northeast Avalon Regional Plan Area								
Primary Household Maintainer by Five Year Age Groups, 2006 to 2026								
	Total	< 25	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75 +
2006	72,651	2,984	11,307	15,896	16,367	12,821	7,388	5,888
2011	76,487	2,822	11,324	14,601	16,854	15,153	9,410	6,323
2016	78,182	2,587	10,903	13,918	15,910	16,034	11,962	6,868
2021	78,552	2,412	9,792	13,590	14,447	16,251	13,875	8,185
2026	78,002	2,242	8,730	13,123	13,733	15,334	14,672	10,168

Scenario 2 - Medium								
Household Projections - Northeast Avalon Regional Plan Area								
Primary Household Maintainer by Five Year Age Groups, 2006 to 2026								
	Total	< 25	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75 +
2006	72,651	2,984	11,307	15,896	16,367	12,821	7,388	5,888
2011	77,692	2,876	11,590	14,907	17,022	15,365	9,535	6,397
2016	82,082	2,719	11,814	14,729	16,382	16,703	12,574	7,161
2021	84,766	2,622	11,293	14,652	15,333	17,173	14,921	8,772
2026	86,361	2,556	10,277	14,782	15,068	16,428	16,073	11,177

Scenario 3 - High								
Household Projections - Northeast Avalon Regional Plan Area								
Primary Household Maintainer by Five Year Age Groups, 2006 to 2026								
	Total	< 25	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75 +
2006	72,651	2,984	11,307	15,896	16,367	12,821	7,388	5,888
2011	80,000	2,887	12,459	15,506	17,176	15,705	9,794	6,473
2016	85,754	2,788	12,961	15,393	16,964	17,062	13,226	7,360
2021	90,359	2,832	11,878	16,212	16,367	17,730	16,019	9,321
2026	94,095	2,914	10,849	16,965	16,214	17,543	17,347	12,263

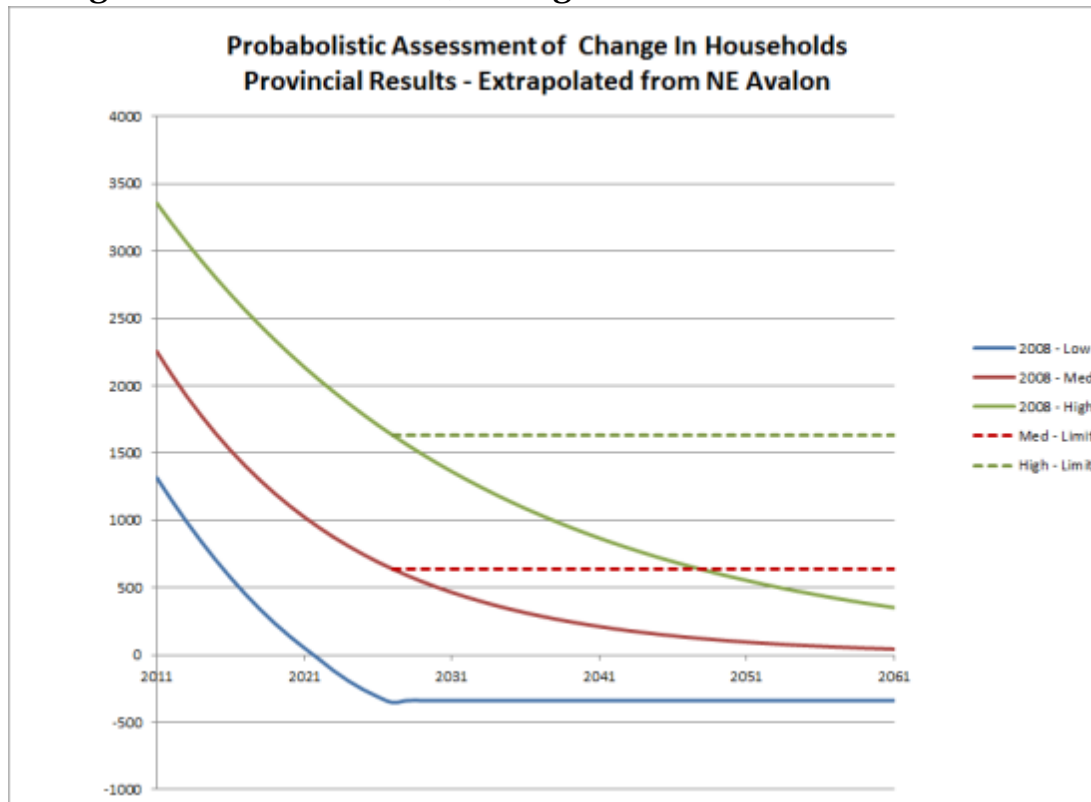
Predicting Demand - A Probabilistic View


- Based on the fitted curves for “Change In Households Per Year” an plot of total households can be generated. This is provided below.
- The “fitted model” is the solid line, where the points are the data from the 2008 NL government document, which serves for comparative purposes only. It demonstrates a reasonable fit between the regression equations provided on the previous slide, with the data reported in the 2008 document.



Predicting Demand - A Probabilistic View

- The curves in question are for the North East Avalon only. However, in the absence of additional data an approximation can be made for households in the rural areas of the province.
- Considering the household starts data provided within Slide 21 of the presentation the following Rural to Urban ratios have been assumed for each projection.
 - Low 0.8
 - Medium 1.0
 - High 1.3 (in a high scenario there is 1.3 rural homes for each urban home)





Predicting Demand - A Probabilistic View

- Although there is a very clear trend, the Author has decided to use the rate for 2026 for the period of 2027-2067.
 - Low -338 households per year post 2026
 - Medium 638 household per year post 2026
 - High 1632 households per year post 2026
- This may seem conservative, however the Author must state that this is consistent, and generated from the data issued by the Government of Newfoundland statistics department in 2008.
- Although the reader may argue with the numbers, the concept itself must be considered prudent.
- From this data a LOW, MEDUIM and HIGH Scenarios can be extended to total Energy approximations.

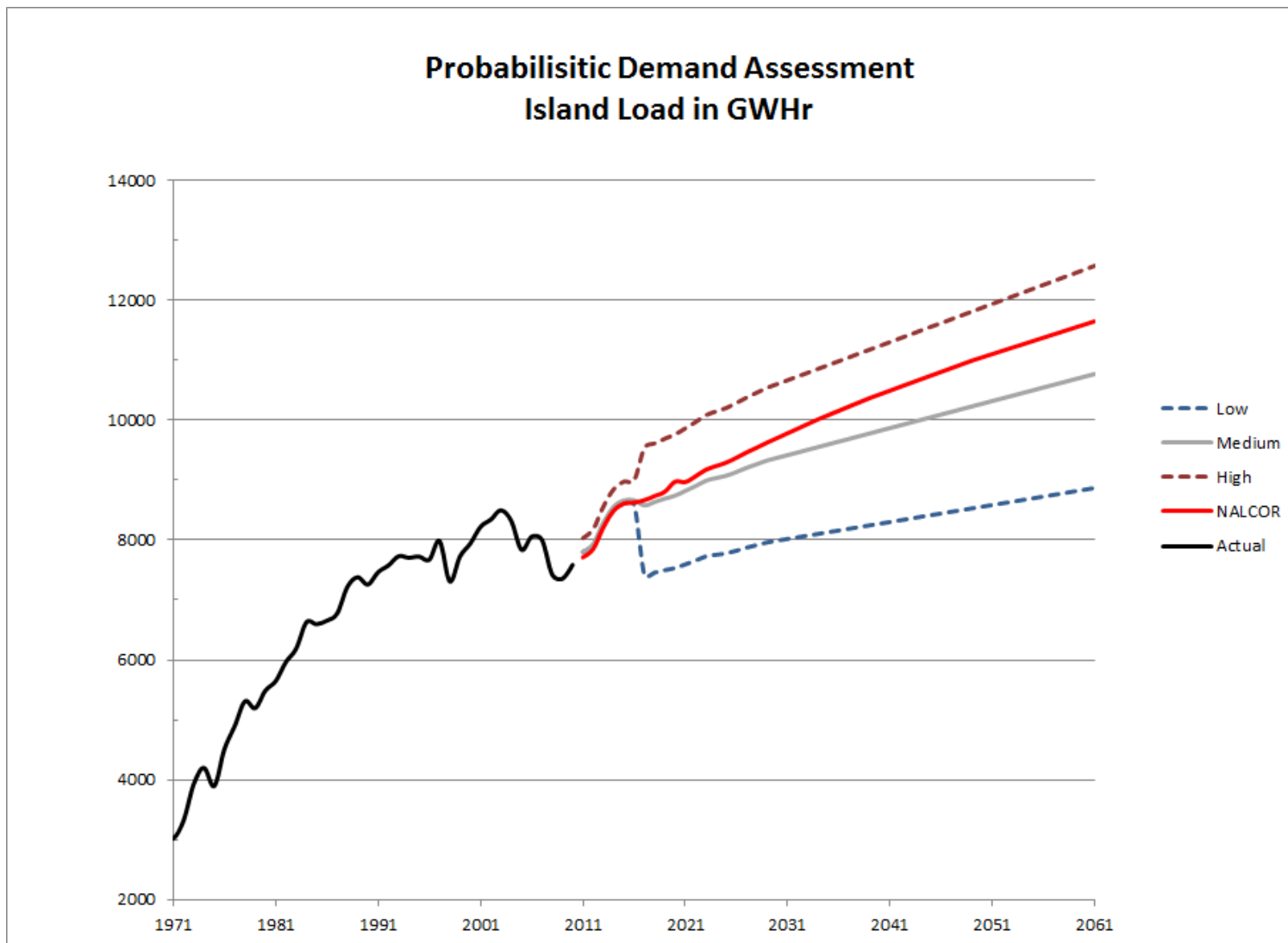
Predicting Island Demand - A Probabilistic View

Data	LOW	MEDIUM	HIGH
Housing Starts 2010-2026 North East Avalon	Slide 35	Slide 35	Slide 35
Rural / Urban Ratio	0.8	1	1.3
Total Household (Province) annual change Post 2026	-338	638	1632
Energy Use Per Household (Compared to NALCOR value in Exhibit 46)	5% Reduction	3% Reduction	3% Increase
General Service Growth (Compared to Exhibit 46)	5% Reduction	No Change	5% Increase
Industrial (Post 2017 Changes)	Remove 880 GWHr to reflect loss of Corner Brook Mill	No Change	Add 500 GWHr to reflect 1 new island mine. The CB mill is maintained
Street (Exhibit 46)	No Change	No Change	No Change
Losses (Exhibit 46)	No Change	No Change	No Change



Due to energy cost increase it is reasonable to assume a higher long term decrease in energy consumption in the medium scenario.

Predicting Island Demand - A Probabilistic View

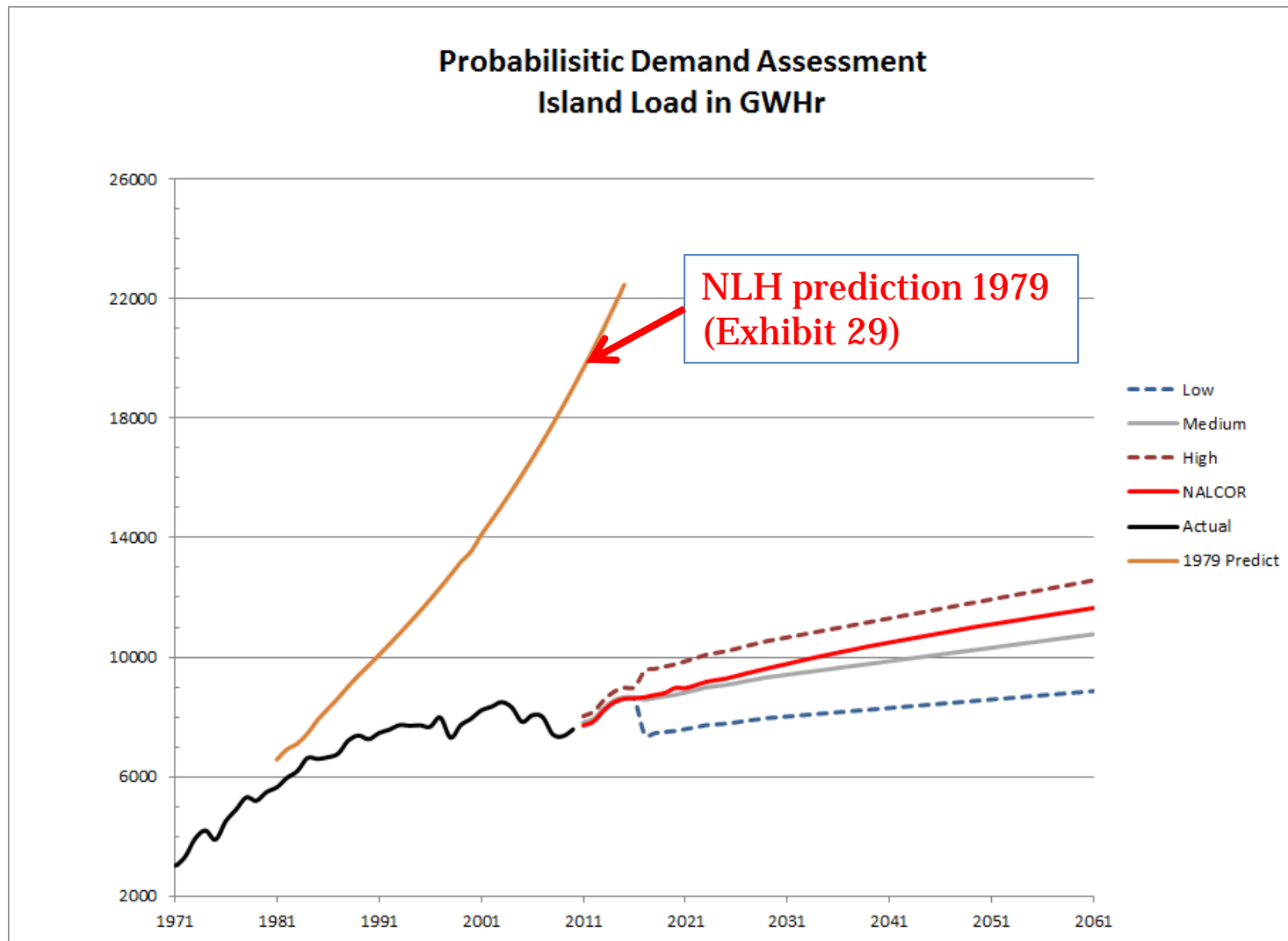




Predicting Island Demand - A Probabilistic View

- In his presentation at the Harris Center Mr. Wade Locke said that the demand projections from Nalcor were reasonable. The Author agrees that the NALCOR demand is reasonable.
- However, the Author agrees that the LOW demand is also realistic. So too is the high demand. It is a very uncertain time in the province to predict energy consumption.
- Due to length of the evaluation period, and the potential closure of the CB mill there is a high level of variability with the demand profile. This must be duly recognized, and quantitatively included in the economic comparison.
- Demand uncertainty has always been an issue. Consider Newfoundland Hydro's demand predictions from 1981 (Exhibit 29) . This prediction looked at the increases in the 1970's to help predict the power demands in the upcoming year. They were off by orders of magnitude.
- Therefore a Monte Carlo simulation should be extended to the demand, the CPW and the associated cost to the NL ratepayer. This is considered an essential activity by the Author.

Predicting Island Demand – A Crystal Ball Is Required





Predicting Island Demand – Peak Load

- The prediction of peak load is also considered to be an essential variable.
- An econometric equation has also been used for this from 2010 to 2029.

$$Y = (0.001524 * X1) + (0.006727 * X2) + (0.157677 * X3) + (-18.6309 * X4) + (0.234852 * X5) + (-8.347 * X6) + (-11.25104 * X7) + (30.44149 * X8)$$

Y=Annual Maximum Hourly Demand (MW)

X1=Number of NP Non-Electric Heat Customers

X2= Number of NP Electric Heat Customers

X3=Wind-Chill Factor

X4= Marginal Price of Electricity in the Previous Year (t-1)

X5= Weather-Adjusted NP General Service Load (GWh)

X6= Technological Change (<1990=0, 1990=1 increasing by 1 each year, 2010=21)

X7= Non Supper Time (5:00=0, 6:00=0, otherwise=1)

X8=Dummy Variable for a December Peak (December=1, otherwise=0)

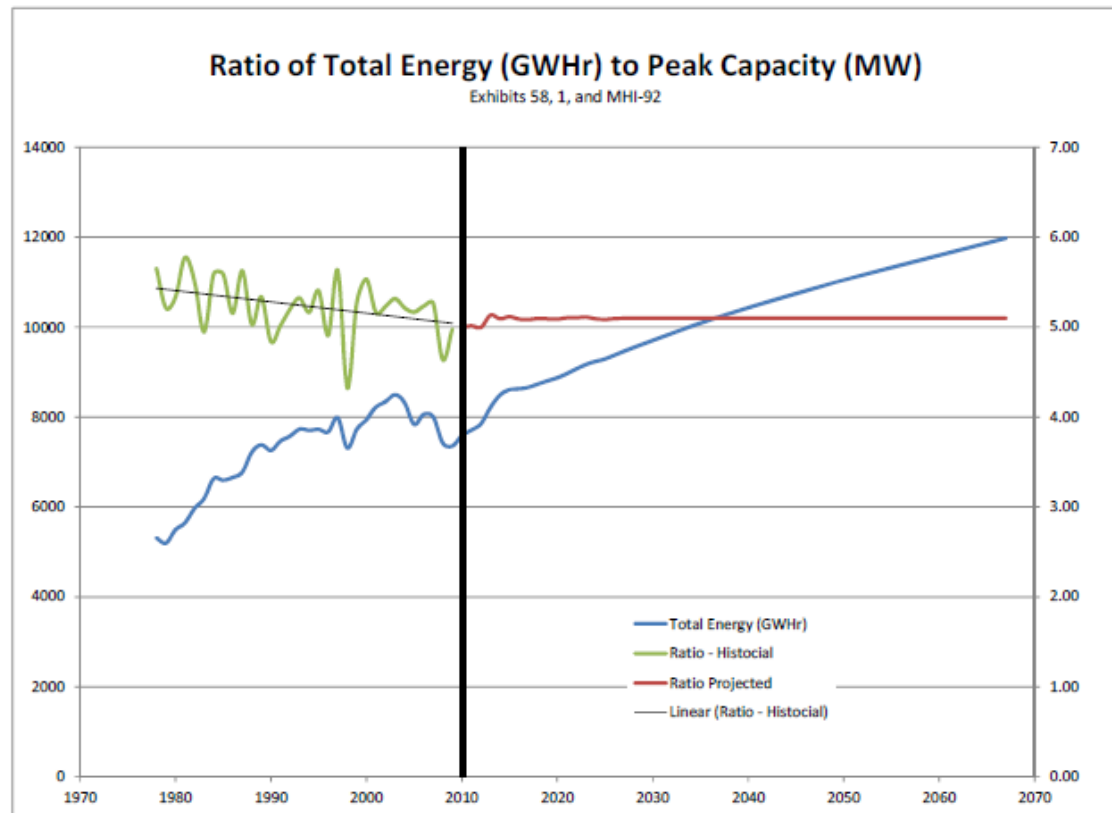
- MHI has recommended that an end use model be used for predicting the peak load.
 2. Nalcor should develop a process to integrate the energy and peak forecasting methodologies. NLH staff should partner with NP to develop a coordinated load research program that is designed to develop load shape information by sector and by end-use. Incorporating domestic, general service, industrial and end-use (e.g. space heating) load research information could be used to integrate the energy and peak forecasting processes. Annual energy forecasts could be distributed throughout the 8,760 hours in a year, based on the hourly load shape profiles developed from the load research information. These hourly load forecasts could then be added together to produce an hourly forecast model for the interconnected system.



Predicting Island Demand – Peak Load

- The prediction of peak load is perhaps more critical than the estimates for total energy use.
- The peak load is driven by the winter heating requirements, and it is a critical input into both options.
- It is unclear what method of extrapolation of the peak was used in the period from 2029 to 2067?
- The author has plotted the ratio of total energy (GWhr) to the peak energy (MW) for the period from 1973 to 2067. This is provided within the next slide.
- This shows that there is a ever decreasing trend from the historical data, but a constant ratio is assumed in the projected time period. Is this correct?
- It should be noted that if the decreasing trend is maintained, there may be additional peak generating capacity which may be required for both options.
- This is especially critical for the interconnected option, especially when considering the EMERA deal, where power is provided during peak times. The peak demand is a critical input when reviewing the EMERA deal (More to follow).

Predicting Island Demand – Peak Load



Nalcor should provide commentary how the Peak was extrapolated for the period beyond 2029. A probability sensitivity should also be considered when comparing the options.



**PUB
Submission
Review**

NALCOR's Option Screening

FACING CHALLENGES, MAKING CHOICES

In addition to the great opportunities our electricity resources present, we have to meet a number of challenges and make specific choices on how to develop and utilize our resources wisely for the greatest benefit to the environment and our citizens.

Our first priority is to ensure we are able to meet our current and future electricity needs with environmentally friendly, stable, competitively priced power. We are thinking long term and making critical choices and investments with respect to our power supply options. Currently, about 85 per cent of our electricity capacity comes from clean, stable and competitively priced hydro power. On the Island, however, approximately 65 per cent of electricity capacity comes from hydro power, while 35 per cent comes from thermal-fired generation that is subject to price volatility and emits GHGs and other pollutants. In Labrador, most electricity is hydroelectric, with the exception of a small amount of isolated diesel and gas turbine generating capacity.

Both electrical systems in the province have adequate generation to meet the demand of existing customers. This demand is forecast to grow at a fairly steady, moderate pace over the next several years. This would result in a need for new sources of supply on the Island prior to 2015, and later in Labrador. As a result, we plan to develop the Lower Churchill project, which will include a transmission link between Labrador and the Island. This major initiative is discussed in detail in the following section.

POLICY ACTIONS

Lower Churchill Project

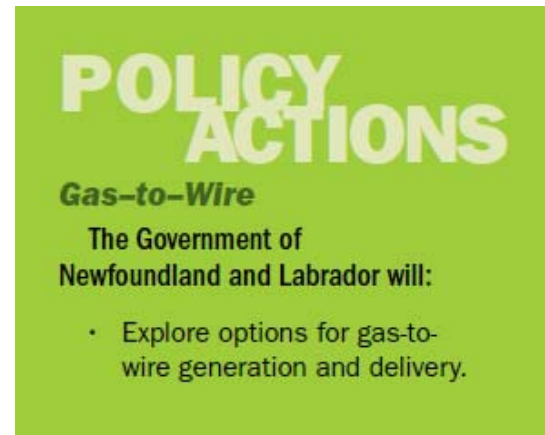
The Government of Newfoundland and Labrador will:

- Lead the development of the Lower Churchill Hydroelectric Project, through the Energy Corporation.
- Ensure that first consideration for employment will be given to qualified personnel adjacent to the resource.
- Conduct a comprehensive study of all potential long-term electricity supply options in the event that the Lower Churchill project does not proceed.

From the Energy Plan - 2007

Project Screening Phase

- NALCOR and the Provincial Government has clearly prioritized the Lower Churchill Development for the province of Newfoundland.
- The screening studies as part of the gated project review have focused on the LCP, with limited review of other options.
- The Gate 1 review conducted in 2007 by NALCOR should have included a screening study. The Gate 1 review was not submitted to PUB, and was not reviewed by the Author. This Gate 1 review should be requested by the PUB.
- Has NALCOR effectively met the commitment in the Energy Plan to look at all sources of power (Page 32) including the gas to wire option?



Energy Plan 2007

PUB Submission – Alternatives Considered

Table 21: Summary of Power Generation Supply Options and Initial Screening

Power Generation Option	Isolated Island	Interconnected Island
Nuclear	×	×
Natural Gas	×	×
Liquefied Natural Gas (LNG)	×	×
Coal	×	×
Combustion Turbines (CTs)	✓	✓
Combined Cycle (CCCTs)	✓	✓
Wind	✓	✓
Biomass	×	×
Solar	×	×
Wave/Tidal	×	×
Island Hydroelectric	✓	✓
Labrador Hydroelectric	N/A	✓
Electricity Imports	N/A	×
Transmission Interconnection	N/A	✓

Source: Nalcor Energy

As these options were all included in NALCOR’s November 10th submission to the board, it is unclear why a review of these options, and the screening process is excluded from the PUB terms of reference. This is a fundamental component of the verification exercise.



NALCOR Alternative Evaluation

The author is in general agreement with the screening assessment performed by NALCOR, with the following exceptions:

1. Deferred Churchill Falls Option (Upper Churchill)
2. Upper Churchill Recall Power (or Power Purchase from Hydro Quebec)
3. Natural Gas



Alternative 1: Deferred Churchill Falls

- The November 10, 2011 submission to the PUB briefly described the “Deferred Churchill Falls” option entailing:
 - ❑ Continuation of Holyrood and additional thermal generation until the Upper Churchill Power was available
 - ❑ Building a LIL transmission to gain access to the Upper Churchill power in 2041.
- This option was discounted for the following reasons;
 - ❑ Uncertainty surrounding the availability of CF power in 2041. However there was little explanation provided
 - ❑ Risks associated with Holyrood life extensions
 - ❑ Price risks associated with reliance on fuel.
 - ❑ Price risks.



Alternative 1: Deferred Churchill Falls

- The decision to eliminate the “Deferred Churchill Falls” option was made during Phase 1, which was conducted in February 2007.
- This decision was made prior to the closure of the mill in Grand Falls, which has had an impact on the predicted timeframe for power deficiencies. This has been argued by Dr. James Feehan.
- A Deferred Churchill Falls option should again be considered in the ongoing CPW analysis with the following revised inputs:
 1. Lower Power requirements resulting from the closure of paper mills.
 2. Consider early construction of the LIL to allow access to the 80 MW of recall power presently available.
 3. Early construction of the 23 MW Portland Creek Facility planned in the Interconnected case in 2036.
 4. Aggressive demand management in an effort to curb the energy demands for the province. This would include peak and off peak pricing to limit the peak load issues within the current system. This has been argued by Dr. Jim Feehan as a reasonable approach in the near term.



