

# **Public Consultations**

(Online Comments)

Submitted

to

**The Honourable Justice Richard LeBlanc**

**Commissioner**

Commission of Inquiry Respecting the  
Muskrat Falls Project

Maurice E. Adams

Email: [adamsmaurice@nrc.ca](mailto:adamsmaurice@nrc.ca)

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**NOTE:-** The portions of my 2012 written submission to the PUB 2-option, least-cost review that precedes 'Systems Planning Assumptions' are included herein for completeness purposes only and are not intended to be relevant to this inquiry.

## PART II

### Public Comments published by The Telegram

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## 1. Preamble

### 1.1 Many of my public comments were written contemporaneously during the 2011-2012 time period.

It is my view that they are as relevant today as they were then.

Accordingly they constitute (and are hereby included/submitted as) part my 2019 online public comments to the Muskrat Falls Commission of Inquiry.

Please note that references in the 2012 PUB submission with respect to various “Exhibits” and to the “Board” for example refer to exhibits filed and on record with Public Utilities Board. The included 2012 Written Submission to the PUB is an accurate image of my February 2012 written comment to the PUB review that is on file at the PUB website

(<http://www.pub.nf.ca/applications/MuskratFalls2011/files/comments/13-MA-2012-02-28.pdf> refers).

### 1.2 I think it fair to say that the written comments, graphics and records contained herein suggest not only that many of the weaknesses in Nalcor’s assumptions, forecasts, etc. were known (and/or knowable) at the time, but that detecting and describing them did not require specialized, broadly experienced or highly qualified professional designations.

Evidence of this is seen in the consistency between the 2019 opinion of an inquiry expert witness and my 2012 PUB comments/submission. There is similar consistency between inquiry co-counsel and the comments expressed in one or more of my earlier published Telegram letters/articles. For example:

- one of the commission’s experts testified that forecasts out to 30, 40, or 50 years in the future were “**meaningless**” (yet seven years earlier, in the pre-sanction time period, in my **February 2012** written submission to the PUB, I wrote in part that “*Beyond 20 or 25 years, “risk magnification” is intensified --- and forecasts become not only unreliable --- but meaningless*”)
- I would further remind the commission that inquiry expert opinion contradicted some of the evidence of other witnesses. One or more witnesses gave evidence that the apparent increased risk associated with the far end of the 50 year CPW cost comparison period was partially mitigated due to the fact that those distant cost-related risks would be reduced when brought forward due to the nature of the present value comparison process. However, there was inquiry expert testimony that stated that ‘risk variation’ at those 30, 40, 50+ year time periods was not factored into the CPW process. This means that such risk variation (or as MHI referred to it --- risk magnification) at those later years was not factored into the CPW process,

i.e. when calculated in terms of its present value. And again, my 2012 submission makes reference to risk magnification not having been quantified by MHI,

- and also, co-counsel (Learmonth), who, near the end of his examination of another of the commission's expert witnesses, referred the expert witness to my **December 2011** Telegram article "The danger of long term forecasts" and described it (paraphrased) as an article as early as 2011 that reflected the position now being espoused by that witness

- 1.3 I would also point out that even though many of my published Telegram letters/articles deal with several, overlapping and diverse aspects of the Muskrat Falls Project and Commission of Inquiry, time and limited resources meant that I could only list each letter/article chronologically (and I was therefore not able to direct the reader to those portions of each document that demonstrate its relevance to the inquiry terms of reference).
- 1.4 Furthermore, because government, Nalcor or various witnesses may not have had knowledge "available" to the institution/agency or to them personally and/or at the time, that does not mean that it was not "available" in the public and/or professional or expert arena. And it does not provide adequate, reasonable grounds to excuse them for not seeking out and obtaining such information.
- 1.5 Also, DG2 costs were considered accurate within a plus 50 and minus 30 per cent -- ---- an 80 per cent spread (meaning that both the MF and Isolated Island cost estimates could have been within each others Margin of Error).

DG3 (the sanction) cost estimates, as I understood them, were to be within a plus thirty and minus 20 per cent error (a 50 per cent spread). Would the DG3 estimates therefore for both options still be within each others Margin of Error?



**PART I**

**Written Submission**

to the

**Public Utilities Board**

of

**Newfoundland and Labrador**

with respect

to the

**Least-cost Analysis and Review**

of the

**Proposed**

**Muskrat Falls and Labrador/Island Transmission Link**

**Hydro Electric Project**

Maurice E. Adams



## Preamble

The Terms of Reference requires that the Board determine whether presentations and submissions, or parts thereof, are relevant to the issue before the Board.

While I had intended to comment more fully on the issue that is before the Board, the limited time frame and the Board's advance Media Release stating what is not relevant and that directed interested parties to submit only those presentations, written submissions and comments that were relevant (and which seemed therefore to place the onus on the public to determine what is relevant) has had the effect of limiting my participation in the review process, the scope of my written submission and the fullness of my comments.

## Submission Topics

My submission is therefore limited to four main topics:

1. **Review Process:** the Terms of Reference (TOR) and the Reference Question (RQ) itself (guideline established by the enabling legislation, appropriateness and impact of a narrow interpretation);
2. **System Planning Assumptions:** the failure of Nalcor to provide a year by year breakdown of the costs of both options using a cost of service method, thereby making it impossible to "compare" the relative merit, the appropriateness and the effects of their 'planning assumptions' especially as they relate to Nalcor's planning assumption that an escalating supply method is the most appropriate;
3. **Forecasting Accuracy and Reliability:** Nalcor's forecasting accuracy and reliability, especially as they relate to Nalcor's load forecasting, the further magnification of risk due at least in part to the long 57-year forecasting and cost comparison period, and the actual and potential risk and impact that reliance on such high and progressively higher (magnified) risk associated with long term forecasting can and will have on the DG2-quality CPW cost calculations and CPW cost difference/preference.
4. **Margin of Error:** How Nalcor's Decision Gate 2 (DG2)-quality cost estimates (consistent with a DG2 industry standard of +50% or -30%) impacts the Reference Question and potential Board findings.

## Review Process

The Terms of Reference states, in part, that:

*"It has been determined that the least-cost option for the supply of power to the Island interconnected system over the period of 2011-2067*

*is the development of the Muskrat Falls generation facility and the Labrador-Island Link transmission line, as outlined in Schedule "A" attached hereto (the "Projects"), as compared to the isolated Island development scenario, as outlined in Schedule "B" attached hereto (the "Isolated Island Option"), both of which shall be outlined further in a submission made by Nalcor Energy ("Nalcor") to the Board of Commissioners of Public Utilities... (emphasis added)".*

It is noted therefore that even before the Board could do its own due diligent investigations and evaluations, the TOR itself had already answered its own Reference Question.

Accordingly, it is submitted that in answering its own Reference Question (as shown in the Terms of Reference itself), the TOR has unduly and inappropriately prejudiced the review process and the preparation of an objectively valid report.

Furthermore, the Public Utilities Board Media Release "Backgrounder" dated February 1, 2012, under the headline "**Scope of the Review**", stated that the "*The parameters of these two options are set out in the Terms of Reference and Nalcor's Submission* (emphasis added)".

It is further submitted therefore that it is difficult if not impossible for a review process to be fair and objective where the proponent (Nalcor), who supports one option over the other, is party to determining the "scope" of the review itself by, in effect, not only determining the two options that are under review, but also (by way of "Nalcor's Submission") determining their "parameters". As the TOR and the Media Notice confirms, the 'parameters' are "set out" both in the TOR Schedules A and B and in Nalcor's Submission. These Nalcor documents thereby **improperly, unfairly and unjustly** become **key determining factors** in identifying the scope, the issues for consideration, investigation, evaluation **and relevancy** --- and they influence practically all matters where the Board is to decide what is appropriate and what is relevant to inform, or better inform the matter before it.

Notwithstanding these fundamental weaknesses and limitations with respect to the fairness and objectivity of the review process, it is noted that the Terms of Reference (TOR) and Reference Question (RQ) has nevertheless been drafted pursuant to section 5 of the *Electrical Power Control Act*, 1994 (EPCA).

Sections 5. (2) of the ECPA states, in part, that:

*"A reference under this section may be general or particular in terms and may specify **criteria, factors and procedures** to guide the public utilities board in making its investigation, examination and report (emphasis added)".*

It is respectfully submitted therefore, as noted above, that while the TOR design itself may favour the proponent's preferred option and may therefore prejudice the review

process, the EPCA allows for the RQ to specify “*criteria, factors and procedures*” to **guide** the Board, and the RQ itself includes no “criteria” and no “procedures” that might limit or constrain the Board in the conduct of its considerations, investigations, and evaluations that “it” might consider relevant and that could bring a greater degree of balance, fairness and objectivity to the process.

And even though the RQ includes certain “factors” only, the Board is not limited to considering, investigating and evaluating **only** those factors. And furthermore, as specified in the EPCA, factors that are included are not intended to be all encompassing and are intended only to “*guide the public utilities board in making its investigation, examination and report* (emphasis added)”.

In addition to the flexibility that the EPCA provides to the Board, the Terms of Reference also states (in part) that:

*“In answering the Reference Question, the Board: **shall consider and evaluate** factors it considers relevant **including** NLH's and Nalcor's forecasts and assumptions for the Island load, **system planning assumptions**, and the processes for developing and comparing the estimated costs for the supply of power to Island Interconnected Customers (emphasis added)...”.*

So, while the RQ states that “*In answering the Reference Question, the Board: shall consider and evaluate factors it considers relevant **including**...forecasts...assumptions... (and) **processes** (emphasis added)”*, the reference question makes it clear that it is the Board that **shall consider and evaluate** not just those factors that are specified in the TOR/RQ itself (and not just those factors that Nalcor or the general public might consider relevant), but factors that “**it**” considers relevant.

And while the RQ specifies **and includes** (as a guide only) certain ‘factors’, the Reference Question does not “exclude” or limit the ‘consideration’ of other factors, or any **criteria or procedures** that the Board itself determines to be relevant and that might inform or better inform the Reference Question.

So the RQ itself makes it mandatory, that is, that “*the Board: **shall consider and evaluate** factors **it considers relevant**”*, and therefore the Board must not be limited in its investigations, evaluations and review because of, or by, the fact that the RQ has included **only some factors** --- factors that are not intended for the purpose of limiting the Board’s investigations and evaluation processes, but are intended for the Board to consider --- and use --- only as a **guide**.

Furthermore, regulatory boards are not required to adhere strictly and precisely to a process, procedures and practices standard that is normally required of courts, but instead regulatory boards are permitted to consider and apply a less formal and less rigid process, practices and procedures standard.

Accordingly, it is respectfully requested that during this more public investigative, evaluation and report preparation phase of the review, that the Board apply a TOR/RQ interpretation (and investigation, evaluation, process and procedures) standard that is at least as broad --- in scope, in parameters, and as flexible as the Board has already granted Nalcor (and as is evidenced by the broad scope and content of Nalcor's Final Submission, its responses to RFIs, and its public presentations to the Board).