Alternative 2: Churchill Falls Recall Power

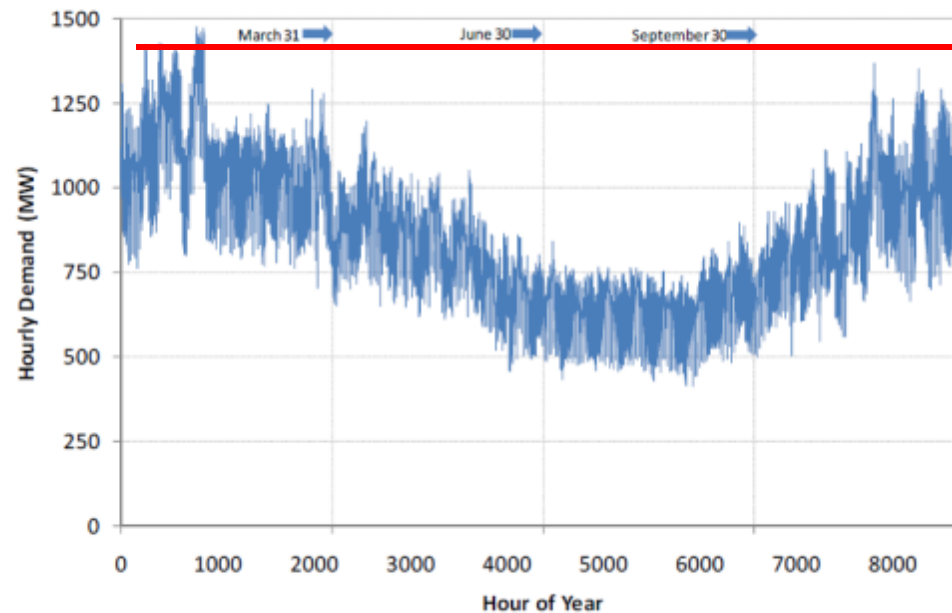
- The November 10th submission to the PUB outlines an option for recall power from Churchill Falls. This would be transmitted to the island via a submarine cable.
- This option was discounted for the following reason;
 - ❑ The 80 MW currently available in winter months does not meet the demands of the island.
- However there are several alternatives available for Upper Churchill power.
 - ❑ 80 MW recall
 - ❑ Redirection of power committed within the Guaranteed Winter Availability Contract
 - ❑ Power Purchases from Hydro Quebec.
- However aside from the peak power requirements, the reader must understand when the power is required.

Alternative 2: Churchill Falls Recall Power

- The Navigant Report (Exhibit 101) contained a plot of the island hourly demands (MW) on a Monthly basis.
- The **red line** represents the total available power from existing island electric generation not including Holyrood (1381 MW pg 16, Exhibit 101) and the 80 MW presently available from the recall power)
- This clearly demonstrates that the winter months are driving the capacity demands.

Source	Capacity
NL Hydro (Hydro)	942 MW
Star Lake	108 Mw
CB P&P	122 Mw
N.P.	136 MW
Other	73MW
Recall	80 MW
Total	1461 Mw

Figure 4: Island Hourly Demand, 2010



Source: Nalcor



Alternative 2: Churchill Falls Recall Power

Guaranteed Winter Availability Contract - 1998

- In 1998 the CFL-Co. signed an agreement with Hydro Quebec to sell additional power (some 800 MW) during the winter period, based on higher utilization of the existing Churchill Falls plant.
- This contract was for the term of the existing 1969 contract, and allowed CFL-Co to raise sufficient funds to help maintain long term solvency.
- Could this power not be redirected to Newfoundland via a Strait of Bell Island Crossing?
- The CF winter energy supply should be sufficient to meet the island requirements until 2041. At potentially much less risk to the rate payers of the province.
- The Author has requested clarification from NALCOR as part of the RFI process.



Alternative 2: Churchill Falls Recall Power

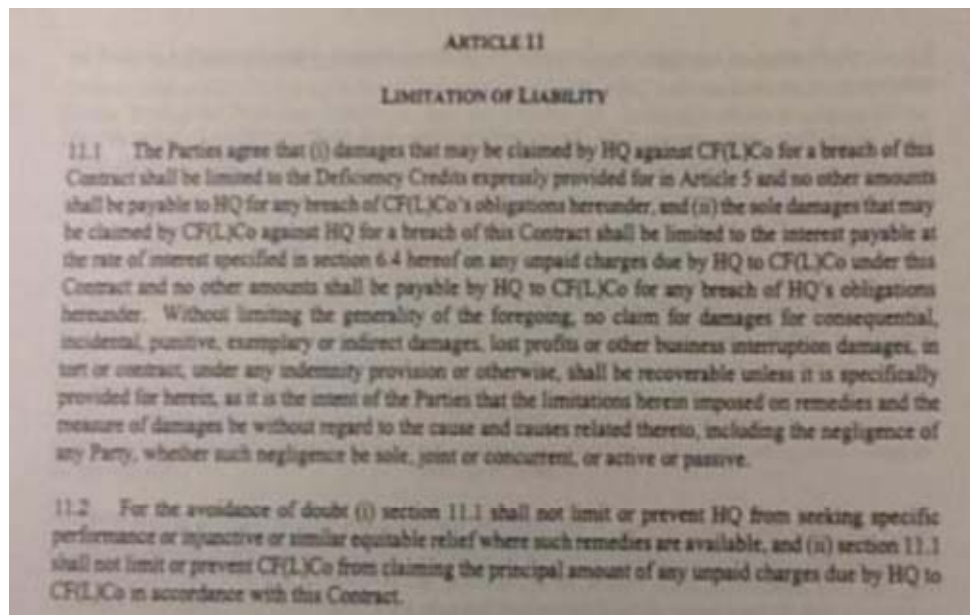
CA/KPL-Nalcor-167
Muskrat Falls Review

Page 1 of 1

- 1 Q. Consumer Question: NALCOR has previously advised through the RFI process that
2 there has been no material negotiations with Hydro Quebec concerning the
3 purchase of power from the Upper Churchill facility. Has NALCOR reviewed the
4 Guaranteed Winter Availability Contract (signed in 1998) as a means to provide the
5 provinces peak energy requirements during the winter months.
6
7
- 8 A. The Guaranteed Winter Availability Contract (GWAC) between CF(L)Co and Hydro
9 Quebec, which extends until 2041, has no provisions relating to energy deliveries to
10 NL and therefore is not a means to provide for NL's energy requirements during the
11 winter months.

Alternative 2: Churchill Falls Recall Power

- Although there is no termination provisions within the 1998 GWAC Agreement, the Limitations of Liability clause does consider deficiencies and the associated penalties. This would be considered in the case of breach of contract or the inability of CFLCo to supply the energy requirements.
- Legal opinion should be sought concerning what damages could be achieved by law (Article 11.2). In the absence of long term power sell arrangements, this may only be capped at loss profit associated with the power. This could be passed on to the rate payer, and would still likely be less expensive than MF.



- It may be that the shareholders agreement may preclude this type of action? This is consistent with what has been previously reported by Jim Feehan in the Dalhousie Law Journal
- If it does the GWAC may not be an option.



Alternative 2: Churchill Falls Recall Power

Negotiations with HQ For Purchase of Upper Churchill Power

- The issue of an increased power recall was previously addressed in the courts, cumulating with a Supreme Court decision in 1988.
- In the original 1982 NF Supreme Court Case the Government of Newfoundland requested an additional 600 MW of power, under the recall arrangement at the same price as Hydro Quebec received under the original agreement.
- The courts ruled that it would not be economically feasible for CFLCo to comply with the province's request [**Power Politics and Questions of Political Will, Royal Commission on Strengthening our Place within Canada, 2003**]
- It has been reported that HQ did not refuse the request, but that the rates should be at the replacement costs.
- This is not an unreasonable position on the part of Hydro Quebec. Although it may not be politically palatable, has NALCOR engaged HQ / CFLCo for a purchase of required power at market prices?



Alternative 2: Churchill Falls Recall Power

- From the Hydro Quebec Website the rate structure for major Type L customers. This would be a likely benchmark for a Market Price.

Demand charge

Billing demand \$12.18/kW

Billing demand in excess of 110% of [contract power](#)

- for each day during which an overrun occurs \$7.11/kW

- monthly maximum \$21.33/kW

Energy charge 2.97¢/kWh



Alternative 2: Churchill Falls Recall Power

- Although the Purchase of Upper Churchill power at “market” or “replacement” cost may not be politically attractive to the people of Newfoundland, it may be a more economical solution.
- With the upcoming court case it would be expected that Hydro Quebec would be very willing to demonstrate reasonableness and sell power to NALCOR at market rates. This may be in fact one positive outcome of 30 years of legal proceedings.
- In the event Hydro Quebec were not willing to release the power at a market rate, it would prudent for NALCOR to also review and provide comment regarding what penalties, and liabilities that would exist if the power required by Newfoundland was not delivered (with warning) and the contract was effectively “breached”.
- There is a legal argument that any penalties available “at law” by Hydro-Quebec would be those contemplated at the execution of the agreement (1969). In the 1975 book by Philip Smith there is ample documentary evidence of Hydro-Quebec pressuring Brinco to lower their sales price, as they did not think the project would be profitable. It has been a windfall. The penalties in the event of the breach may not include the “windfall” element that was clearly not contemplated when both parties entered into the original power agreement.
- As such NALCOR have an obligation to explore all options which may potentially reduce the burden to the NL rate payer.



Alternative 2: Churchill Falls Recall Power

- The author has queried NALCOR concerning what would be the CPW for a scenario where Upper Churchill power is purchased at market rates?

CA/KPL-Nalcor-168
Muskrat Falls Review

Page 1 of 1

- 1 Q. Consumer Question: NALCOR is requested to provide a CPW analysis for the
2 interconnected island option with no Muskrat Falls, with Churchill Falls power
3 available at a rate consistent with a Class L customer within Hydro-Quebec. This is
4 roughly 2.97 cents per kwhr.
5
6
7 A. This analysis does not assist consideration of the Reference Question. No power is
8 available to NL from Churchill Falls at a rate consistent with a Hydro Quebec L Class
9 customer.

Has Nalcor asked the question to HQ?



Alternative 2: Churchill Falls Recall Power

CFLCo and Hydro Quebec 37% Ownership

- In the Dalhousie Law Journal article “ The Origins of a Coming Crisis : Renewal of the Churchill Falls Contract” by James Feehan and Melvin Baker there is considerable debate presented about the renewal terms. However there is also reference to By Law 13.
 - By-law 13: Hydro-Québec required that the CFLCo Board of Directors approve a new by-law. By-Law 13 would require approval by those holding at least 75% of CFLCo shares for certain decisions to be made. For instance, without 75% approval, CFLCo could not engage in other projects, incur debt for purposes unrelated to the project and its operation, increase the authorized share capital, or amend or repeal the by-law itself. With Hydro-Québec to hold 25.7% by year’s end, this would give it a veto over such matters.
- If this bylaw exists then it may negate the commentary of the previous slides. NALCOR should educate the public of Newfoundland as to what this clause means now, and what it implies for the period after 2041.
- This may influence peoples opinions as to proceeding with the Muskrat Falls option.



Alternative 3: Gas to Wire (Local)

- Although the Energy Plan clearly demonstrated that the Provincial Government would review a Gas to Wire option, it was not included in the November 10, 2011 submission to the PUB.
- The reasons were based on the lack of proven economics as established by a 2001 report (Exhibit 108).
- The 2001 report was based on a large diameter (large flow) option to serve a full gas development project.
- Natural Gas was screened out with no real analysis for a island only (domestic demand only – low volume) scenario.
- The economics of using associated gas from the existing fields for a small scale gas pipeline to shore (NL only) could have been considered for a Gas to Wire alternative. This would require minimal CAPEX to the existing offshore fields to support gas export.



Alternative 3: Gas to Wire (Local)

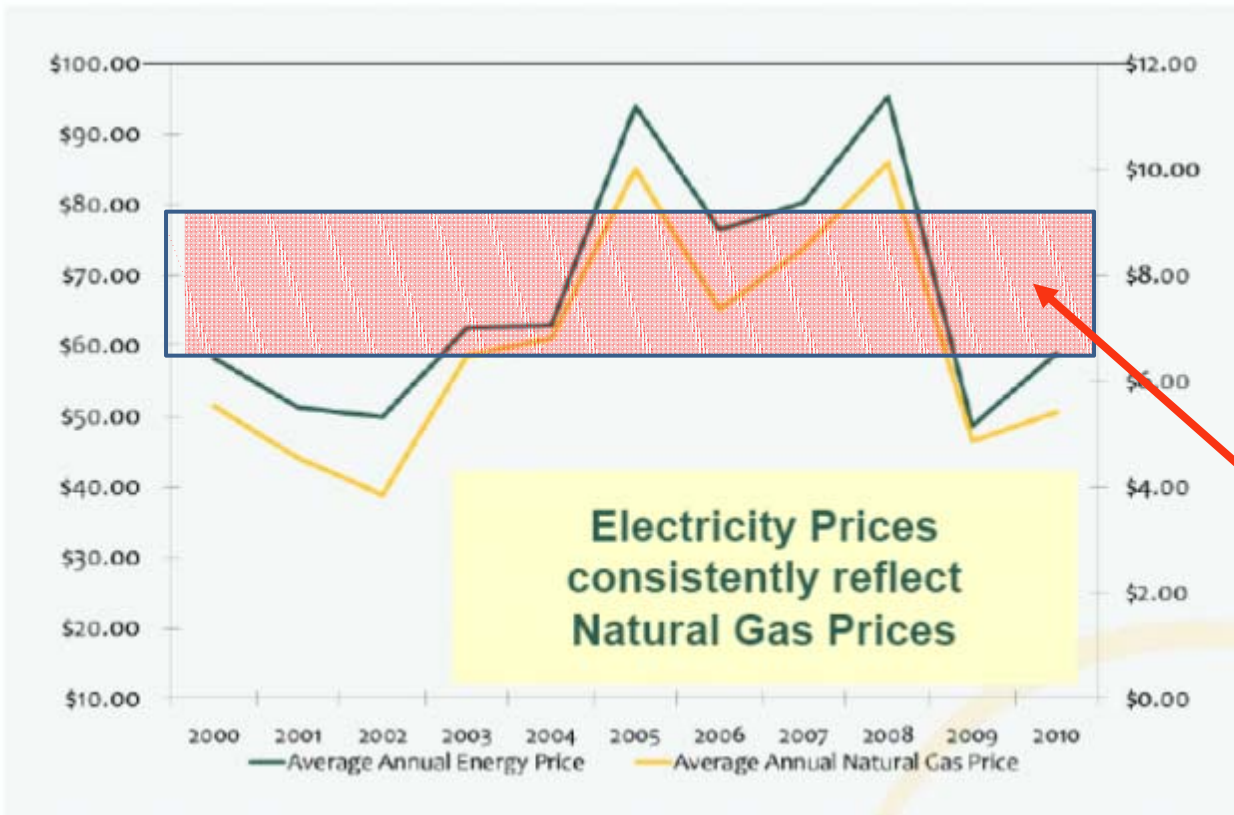
- Associated gas is a by product of oil production. It is burned for fuel (topside generators), re-injected for pressure maintenance, for gas lift, and just for storage for future use.
- The NALCOR CEO has indicated that the existing operators re-inject the associated produced gas currently produced from existing wells (***Ref: Making the Best of the Lower Churchill, David Vardy, August 31, 2011***).
- However not all associated gas is used. The White Rose and Terra Nova facilities presently store gas in a reservoir as there is no option for gas export.
- Is a small scale gas pipeline for presently produced associated gas a viable alternative??



Alternative 3: Gas to Wire (Local)

- Stephen Bruneau and others have suggested that electricity could be produced (600 MW generator) at a substantially lower cost than the MF project. This would be based on a small diameter (12”) subsea pipeline.
- Considering that Husky are presently planning a major CAPEX to determine alternate means for Gas Injection on the White Rose field, NALCOR may have missed an opportunity to provide a lower cost solution for our provincial energy requirements.
- The NALCOR proposal could prove to be the catalyst to full scale gas production from the Grand Banks. This would have additional value added opportunity to the province, and the local Operators.
- Gas represents a very robust solution, proven on a world wide basis, and an alternative that should have been included by NALCOR in their alternatives. It is a 6 month and 1,500,000 \$ study to complete a Class 4 estimate for this work. It was a commitment of the 2007 Energy Plan.
- NALCOR has spent 7 years and 200 million dollars, to arrive at a solution to generate electricity at 22 cents per kw hr to the NL consumer (RFI-KPL-27 Rev 1).
- Why not spend an additional 1.5 million, wait 6 months, and see if we can not generate electricity in the 6 to 10 cents range, as suggested by Bruneau, Martin and others.

Alternative 3: Gas to Wire (Local)



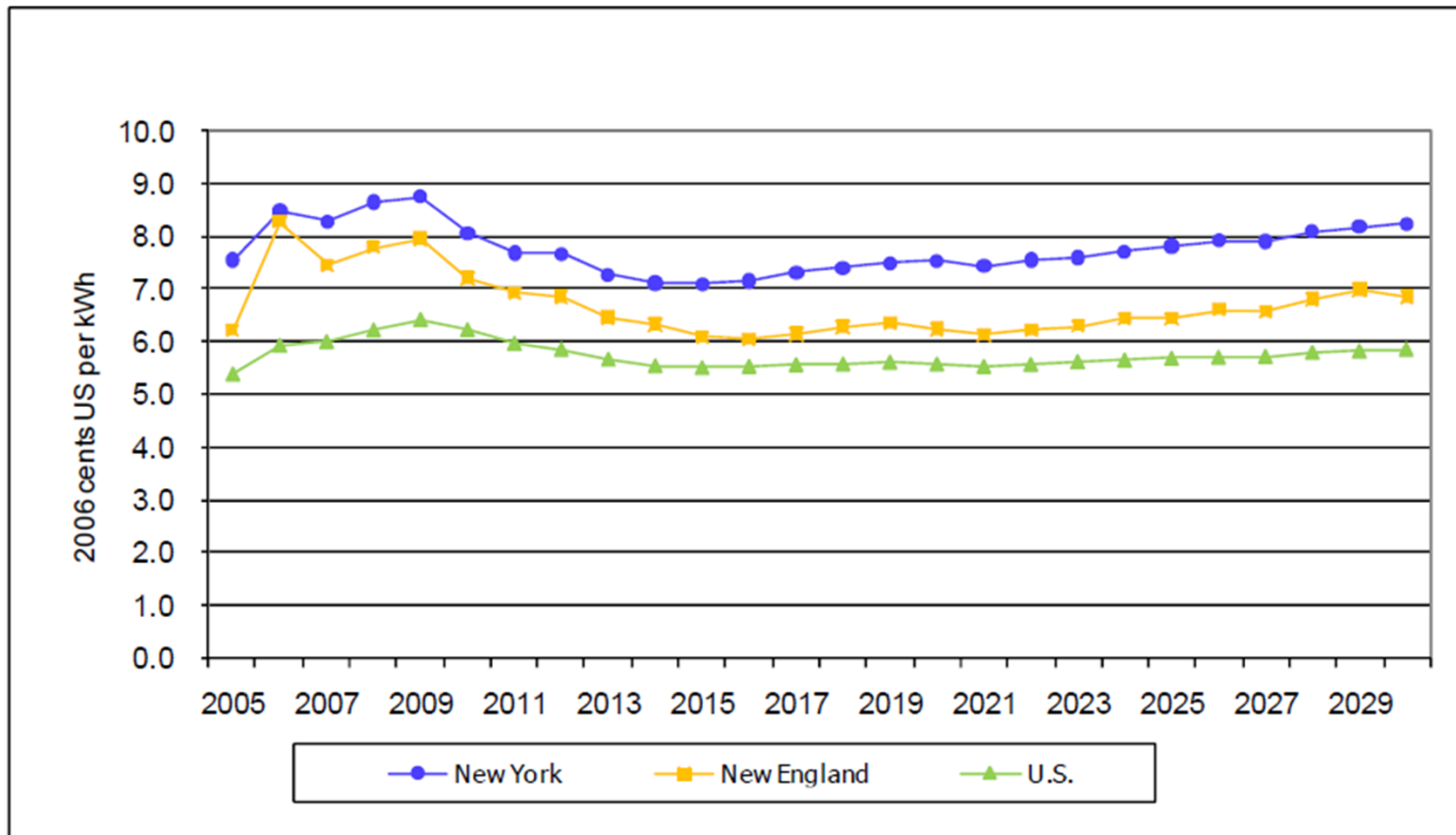
**Figure 24, Nalcor
Main PUB
submission
November 10, 2011**

**The influence
of Shale Gas –
Is this the
long term
price band**

- As Mr. Cabot Martin has proclaimed in his PUB presentation the Shale Gas Revolution in the United States will keep gas prices low.
- As NALCOR has indicated low gas prices will keep US electricity prices low. This is a key input when considering potential energy export prices



Alternative 3: Long Term Gas Electricity Prices



Source: USDE 2008b, Internet site

Figure 2-2 United States Department of Energy Natural Gas Price Forecast

Source: Volume 1, Part A
Lower Churchill
Hydroelectric Station EIS.



**PUB
Submission
Review**

Cumulative Present Worth



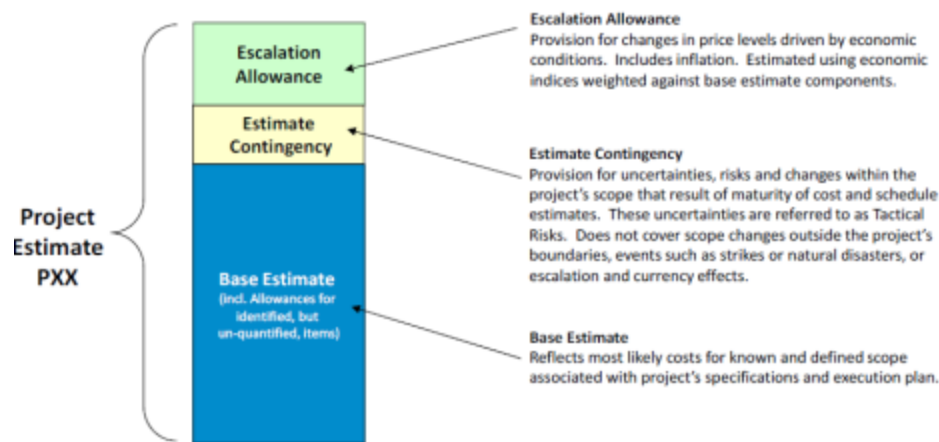
Cumulative Present Worth Analysis

- NALCOR has evaluated the options using a Cumulative Present Worth Analysis, utilizing the software Strategist.
- The end term of the analysis period is 2067
- There has been a base case scenario for both the interconnected and isolated island options.
- There has been several sensitivity analysis completed, however they have not been combined.
- The estimate has been built up from recognized procedures. However the accuracy of the estimate should be evaluated.

Cumulative Present Worth Analysis – Cost Estimate

- NALCOR has developed a cost estimate in accordance with AACE procedures. (Exhibit 31)
- An escalation factor was applied to the estimate. This accounted for inflation and was correctly adjusted considering the economic situation within Newfoundland and Labrador.
- Contingencies of 15% were added to account for risk to the project. This is considered to be a reasonable value to add to the base estimate to account for expected growth.

Figure 1: Project Cost Estimate Components (Nalcor Energy)



Cumulative Present Worth Analysis – Cost Estimate

- The final estimate of the project will have a frequency curve associated with it.
- The curves for projects do not follow a “normal” distribution, but often will follow a skewed or “log normal distribution” as shown below.

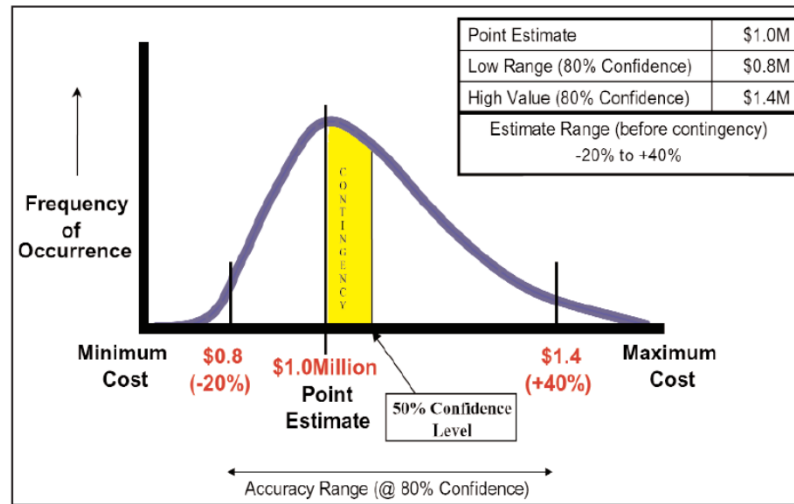


Figure 1 – Estimate Accuracy Range around the Point Estimate

*From 2006 AACE
International Transactions.
“Is Estimate Accuracy an
Oxymoron”*

- The inclusion of a “contingency” is often added to bring the “expected” cost having the highest frequency, to the “P50” level.
- The P50 level is where there is an equal probability of having over-runs, to under-runs.
- Does 15% bring us to a P50 level?

Cumulative Present Worth Analysis – Cost Estimate

All values in \$ millions Canadian

Project	Base Estimate (2010\$)	Historical Cost (pre 2010)	Adjusted Base Cost (Base Cost – Historical)	Estimate Contingency	Escalation Allowance	Total Project Cost (Escalated Nominal)
Muskrat Falls Generating Facility	\$2,206	\$20	\$2,186	\$328	\$335	\$2,869
Labrador – Island Transmission Link	\$1,616	\$42	\$1,574	\$236	\$208	\$2,060

- Within the RFI Process NALCOR have confirmed that the accuracy of the estimate is -20% to +50%.
- This estimate accuracy should be duly considered within the CPW analysis as a sensitivity.
- Within the hearings, NALCOR has committed to completing a Monte Carlo simulation of the project costs. This is considered to be a very positive action to complete.



Cumulative Present Worth Analysis – Cost Estimate

There are some questions which should be asked of NALCOR concerning the Cost Estimate:

1. How has the estimate progressed since the completion of the CPW presented in the PUB submission. Has there been growth?
2. Based on the 200+ million CAD spent under the current project team, what is the earned value assessment of the work completed to date? Has the work completed to date been on budget? Considering the strategic front end loading of the project, this is a good indicator of the final project forecast spend.
3. The Project Management and Engineering component of the cost estimates appear to be very robust. How do the PME costs compare to other hydro-electric projects of similar size.
4. Are the requirements for NL residents as outlined within the benefits plans being met.
5. Considering the very high utilization levels of these professions within NL (due to other ongoing projects) has NALCOR considered completing more work within SNC-Lavalin's other offices to reduce the overall cost burdens to the project. This should be duly considered.
6. What impact does a 1 year delay to the project first electricity (extended construction) and delayed income generation have on the overall economics. Is this within the 15% contingency which has been carried?

The author has queried question 2 (CA/KPL-170) which was deemed outside the terms of reference. Question 3 was also queried



Cumulative Present Worth Analysis – Cost Estimate

CA/KPL-Nalcor-171
Muskrat Falls Review

Page 1 of 1

- 1 Q. Consumer Question: How does the PME % compare to other hydro-electric
2 projects of similar size.
3
4
- 5 A. Nalcor's DG2 capital cost estimates, including those for project management and
6 engineering have been provided to the Board and its Consultant. Nalcor does not
7 have access to contract information from other projects in order to assess PME
8 expenditures on those projects.

From page 44 of exhibit 101 there is 607 million or 16% of the project costs allocated to Project Management and Engineering. Considering the response, how has this been benchmarked?

CPW Analysis - Isolated Island

- Incremental CAPEX commitment to match the progressive demand growth (Positive)
- Heavy dependence upon fuel oil (Negative)
- Does not consider new Gas CCT, rather appears to be based on oil.
- The isolated island alternative has limited inclusion of alternative energy sources.