### System Planning Assumptions

Nalcor's own documents make it clear that one of Nalcor's key system planning assumptions is that "**supply pricing analysis**" is its chosen and considered to be Nalcor's best way to "**derive an appropriate price**" for Muskrat Falls generated power, **and** for the development of the 2-option CPW **cost calculation** comparisons.

In support of this assumption, and as outlined in Nalcor's Exhibit 36, Nalcor makes it clear that

*"(i)n order to derive an **appropriate price** for Hydro's power purchase requirements for the Island, Nalcor has undertaken a **supply pricing analysis** for MF assuming that Hydro is the only viable customer. **The objective of this analysis is to determine the "escalating supply price"** (that is, the price per MWh of power actually used by ratepayers, expressed in real dollars subject to escalation at CPI), which recovers **all costs-- operating costs over time, debt service costs** (emphasis added) for the debt portion (as applicable) of the capital investment, and an equity return on the equity portion of the capital investment at a defined Internal rate of Return ("IRR") over the life of the project (emphasis added)."*

Furthermore, Nalcor (in its Exhibit 36) also argues and explains how and why it needed to "**derive (at) an appropriate price for Hydro's power purchase requirements for the Island** (emphasis added)", and how and why its assumption that an escalating supply method is an **appropriate** system planning assumption.

And again, in Nalcor's own documents, particularly in Nalcor's Final Submission to the Board, Nalcor demonstrates that its escalating supply price assumption is a key part of Nalcor's total "system planning assumption".

In its Final Submission, section 1.3 (Report Structure) Nalcor states that "*The structure of this report reflects the system planning process NLH employed to determine the least cost option for the supply of power to the Island (emphasis added)".*

And again in section 1.3 of Nalcor's Final Submission (at lines 4 and 5, page 10) Nalcor further states (in its **System Planning** Criteria and Need Identification section) --- that "*Section 3 of the report describes **the system planning criteria, methodology, and tools used in completing this assessment** (emphasis added)*". Nalcor then goes on to discuss, in

some detail, the system planning criteria and methodology, their escalating supply price system planning criteria, methodology, etc., which flows from Nalcor's own, earlier, foundational '**system planning assumption**' that an escalating supply method is the most **appropriate** method for developing and comparing costs for the Muskrat Falls generation station (and which is also used as the underlying principle for the CPW calculations and 2-option **cost comparison**).

It seems clear therefore (from Nalcor's own documents), that Nalcor's escalating supply price planning assumption underlies (and is used) to develop Nalcor's cost comparison calculations, that it is one of Nalcor's **key "system planning assumptions"**, and therefore, as a 'system planning assumption' it is a factor that falls within the scope of the Terms of Reference and/or Reference Question.

Not only does the Reference Question include within its scope Nalcor's 'system planning assumptions', but the Terms of Reference also requires that "(i)n answering the Reference Question, the Board: **shall consider and evaluate factors it considers relevant including (but not limited to) NLH's and Nalcor's...system planning assumptions...** (emphasis added)".

But how can the Board "evaluate" Nalcor's escalating supply price assumption, how can the Board determine the objective and relative merit of this assumption if it is not compared on an equally thorough, complex, year-by-year, analytical, cost comparison basis with an alternative cost of service assumption? Is Nalcor's key escalating supply price system planning assumption to be accepted by the Board without being thoroughly and fairly 'evaluated'? Is Nalcor's escalating supply price assumption to be evaluated only against itself? Is Nalcor's key escalating supply price assumption to be assessed in a vacuum?

Nalcor has explained, assessed, examined and presented the apparent merits of its escalating supply price assumption through its Final Submission to the Board, through numerous exhibits, through Requests For Information (RFI) responses and graphs (graphs which show the same apparent merits of its escalating supply price assumption over and over --- but only from different perspectives).

But all of these different perspectives offer (as a substitute for rational, comparative and objective analyses) only an inadequate and self-serving point of view. They are all based on the same escalating supply price system planning assumption/cost comparison method, and use repetition and changes in perspective only. They paint what is little more than the same picture, viewing the same subject matter, but only from a different perspective --- over and over (CA/KPL 27 Rev. 1 refers).

Although Nalcor has presented its escalating supply price system planning assumption to the Board through and in, many different narrative forms and through various graphs and by way of various presentations, it is respectfully submitted that since all of these rely on the same escalating supply price assumption, that therefore this does not constitute a thorough and appropriate "evaluation" as required by the TOR/RQ.

It is submitted that Nalcor's assumption that an escalating supply method is the most "appropriate" for Muskrat Falls is itself a 'system planning assumption', and therefore it falls within the scope of the TOR/RQ. Accordingly the requirement for the Board to conduct a thorough, rational, objective and relative merit evaluation of this assumption falls within the scope and parameters of the TOR/RQ.

- In support of this position it is important to note that in order to 'evaluate' the proposed Muskrat Falls project, the TOR/RQ itself requires that the Muskrat Falls option be evaluated by way of a 'comparison' --- a comparison with something else -- the "Isolated Island" option.
- It is also important to note that Nalcor's Decision Gate 2 (DG 2) cost estimates are **compared**, in their degree of accuracy/reliability, against the DG 2 industry standard of +50% or -30%.
- And in order for MHI to "evaluate" Nalcor's load forecast accuracy, MHI not only '**compared**' Nalcor's 10 year, end-of-year accuracy against the industry standard of + or - 1%, MHI's load forecast accuracy evaluation was both a year-end (+17.4%) comparison and a year over year accuracy comparison over the entire 10-year accuracy comparison period (year over year, from year 1 to year 10) --- **against the + or - 1% industry standard**.
- Furthermore, in order for MHI to "evaluate" Nalcor's planned transmission reliability of 1:50, MHI 'compared' (once again) Nalcor's 1:50 reliability factor to the 1:150 and 1:500 industry standard (and also **cost-compared** it against a 1:150 reliability standard).

Accordingly, I would submit that relative merit (comparative analyses in its full sense) is an appropriate part of a thorough evaluation process and that a 'comparison' with industry standards, other options and other industry 'assumptions' year by year, over the entire relevant time period is firmly within the scope of the TOR/RQ. The Board's review process itself, by way the required TOR 2-option 'comparison' and by way of MHI's evaluations and industry comparisons, has recognized and demonstrated that comparative analyses form a key component of an evaluation process and is therefore within the scope of the TOR/RQ.

To consider and appropriately "evaluate" Nalcor's escalating supply price system planning assumption, Nalcor's assumption must be compared to a year-by-year breakdown of costs over the entire 57-year (or 50-year, as appropriate) assessment period calculated using the utility industry's "cost of service" standard --- an approach or assumption other than (and different from) Nalcor's escalating supply price assumption.

Only by providing an appropriately clear, accurate and thorough 57-year (or 50-year, as appropriate) year-over-year statement of costs using a cost of service methodology can the Board (and the public) 'consider and evaluate' the full extent to which Nalcor's

escalating supply price system planning assumption might, or might not, be as Nalcor claims, the best (the most “appropriate”) assumption for the Muskrat Falls option and CPW cost comparison calculations.

It is respectfully submitted therefore that:

- the Board require Nalcor to apply a cost of service assumption/ methodology to its analyses of both options and provide both the Board and the public a clear, accurate and thorough year-over-year breakdown of costs (including graphs) over the entire 57-year (or 50-year, as appropriate) Reference Question time period,
- the Board and the public be provided an appropriate opportunity to review the cost of service data and analyses, to make presentations and/or to provide comments, and that the Board defer submitting a final report to government until receipt, consideration and evaluation of the application, impact and merit of this alternative cost of service system planning assumption is completed and compared against Nalcor’s escalating supply price assumption, and
- such other relief as deemed appropriate by the Board.

### Load and Forecast Accuracy

Nalcor has said repeatedly that the island’s 40-year average growth rate is 2.3% annually and that therefore, its forecast average compound annual growth rate of 0.8% is ‘conservative’.

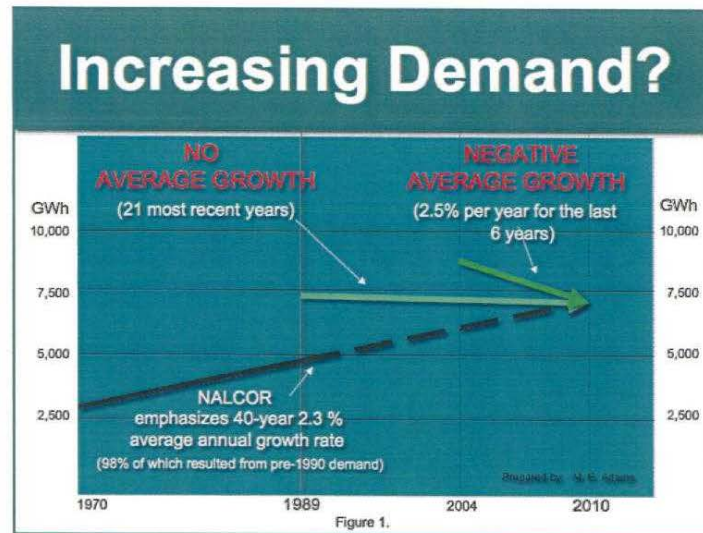
But is it?

About 98% of that 40-year average annual growth rate of 2.3% resulted from pre-1990 demand. Clearly there has been virtually no average growth over the more recent and **more relevant** 21-year period, and furthermore, there has been on average an annual **negative growth** rate of 2.5% over the most recent and most relevant 6-year period.

So, is a 0.8% forecast average compound annual growth rate for the next 57 years really, as Nalcor claims, “conservative”, when 0.8% is 8 times more than the 0.1% average growth rate that the island has actually experienced over the most recent and most relevant 20-year period? See Figure 1 (below).

And if the forecast growth rate is reduced by 50% (from 0.8% to 0.4%) annually, as shown in Nalcor’s “sensitivity analysis”, how meaningful is that --- when a 0.4% average compound annual growth rate is still four (4) times more than the 0.1% average growth rate that the island has actually experienced over the most recent and most relevant 20-year period?





Notwithstanding the island's historical load record, whether or not Nalcor is conservative, reasonable, or has used due diligence and applied sound methodologies in the conduct of its load and other forecasts --- **is not the issue.**

**The issue is,** instead, whether or not Nalcor has attained (**and demonstrated**) a consistent, reliable, and acceptable standard of energy forecast accuracy, and whether or not Nalcor's forecasting and cost comparisons are conducted over a reasonable and foreseeable period of time.

Newfoundland and Labrador Hydro's own legislation (the Hydro Corporation Act, 2007, section 12), under the heading "Future power demand forecasts", requires any corporation or person receiving power from NL Hydro and requested by NL Hydro to provide "*a forecast of his or her future power requirements...(shall do so by)...covering a period...not in excess of 20 years*".