**Table 22: Isolated Island Alternative – Installations, Life Extensions and Retirements
(In-service capital costs; \$millions nominal)**

Year	Criteria Driven		Life Extension/ Replacement		Retirements
	Description	Cost	Description	Cost	Description
2014	25 MW Wind	PPA			
2015	36 MW Island Pond	\$199	Holyrood ESP & Scrubbers	\$582	
2016			Holyrood Upgrade	\$100	
2017			Holyrood Low No _x Burners	\$20	
2018	23 MW Portland Creek	\$111			
2019			Holyrood Upgrade	\$121	
2020	18 MW Round Pond	\$185			
2022	170 MW CCCT	\$282			Hardwoods CT (50 MW) Corner Brook Pulp and Paper Co-Generation (PPA)
2024	50 MW CT	\$91	Holyrood Upgrade	\$9	Stephenville CT (50 MW)
2027	50 MW CT	\$97			
2028			Replace 2 Existing Wind Farms (~54 MW)	\$189	2 * 27 MW Wind farms (PPA)
2029			Holyrood Upgrade	\$4	
2030	50 MW CT	\$103			
2033	Holyrood Replacement (2 units) 170 MW CCCT 170 MW CCCT	\$464 \$346			Holyrood Unit 1 (161.5 MW) Holyrood Unit 2 (161.5 MW)
2034			Replace 2014 Wind Farm (~25 MW)	\$98	25 MW Wind (PPA)
2036	Holyrood Replacement (3rd unit) 170 MW CCCT	\$492			Holyrood Unit 3 (142.5 MW)
2042	50 MW CT	\$130			
2046	50 MW CT	\$141			
2048			Replace 2 Existing Wind Farms (~54 MW)	\$281	2 * 27 MW Wind farms
2049	50 MW CT	\$149			50 MW CT
2050	170 MW CCCT	\$477			
2052	170 MW CCCT	\$665			50 MW CT & 170 MW CCCT
2054			Replace 2034 Wind Farm (~25 MW)	\$146	25 MW Wind
2055					50 MW CT
2056	170 MW CCCT	\$534			
2063	50 MW CT 50 MW CT 170 MW CCCT	\$197 \$197 \$818			2 * 170 MW CCCT
2064	50 MW CT	\$201			
2066	170 MW CCCT	\$645			170 MW CCCT
2067	170 MW CCCT	\$882			50 MW CT

Source: NLH, 2010 PLF Strategist Generation Expansion Plans, 2011 (Exhibit 14)

CPW Analysis - Interconnected Island

- Large CAPEX prior to the firm realization of the demand (Negative)
- CT units added late in the period to account for final requirements. Upper Churchill Power not considered.
- Portland Creek is added in 2036. there is still for 6 x 50 MW CT units latter in the period.
- This is driven by Capacity issues rather than total power generation (ie; cold winter months).

Table 26: Interconnected Island - Installations, Life Extensions and Retirements
(In-service capital costs; \$millions nominal)

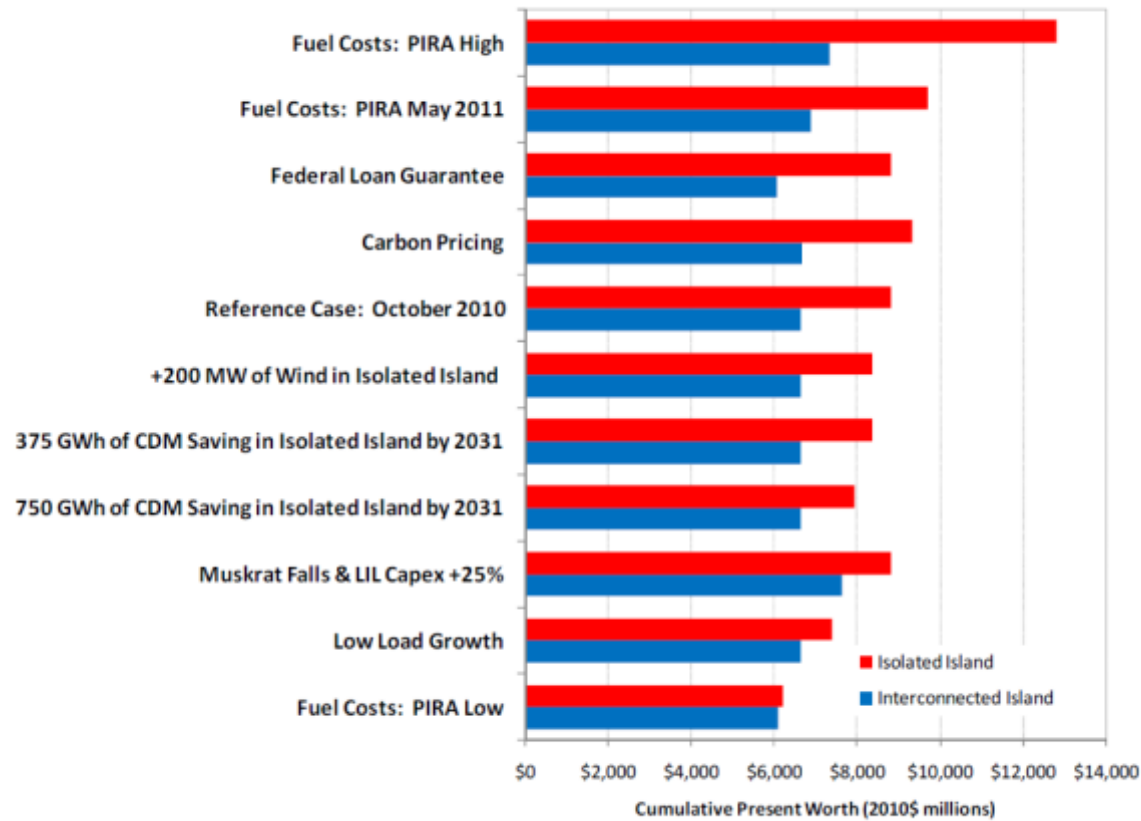
Year	Criteria Driven	Cost	Life Extension/ Replacement	Cost	Retirements
	Description		Description		Description
2014	50 MW CT	\$75			
2017	Holyrood Unit 1 & 2 Synchronous Condensers 900 MW Labrador Interconnection Commencement of Supply from Muskrat Falls	\$3 \$2,553* PPA			
2021					Holyrood Unit 1 (161.5 MW) Holyrood Unit 2 (161.5 MW) Holyrood Unit 3 (142.5 MW)
2022					Hardwoods CT (50 MW) Corner Brook Pulp and Paper Co-Generation (PPA)
2024					Stephenville CT (50 MW)
2028					2 * 27 MW Wind farms (PPA)
2036	23 MW Portland Creek	\$156			
2037	170 MW CCCT	\$373			
2039					50 MW CT
2046	50 MW CT	\$141			
2050	50 MW CT	\$152			
2054	50 MW CT	\$165			
2058	50 MW CT	\$179			
2063	50 MW CT	\$197			
2066	50 MW CT	\$209			
2067					170 MW CCCT

* \$2.553 billion includes total capital cost of \$2.073 billion plus \$480 million in allowance for funds used during construction (AFUDC)

Source: NLH, 2010 PLF Strategist Generation Expansion Plans, 2011 (Exhibit 14)

Cumulative Present Worth Analysis – The Results

Figure 20: Sensitivity Results: Interconnected Island and Isolated Island CPW



Source: Nalcor. MHI-Nalcor 41. August 11, 2011 and Navigant.



Cumulative Present Worth Analysis

- Considering the population demographics, and the Government of Newfoundland housing predictions (Slide 22) the “Low Load Growth” sensitivity case (50% of NALCOR base scope) could be considered as the reference case. This would be a conservative assumption.
- Considering the cost of electricity and the associated impact on consumption rates a small reduction (CDM saving) should also be considered.
- Addition sensitivity analysis (combining factors) could in-fact make the isolated option more attractive. NALCOR should complete the following CPW.
 - Medium PIRA Fuel Costs
 - Medium Load Growth (calibrated to the Government of NL housing stats) as suggested by the Author.
 - 10% escalation of Project Costs (To recognize the accuracy of the estimate)
 - **It would be prudent to consider this combination of assumptions as the “reference case”**

Cumulative Present Worth Analysis – MHI Assessment

- The MHI results did show an interesting comparison of the CPW results

Table 42: CPW Sensitivity Analysis Summary

	Sensitivity Summary	Isolated Island Option	Infeed Option	Difference
1	Base case	\$8,810	\$6,652	\$2,158
2	Annual load decreased by 880 GWh	\$6,625	\$6,217	\$408
3	Fuel costs: PIRA's low price forecast	\$6,221	\$6,100	\$120
4	Fuel price reduced by 44% from base case	\$6,134	\$6,134	\$0
5	Labrador-Island Link capital cost increased by 25%	\$8,810	\$7,050	\$1,760
6	Muskrat Falls GS capital cost increased by 25%	\$8,810	\$7,229	\$1,581
7	Muskrat Falls GS and Labrador-Island HVdc Link capital cost increase by 25%	\$8,810	\$7,627	\$1,183
8	Labrador-Island HVdc Link and Muskrat Falls capital cost increased by 50%	\$8,810	\$8,616	\$194
9	Scenario with <ul style="list-style-type: none"> Fuel cost decreased 20% Annual load growth decreased of 20% Capital cost increased for Muskrat Falls GS and Labrador-Island HVdc Link by 20% 	\$7,037	\$6,878	\$159
10	Scenario with <ul style="list-style-type: none"> Annual load decreased by 880 GWh Muskrat falls GS and Labrador-Island HVdc Link Capital cost increased by 10% 	\$6,625	\$6,598	\$27

Sources:

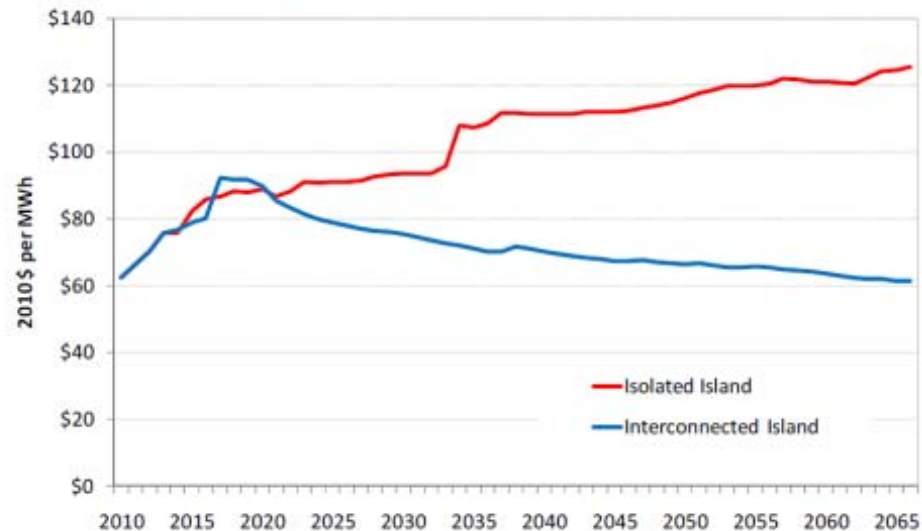
Scenarios 1,2,3,4,5,6,7: Response to RFI MHI-Nalcor-41 Revision 1 and EX-43 Rev.1

← This should be very close to the scenario requested by the Author on Slide 77.

Cumulative Present Worth Analysis

- NALCOR should replicate this plot of costs per kw/hr for this proposed new reference case. This would allow the people of Newfoundland and Labrador to understand entirely how this project will impact electricity costs.
- The substantial financial risk of the LCP if the market is not there does not appear to factor into the CPW analysis. The risk of the upfront CAPEX commitment prior to the demand realization should be factored within the CPW. The risk for low demand should not be a sensitivity case, but should be included as a contingency line in the base case CPW analysis .

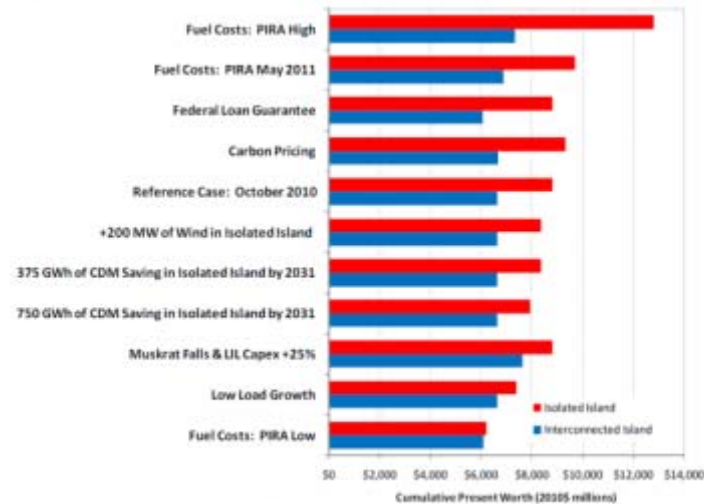
Figure 28: Average Real Rate per MWh



*Excerpt from the
Navigant Report*

Cumulative Present Worth Analysis – Quantifying Risk

Figure 20: Sensitivity Results: Interconnected Island and Isolated Island CPW



Source: Nalcor, MHI-Nalcor 41, August 11, 2011 and Navigant.

- There are 3 major risk to the project(s) which will influence the CPW Analysis
 1. Demand Growth (or the lack thereof)
 2. Increase in Oil Cost (Isolated Option)
 3. Increase in LCP construction costs (Interconnected Option)
- Each of these are considered in the CPW comparison table above as a sensitivity.



Cumulative Present Worth Analysis – Quantifying Risk

- However, the reader must acknowledge that the major advantage of the Isolated Option Scenario is that there is an incremental outlay of Capital Expenditures (ie; we are not spending 5 Billion dollars in 2017).
- In an isolated option there is always the opportunity to construct the LCP in the event that there is long term substantial increase in oil prices. The Fuel Cost “PIRA High” Sensitivity should be viewed in this context. This is true until 2033 when the Holyrood Replacement CAPEX will be committed.
- Generally when considering a large outlay of capital, companies will take a “hurdle” approach to quantify the risk associate with the large commitment of spend.
- This is usually achieved by requiring a higher rate of return, or by selecting a more severe discount rate. For NPV analysis this would usually result in a higher discount rate.
- NALCOR has not adopted a hurdle approach, therefore the major advantage offered by the isolated alternative (incremental capex commitment) has not been included in the comparison.

Cumulative Present Worth Analysis – MHI Assessment

- The MHI results did show an interesting sensitivity of Discount Rate

Table 30: CPW Sensitivity to Discount Rate

Discount Rate:	6%	8% (Nalcor)	10%	17.1%
Isolated	\$13.241	\$8.807	\$6.353	\$3.025
Infeed	\$9.011	\$6.651	\$5.248	\$3.025
Gap	\$4.231	\$2.156	\$1.102	\$0

(Source: MHI derived)

- A “Hurdle penalty” associated with the MF + LIL option, combined with a realistic combination of other sensitivities (as proposed on slide 76), would likely result in the isolated option being the preferred CPW.

Cumulative Present Worth Analysis – The Demand Risk

- In the absence of firm demand in Labrador, or an export market, the real risk is if the provincial load growth does not materialize per the NALCOR predictions. The demand growth is a bigger risk to the NL consumer compared to the price of oil.
- The author has asked the simple question. What would be the price per kw-hr to the NL consumer for the “Low Load Growth” option presented in the sensitivity analysis.

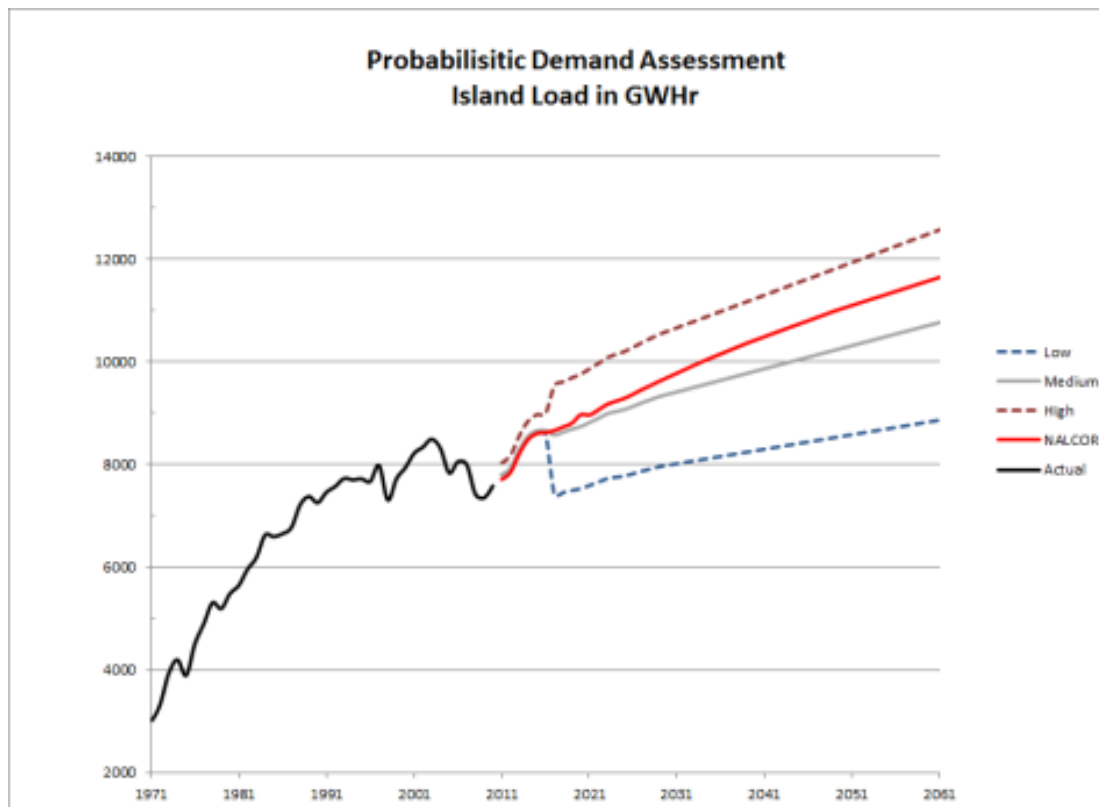
CA/KPL-Nalcor-161
Muskrat Falls Review
Page 1 of 1

1	Q.	Consumer Question: Within Exhibit 101 (Navigant Report) there is a reference to a
2		CPW of a "low demand profile". NALCOR are requested to provide how this will
3		impact the cost to the consumer on a kw-hr basis.
4		
5		
6	A.	Nalcor interprets this question to refer to the "Low Load Growth" sensitivity
7		analysis in Exhibit 101, as the phrase "low demand profile" cannot be found in the
8		report.
9		
10		The analysis requested does not assist consideration of the Reference Question.
11		Nalcor's analysis for this proceeding is based on system costs over the planning
12		period, and the Low Load Growth sensitivity analysis indicates a CPW preference for
13		the Interconnected Island Alternative of \$763 million (2010\$) ¹ over the Isolated
14		Island Alternative.

- The author has completed a “back of the envelop “ assessment to determine what the impact would be.

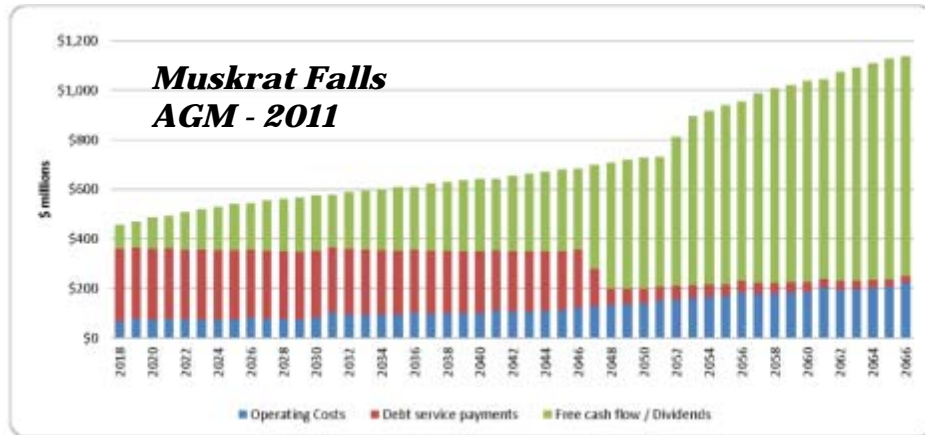
Cumulative Present Worth Analysis – The Demand Risk

- Consider again the probabilistic demand profile developed by the Author.



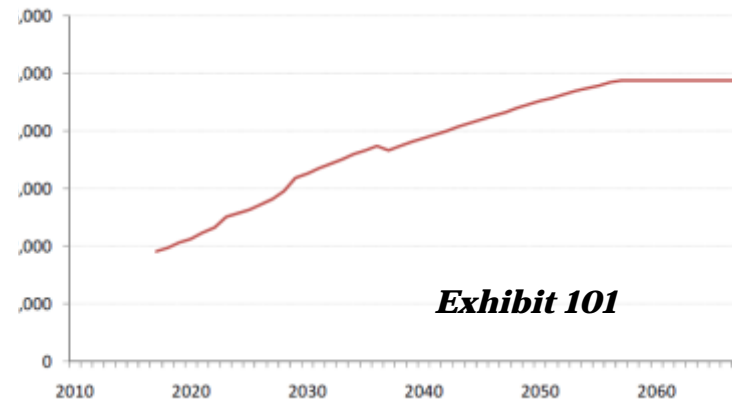
- Within CA/KPL-Nalcor-27 Rev. 1 there has been an incremental Hydro Costs associated with MF. This is on next slide

Cumulative Present Worth Analysis – The Demand Risk



Required Revenue (Take or Pay)

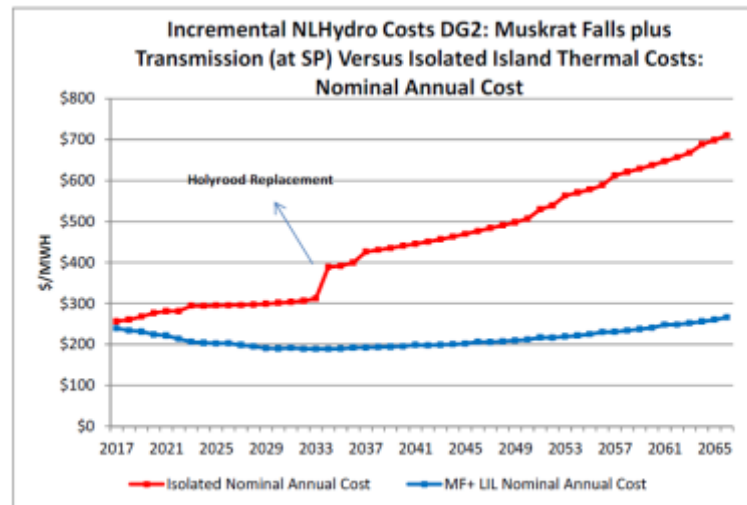
Figure 19: Muskrat Falls Projected Purchase Volumes



Assumed MF Power Demand (PPA)



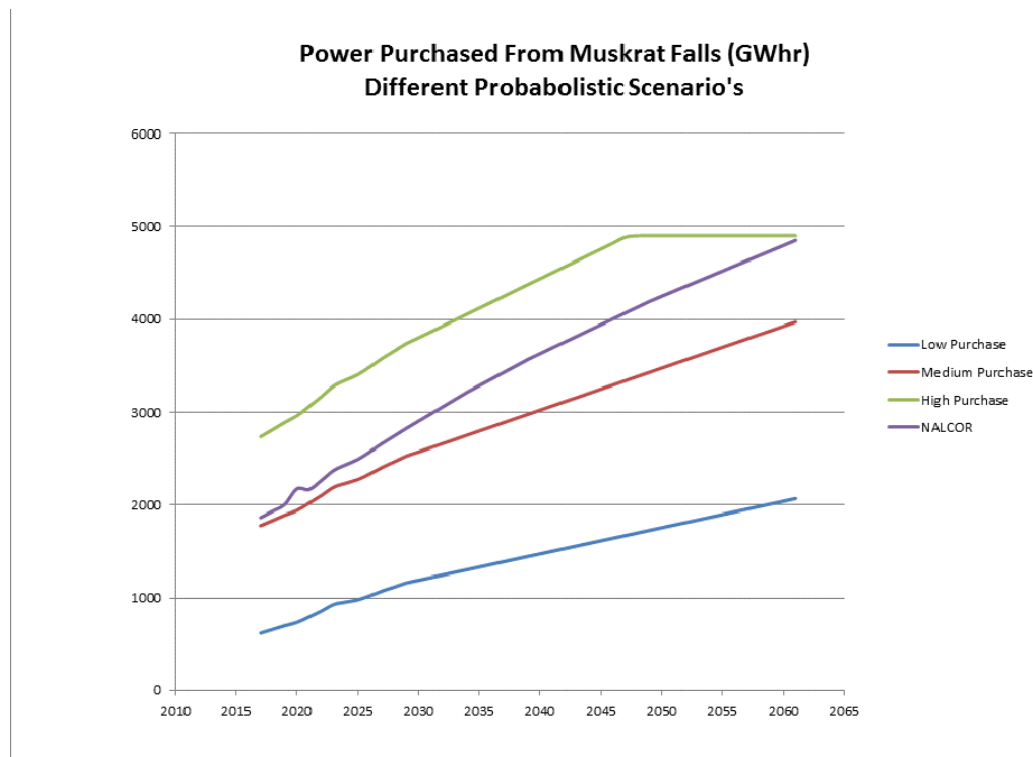
Based on the Required Revenue, and assumed power sales, an incremental cost has been developed.



Incremental Cost of MF Power (KPL-Nalcor-27 Rev. 1)

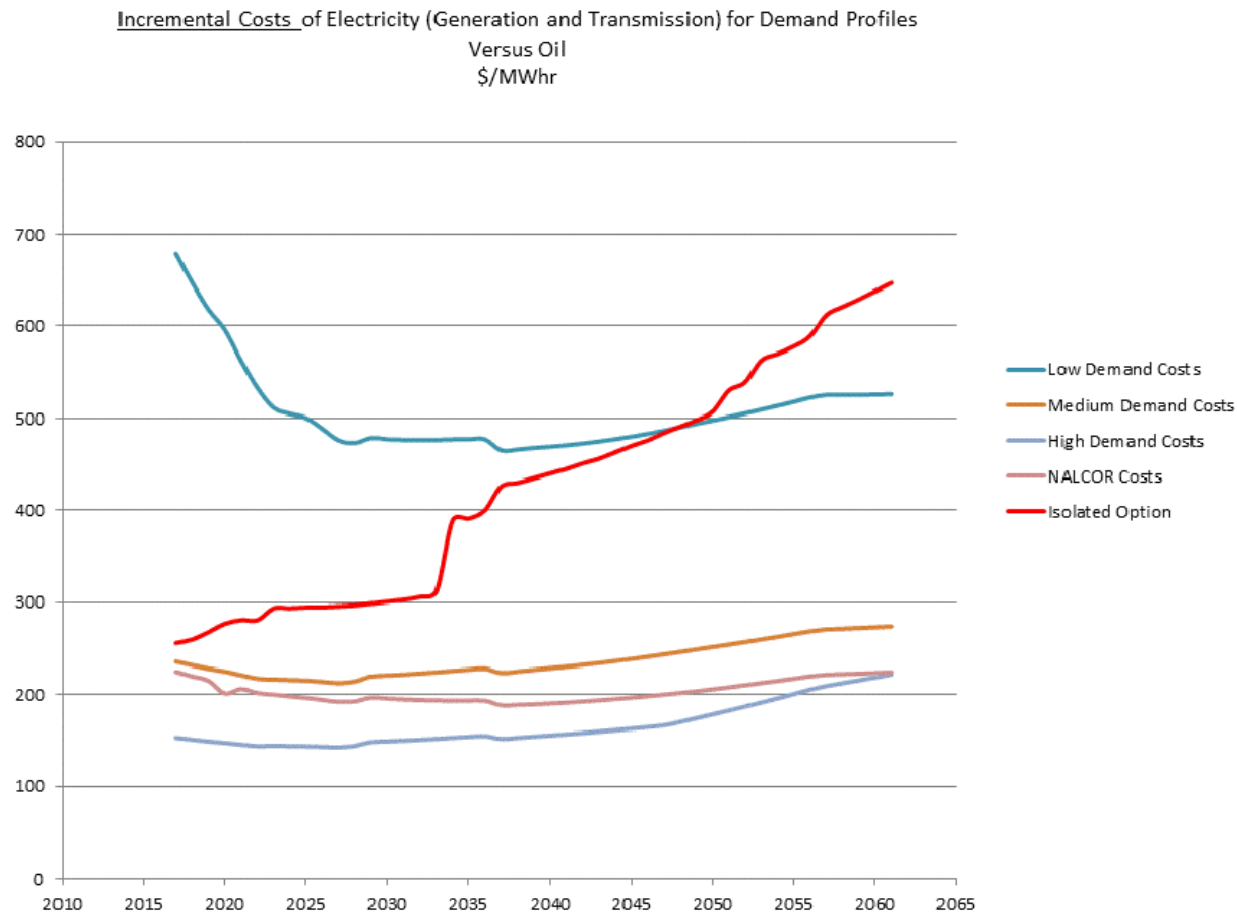
Cumulative Present Worth Analysis – The Demand Risk

- The author has reconstructed the cost graph from KPL-27, in an effort to understand the potential impact of the probability assessment of the LOW, MEDIUM and HIGH demand profiles.
- For simplicity it has been assumed there is 6800 GWhr of legacy average energy available on the island (with no Holyrood). This is an simplification to demonstrate the point. The following is the resulting Power Purchase from MF.



Cumulative Present Worth Analysis – The Demand Risk

- Updating the chart provided in KPL-27 provides the following



- For the first 10 years of the project the Demand Risk is very critical (Prior to Holyrood Replacement)
- This is likely why NALCOR did not provide an answer to CA/KPL-NALCOR-161. The “Low Load Growth” will have a large impact on rates.
- The reader is reminded that this is the incremental cost increase, and not the final aggregate rate.



Cumulative Present Worth Analysis – The conclusions

- There has been significant concerns, and valid alternatives raised by the general public regarding the Muskrat Falls development during the PUB process.
- Nalcor has committed to completing a revised CPW prior to any Project Sanction. This will be based on the updated project costs, and a Monte Carlo simulation.
- The author has suggested that a Monte Carlo simulation of the projected demand should also be included within this assessment. However as a minimum a more complete sensitivity case should be reviewed.
- For the people of Newfoundland to make an informed decision regarding this project there are 2 items required:
 - I. A complete CPW analysis to be considered. ***A suggested template is provided on the next slide.***
 - II. In addition to the CPW the people need to understand what the cost per kw-hr will be for each option.

Cumulative Present Worth Analysis – The conclusions

Option	Description	Growth Profile	PIRA Oil Note 3	MF + LILCost Overrun	CPW Value	Incremental Cost 2017 ¹ \$/MWhr	Blended Costs 20172 \$/MWhr
1	Reference Case Interconnected Island	2010-PLF	Medium		6,652,000	240	~95
1A	Medium Growth	Slide 39 - Medium	Medium	10%	TBA	TBA	TBA
1B	Low Growth	Slide 39 - Low	Low	10%	TBA	TBA	TBA
1C	High Growth	Slide 39 - High	High	10%	TBA	TBA	TBA
2	Reference Case - Isolated Island	2010-PLF	Medium		8,810,000	TBA	~87
2A	Medium Growth	Slide 39 - Medium	Medium	10%	TBA	TBA	TBA
2B	Low Growth	Slide 39 - Low	Low	10%	TBA	TBA	TBA
2C	High Growth	Slide 39 - High	High	10%	TBA	TBA	TBA
3	LIL + Recall Churchill + Portland Creek (Review period till 2041 only)						
3A	Medium Growth	Slide 39 - Medium	Medium	10% on LIL	TBA	TBA	TBA
3B	Low Growth	Slide 39 - Low	Low	10% on LIL	TBA	TBA	TBA
3C	High Growth	Slide 39 - High	High	10% on LIL	TBA	TBA	TBA
4	LIL + Recall Churchill + Hydro Quebec Power Purchase at Market Rates						
4A	Medium Growth	Slide 39 - Medium	Medium	10% on LIL	TBA	TBA	TBA
5	Gas To Wire Option						
5A	Medium Growth - White Rose Gas	Slide 39 - Medium	Level 5 Cost Estimate to be developed		TBA	TBA	TBA
5B	Medium Growth - LNG	Slide 39 - Medium	Level 5 Cost Estimate to be developed		TBA	TBA	TBA
5	Emera Deal - Include the Commitments to Emera and 1 TWhr of annual sales at market rates when capacity exists						
5A	Medium Growth	Slide 39 - Medium	Medium	10%	TBA	TBA	TBA
5B	Low Growth	Slide 39 - Low	Low	10%	TBA	TBA	TBA
5C	High Growth (additional generation required)	Slide 39 - High	High	10%	TBA	TBA	TBA

1) Per KPL-Nalcor 27

2) Per Figure 19, Exhibit 101

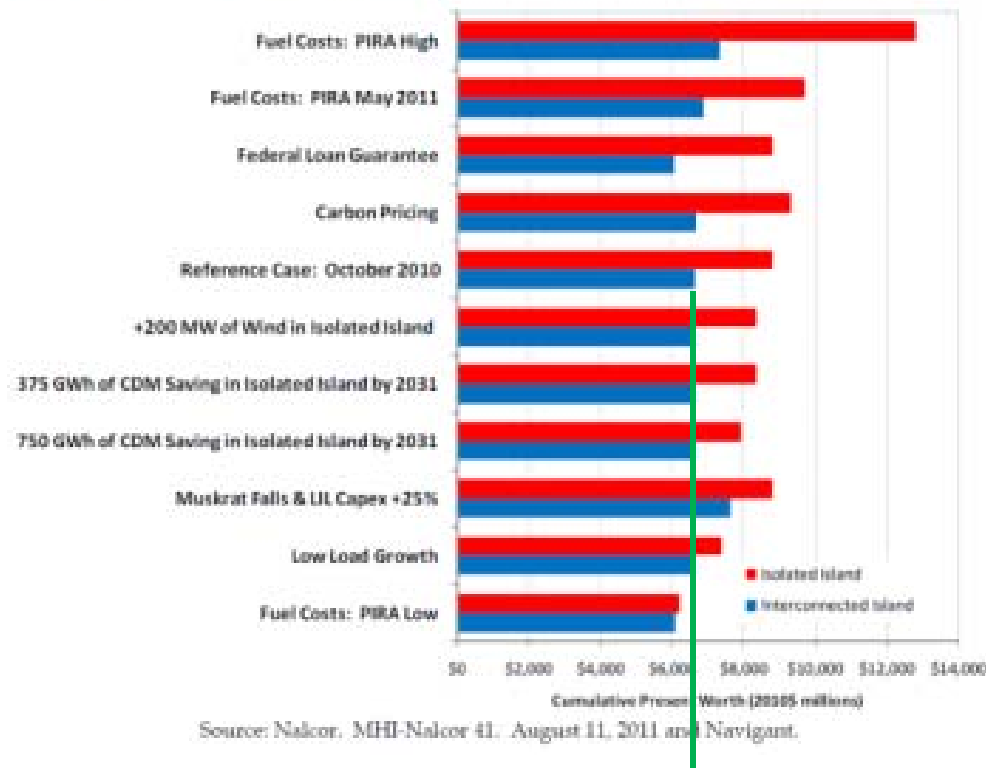
3) Based on the relative dependence of the NL economy on oil the demand growth is pegged to the PIRA oil price (High Demand and High Oil Prices at same time)

(I) A complete CPW is required. This should have been a DG2 deliverable.

Cumulative Present Worth Analysis – The conclusions

(II) The impact on the final electricity costs.

Figure 20: Sensitivity Results: Interconnected Island and Isolated Island CPW

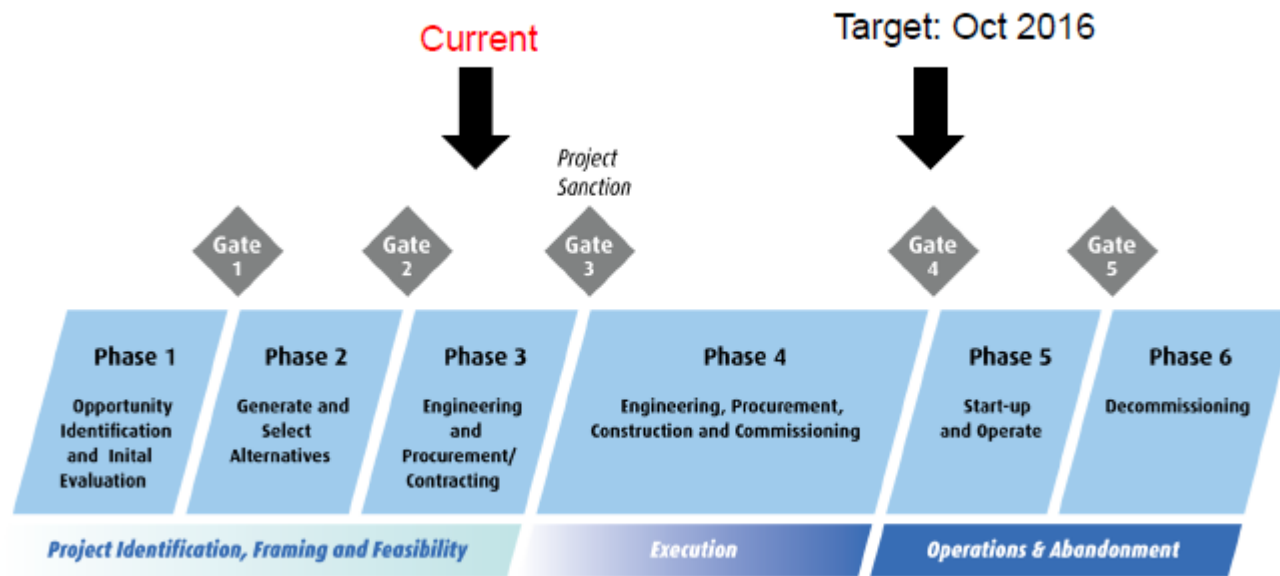


- The Cumulative Present Worth of the “Low Load Growth” sensitivity and the “Reference Case” are the same.
- However based on a PPA the final rate charges to the consumer will **not** be the same.
- NALCOR should be forthcoming and advise what the consumer costs will be for each sensitivity case.



Project Schedule

- The MFGF + LIL schedule has first power scheduled for October 2016

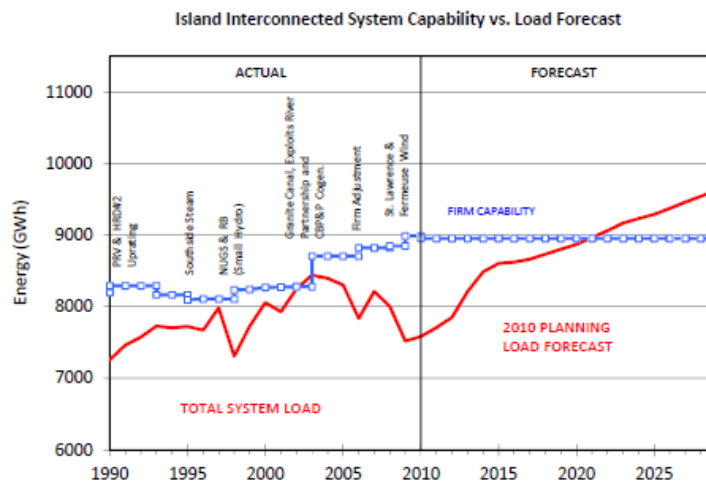


Project Schedule

- With NALCOR's load projection there will be a deficiency in power by 2015, considering the requirements for reliability.
- Considering a SOBI + LIL proceeding per the current project schedule, what would be the deficiency date considering that the "Recall Power" is available.
- Is a SOBI + LIL option with a delayed MF hydroelectric facility an option worth considering?

Island Requirements

Additional generation required by 2015 for capacity deficits





Project Schedule

- The author has asked the question:

CA/KPL-Nalcor-169
Muskrat Falls Review

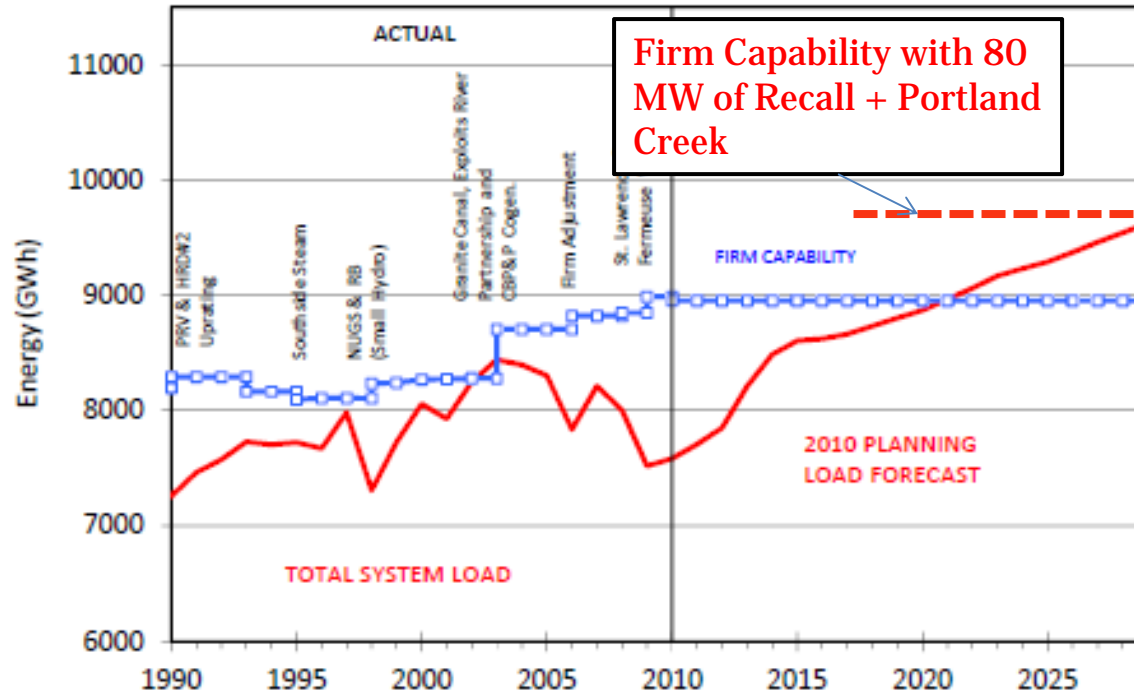
Page 1 of 1

- 1 Q. Consumer Question: Considering the 80 MW recall power, the 26 MW Portland
2 Creek Facility and the additional system reliability provided by the LIL when is the
3 anticipated period of peak and total energy deficiency in a delayed MF scenario?
4
5
- 6 A. Nalcor does not foresee a scenario where the Labrador Island Transmission Link
7 would be constructed in isolation. The 80 MW of recall power available from
8 Churchill Falls in the winter is insufficient to meet the Island's needs, and imports
9 from other jurisdictions have been screened out as a supply alternative¹.

*The reader must remember that Portland Creek will be built
in 2036 under the Interconnected Scenario*

Project Schedule

Island Interconnected System Capability vs. Load Forecast



- Portland Creek – 140 GWhr (MHI – V2)
- 80 MW Recall – ~700 GWhr

- The building of Portland Creek with the LIL + SOBI would meet our energy needs until the next decade.
- From inspection this would be ~2025.
- What is the CPW of this alternative “a delayed MFGF”.



Project Schedule – Delayed MF Generation

Building the SOBI + LIL per the current schedule, but a deferred MFGF has several immediate benefits.

1. Near term security of Newfoundland's power supply
2. Verification of the SOBI subsea crossing reliability prior to a larger CAPEX commitment.
3. Deferral of the labour requirements to meet other resource developments in the province.
4. Additional 5-6 years (TBC) to verify the PLF – 2010 projections to ensure the suitability prior to committing to a marine crossing (1.2 Billion) or the MF power station (2.2 Billion). (Exhibit 101)
5. With power demand management (as proposed by Jim Feehan) we may be able to span to 2041 when Upper Churchill Power becomes available. By then there will be 20 years experience of HVDC technology.... And a large bargaining card in dealings with HQ.

In the opinion of the author there is real justification to delay the construction of the MF facility, while maintaining an early LIL + SOBI option.

1) Security of Newfoundland's Power Supply

- The SOBI crossing will ensure access to a minimum of 80 MW of power to assist with Newfoundland's power requirements. As requested by the author Nalcor, should establish when the revised deficiency date will be.
- It also permits the option to purchase power from Hydro Quebec. The prevalence of Shale Gas in North East US may improve the negotiating position with Hydro Quebec.
- A delay of 4+ years to the MF generation project would allow a phased project approach, which would reduce risk, and help confirm the inputs within the economical analysis (allow a firm up of the cost estimate based on experience). The immediate CAPEX would be reduced by over 50%.

Table 6: Summary of Muskrat Falls and Labrador-Island Link Capital Cost Estimate

All values in \$ millions Canadian

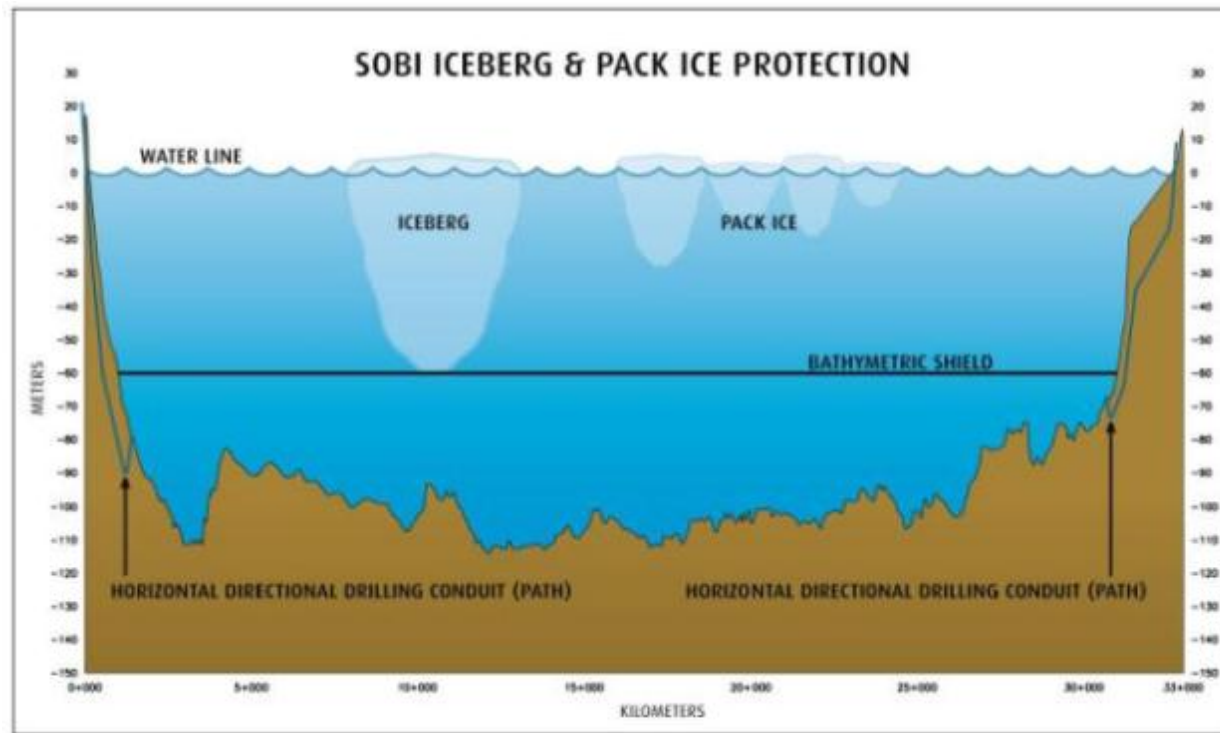
Project	Base Estimate (2010\$)	Historical Cost (pre 2010)	Adjusted Base Cost (Base Cost – Historical)	Estimate Contingency	Escalation Allowance	Total Project Cost (Escalated Nominal)
Muskrat Falls Generating Facility	\$2,206	\$20	\$2,186	\$328	\$335	\$2,869
Labrador – Island Transmission Link	\$1,616	\$42	\$1,574	\$236	\$208	\$2,060



2) Reliability of the Subsea Power Cable

- Aside from the established track record for subsea cables, it would certainly reduce the risk profile to have 4-5 years of operations of the cable, with Holyrood still within the Newfoundland grid.
- 5 Years of operation would effectively identify any maintenance issues in the early life of the cable.
- Although HVDC is proven and reliable technology there are some unique aspects of the SOBI crossing.
 - Has there been any subsea cables of this size installed in near artic conditions.
 - Has there ever been a subsea cable with a HDD approach on both ends?

2) Reliability of the Subsea Power Cable



- The author has asked about previous experiences with HDD on both ends. Nalcor has responded in CA/KPL-NALCOR-174. There was no definitive answer.
- Has the multiple subsea cable splices been considered within the reliability assessments?
- This is a risky installation operation, and doing this well in advance of major power exports (MF or UC) would be of benefit.

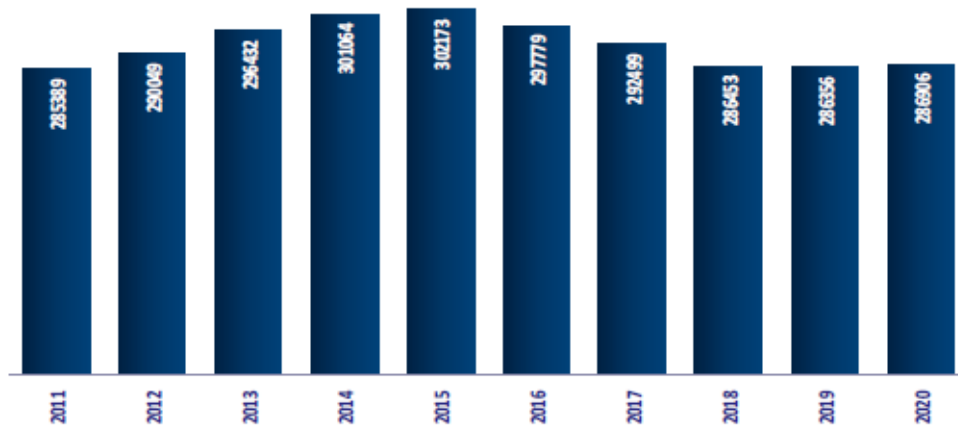


3) Deferral of the Labour Requirements

- The province is under a massive labour shortage in trades and technology. This is due to the resource projects underway
 - Hebron
 - Vale Inco
 - Hibernia Southern
 - FPSO off-station projects
 - Husky Wellhead Platform
- These projects overlap with the proposed project schedule for the Muskrat Falls project.
- The result is that these projects will depend upon workers from the remainder of Canada, and the rest of the world to complete.
- Forgetting the power requirements, is a delay to the MFGF not a better option to the province, to help provide long term sustainability in labour markets.
- Consider the “Employment Outlook 2020” document prepared by the provincial government in 2010.

3) Deferral of the Labour Requirements

Figure 68: Employment Forecast, NL, 2011 to 2020



Data Source(s): HRLE Occupational Demand Forecast (March 2011)

5.3 Employment Outlook

It is anticipated that total employment, in terms of the actual number of workers needed at some point during the year, will grow by 2.8% over 2010 levels during the horizon period of 2011 to 2020. This represents about 7,700 new jobs in the economy. However, there will be two distinct periods of growth and decline:

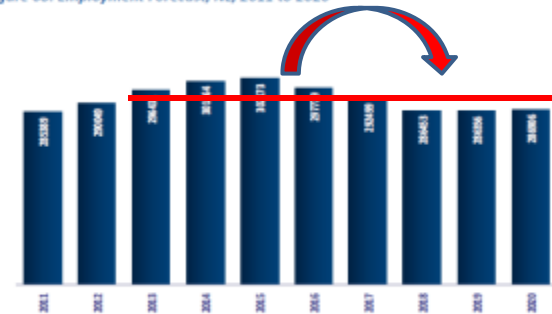
- Employment is expected to grow by 8.2% (22,950 workers) to reach a peak in 2015, followed by a decline in employment of approximately -5.1% (-15,300) by 2020.
- The majority of new jobs in the first half of the projection period will be created as planned major project developments come on stream. Subsequent employment losses will result as the projects ramp down after construction.
- Significant job openings are anticipated over the next decade due to an increasing number of retiring baby boomers. These job openings will more than offset the job losses in the latter part of the the horizon period decade.

Why not strategically delay the MFGF major capital works project to “fill the gap” on labour and resource availability?