Furthermore, while Nalcor uses a 50+ year energy/oil forecast and Cumulative Present Worth cost comparison period, Nalcor's Final Submission refers, not to NL Hydro's experience in conducting 30, 40, 50 or 57 year energy forecasts, but Nalcor's Submission refers repeatedly to NL Hydro's experience in conducting only 20 year energy forecasts.

Secondly, while Manitoba Hydro International (MHI) warns, in its recent report, that Nalcor's very long term 50+ year forecasts may "**further magnify**" risks, MHI does not say whether 30, 40 or 50+ year forecasts and cost comparison periods are within, or outside, accepted industry standards.

What Manitoba Hydro International (MHI) does however make clear, in section 3.1.1 of its report, is that *“Experience within the industry based on the results from Manitoba Hydro and other Canadian utilities indicate that a reasonable measure for forecast accuracy is a forecast deviation of 1 percent per year into the future”*.

Accordingly, the industry standard then (what the industry considers a ‘reasonable measure for forecast accuracy’) --- is an average forecast deviation of no more than **plus or minus** 1% per year into the future. Presumably, anything outside that would generally be unreasonable.

The Manitoba Hydro report then further explains that *“this means that a 10-year-old forecast should be within plus or minus 10 percent of the actual energy load observed...”*.

Now even though Manitoba Hydro International also states, quite clearly, at page 14 of its report, that risks associated with inputs such as load forecasting *“are **further magnified** considering the 50+ year period (2010 – 2067) used in the preparation of the cumulative present worth analysis”*, for now let’s not look at those **magnified** risks that are caused by the 50+ year forecast period. Let’s look only at Nalcor’s most recent 10 and 6-year energy forecast accuracy record.

First of all, page 42, section 3.1.1 of MHI’s report states that over the most recent 10 year period, the forecast results for the domestic and line loss sectors were both within the accepted industry average standard deviation of plus or minus 1%.

Accordingly, MHI goes on to say that the *“forecast results for the domestic and line loss sectors were reasonable...”*

From this it would seem therefore, that **if** Nalcor’s average deviation for these sectors were **not** within the accepted industry deviation standard of 1% annually, then MHI would have found it difficult to conclude that those forecast results (for these specific sectors) were within the industry accepted *“reasonable measure for forecast accuracy”*, and MHI would also have found it hard to conclude that *“forecast results for the domestic and line loss sectors were reasonable”*.

But Nalcor’s energy forecasts for our **total island needs**, that is --- **the total energy forecasting on which the Cumulative Present Worth depends** (and on which the very viability of the Muskrat Falls project depends), is more than just the energy needs of the domestic and line loss sectors.

The domestic and line loss sectors make up only about 50% of our total island needs.

While MHI’s report emphasizes Nalcor’s forecast accuracy with respect to only a portion of the island’s energy needs, Nalcor’s Final Submission makes it clear that the energy forecast inputs and calculations used to support the options in the Reference Question, are not based on just 50% of our energy needs --- they are, **as they must be**, based on our

**total island energy needs.**

So the more important question is --- not whether or not, over the most recent 10 and 6-year forecast periods, Nalcor's **domestic** energy forecast, which accounts for only about 50% of the island's total energy needs, has been within acceptable industry deviation standards, but instead, **the relevant question** is whether or not Nalcor's average energy forecast accuracy and deviation record for the island's **total energy needs** have been within acceptable industry standards.

Again, MHI's Table 1, at page 42, shows that Nalcor's total "Energy Forecast Accuracy Measured in Percentage of Deviation from the Actual Load", through the most recent 10 years of history (from year 2001 through to year 2010), ranged from a +0.4% too high in year 2001 to a +17.4% too high in year 2010 --- +0.4%, +1.9%, +3.7%, +5.5%, +7.9%, +10.6%, +11.4%, +13.3%, +16.6%, and +17.4% respectively.

So, as can be seen from Nalcor's and MHI's own numbers, over the most recent 10-year forecast period, **Nalcor's total island forecast deviation has always been higher** than the island's actual load, and on average it has been 1.74% per year too high --- a full 74% higher than the industry, MHI and Canadian acceptable deviation of 1% per year.

In fact, and as can be seen from Nalcor's own numbers, over that 10 year period, Nalcor's total island energy forecasting deviation seems to have gotten --- not more accurate --- but **less accurate**.

Therefore, based on the industry, MHI and Canadian accepted deviation standard of plus or minus 1% annually, Nalcor's total island average annual forecast has not, over the last 10 years, fallen within what MHI has described as the "*accepted industry standard average deviation of plus or minus 1%*". Accordingly, by MHI's own definition, Nalcor's 10-year total island load forecast track record would not be a "*reasonable measure for forecast accuracy*".

Now, if one looked closely at the most recent 6-year (instead of the last 10-year) period, it can be seen that not only has Nalcor's total island forecasting become less accurate, but Nalcor's 6-year deviation accuracy over that 6 year period has averaged, not 1.74% higher, but 2.6% per year higher --- a shift from being on average 74% higher than the industry standard of 1% deviation per year, to 160% higher than the industry standard deviation of 1% (see Table "A" below).

**TOTAL ISLAND ENERGY**  
(Data source: Nalcor's Exhibit 103)

**6 YEAR**

**(ACTUAL LOAD AND FORECAST DEMAND)**  
(GWh)

	2004	2006	2008	2010
<b>ACTUALS</b>	8,637	8,088	8,103	7,608
<b>FORECASTS</b>				
<b>2004</b>	8,409	8,519	8,618	8,777
<b>2006</b>		8,075	8,200	8,428
<b>2008</b>			8,112	8,251
<b>2010</b>				7,585

Table "A".