3) Deferral of the Labour Requirements

- It is unknown if the 2010 outlook includes the Husky Wellhead Platform which will be a major employer.
- Delaying the 2.2 Billion MF generating project would allow a “smoothing” of the employment curve.
- This long term sustainable labour market would result in several benefits.
 - ❑ Longer term sustainability for the employees of the province.
 - ❑ Longer term outlook for attracting Newfoundland born employees back to the province. **The impact of this can not be understated.**
 - ❑ Ultimately lower labour costs for the MF project, but also the other non public works projects currently underway.
 - ❑ In addition to labour costs, there would also be less pressure on other associated project costs.
 - ❑ Would effectively bridge the gap to the next project (Orphan Basin, Mizen Etc)
 - ❑ **Maximize long term opportunities for companies of NF and Labrador.**

Figure 68: Employment Forecast, NL, 2011 to 2020



Data Source(s): HRIE Occupational Demand Forecast (March 2011)

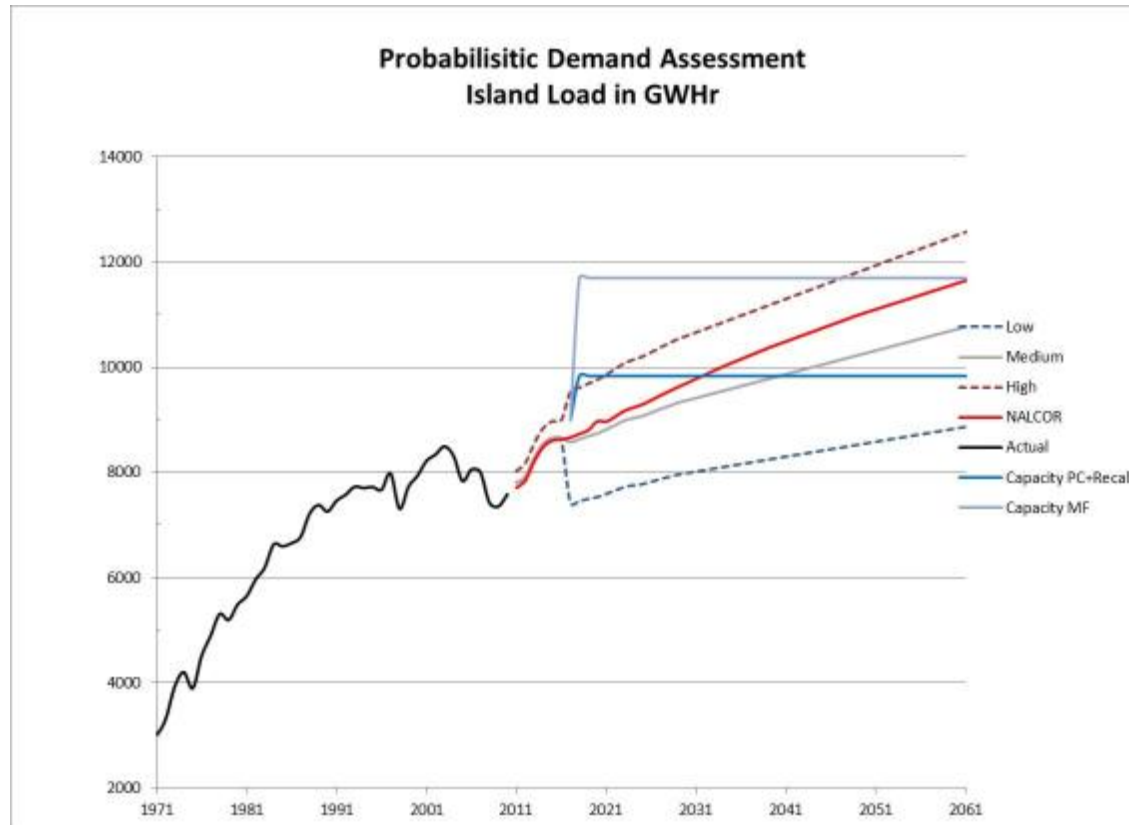


4) Time to review PLF projections

A delay to the MF sanction (and cost commitment) would allow time to verify the projections for energy requirements as established for NALCOR

- ❑ The current hyper-active economy will be at the end of its tenure.
- ❑ Demographic projections can be solidified.
- ❑ The future of the paper industry, and the impacts on the Corner Brook Pulp and Paper mill may be better understood.
- ❑ There will be an opportunity to defer the cost until we actually need it. It is unclear why this was not considered by NALCOR when there presently is surplus power available in Labrador.
- ❑ The SOBI- and LIL will result in an blended increase in rates. The resulting increase in rates would confirm the impact on energy consumption.
- ❑ There will be time to complete consumer end modeling as recommended by MHI.

4) Time to review PLF projections



- If the demand projections are lower than predicted by NALCOR [medium projection] then we would be very close to meeting the requirements to 2041.
- If Labrador Opportunities exists (600 MW of power in mining opportunities) maybe Gull Island would prove to be the better alternative.

5) LIL + SOBI + Small Hydro – Spanning to 2041

- As proposed by Jim Feehan and others the addition of a small amount of generation capacity, with peak demand management, would likely result in bridging the gap to when power becomes available in 2041.
- In this scenario if there are increased industrial demands, or excess requirements in Labrador a decision can always be reached to proceed with the Muskrat Falls development. Or in the event all Labrador mining projects occur there may be justification for Gull Island.
- However, this is entirely dependent upon the Government of Newfoundland being forthcoming on their view regarding the availability of power from the Upper Churchill in 2041. I do not believe this is clear to the people of the province at present. Is it clear to those in government?



Jerome Kennedy @jerome_kennedy

22 Feb

@JackRoseHG. UC power will be returned in 2041 but still need access across Quebec. HQ is a 35% shareholder in CFLCo which causes problems.

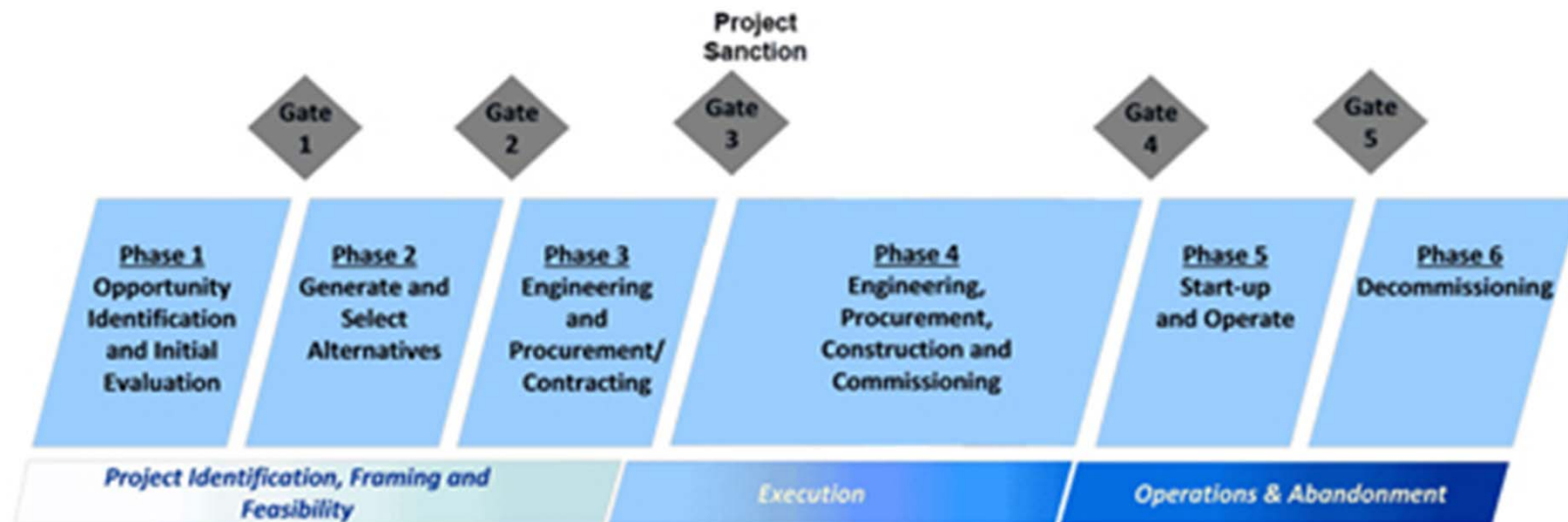
← In reply to Jack Rose

What are the problems?



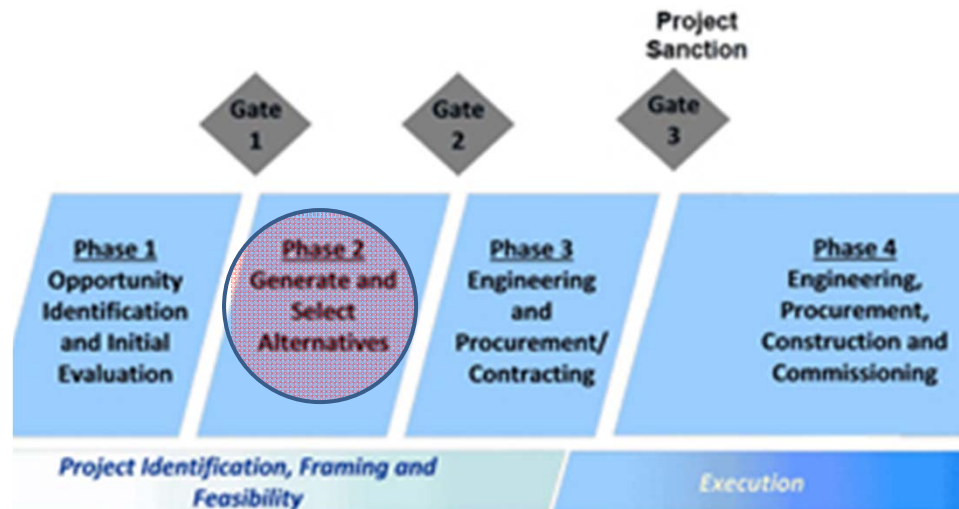
Gated Project Management Process

- Nalcor have adopted a gated project delivery model for the Lower Churchill Project.
- This is a recognized process for planning large projects. The project is divided into a number of Phases divided by Gates. At each gate the status of the project is reviewed, and the criteria for continuing the project re-affirmed. This is usually facilitated by a steering committee of senior management.
- Generally the Gate process approves the budget expenditures for the subsequent phase.



Gated Project Management Process –Comments

- The Gated process initiated by NALCOR in 2006 was for the development of the Lower Churchill. It is unclear if the Decision Gate 1 completed in February 2007 completed a full screening of options. The DG1 report should be requested by the PUB.
- The Decision Gate 2 (DG2) report [Exhibit 22] had limited discussion on the alternatives for project development. However choosing the lowest cost alternative should be the primary mandate of Decision Gate 2, as defined by NALCOR's own process.





Gated Project Management Process –Comments

- Consider NALCOR’s description of DG2 (Page 32 of Volume 2 of November 10th submission)

During Gateway Phase 2 there was a convergence of work by Nalcor’s System Planning team and the LCP Project Team to ensure the selection of alternatives meets the future generation needs of the island and that Project team efforts were closely aligned. In this case it was the Generation Planning Issues 2010 July Update, which determined a requirement for additional generation capacity on the island of Newfoundland. Further engineering and economic analysis during Gateway Phase 2 ultimately determined Muskrat Falls and the Labrador- Island Transmission link to be the least cost alternative to meeting the island’s long-term generation requirements.

- When the project mandate changed from “Develop Lower Churchill Power for Export” to “Developing Lower Churchill Power for Island Requirements” there was an obligation to review the screening process to review all alternatives for the new requirement of developing the “lowest cost power for the island”.
- It is unclear if there has been additional work at reviewing alternatives other than the November 10th PUB submission. However, as discussed by many public commentators the November 10th submission is lacking in this regard, especially as it relates to Natural Gas.



Gated Project Management Process –Comments

- Phase 3 of the project includes the following activities as defined by NALCOR.

During Gateway Phase 3, engineering will progress to a level of completeness required to award key construction and supply contracts required to maintain the overall project schedule and provide the level of cost and schedule certainty for passage through Decision Gate 3. Also during Phase 3, subject to environmental approval and approval of the necessary permits, some early activities such as access roads, construction power and site clearing may commence in advance of the full Project sanction at DG3. This early work may be essential to ensure critical path activities are carried out in a timely manner and future project milestones are not compromised. Such early works are typically not subject to Project sanction.

- NALCOR has made considerable commitments in advance of the Project Sanction decision, based on the original project schedule.
- As previously described within this presentation it is unclear if the availability of 80 MW of recall power requires any early site works for the MF generating facility. What is so critical about 2016 delivery of MF power considering the RECALL availability?



Gated Project Management Process –Comments

- NALCOR has also undertaken considerable activities prior to the Project Sanction decision.

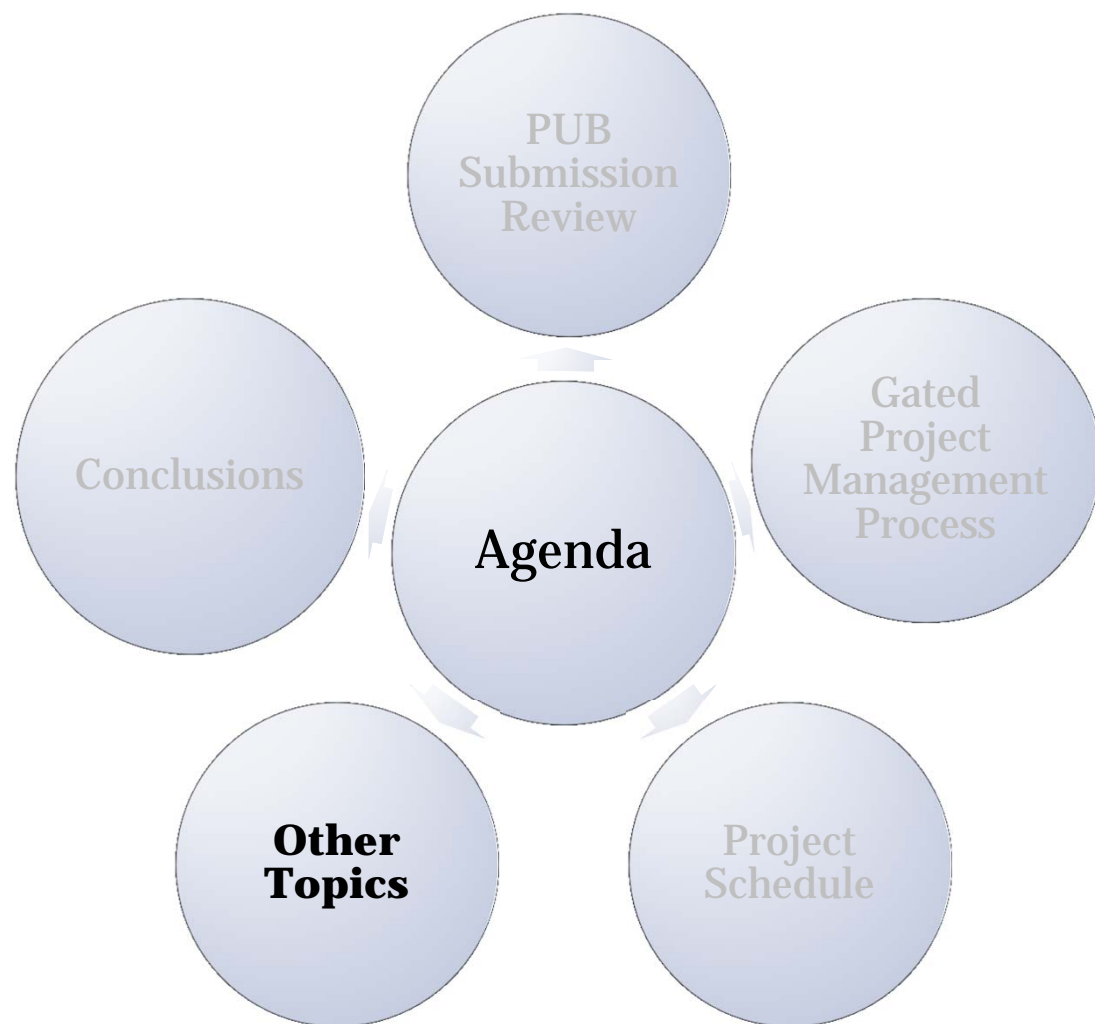
PUB-Nalcor-178

Muskrat Falls Review

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-
- 1 Q. What financial expenditures are expected to be incurred on the Infeed Option
2 Development from DG2, November, 2010 to DG3? Please provide in the response
3 actual expenditures to December 31, 2011 and forecast expenditures from
4 December 31, 2011 to DG3.
5
6
7 A. The total expenditures incurred for the period from DG2 (November 2010) to
8 December 31, 2011 was approximately \$82,800,000. The forecasted expenditures
9 from January 1, 2012 up to DG3 are estimated at approximately \$12,000,000 to
10 \$15,000,000 per month.

- It is the opinion of the author that the project has proceeded on the MFGF + LIL option with significant expenditure, without a full and complete costed screening study of the various options. This should have been completed in the event of LC not proceeding, as was a commitment within the Provincial Energy Plan – 2007. The availability of recall power should also driven the NALCOR PMT to delay the long lead activities for MFGF until following the Project Sanction review 3.





Maritime Link



Maritime Link

- The Emera link is a 500 MW cable from NS to NL. The Emera term sheet references a block of 0.98 TWhr of energy (of 4.9 TWhr of total energy).
- In exchange of providing the Maritime Link, Emera received the Nova Scotia Block of energy equal to 980 GWhr for a period of 35 years. From the term sheet.

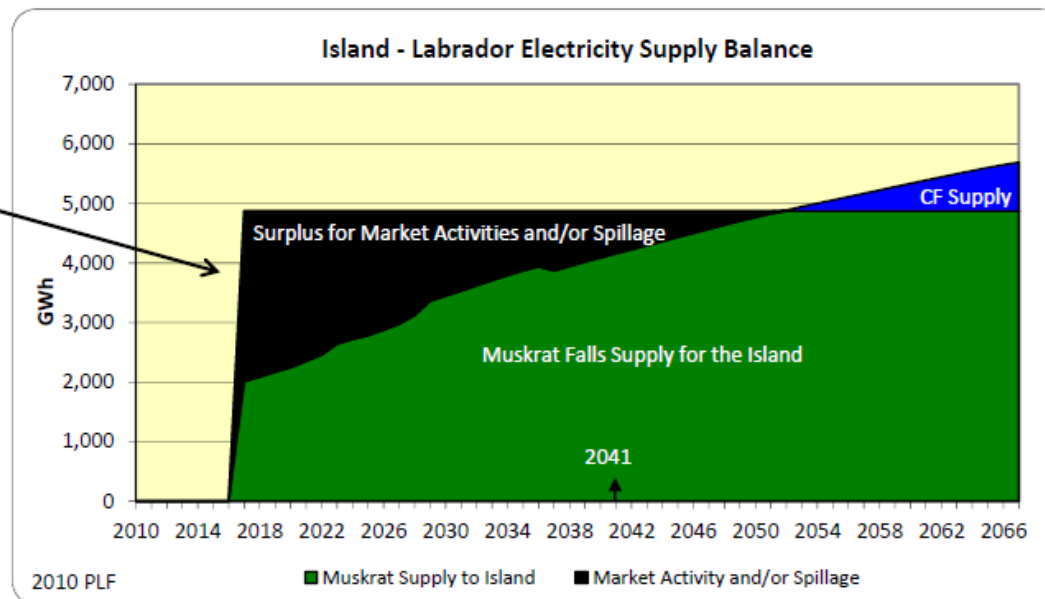
- (j) **"Nova Scotia Block"** means the energy entitlement of Emera from the Muskrat Falls Plant:
 - (i) in the Initial Term, to be taken on a calendar year basis (and pro-rated during the first and last calendar years if necessary to reflect the date on which First Commercial Power occurs), currently calculated as (A) 0.98 TWh of energy plus a supplemental amount of energy to be determined by Nalcor that will apply to the first five (5) years of the Initial Term as described in Appendix "G", less (B) Transmission Losses to the Delivery Point; and
 - (ii) in respect of any Subsequent Term(s) or Renewal Term, such amount as may be agreed by the Parties;

- NALCOR is then permitted to sell energy through the EMERA transmission system subject to transmission fees.

Maritime Link

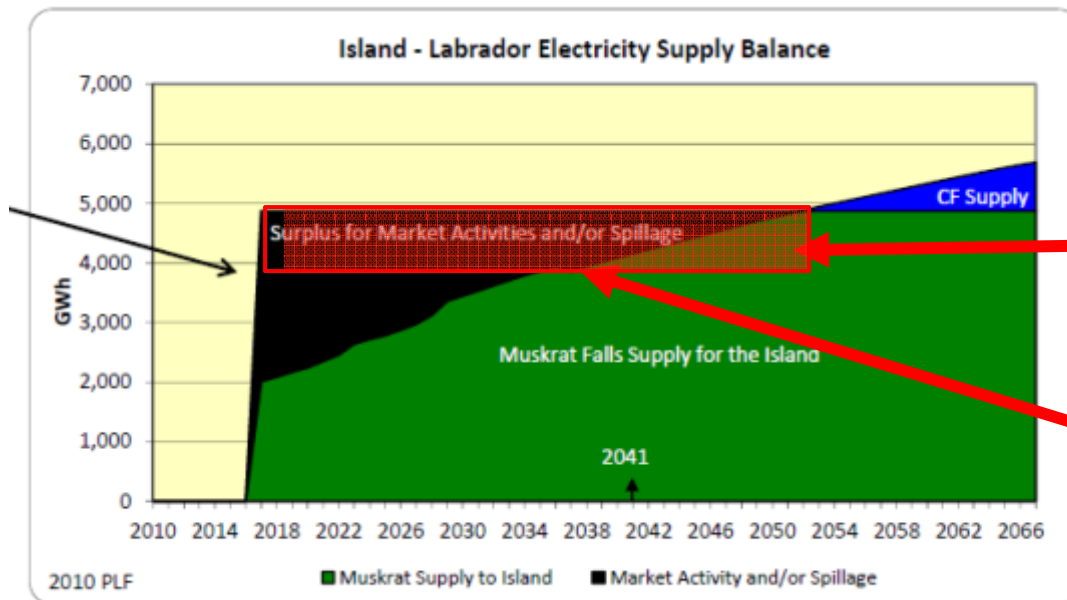
- It is unclear to the author why the fixed link to the Maritimes has been excluded from the economic analysis presented by NALCOR in the PUB submission.
- Within the PUB submission and in the NALCOR public presentations there is references to being able to commercialize the excess power. There is limited to no technical review of the implications of the EMERA deal on the CPW assessment of the 2 primary alternatives.

The price paid by the Island ratepayers is based on LCP cost assuming a return similar to a regulated utility



Nalcor presentation to PUB, July 18, 2011

Maritime Link



Nova Scotia
Block

Energy
Shortfall

- The Emera Commitment of 980 GWhrs of power on an annual basis, until 2052 means that there will be a projected deficiency for island consumption. (Recall power has not been considered in this assessment).
- Emera will receive this energy, at no cost other than supplying the Maritime Link and providing access rights for NALCOR.
- There will be therefore be potentially additional energy generation required for the province ~ 2035.



Maritime Link

- The author has posed the simple, but very relevant question.

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Muskrat Falls Review

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-
- 1 Q. Consumer Question: The EMERA term sheet references the "NS Block of Power"
2 which equates to 980 GWhr which is provided in exchange for construction of the
3 Maritime Link, the enabler of additional power sales. However when considering
4 the Muskrat Falls power purchase profile, assumed in the interconnected island
5 case, there is a potential deficiency in total energy observed around 2035. NALCOR
6 are requested to confirm if the EMERA commitment will provide an energy shortfall
7 in the interconnected option?
8
9
- 10 A. The information requested does not assist consideration of the Reference Question,
11 as neither the Terms of Reference nor the Reference Question addresses matters
12 related to the Emera term sheet.

- This may be outside the terms of reference. But it should be answered before the Emera deal is executed fully.

Maritime Link

- The interconnected island planning scenario presented by NALCOR within the PUB submission (Slide 75) has additional generation capacity included within the economic analysis. However, it does not state if this is sufficient for the Maritime Link option.
- Line 18 of Page 116 of the main NALCOR submission indicates that the additional capacity included in the interconnected island CPW is for Capacity Shortfalls and not Energy Shortfalls.

Year	Island Demand GWhr	Heirloom Firm ¹ GWhr	Heirloom Average ¹ GWhr	Muskrat FIRM GWhr	Muskrat AVG GWhr	Emera GWhr	Balance Firm	Balance Average
2017	8,666	5957	6847	4500	4900	980	811	2,101
2020	8,872	5957	6847	4500	4900	980	605	1895
2030	9,704	5957	6847	4500	4900	980	-227	1063
2035	10,087	5957	6847	4500	4900	980	-60	680
2040	10,431	5957	6847	4500	4900	980	-954	336
2041	10,493	5957	6847	4500	4900	980	-1016	274
2045	10,744	5957	6847	4500	4900	980	-1267	23
2050	11,048	5957	6847	4500	4900	980	-1571	-281
2052	11,158	5957	6847	4500	4900	980	-1681	-391
2055	11,322	5957	6847	4500	4900	0	-865	425
2060	11,596	5957	6847	4500	4900	0	-1139	151
2065	11,869	5957	6847	4500	4900	0	-1412	-122
2067	11,979	5957	6847	4500	4900	0	-1522	-232

1) Exhibit 16, Table 3-1 with Holyrood removed

- Considering FIRM Energy there will be a deficiency in ~2035 with the Emera commitment of 980 GWhr.
- If the demand profile is correct there will be additional energy requirements not included within the Interconnected Island option, if the Emera deal proceeds.

Note: This table does not include the Portland Creek or small CT included in the Interconnected Island. This is scheduled for 2036. Does it have to be earlier for the Emera Commitment, and therefore increase the CPW.

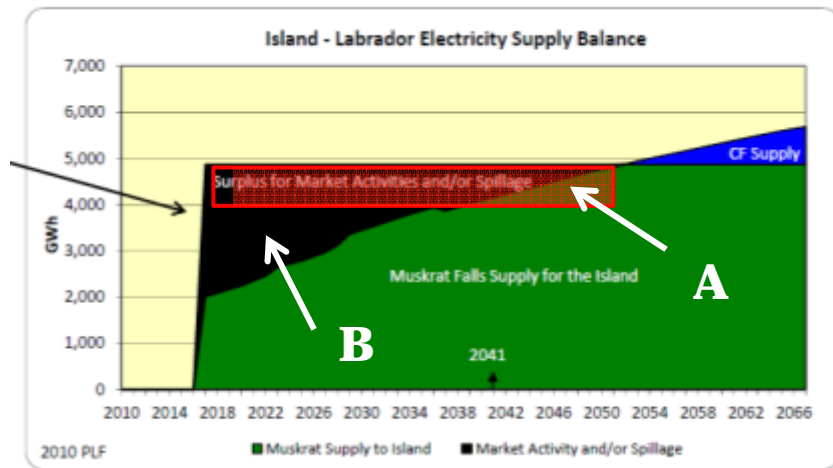


Maritime Link

- To offset the deficiencies created by EMERA there may be more power available to the province in ~2041 when the CF contract terminates. However, NALCOR should provide clarity on the following points.
 - ❑ The adequacy of the 900 MW LIL to take the additional power (This line will be at peak with MF and Recall power)
 - ❑ As previously discussed NALCOR's opinion regarding Churchill Falls power being redirected to the island considering Hydro Quebec's apparent Veto rights in the CFLCo Shareholder Agreement. This uncertainty is referenced, but not explained by NALCOR within the November 10th submission (Volume 1) to the PUB.
- Within an earlier part of this presentation the Author has questioned several inputs into the 2010 – PLF used to arrive at the demand profile. The Emera deal does reduce the risks associated with a lower than expected island demand for Energy.
- The Emera arrangement reduces risk in the event that demand is less than expected. However it will potentially increase risk to the NL consumer if the demand profile is as suggested by NALCOR.
- Does the commitment of the NS Block by NALCOR mean that it too considers the 2010 PLF predictions to be an upper bound?