As can be seen from Nalcor's own numbers, Nalcor has over-forecasted total island energy needs by 1,169 GWh (8,777 GWh minus 7,608 GWh) over the most recent 6 year period, for a deviation over a 6 year period of 15.4% (or an average annual deviation of 2.6% annually --- 160% higher than the industry deviation standard of 1% annually).

So compared to industry standards, Nalcor has **not demonstrated**, in its total island forecasting, an acceptable, industry standard of accuracy and reliability.

Therefore, while Nalcor's total island demand forecast is a major, **determining**, and very high risk --- a **key input factor** in its development of its DG2-quality Cumulative Present Worth (CPW) cost estimates and comparisons, Nalcor has not **demonstrated** ---- with any level of accuracy and reliability associated with industry standards, that its total island forecasting accuracy and reliability is reflective of the island's **actual** total island energy needs.

Given Nalcor's demonstrated and consistent failure to meet acceptable forecast deviation standards for our total island needs, it is submitted that Nalcor has failed to demonstrate that Nalcor's total island energy forecast is within an acceptable level of accuracy and reliability, that Nalcor has not demonstrated that its total island energy forecast is reflective of the island's total and actual energy needs and therefore cannot and should not be relied on and used for what MHI has described as a "major" input factor into the Cumulative Present Worth calculations.

Furthermore, as Figure 2 (below) demonstrates, Nalcor's demonstrated track record for over-forecasting the island's total energy demand appears to have been systemic.

While total island load kept going down, year over year, Nalcor's forecast kept going UP, year over year.

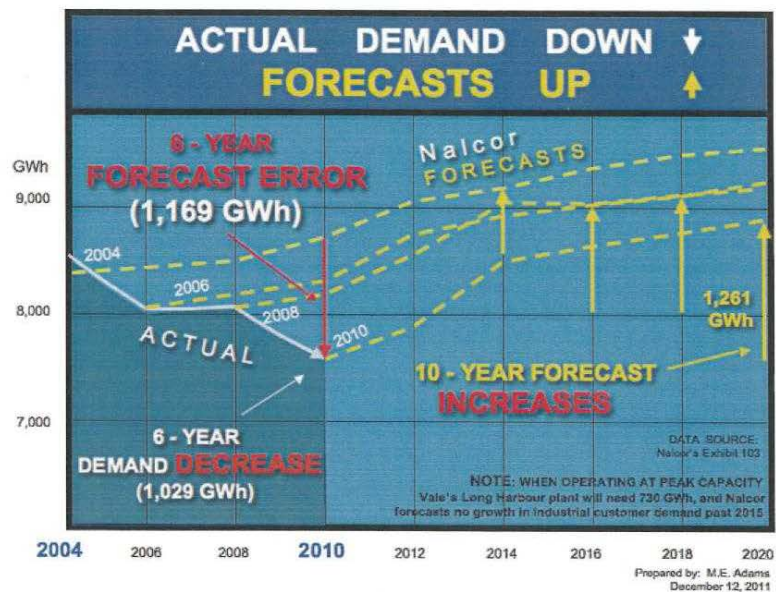


Figure 2.  
Systemic Forecasting Error

(Figure 2 shows systemic error in Nalcor's/NL Hydro's forecasting. Over a 6-year period demand moved consistently DOWNWARD, while forecasts moved consistently UPWARD. **Note:** Vale's energy forecast has since been downgraded to 640 GWh. Also, only forecasts for every second year are shown for the sake of clarity)

### Risk Magnification

Now let's look, not at a 10-year or a 6-year forecast deviation track record, but let's look at what forecast deviations could mean for Nalcor's 50+ year (2010-2067) forecast and cost comparison period.

Again, Manitoba Hydro International, at page 14 of its report, states clearly, and firmly,

that *“The risks associated with these inputs (inputs such as Nalcor’s energy forecasts) are **further magnified** considering the 50+ year period (2010 – 2067) used in the preparation of the cumulative present worth analysis”*.

So what does “further magnified” mean?

If we took Nalcor’s 2.6% per year, 6-year annual total island average forecast deviation level and applied only the 1.6% portion (the amount that is above the standard, acceptable 1% deviation level) not just 10 years into the future, but for the entire 57 years that the Reference Question says must be used, then by year 2067 Nalcor’s total island energy forecast would be 91.2% higher than the 1% industry deviation standard.

Reasonable?

It is noteworthy that when MHI documented that Nalcor had forecast 50% of the island’s total demand (that is, its domestic and line loss demand) at the lower end of the acceptable 1% plus or minus deviation standard, MHI emphasized the point that Nalcor should have forecasted 1% higher.

Accordingly, applying this same reasoning, going forward for the full 57-year forecast period, it seems that MHI could (and perhaps should) have also said that for total island demand (the forecast demand that is used to calculate the cumulative present worth), Nalcor should have forecasted annually 1.74% lower.

Using the same reasoning, then Nalcor’s 6-year average deviation for the full 2.6% annually would mean that over Nalcor’s full 57 year period, Nalcor’s total island forecast could therefore be 148% **too high**.

Accordingly, and clearly, with this kind of forecast deviation, it is submitted that Nalcor has failed to demonstrate (within the accepted industry deviation standard of plus or minus 1% annually) that the island has a need for the energy that has not only been forecasted by Nalcor, but has also been used as a “**cornerstone**” of Nalcor’s claim that the Muskrat Falls option has a \$2.2 billion cumulative present worth preference over the Isolated Island option.

Furthermore, when Manitoba Hydro International, at page 14 of its report, states clearly, and firmly, that *“The risks associated with these inputs (such as Nalcor’s energy forecasts) are **further magnified** considering the 50+ year period (2010 – 2067) used in the preparation of the cumulative present worth analysis”* --- what degree or numerical value can or should be placed on this “magnified”, but un-quantified risk?

Even though common sense would lead one to think that such a ‘magnified’ risk might be substantial, why did MHI not quantify it?

Can a numerical value associated with this magnified risk be determined from Nalcor’s actual 10-year forecasts?



Referring again to MHI's report at page 42 --- MHI's Table 1 shows that Nalcor's total "Energy Forecast Accuracy Measured in Percentage of Deviation from the Actual Load", through the most recent 10 years of history (from year 2001 through to year 2010), ranged from a +0.4% too high in year 2001 to a +17.4% too high in year 2010 --- +0.4%, +1.9%, +3.7%, +5.5%, +7.9%, +10.6%, +11.4%, +13.3%, +16.6%, and +17.4% respectively.

It should perhaps be noted here, that while MHI argues that Nalcor's inaccuracy in forecasting the needs of industrial customers (and therefore total island load) was due to the 'unforeseen' closure of two of the island's paper mills, Table 1, Vol. 1 (see above excerpt) of the MHI report seems to refute that argument in that even though the reduction in actual load was indeed primarily due to mill closures, at least 4 years before the closure of these mills [year 2001 (+0.4%), year 2002 (+1.9%), year 2003 (+3.7%), and year 2004 (+5.5%)] Nalcor had been forecasting increases that were all well above the deviation standard of plus or minus 1% --- averaging +1.4% per year too high.

Accordingly, I would submit that it is unreasonable, and not supported by the facts, for MHI to effectively explain away Nalcor's significant and consistently over-forecasted industrial and total island energy demand (because, it is argued, that industrial demand reductions were "unforeseeable"), and that it is even more unreasonable when MHI states that with the exception of these 'unforeseeable' closures, Nalcor's industrial demand (and therefore total island demand) would **otherwise** have been "accurate".

**The facts are that Nalcor's 10-year actual total island demand forecast accuracy record has been demonstrated to be well below the industry standard of + or - 1% annually.**

With respect to MHI's warning that the long, 57-year forecast period "further magnifies" risk, from Nalcor's own numbers then it can be seen that for year 1 into the future Nalcor's forecast was only +0.4% too high. But for year 10 into the future, Nalcor's forecast was 17.4% higher than the actual load. That shows that forecast error, just 10 year out, is **magnified** more than 40 times (more than 4,000%) greater than what it is for just year 1 into the future.

Even for the island's domestic demand, Nalcor's 10-year forecast record (again from MHI's Table 1, page 42) shows that while in year 1 Nalcor's forecast was only 1.3% too low, for year 10 into the future Nalcor's forecast deviation was 10% too low. Again, in this case, the actual numbers show that the further into the future you go, the greater (**the more magnified**) is the deviation --- that is, the more magnified is the forecast error.

Even in the case of domestic load forecasting, the forecast error 10 years out is 7.7 times (770%) greater than what it is just 1 year into the future.

So, these are not just mere probabilities, these are actual numbers from Nalcor's medium term forecasting itself. It shows that even just 10 years out, risks (forecast errors) were **magnified** by between 770% and more than 4,000%.

Is this then, the kind of magnified risk that MHI was getting at (but did not quantify) when it said that *"The risks associated with these inputs (such as Nalcor's energy forecasts) are **further magnified** considering the 50+ year period (2010 – 2067) used in the preparation of the cumulative present worth analysis"*?

Now if risk (if forecast error) is magnified 4,000% just 10 years into the future, what level of risk magnification can reasonably be expected for the duration of Nalcor's 57-year forecast period?

It seems to me then that over 57 years, risk could be magnified (5.7 times 4,000%), or almost 23,000%.

Or to quantify the "magnified" risk another way.

In year 2010 the island's total actual energy load was 7,608 GWh.

A +1% annual forecast deviation for year 1 (of a 57 year forecast period) would therefore be 76 GWh too high, and for year 57, the forecast error could be 57 times that amount, or 4,332 GWh too high, and such a forecast deviation would apparently still be within industry standards.

But to look further at how unrealistic 50+ year forecasting is.

Nalcor's 6-year total energy deviation track record accuracy has not been 1% per year. Instead, it has been much higher --- 2.6% per year too high. So, at Nalcor's 2.6% average annual deviation rate, year 1 forecast deviation would be 198 GWh too high, and for year 57 it would be 11,275 GWh too high.

Now how would that impact on the Cumulative Present Worth preference for the Muskrat Falls option?

**It is important to note that the long term risk magnification as noted above is based on extending the first 10-year average error only out to the 57-year period. Such an approach would not appear to take into account how the error itself actually magnifies over time, but only applies the first 10-year average error (the generally more accurate forecast period) out 57 years.**

Finally, while **energy forecast demand** is just one of several key factors that MHI has described as '**major**' inputs into the cumulative present worth (CPW) calculations, other major factors such as oil forecasts would also likely be subject to a similar kind of "**risk magnification**".



Perhaps **risk magnification** helps explain why NL Hydro's legislation restricts demand forecasting to 20 years, why the PIRA Energy Group only forecasts oil prices out to 15 years, why the National Energy Board only forecasts oil prices out 25 years, and why the NL government forecasts demographic estimates out to only 20 years.