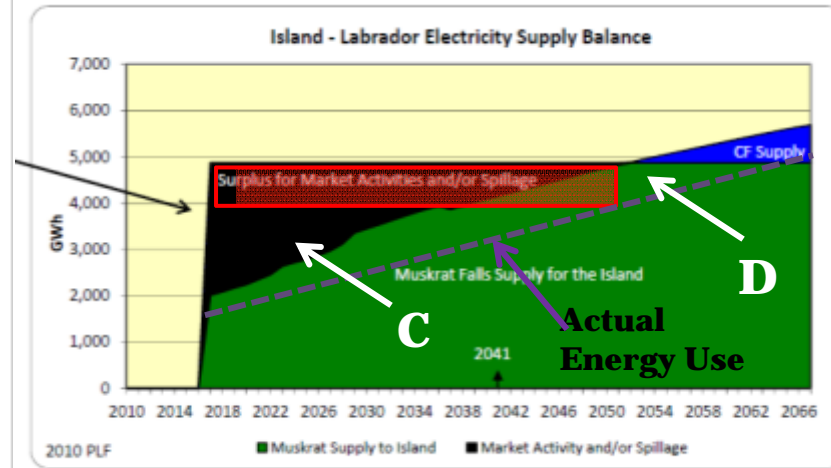
Maritime Link – Sensitivity of Demand

If 2010 – PLF Is Accurate



- Any additional power sales (Region B), less the taxes, tariffs and other burdens must be less than the additional CAPEX and OPEX costs associated with meeting the demand profile in Region A, where energy is still committed to Emera.

If 2010 – PLF Is Optimistic



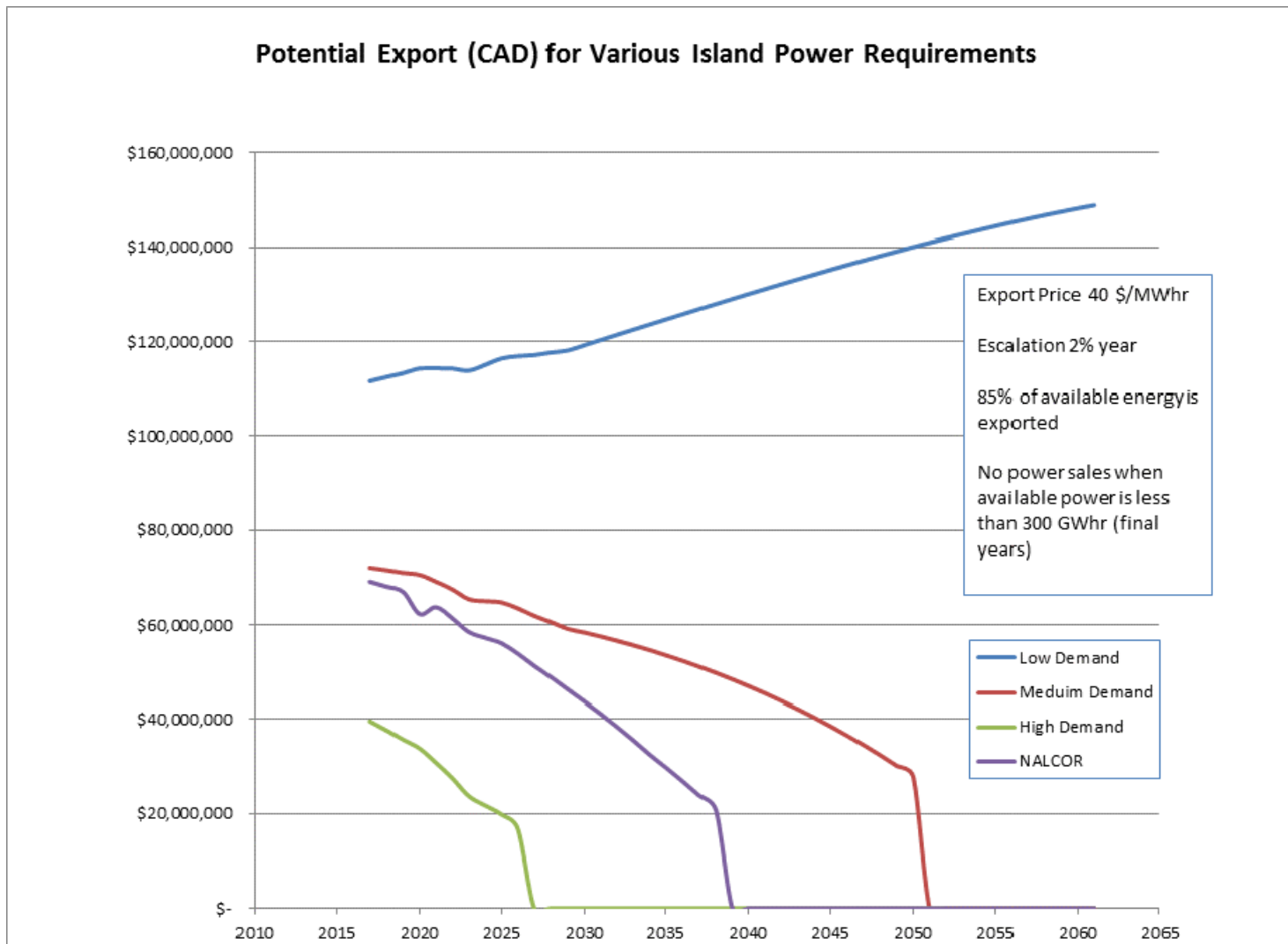
- The additional power sales in C and D must be sufficient to keep the NL rate payer whole over the life of the project.
- If the power in Region D can not be sold for the rates stated for the NL rate payer, then the rates for the NL rate payer will increase.



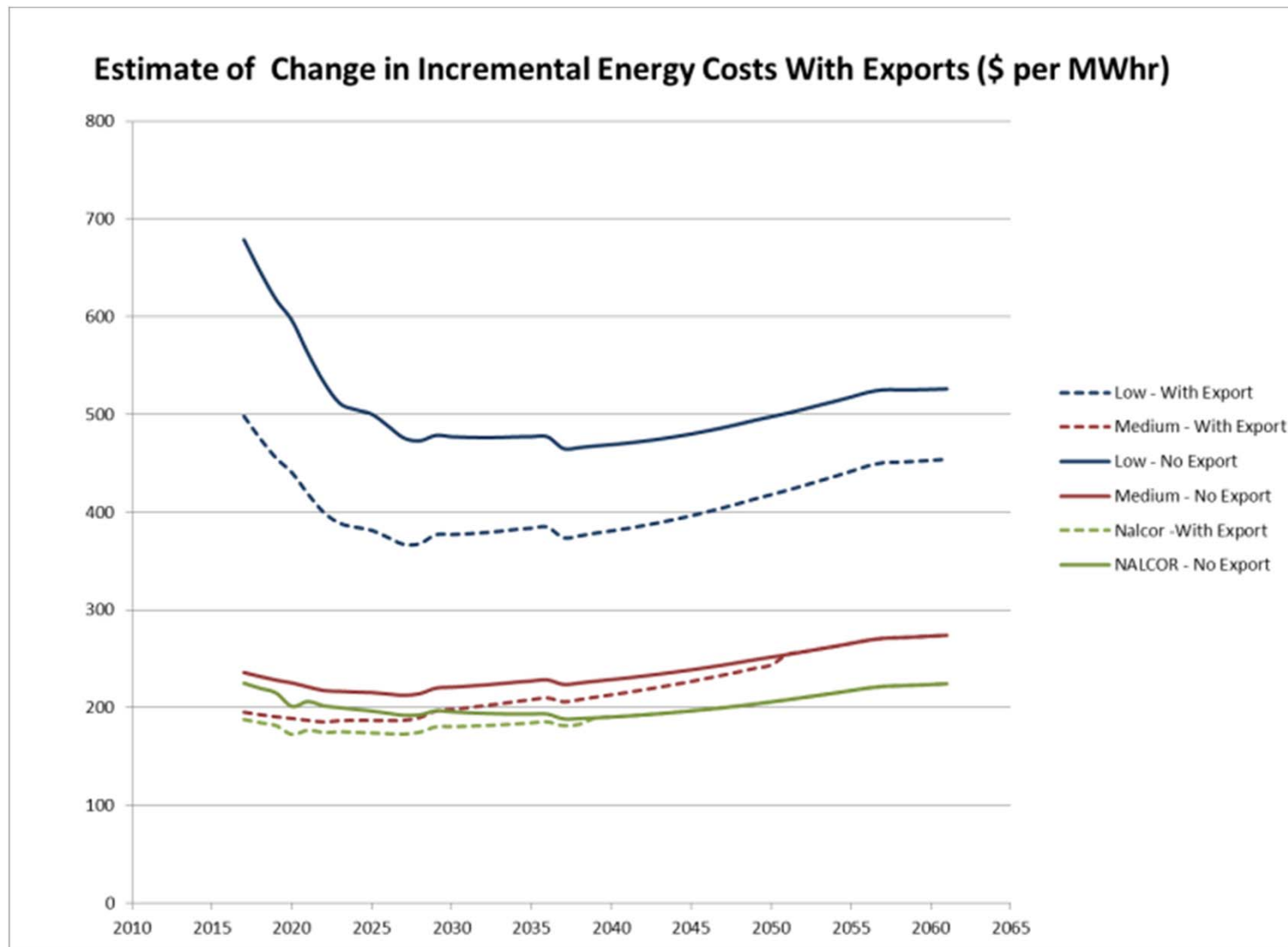
Maritime Link – The Benefits

- The Maritime Link does provide opportunity to sell excess power in the event that the demand is not present on the island.
- It is a risk mitigator, but what is this worth?
- A calculation of the potential power sales can be provided. The Author has attempted to complete this. Consider the following inputs
 1. The various demand projections for HIGH, MEDIUM, LOW and NALCOR provided within Slide 86.
 2. Considering the shale gas phenomenon (Slide 66) a export sales price of 4 cents per kwhr. This has been escalated 2% a year.
 3. 85% of available power (Average power not sold to the island consumer) is sold to export markets.
 4. Note that this is approximate only. It is provided as NALCOR have not answered questions concerning potential power exports.

Maritime Link – The Potential Export Value Per Year



Maritime Link – Does it Practically Mitigate the Low Demand Risks





Maritime Link – Does it Practically Mitigate the Low Demand Risks

- Due to the relative high costs of MF power, and the potential low sales rate, the Export market will only marginally decrease the cost to the NL consumer in the event that the demand profile does not grow as predicted by NALCOR.
- The author has used 40 \$/MWhr for a sales rate, escalated at 2% per year. This is based on long term power projections for the US, with some allowance for losses, transmission fees and profits.
- Obviously if a higher rate could be achieved, it would prove more effective as a risk mitigation.
- The author can not provide an real comments as to if this is reasonable. However it is higher than the rates within the 1998 GWAC power contract for Upper Churchill power.
- The Author has again asked this question of NALCOR



Maritime Link – Does it Practically Mitigate the Low Demand Risks

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- 1 Q. Consumer Question: Based on market rates in the final selling point, what would be
2 the kw-hr value to the NL rate payer considering the transmission, tariffs and other
3 charges which must be taken off the top.
4
5
- 6 A. The information requested does not assist consideration of the Reference Question,
7 as neither the Terms of Reference nor the Reference Question addresses matters
8 related to export sales.



Maritime Link

- To allow the public of Newfoundland to make an educated view on the Maritime Link deal the CPW analysis completed by NALCOR (as included within the main submission of November 10th) should include sensitivities which reflect the basics of the EMERA deal
- Again this is outside the current terms of reference, but it needs to be asked prior to project Sanction.
- Suggested cases include:
 - (I) Inter-connected, Base Case Demand Profile, Emera Link with 1 TWH or additional sales at market rates. The sales to be the surplus of Island requirements, and transmission capabilities. The power shortfalls anticipated in the period of 2035 should be addressed within this case.
 - (II) Inter-connect, Medium Demand Growth Profile, Emera Link, with 1 TWHr of additional sales at market rates. The 1 TWhr of energy will only be when surplus of Island requirements and within NS transmission capabilities.



Peak Demand and Timed Delivery

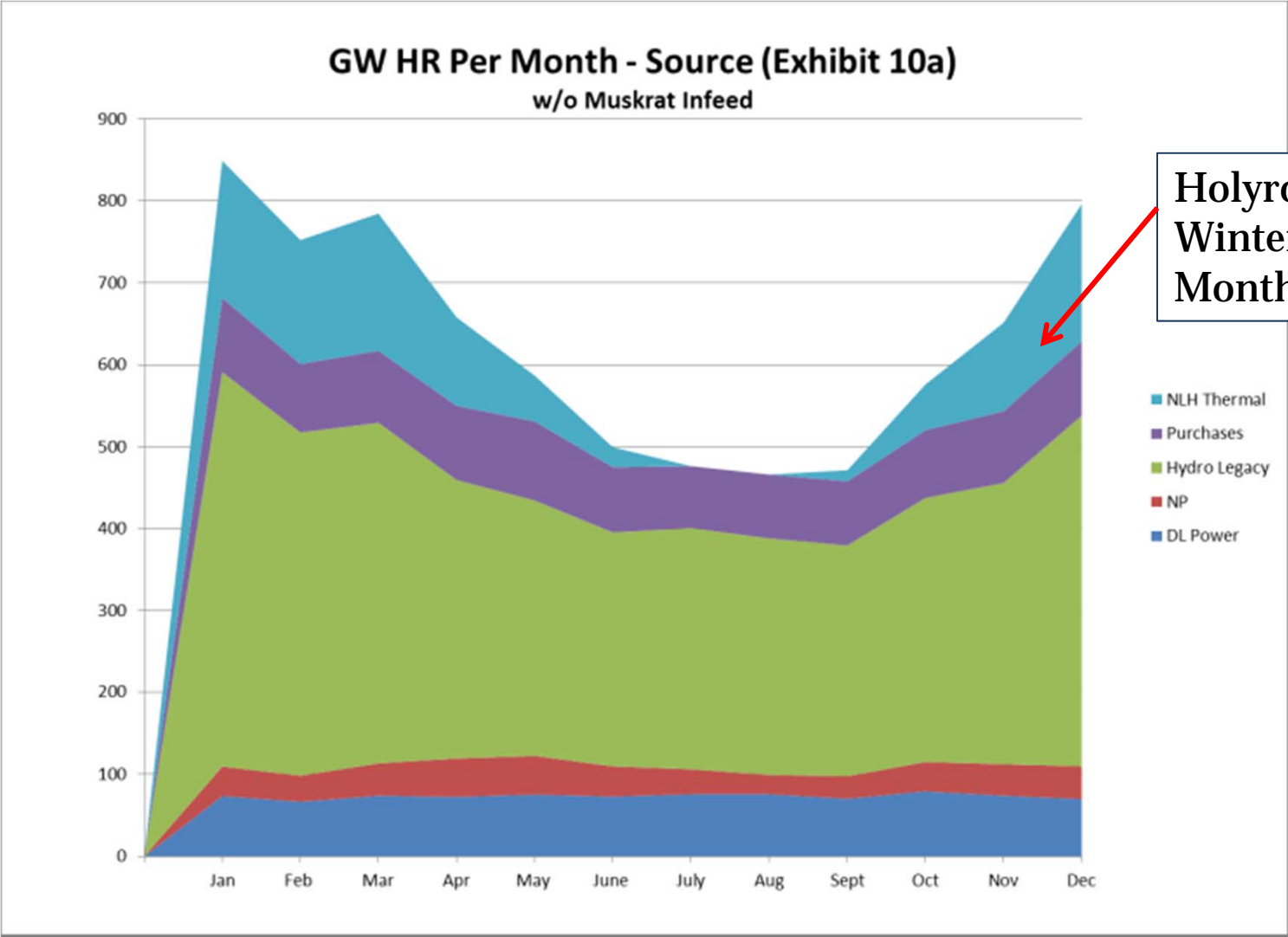


Peak Demand and Energy Requirements

- When the energy is required is a key input within the analysis.
- It is the belief of the Author that the program Strategist, as used by NALCOR, reviews the time domain profile of energy requirements in it's analysis (To be confirmed).
- However, the program is as only as good as the inputs. Based on a 50 year extrapolation period these inputs are critical.
- Although the author has limited to no experience in this field there are at least three essential variables which must be evaluated:
 1. Ratio of Peak Demand (MW) to overall energy requirements (GWhr)
 2. Ratio of the Winter requirements to the Summer requirements, and how each of these comprise the overall energy requirements.
 3. Considering the Emera energy delivery period, when is the power required in Newfoundland.
- There is limited discussion within the PUB submission relating to how this comes together. A full generation profile should be provided.
- The author has attempted to generate a monthly demand and capacity profile from the information provided within the PUB submission.

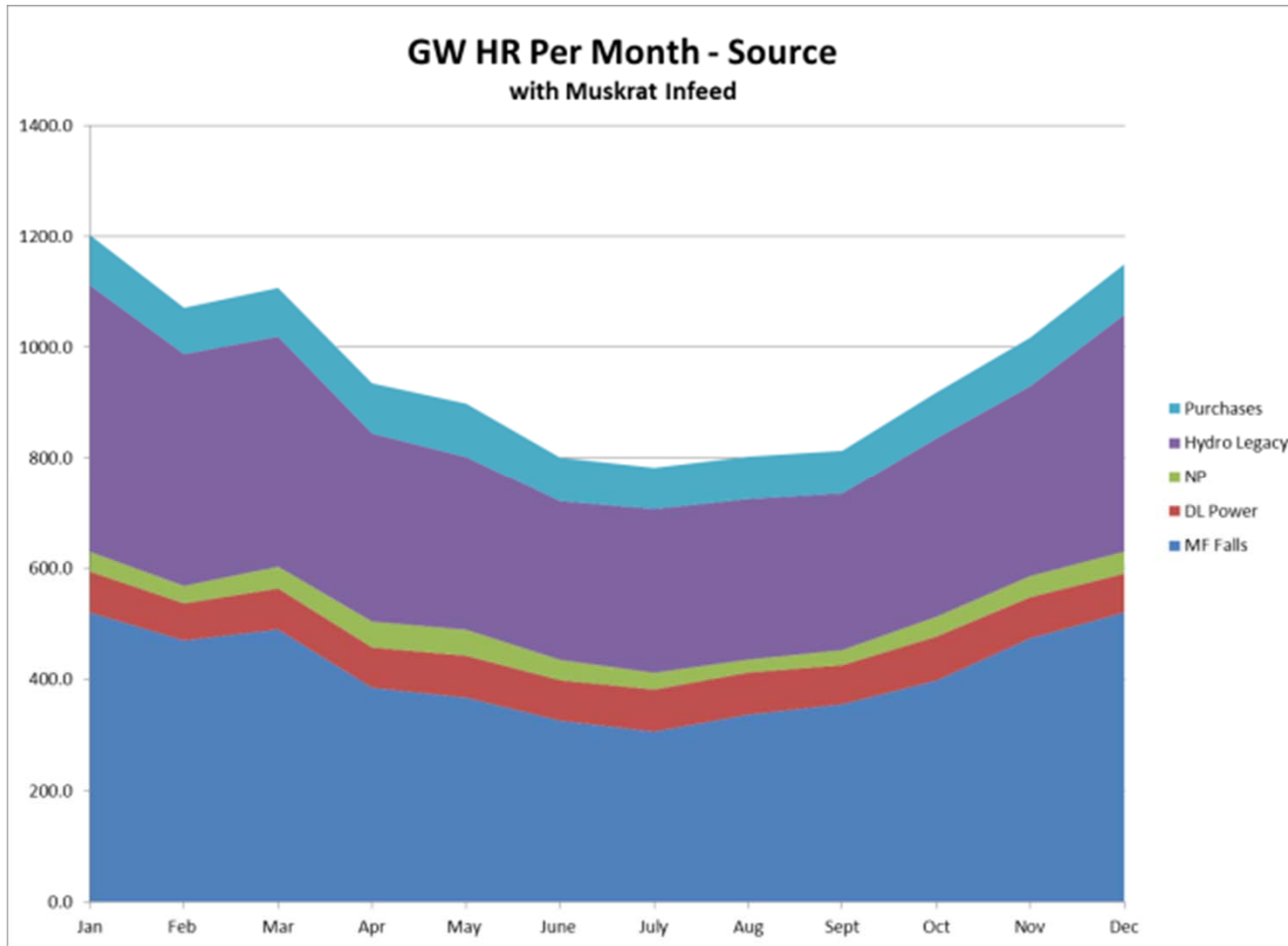


Typical Demand on Monthly Basis - 2010





Assumed Generation Profile – With MF Infeed

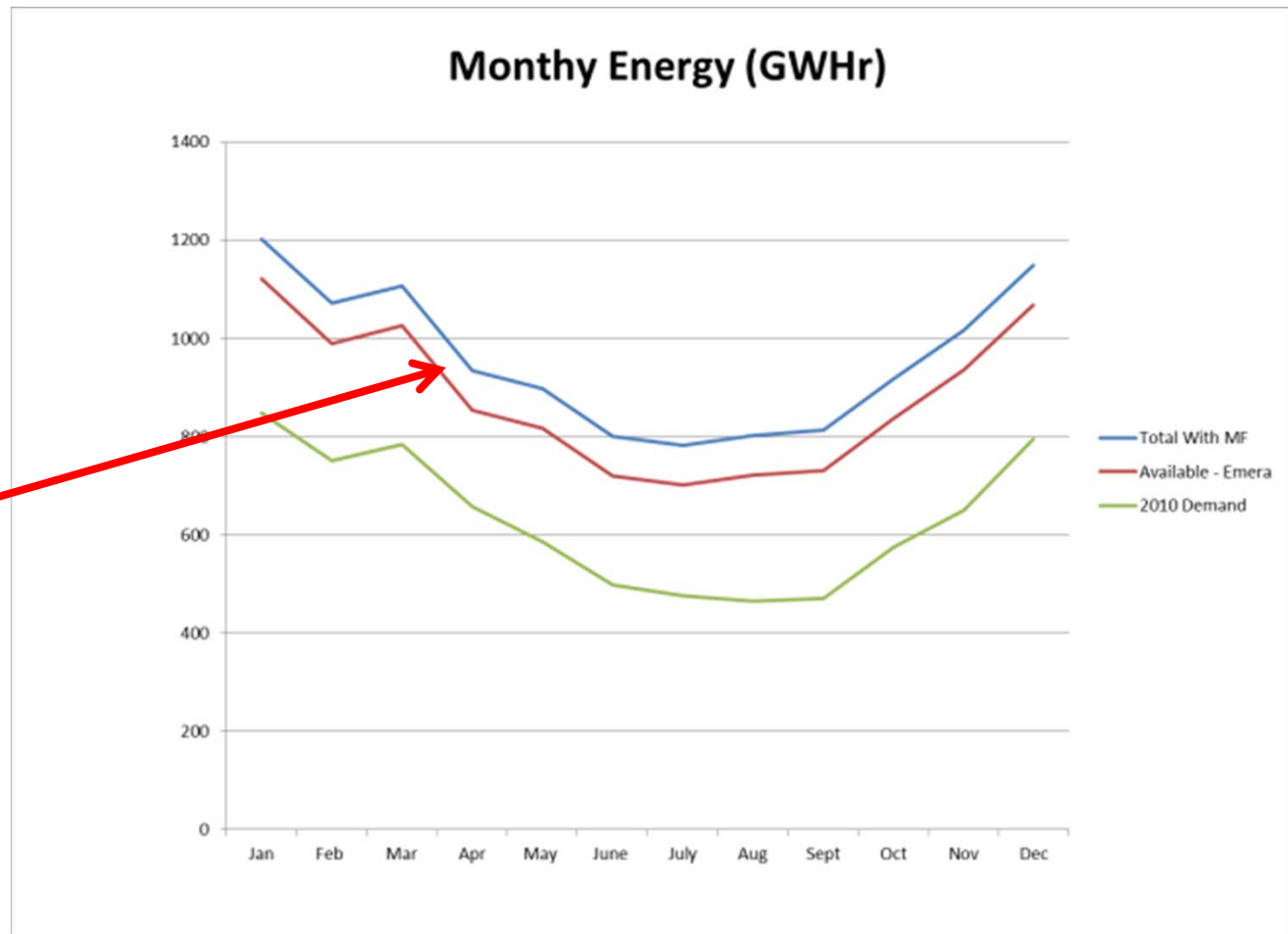


Month	Days	Total Possible Energy Based on 824 MW Rating	Factor	Total
Jan	31	613	0.85	521.1
Feb	28	554	0.85	470.7
Mar	31	613	0.8	490.4
Apr	30	593	0.65	385.6
May	31	613	0.6	367.8
June	30	593	0.55	326.3
July	31	613	0.5	306.5
Aug	31	613	0.55	337.2
Sept	30	593	0.6	356.0
Oct	31	613	0.65	398.5
Nov	30	593	0.8	474.6
Dec	31	613	0.85	521.1
Annual		7218		4955.9

- This is based on an assumed generating profile for MF as shown above
- Portland Creek, Recall and small CT not included

Summer/Winter Requirements – With MF Infeed

Power Available to Island considering Emera commitment



- This is a plot of Monthly generation capacity with the assumed MF infeed, with the Emera commitment removed, and the 2010 demand profile

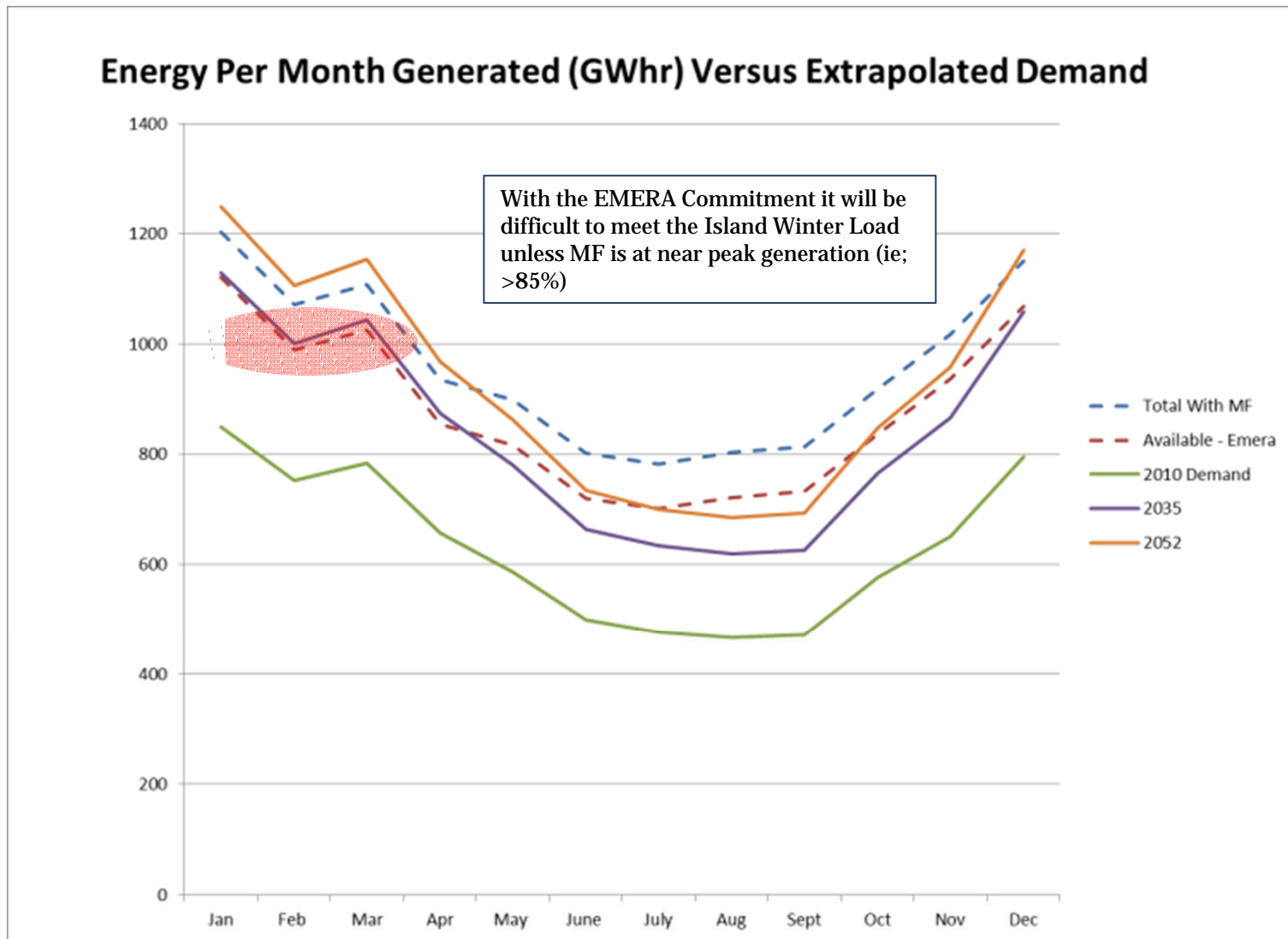
Summer/Winter Requirements – With MF Infeed

- If the monthly demands (Winter / Summer Ratio) remains unchanged then the 2010 power profile can be simply magnified by the ratio of the total Energy as predicted in the NALCOR 2010-2067 demand profile.
- The author has completed this “back of the envelop” assessment as a simple check.

Year	Total Energy GWhr	Ratio
2010	7,585	1.00
2017	8,666	1.14
2027	9,464	1.25
2035	10,087	1.33
2037	10,228	1.35
2041	10,493	1.38
2047	10,869	1.43
2052	11,158	1.47
2057	11,431	1.51
2067	11,979	1.58

Reference: Exhibit 1

Summer/Winter Requirements – With MF Infeed



Summer/Winter Requirements – Sensitivity

- Based on the assumed generating profile for the MF facility, the demand in the winter months (per the NALCOR demand profile) will be near the capacity of the MF facility minus the commitment to Emera in 2035. This is 17 years before the NS block term is completed.
- These results can be improved by increasing the efficiency of the MF facility in the winter months to above 90%. This will match the Upper Churchill generation per the GWAC.
- The author has yet to find evidence within the PUB submission which shows that NALCOR has considered this timed delivery on a monthly / hourly basis. The issue of water ability to allow MF to generate at peak capacity in the winter has been raised by many pundits, including Tom Adams.

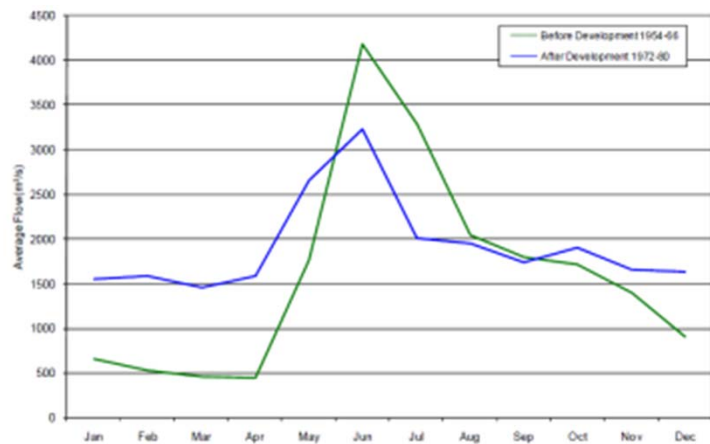


Figure 5-3 Average Monthly flow at Muskrat Falls - Before and After Churchill Falls Power Station Operation

Source: Volume 1, Part A
Lower Churchill
Hydroelectric Station EIS.



Summer/Winter Requirements – Sensitivity

- The basic question has also been asked by the author:

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- 1 Q. Consumer Question: NALCOR requested to provide a monthly profile for MF
2 generation, Island Consumption and potential export sales in the interconnected
3 island option. This shall be for 2035 when there is a deficiency anticipated per the
4 980 GWhr commitment to Emera.
5
6
7 A. The information requested does not assist consideration of the Reference Question,
8 as neither the Terms of Reference nor the Reference Question addresses matters
9 related to export sales.

- This should be a simple question, with an existing answer. Has it been done?
- This question should also be asked for the base case (No Emera) to also answer the various questions asked by Tom Adams and others.



Maritime Link – Energy Delivery Requirements

- In addition to the monthly generation the Term Sheet signed by NALCOR and Emera does not seem to be specific as to when the NS Block will be delivered. However there is a section in the term sheet which refers to:

7. POWER AND ENERGY SUPPLY

- (a) Subject to the provisions of sections 6(d) and (e), during the Initial Term, Nalcor shall deliver to Emera the Nova Scotia Block at the Delivery Point at a constant rate on a sixteen (16) hour basis, from 7:00 a.m. to 11:00 p.m. Atlantic Time.

- This should be reviewed. If the 980 GWh is to be delivered on an equal basis of 365 days a year between the hours of 7:00 AM and 11:00 PM then the power requirements are.

980 GWhr →

2.68 GWhr per day based on 365 days a year

2.68 GWhr per day →

167 MW of continuous requirements per that time

- The requirements for EMERA is 167 MW in peak times only.
- Does this limit the ability for NL to service our own requirements, and to sell power if Emera already has the peak time covered?

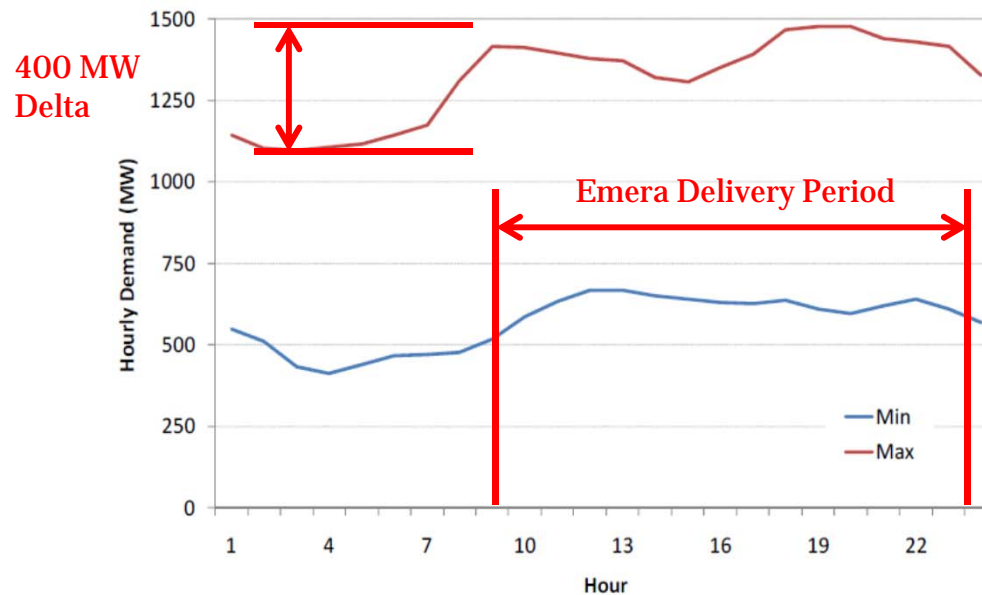
Summer/Winter Requirements – Sensitivity

- However, the requirement for the Emera power to be delivered over 16 hours a day may further limit the ability for the MF facility to meet the requirements for the island of Newfoundland in the winter months.
- Will the export market be primarily in the off peak hours. How does this impact the sales rate?

NAVIGANT

Introduction

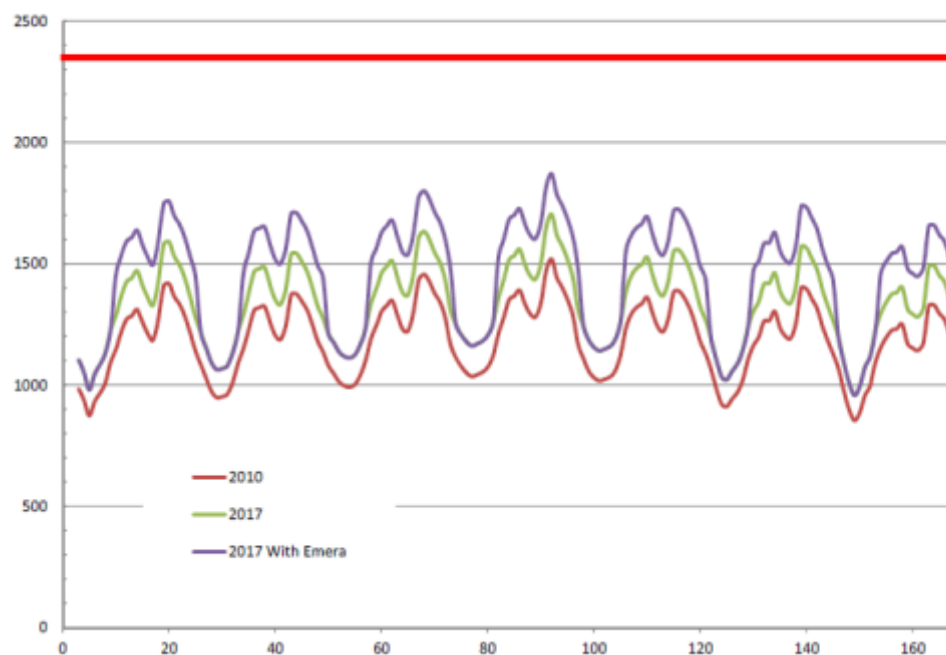
Figure 5: Minimum and Maximum Island Daily Demand, 2010



Source: Nalcor and Navigant Analysis

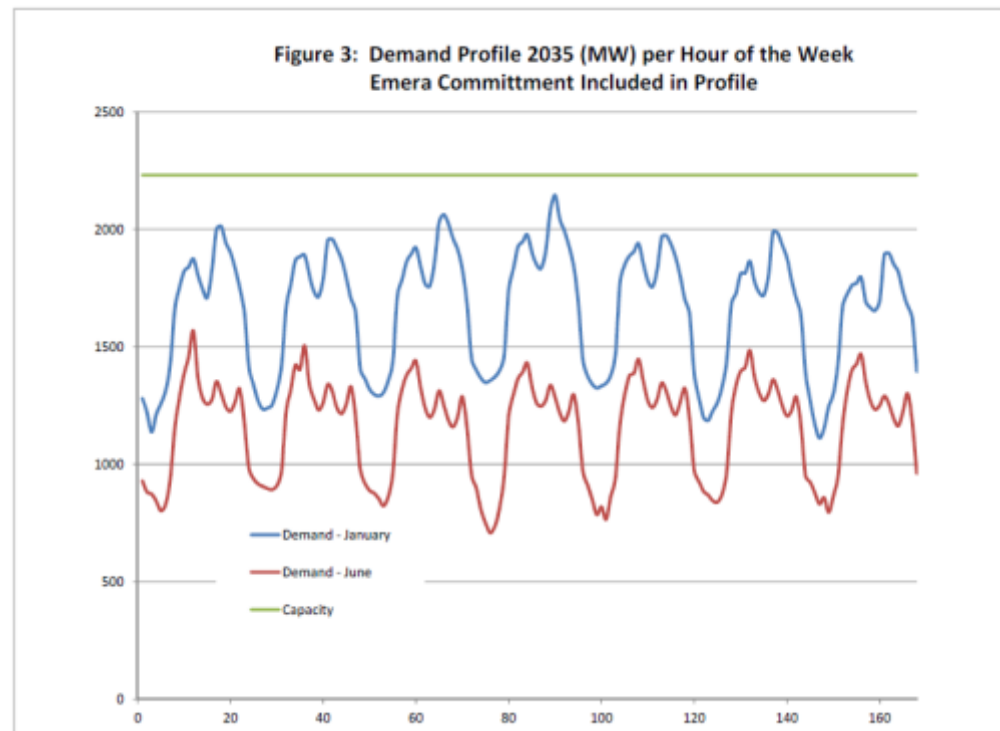
Daily Demand Profile – Winter Months

Figure 2: January Demand Profile (MW) per Hour of the Week



- Exhibit 2 provides the hourly demand profile. The author has extrapolated this based on the changes in overall annual energy demand. The 2017 line is the projected hourly demand profile
- The Purple line is the EMERA hourly commitment superimposed on the island demand.
- The RED line is the installed capacity (MW) of the island considering Muskrat Falls.

Daily Demand Profile – Winter Months



- Following a similar approach the demand has been extrapolated to 2035.
- The day time demand is very close to the overall installed capacity.
- The “night” or “off peak” demands are well less of the peak demands.
- This raises some basis questions which have been raised by the Author.



Daily Demand Profile – Winter Months – Basic Questions

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- 1 Q. Consumer Question: Has a full analysis of EMERA power requirements been
2 completed in Strategist. What additional capacity requirements are required for
3 the interconnected scenario in the winter months? Has this been completed on an
4 hourly basis over the full period of 2017 – 2067.
5
6
7 A. The analysis requested does not assist consideration of the Reference Question, as
8 neither the Terms of Reference nor the Reference Question address export sales to
9 Emera.



Daily Demand Profile – Winter Months – Basic Questions

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- 1 Q. Consumer Question: What would be a realistic price for surplus energy considering
2 that it is to be sold primarily in off peak times. The GWAC contract has a very
3 pronounced difference in peak and non-peak rates in the winter (Peak = 22.8
4 \$/MW-hr versus Non-Peak = 6.7\$ \$/MW-hr). Is this considered representative?
5
6
- 7 A. The information requested does not assist consideration of the Reference Question,
8 as neither the Terms of Reference nor the Reference Question addresses matters
9 related to export sales.



EMERA Recap (Rev. 1 Addition)

- Within the previous slides the Author has attempted to review the EMERA deal in the context of the PUB submission. The commentary has been made in the context that the RECALL power has been excluded (Ref. Slide 118).
- This is consistent with the commentary from NALCOR that Emera will get 20% of the energy for 20% of the costs. From the November 18, 2010 press release announcing the deal.
 - Approximately 1.0 terawatt hours per year, or 20% of the output of Muskrat Falls, will be provided to Emera Inc. for use in Nova Scotia. In exchange, Emera will invest over \$1.2 billion, or 20% of the overall capital cost of the entire project, and will be responsible for 20% of the operating costs of the entire project for the 35 year life of the contract. As an additional investment, but not associated with a power sale, Emera will invest approximately \$600 million towards the Labrador-Island Link in exchange for transmission rights for Nalcor Energy in Nova Scotia, New Brunswick and New England.
- However, a last minute review of the MHI report has indicated that the recall power has been included in the CPW assessment completed by NALCOR. ***The previous slides have not been changed, but Slides 142 - 148 have been added to the current revision. No other changes have been made to the presentation from the Rev. 0 version.***

EMERA Recap (Rev. 1 Addition)

- There has been 5943 GWhR of energy production added in 2017 in the Strategist calculations (According to MHI). This is presumably for RECALL power added to the 4900 GWhR of average energy from MFGF. NALCOR should confirm this.
- There remains additional generation added latter in the review period to account for peak requirements.
- As there is plenty of “Energy Surplus” has this additional capacity been added to meet the EMERA requirement.
- Is this additional capacity added only for the EMERA commitment?
- Will the Emera Commitment require additional generation to meet the domestic demand?
- In the opinion of the author there remains many questions, and little public data relating to the details of the EMERA partnership.
- **The terms of reference should be extended to review this critical element of the project.**

Table 32: Energy Balance for Infeed Option

Year	Forecast Requirement		Firm Avail.	Energy Surplus	Additions and Retirements		Addition	Retirement
	MW	Firm (GWh)	(GWh)	(GWh)	Addition	Retirement	(GWh)	(GWh)
2010	1,519	7,585	8,953	1,368				
2011	1,538	7,709	8,953	1,244				
2012	1,571	7,849	8,953	1,104				
2013	1,601	8,211	8,953	742				
2014	1,666	8,485	9,347	862	50 MW CT		394.2	
2015	1,683	8,606	9,347	741				
2016	1,695	8,623	9,347	724				
2017	1,704	8,663	15,290	6,627	Muskrat Falls / HVDC Link		5943.0	
2018	1,714	8,732	15,290	6,558				
2019	1,729	8,803	15,290	6,487				
2020	1,744	8,874	15,290	6,421				
2021		8,965	12,294	3,329				
2022	1,776	9,062	12,229	3,167		Holyrood 1, 2 & 3 Hardwoods CT1 & CBP Co-Gen		-2995.9
2023	1,794	9,169	12,229	3,060				
2024	1,813	9,232	12,229	2,997		Stephenville CT1		-65.0
2025	1,827	9,290	12,229	2,939				
2026	1,840	9,372	12,229	2,857				
2027	1,856	9,461	12,229	2,768				
2028	1,872	9,543	12,062	2,519		2x27 MW Wind farms		-167.0
2029	1,888	9,623	12,062	2,439				
2030	1,903	9,701	12,062	2,361				
2031	1,918	9,779	12,062	2,283				
2032	1,934	9,857	12,062	2,205				
2033	1,949	9,935	12,062	2,127				
2034	1,964	10,014	12,062	2,048				
2035	1,978	10,084	12,062	1,978				
2036	1,992	10,154	12,161	2,007			99.0	
2037	2,006	10,225	13,501	3,276	Portland Creek 170 MW CCCT		1340.0	
2038	2,020	10,295	13,501	3,206				
2039	2,033	10,365	13,107	2,742	50 MW CT			-394.2
2040	2,047	10,428	13,107	2,679				
2041	2,058	10,491	13,107	2,616				
2042	2,070	10,554	13,107	2,554				
2043	2,082	10,616	13,107	2,491				
2044	2,095	10,678	13,107	2,429				
2045	2,107	10,741	13,107	2,366				
2046	2,119	10,803	13,501	2,698	50 MW CT		394.2	
2047	2,132	10,866	13,501	2,635				
2048	2,144	10,928	13,501	2,573				
2049	2,156	10,991	13,501	2,510				
2050	2,167	11,046	13,896	2,850	50 MW CT		394.2	
2051	2,178	11,100	13,896	2,796				
2052	2,188	11,155	13,896	2,741				
2053	2,199	11,210	13,896	2,686				
2054	2,210	11,264	14,290	3,026	50 MW CT		394.2	
2055	2,220	11,319	14,290	2,971				
2056	2,231	11,374	14,290	2,916				
2057	2,242	11,429	14,290	2,861				
2058	2,253	11,483	14,684	3,201	50 MW CT		394.2	
2059	2,263	11,538	14,684	3,146				
2060	2,274	11,593	14,684	3,091				
2061	2,285	11,648	14,684	3,036				
2062	2,296	11,702	14,684	2,982				
2063	2,306	11,757	15,078	3,321	50 MW CT		394.2	
2064	2,317	11,812	15,078	3,266				
2065	2,328	11,866	15,078	3,211				
2066	2,339	11,921	15,472	3,551	50 MW CT		394.2	
2067	2,349	11,976	14,132	2,156		170 MW CCCT		-1340.0

EMERA Recap (Rev. 1 Addition)

- The Author assumed that the recall power would be continued to be wheeled through Quebec for additional revenue generation with potential to redirect to Labrador as required.

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Executive Council
Natural Resources
April 2, 2009

Historic Arrangement Sees Newfoundland and Labrador Wheel Upper Churchill Power Through Quebec to North American Markets

For the first time in the province's history, Newfoundland and Labrador is now wheeling hydroelectric power through neighbouring Quebec into the North American marketplace. The Honourable Danny Williams, Premier of Newfoundland and Labrador, today announced that the province's energy corporation, Nalcor Energy, through its subsidiary, Newfoundland and Labrador Hydro (Hydro) has signed an agreement to wheel power through Quebec to the Canadian – United States border.

"This is truly a historic and momentous occasion for the people of our province, as never before have we been granted access through the province of Quebec with our own power," said Premier Danny Williams. "Today marks another significant milestone for us as a people, as we continue on our path to self-reliance and long-term prosperity. This power sales arrangement puts us squarely in the game as a hydroelectricity producer and seller. We have clean, hydroelectric generation being sold from Newfoundland and Labrador and finding its way into the North American market place. Just as we have taken equity stakes in our offshore resources, we see tremendous potential for long term value in entering this business and will continue to assess this potential."

N.L. signs historic deal to sell Churchill Falls power to U.S.

April 2, 2009 - The Associated Press

"Our confidence has grown," said Nalcor Energy president Ed Martin.

"We've done a bunch of historic work indicating that if we had this type of arrangement over the past five to 10 years, we would've made upwards of maybe 40 to 45 per cent more than we would've under other arrangements."

At peak, the province will be able to sell 250 megawatts of energy to the North American grid, Martin said.

Based on current electricity prices, Newfoundland and Labrador could earn about \$40 million to \$80 million in profits annually, Martin said.

- From the information the Author reviewed within the PUB submission there was little to no information about using this Recall power for the Emera commitment.
- The information from the government is that the Emera Block represented 20% of the MF generation.



EMERA Recap (Rev. 1 Addition)

- Nalcor need to provide clarity around this, as maybe it is purely a typo within the MHI report. However, as it currently stands
 - ❑ NL rate payers will buy the full production from MFGF on a take or pay basis. The NL rate payer will take all risk on the construction cost, and the final cost per kwhr based on demand.
 - ❑ The NL rate payer will pay for the transmission across the LIL (which is jointly owned between NALCOR and EMERA). This will be a conventional COS structure, where the NL ratepayer will take all construction costs risk, and the final cost per kw/hr based on the actual demand per the take or pay deal.
 - ❑ EMERA will build the Maritime link to NL, which they will be entitled to 1 TWhr of energy. This energy is not coming from MFGF, but is in fact the Recall Power from the Upper Churchill. They have to build a cable and plug it in.
 - ❑ NL rate payers will take a partial risk in cost over-runs in the Maritime Link. EMERA will make a regulated profit in accordance with the original press release from NALCOR (backgrounders).
 - ❑ NALCOR will have free access to wheel excess energy over the Maritime Link, but will have to pay a tariff to both Emera and New Brunswick to wheel the additional power. NALCOR has refused to answer what this tariff would be.
 - ❑ The NL ratepayer has received no assurance that any of this additional revenue will be used to offset the rate to the NL consumer.
 - ❑ If the NL demand projections hold true, it is unclear how any additional power can be provided to Labrador without developing new generating facilities, or purchases through HQ.

EMERA Recap (Rev. 1 Addition)

- Consider NALCORS own view http://www.nalcorenergy.com/assets/pdf/faq%20-%20surplus%20electricity_july%2019%202011%20final.pdf



Muskrat Falls Development: Frequently Asked Questions

EXPORTING SURPLUS POWER

Q1: Why is Nova Scotia getting electricity from Newfoundland and Labrador?

Nova Scotia is required to meet regulatory requirements for clean, renewable energy by 2020 to reduce their reliance on coal-fired plants. Emera Inc., Nova Scotia's energy company, expressed an interest in Muskrat Falls as an option to offset their coal-fired electricity. Through Nalcor's agreement with Emera, a 20% block of Muskrat Falls energy will be reserved for Nova Scotia, which means Muskrat Falls will provide approximately 10% of Nova Scotia's total electricity supply.

Q3: Will power be available for new industries in Newfoundland and Labrador or will it all be sold outside the province?

Forty per cent of the power from Muskrat Falls will be available for export outside the province. Nalcor will be able to recall this power at any time and use it for industrial development in Newfoundland and Labrador.

Q5: What happens to revenue from selling surplus power? Will it subsidize our rates?

Revenue from the sale of surplus power from Muskrat Falls will be added to Nalcor's total annual earnings. This extra revenue, along with new revenues from our oil and gas projects for example, will improve Nalcor's financial performance. As Nalcor's 100% Shareholder, the Government of Newfoundland and Labrador will decide what to do with profits the company earns. Government will also decide if the money should be used to subsidize electricity rates for Newfoundlanders and Labradorians.

This is a nice way of saying we will be raising taxes through electricity rates.



EMERA Recap (Rev. 1 Addition)

- The Author will repeat earlier statements that the EMERA partnership has such a fundamental impact of the economics of the project that it must be reviewed properly. Right now it is not.
- This may be a good deal, however the economic analysis nor the transparency are to the level to allow the public to reach an informed decision.
- What is in the terms of reference however is the impact that this use of the Recall power in the interconnected option has on the CPW analysis.
 - ❑ The premise of a CPW analysis is that the benefits between the options are the same. Consider NALCOR's response to RFI –CA/KPL-NALCOR-183.
 - ❑ With the RECALL power being considered in the interconnected option, the CPW analysis is not valid as the benefits are not the same. There is 40-80 million of annual revenue associated with the RECALL power sales through Quebec. The reduction in this revenue stream must be duly included within the CPW analysis between the 2 options. It is unclear at present if it is. This should be queried by the PUB.
 - ❑ Considering the combination of sensitivities (Cost Growth, Demand Management), a risk hurdle approach, the inclusion of RECALL revenue reduction, and the adjustment of the discount rate to reflect the final financing details will the Interconnected Option still be preferred??? Slide 89 must be completed to know.

EMERA Recap (Rev. 1 Addition)

- The Author has been raised by the Author. It should be raised within the House of Assembly prior to the project being sanctioned.

CA/KPL-Nalcor-163
Muskrat Falls Review

Page 1 of 1

- 1 Q. Consumer Question: With respect to the potential power exports in the early
2 stages of the project can it be confirmed that the revenue will be directed to lower
3 rate payer rates. Please provide a Yes or No answer.
4
5 (a) If Yes, what is the expected power sales, and how much will the rates
6 decrease because of the Emera partnership.
7
8 (b) If No, please explain to the NL rate payer as to why not.
9
10
11 A. The information requested does not assist consideration of the Reference Question,
12 as neither the Terms of Reference nor the Reference Question addresses potential
13 power exports.

- If the answer remains No, then we need to have a general discussion about what is effectively a tax on the NL ratepayers to pay for general government spending (See Slide 155). This is a public policy question, which should be properly classified, and openly debated.



Redress of the 2016 Renewal



Other Considerations – Redress of the 1969 Contract

- **Nalcor has initiated a review of the original 1969 contract within Quebec courts. It is premised upon good faith obligations throughout the life of a contract.**

In 2009, CF(L)Co formally requested that Hydro-Québec enter into discussions to amend the pricing terms for the remainder of the 1969 Power Contract. Hydro- Québec did not respond and therefore, in early 2010 CF(L)Co filed a motion against Hydro-Québec in Québec Superior Court seeking to change, as of November 2009, the pricing terms for the remaining term of the Power Contract. It is the position of CF(L)Co that the change in circumstances since the original contract was signed, has resulted in a gross inequity in the distribution of contractual benefits. This situation, combined with the obligation under the Québec Civil Code to act in good faith throughout the term of a contract, CF(L)Co believes obliges Hydro-Québec to renegotiate the terms of the contract to re-establish the equilibrium of benefits.

2011 NALCOR Strategic Plan

- **During the course of this research it is clear to the Author that there is an legal argument that the original contract was signed under duress (P. Smith, 1975 “Brinco: The Story Of Churchill Falls”). This has been previously suggested by Feehan and Baker in the Dalhousie Law Journal.**
- **It has been presented that the original Letter Of Intent indicated that the renewal clause would contain “upon mutually agreed terms” which was latter removed in a “do or die” position (Ref. Feehan and Baker “The Churchill Falls Contract and Why Newfoundlanders Cant Get over It)**



Other Considerations – Redress of the 1969 Contract

- As promoted by Feehan and Baker if the principles of economic duress can be validated there is a case to be argued that the contract should revert to the original terms of the LOI. This being, that the 2016 renewal should not in fact be automatic, but should be negotiated.
- Furthermore there may be an argument that Bylaw 13 of the shareholders agreement (if it still exists) should be revoked.
- The ideas suggested by Feehan / Baker should be reviewed and investigated by NALCOR. Any commitment on MF generation should be reviewed in this context.
- The applicability of “economic duress” within Quebec civil code should be understood.
- Again NALCOR educating the public on the legal position may sway public opinion towards a MF project.



Redress of the 1969 Contract: Doctrine of Economic Duress

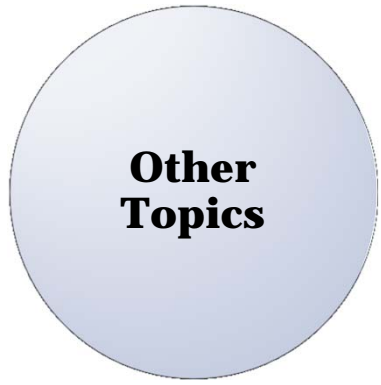
Source: Essentials of Canadian Law, "The Law of Contracts". John D. McManus

- In English law the recognition of economic duress as a form of coercion that could undermine the enforceability of a contract did not happen until the late 1970's
- There are 2 general principals to be applied to as a test to the doctrine of economic duress.
 - (i) Lack of Practical Alternative

From the 1975 book by P. Smith it is documented that BRINCO had no alternative but to sign the contract with Hydro Quebec. The alternative would have been bankruptcy. The description of the "do or die" aspect of the renewal term was very clear that this was being forced by HQ. As a partner within CFLCo, HQ were very clear of the economic situation BRINCO were in during the time leading up to the final agreement of the 1969 contract.

(ii) Illegitimacy of the Threat

Was the pressure exerted by HQ in the negotiations normal or legitimate types of commercial pressure, or was it illegitimate? As a LOI existed which allegedly contained the renewal clause subject to mutually agreed terms it is clear that there was agreement, subsequently changed. I am not sure if this would meet the requirements of good faith bargaining. The other commercial pressures, including the continual decrease of the final negotiated price, would also add further evidence to the changing pendulum at the negotiating table. The delay to the project, and the deepening of Brinco's financial problems, clearly eroded their bargaining position to where on several key aspects the final agreement was much more one sided than the original Letter of Intent.



**Other
Topics**

Ready for 2041

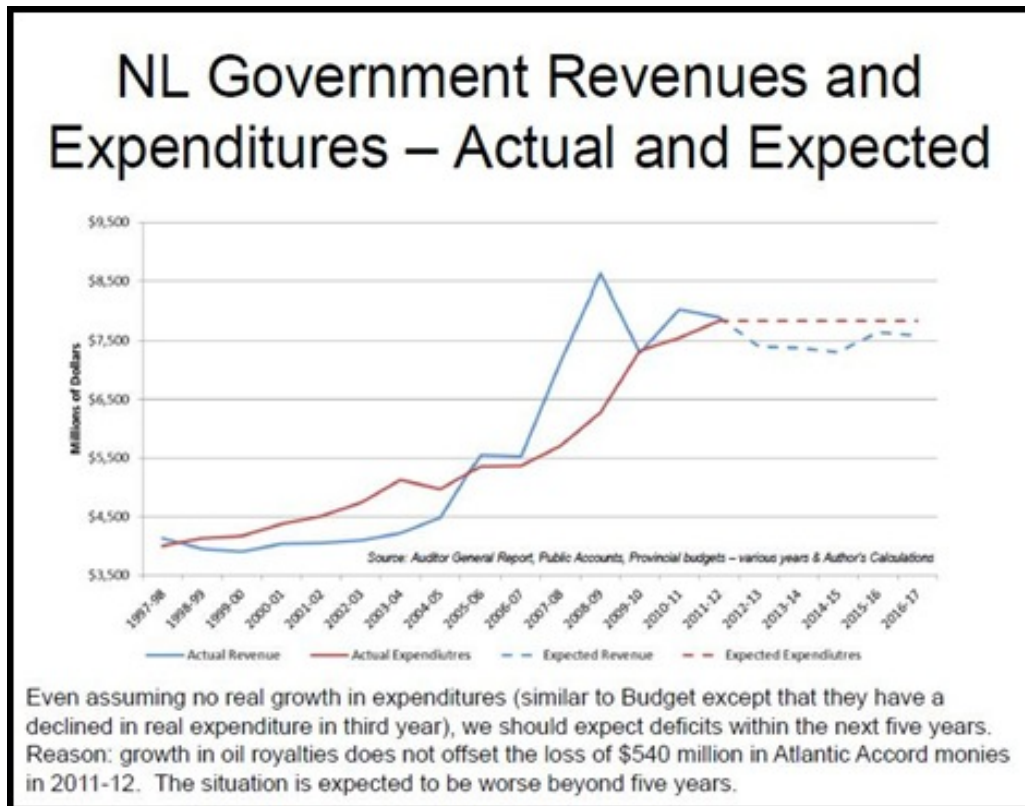


2041 Re-Negotiation

- Notwithstanding the previous section, the 1969 contract will expire in 2041 at which point the Government of Newfoundland will have to:
 1. Negotiate with HQ to continue to use the existing power routes.
 2. Be able to freely transmit power through Quebec, and invest in new transmission activities
 3. Invest in a large cable through the Anglo-Saxxon Route
- CFLCo / NALCOR must be in a position to engage a large multi-billion project in 2035, in order to achieve the best negotiating position with Hydro Quebec.
- Will NALCOR and/or the province be in a position to engage in such an activity if we proceed with MF + LIL developments now?
- Will our desire to develop the Lower Churchill limit our ability to negotiate the best deal in 2035 for the Upper Churchill Power? As per Brinco in 1966 will we be cash short, and effectively at the mercy of Hydro Quebec?
- With Hydro-Quebec's ramp up of hydro in Quebec, and the explosion of shale gas will NALCOR be able to sell power at a rate sufficient to pay for the transmission.
- Will we be any more effective in negotiating with Nova Scotia and New Brunswick than Quebec?

2041 Re-Negotiation

- There are 3 important items to consider in this argument. Current government spending trends, future oil production, and debt obligations under the MF deal.

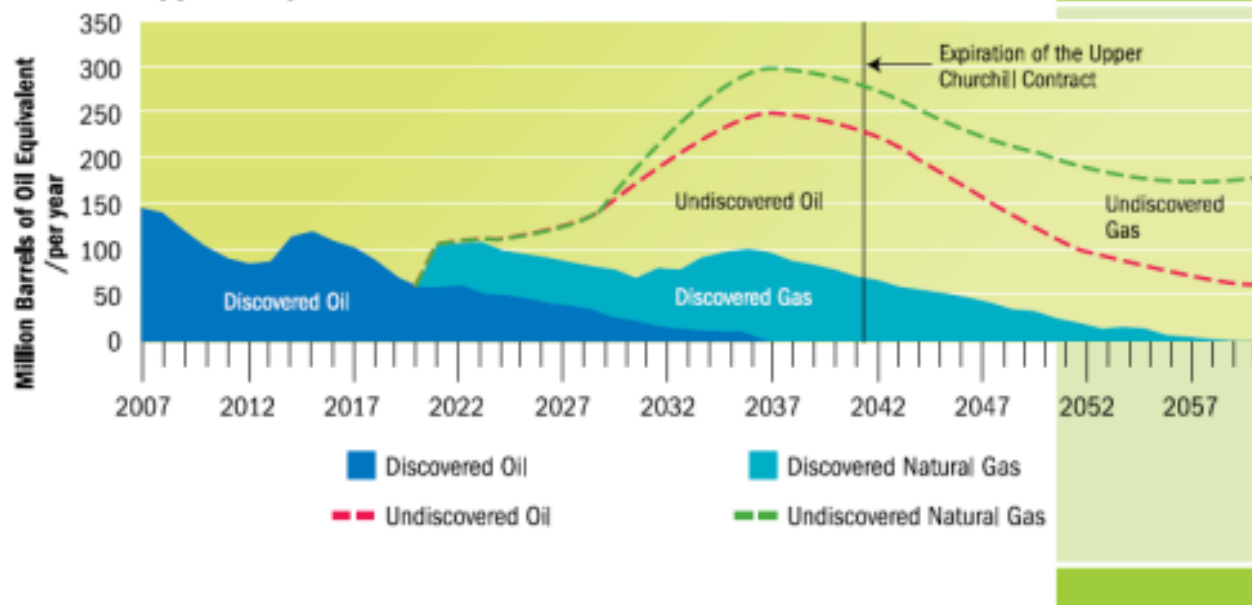


**There has been
a ~52%
increase in
government
spending since
2004-2005**

**Ref: Wade Locke May Presentation to
Conference of NL Credit Unions**

2041 Re-Negotiation

Figure 2.2
Potential Opportunity for Petroleum Production: 2007-2060




Even with Hebron the majority of the MF debt will be repayed in a period of declining oil production.


Ref: 2007 Energy Plan

2041 Re-Negotiation - Debt

Ref: Wade Locke Presentation to Harris Center



Debt Implications of Borrowing Set Principal for 30 Years at Various Interest Rates – Annual Payments



	\$3 B	\$4 B	\$5 B	\$6 B	\$7 B	\$8 B
5%	\$195 M	\$260 M	\$325 M	\$390 M	\$455 M	\$520 M
6%	\$218 M	\$291 M	\$363 M	\$436 M	\$509 M	\$581 M
7%	\$242 M	\$322 M	\$403 M	\$484 M	\$564 M	\$645 M
8%	\$267 M	\$355 M	\$444 M	\$533 M	\$622 M	\$711 M
9%	\$292 M	\$389 M	\$487 M	\$584 M	\$681 M	\$779 M
10%	\$318 M	\$424 M	\$530 M	\$637 M	\$743 M	\$849 M

If the one could borrow between \$5 billion to fund Muskrat Falls at between 7% and 8% over a 30 year term, then a cash flow of \$400 and \$450 million would be needed.

- To put this debt into perspective the total revenue for NL hydro in 2009 was 573 million CAD (Source:http://www.nalcorenergy.ca/assets/derrick%20sturge%20-%20agm%202010_final%20final%20june%2009.pdf)
- This is not a negligible debt burden.
- The inputs of Fortis and Newfoundland Power would be appreciated in this scenario.



2041 Re-Negotiation

Consider

- A life with oil production less than 100,000 barrels a day combined.
- Considering the entrance of Shale Gas there is no gas production on the Grand Banks
- 35% of the population above 65 yrs old.
- Un-quantified provincial pension liabilities.
- A provincial debt in excess of 10 Billion (in 2010 dollars).

Will our desire and ambition to develop the Lower Churchill eventually preclude our ability to address the Upper Churchill. In 20 years when we will need to begin planning for the 2041 end of contract, will we have all options within our means?

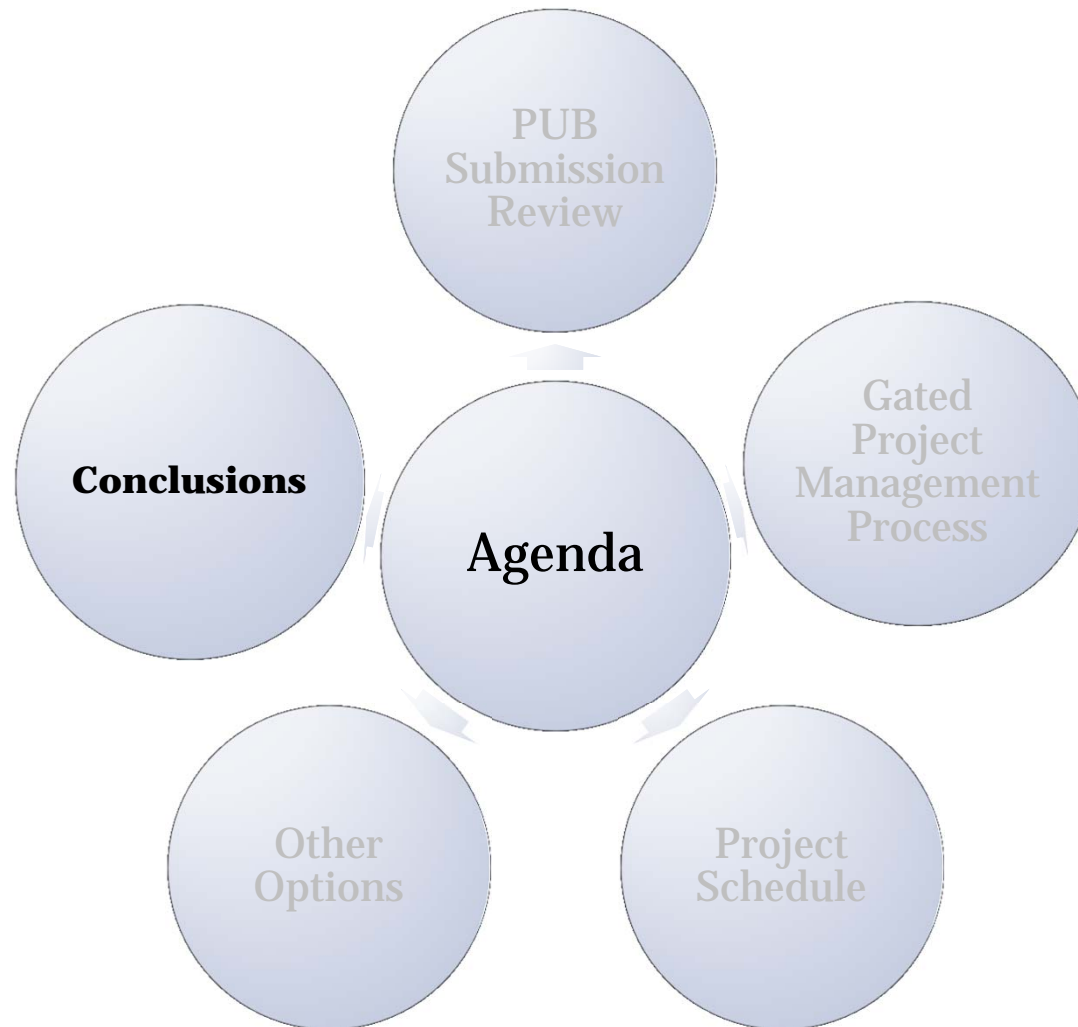


Labrador Demand



Labrador Demand

- Within the public input process into the PUB review there was considerable discussion relating to the potential energy requirements in Labrador.
- From Yvonne Jone's presentation (Page 78 of Transcript for February 21, 2012) the following are listed:
 - ❑ IOC expansion – 200 MW
 - ❑ New Millennium – 300 MW
 - ❑ Alderon's – 50 MW
 - ❑ Vale – 50 MW
 - ❑ Others – 50 MW
- It is not clear what this energy requirement would be. But assuming consumption at 50% of capacity requirement this would be in excess of the generation of Muskrat Falls.
- NALCOR have no firm commitment with respect to this requirement yet. However, it should be within the next 5 years.
- The Labrador + Island demand will be much greater than MF. Are we better off in waiting to determine if Gull Island (16 GWhr) of energy would not be a better option?
- Should NALCOR not consider industrial partners to help share the risk with the hydro development.
- Again this is a strong argument for the Phased Approach to the development.





Recommendations Prior to DG3

Based on the research of the author it is recommended that the following activities be completed prior to Project Sanctioning:

- 1) Determine when the energy deficiency will occur with a SOBI + LIL and Portland Creek Scenario.
- 2) Pending the results of 1 limit expenditures on the MFGF to engineering only (ie; not site clearing etc).
- 3) Complete a screening study on natural gas. This would consider Newfoundland gas, as well as international LNG imports.
- 4) Complete a Monte Carlo simulation of Costs (commitment of NALCOR in PUB hearings).
- 5) Complete a Monte Carlo or probabilistic assessment of the demand projections based on the most recent census results.
- 6) Reconfirm the model used to predict peak demand, especially considering the increasing percentage of energy consumption which is based on home heating.
- 7) Based on 3-5 complete a full and complete CPW assessment as presented within Slide 89. This specifically includes a phased approach to the project, with a delayed MFGF
- 8) Include a full assessment of the EMERA deal including the daily and monthly energy profiles as suggested herein.
- 9) Evaluate the Labrador potential. Review the potential of Gull Island in light of this.



Conclusions

Consider the 4 basic questions from the second slide of the presentation.

1. Do we need the additional electricity?
2. Is the Muskrat Falls the lowest cost option?
3. Considering the relative robust economic outlook for the next 4 years, why are we completing the largest public works project in our provinces history now?
4. Does the Emera partnership add value to the people of the province?



Do We Need the Additional Electricity?

Newfoundland is presently in a period of relative economic prosperity, fuelled by the offshore oil and mining industries. The present overlap of major resource projects has created a hyperinflationary effect within the North East Avalon. The rural regions are also experiencing surprisingly strong housing growth based on remittance payments from Alberta, and returning Newfoundlanders. The strong economic performance is driving the short term energy demand growth, even in the absence of major population changes.

This economic prosperity should be reviewed in context. The effects of an inevitable economic slowdown, combined with the unique changes in Newfoundland's social demographics, may have a very pronounced impact on energy requirements within the island. Furthermore the future of the Corner Brook Mill is also very much in doubt. The closing of one of the islands largest industrial consumers would have a further impact on the demand projections.

If everything continues as they are, we will need the power eventually. However these inputs change, and the economic analysis justifying the large Muskrat falls expenditure should account for this variability. The people at risk are the Newfoundland rate payer, as under the proposed Power Purchase Agreement the take or pay basis ensure that the risk is transferred directly to us.

So in the absence of an immediate need for power the question must be asked. If we can wait, why don't we wait. A delay of 4-5 years would put us on the back end of several major resource projects (Hebron, Vale, Husky White Rose Platform). There will be a much more realistic view on the provinces economic future, which will be premised on any additional deepwater reserves on the Grand Banks. Within 4-5 years, the current offshore prospects (Mizzen, Ballicaters, Orphan) will either be Feed Projects, or abandoned exploratory wells. Within 4-5 years the major potentials of the Labrador mining belt will also be known. In 4-5 years the demand will either be minimal, exceptional or something in between. For the first 2 of these alternatives MF is not the right solution.

We will need the electricity, but immediate access to the Recall power will ensure that this needs is not in the foreseeable future. If we can wait it would be prudent to wait.



Is Muskrat Falls the Lowest Cost Option?

The NALCOR submission to the board does provide ample evidence to answer the terms of reference. The interconnected option is preferred over the isolated thermal oil option. Muskrat Falls is more economical than continued oil generation at Holyrood. However, is it the least expensive option to the people of Newfoundland and Labrador? The answer is that we are unsure.

As many pundits have pointed out, there have been several omissions from NALCOR's work to date, namely the Grand Banks gas option, LNG imports, and power purchases from Quebec. I would also like to add that a variation of the option proposed by NALCOR, with a early Portland Creek Facility and a delayed MFGF may ultimately have a lower CPW. There remains fundamental screening work which should be completed prior to any project sanctioning.

When the project mandate changed from developing the lowest cost Lower Churchill power for export to that of supplying the island demand NALCOR had an obligation to review all available options. The inclusion of gas to wire generation should have been included within this assessment, as committed within the 2007 Energy Plan. There will be those that indicate that it is now too late to review this option. This argument should be resisted, as this work should and can be completed for the DG3 decision.

With respect to power purchases from Quebec this may not be a popular alternative. However, we as a people must be mature enough to realize that a short term (20 year) power purchase at market rates, must be preferred over a massive debt commitment, and ultimately higher cost power.

Therefore to answer to the question, in the opinion of the author even after 200 million dollars spent, there is not a definitive answer to this question.



Why are we Completing this Project Now?

The author migrated from Newfoundland in the late 90's. As the saying went "you could not buy a job" Within St. John's things are very different now. The economy is very brisk, and some would say hyper-inflated. There are 3 major projects underway, which are employing scores of people, and keeping local fabrication shops very busy. This is true of the NE Avalon and Western Labrador.

However in 2017 things will be very different. The current resource projects will be completed, and the major offshore prospects are likely not be the construction phase, if they happen at all. The provincial government acknowledge this natural downturn and are predicting a loss of 5% of the jobs within their 2020 Employment Outlook.

If there was no immediate need for additional energy it is unclear why the Lower Churchill project should be completed now. A delay of 4-5 years would bridge the gap on the employment front. It would provide longer term sustainability, and growth. It would also help curb the hyper-inflation of the St. John's economy. Most importantly it would maximize long term benefits to the Newfoundland supply chain, and labour force.

Even though the politicians say there will be blackouts by 2019, I do not believe this is true. We can accommodate a delay, through an early LIL with access to recall power, and with aggressive demand management. There are many advantages to this deferral, or at least a partial deferral of the non time critical components. This should be given due consideration by Government and Nalcor.



Does the Emera Partnership Add Value?

The author has attempted to ask some pertinent questions related to the EMERA deal. There are 2 obvious advantages offered by the partnership. First the ability to export power will provide some mitigation to the risk of the domestic island demand not increasing as per the current Nalcor projections. The second advantage is that it provides secondary access to the larger North American grid, and will therefore add security to our energy supply.

These are very important benefits, however the Maritime Link does have some disadvantages:

1. NALCOR, and therefore the province, do take some element of risk in the event there are project overruns.
2. The 1 TWhr of energy may be required for domestic requirements if island demand grows faster than expected. The author has suggested that even with NALCOR's current demand projections the Emera commitment may lead to firm energy deficiencies in the 2035-2040 period.
3. Assuming an additional power sales are benchmarked to projected US prices the "gravy" offered by access to markets may not be that lucrative due to the Shale Gas revolution happening in North East US.

As the Emera Term Sheet has not been included within the PUB review there is limited financial analysis available within the public domain. It is therefore difficult to make a firm opinion on the question. However I again do not see the urgency to sign this agreement. The delays would allow NALCOR to firm up demand, especially in Labrador, prior to offering 20% of the electrical generation. Slide 89 must be completed to make the decision.

This should be a key part of the debate when the House of Assembly opens.



Conclusions

Considering these basic points, and with further investigation summarized herein, the author has reached the personal conclusion that the Labrador-Island-Link (LIL) and the Strait of Bell Island (SOBI) crossing should be completed within the current project schedule, however the Muskrat Falls Generating Facility (MFGF) should be delayed until the demand requirements are certain. This conclusion is qualified on the completion of a full screening assessment of the Natural Gas opportunities.

The construction of the LIL and SOBI would provide immediate access to Upper Churchill recall power, and will also provide the further advantage of greater system reliability. This should defer the capacity and energy deficiency currently predicted to be 2015 and 2019 respectively, well into the next decade. A delay to the MFGF decision will allow time to review the potential Labrador power requirements, provide further certainty concerning the Corner Brook Mill, and alternate sources of energy such as shale gas. A decision can then be made on a near term basis when this information is better known. It could be that with the additional requirements in Labrador a “Gull Island First” option may be ultimately preferred.

In this presentation the author has presented various analysis and commentary. I may be incorrect in some of my analysis and assumptions. As this is not my core business I apologize for any errors or omissions. However I do hope that I have been able to stir further debate within the minds of the reader on this very important issue.



Conclusions - Others

However, the Panel concluded that Nalcor's analysis, showing Muskrat Falls to be the best and least-cost way to meet domestic demand requirements, was inadequate and recommended a new, independent analysis based on economic, energy and environmental considerations. The analysis would address domestic demand projections, conservation and demand management, alternate on-Island energy sources, the role of power from Churchill Falls, Nalcor's cost estimates and assumptions with respect to its no-Project thermal option, the possible use of offshore gas as a fuel for the Holyrood thermal generating facility, cash flow projections for Muskrat Falls, and the implications for the province's ratepayers and regulatory systems.

The Panel also recommended consideration of Integrated Resource Planning as a better planning approach compared to the traditional approach of forecasting loads and then finding the lowest cost solution for meeting them.

Page 8 CEAA Independent Review August 2011



Conclusions - Others

And we probably should not be too hard on Nalcor either. Hydrocarbon supply and price uncertainty has all of a sudden made this one of the most difficult times in over 30 years at which to commit to large scale electrical generation projects in eastern North America.

Cabot Martin, Letter to the Telegram September 15, 2011



Conclusions - Others

Muskrat Falls - the first phase of the Lower Churchill development – “is the second or third best solution”

Mr. Dave Vardy

Making the best use of the Lower Churchill: The Muskrat Falls development”



Conclusions - Others

Conclusion

The electricity options facing Newfoundland are costly. Making the right choice, getting the timing right, and maximizing the net benefits have to be based on the correct price signals. The provincial government should allow efficient pricing and then reconsider the options. Authorizing Muskrat Falls now would be premature and imprudent.

James Feehan
CD Howe Institute and Memorial University



Conclusions - Others

The Muskrat Falls project is by far the largest capital works project ever undertaken by the provincial government and the most important public policy issue ever to have faced Newfoundland and Labrador.

It requires careful and comprehensive independent analysis and a public debate, informed by that analysis. That is the purpose of the reference to the board and to restrict that review does a disservice to the people of the province.

This project exposes us to significant risk.

*Ron Penney, Letter to the Telegram
January 12, 2012*



The Last Word

The Period from 1920-21 to 1931-32.

128. As will be seen from paragraph 117, the close of the War found Newfoundland in the enjoyment of a greater measure of prosperity than she had previously experienced. The price of codfish had risen during the War to heights hitherto undreamed of, and fishermen and merchants alike were able to congratulate themselves on the making of large profits. A great improvement had taken place in the standard of living; for the first time in their lives the fishermen had more money than they required for immediate necessities and standards were set up which in later years could not be maintained. It was forgotten that the conditions brought about by the War were transitory and exceptional; men grew accustomed to thinking in large figures and schemes and projects which a few years earlier would have seemed visionary and fantastic were regarded as the natural product of the new era. Government and people alike were the victims of an over-confidence, which, in the years following the War, was to blind them to realities, to induce a fatal disregard of the elementary canons of public finance and finally to involve them ever more deeply in financial embarrassment. Within 12 years the public debt was more than doubled. As a result of a long succession of unbalanced budgets, which in turn necessitated continuous borrowing, the financial position of the country was clearly unsound even in the seemingly prosperous years of 1929 and 1930; when the economic depression set in and the price of fish started to fall, the Island was faced with bankruptcy.

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Newfoundlander's remain the only people in the world to freely give up a democratic society. This was caused by the tremendous burden of debt. We should not enter into the Muskrat Falls commitment lightly. There has to be debate, and it should include the NALCOR officials defending the project at the House of Assembly, and answering questions from the public regardless of the Terms of Reference.