Beyond 20 or 25 years, "risk magnification" is intensified --- and forecasts become not only unreliable --- but **meaningless**.

### Margin of Error

The Reference Question states that:

*"The Board shall review and report to Government on **whether** the Projects represent the **least-cost** option for the supply of power to Island Interconnected Customers over the period of 2011-2067, as compared to the Isolated Island Option, this being the 'Reference Question' (emphasis added)".*

Clearly, the Reference Question does not ask or direct the Board to **objectively** evaluate the Infeed Option **in isolation** or to review only one option and then report that this one option, the Infeed Option, is or is not the best option, the right option or the 'lowest possible' cost option.

Instead, the Reference Question requires that the Board determine the "relative merit" (rather than the 'objective' merit) of the Infeed Option. And the relative merit is to be determined by "**compar(ing)**" the Infeed Option "to" the Isolated Island Option, and this comparison is measured primarily by way of Decision Gate 2 (DG2)-quality CPW cost calculations and cost difference.

Accordingly, since the principal measure of merit is a 'relative' (rather than an 'objective') measure of merit, the relationship between the two DG2 CPW cost estimates and the **margin of error** in the cost estimates are critical to "whether" or not the Board has rational and reasonable grounds to conclude that **either** of the two options is --- or is not --- 'least cost'.

Applying a +50% or -30% margin of error to the Isolated Island Option DG2 CPW cost estimate of \$8.810 billion produces a DG2 cost estimate ranging from as high as \$13.215 billion to as low as \$6.167 billion (for a total error spread of \$7.048 billion --- almost equal to the Isolated Island DG2-quality cost estimate itself).

Applying a +50% or -30% margin of error to the Infeed Option DG2 CPW cost estimate of \$6.652 billion produces a DG2 cost estimate ranging from as high as \$9.978 billion to as low as \$4.656 billion (for a total error spread of \$5.322 billion --- again, an amount almost equal to the Infeed Option DG2-quality cost estimate itself).

So, Nalcor's **DG2** +50% or -30% margin of error for both options ranges from \$7.048 billion for the Isolated Island Option to \$5.322 billion for the Infeed Option.

In the case of the Reference Question before the Board, both DG2-quality CPW cost estimates (\$8.810 billion and \$6.652 billion) are well within each other's DG2-quality +50% or -30% industry standard margin of error of \$7.048 billion for the Isolated Island Option and \$5.322 billion for the Infeed Option.

Since each DG2-quality cost estimate is **well within the industry margin of error (+50% or -30%) of the other**, it is submitted that the DG2-quality cost estimates are both 'statistically tied'. Figure 3 (below) refers.

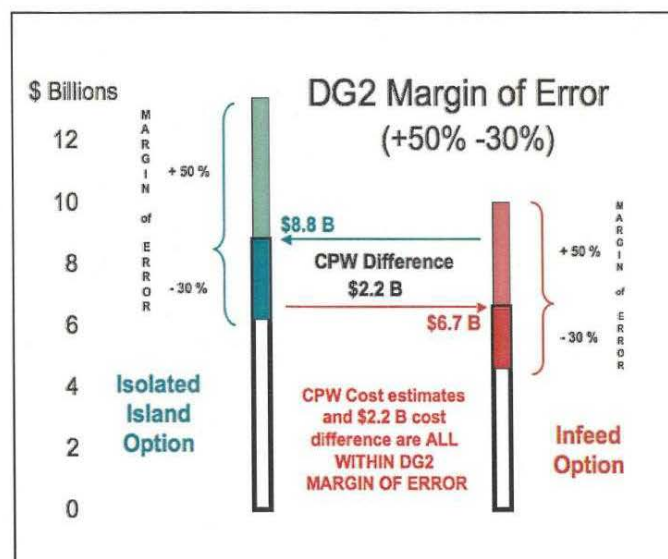


Figure 3.

[CPW DG2-quality cost estimates in relation to each other (and the difference between them) are within the DG2 margin of error]

Given therefore that the DG2-quality cost estimates that are before the Board (as well as the CPW cost difference of \$2.2. billion) are within each other's DG2 margins of error of +50% or -30%, and given that it is on the basis of this cost relationship (relative merit) that the Board is asked to base an analysis and to report "whether" the Infeed Option represents least cost "as compared to" the Isolated Island Option, it is respectfully submitted that these DG2-quality, Class 4, feasibility level estimates are in a "statistical (margin of error) tie" and therefore they provide **no prudent, rational and reliable**

**grounds** for a finding or a report that concludes that the Infeed Option is “least cost”.

Accordingly, since there are no rational and reliable grounds for a finding that the Infeed Option is ‘least-cost’, any such finding would not be well founded, would be fundamentally flawed --- and in error.

Accordingly, it is submitted that since the Infeed Option is within the margin of error, and in a statistical tie with, the Isolated Island Option, the Infeed Option cannot be rationally and reliably found to be --- “least-cost”.

## Conclusion

### The Reference Question

*“The Board shall review and report to Government on **whether** the Projects represent the **least-cost** option for the supply of power to Island Interconnected Customers over the period of 2011-2067, as compared to the Isolated Island Option, this being the ‘Reference Question’ (emphasis added)”.*

In answering the Reference Question, the Board should not only consider the systemic error in Nalcor’s load forecasts and should not only weigh the magnified risks associated with 57-year forecasts, but the Board should also give considerable weight to two **key factors** --- the cost estimates’ **high margin of error** (DG2, low quality, class 4, feasibility level), and **the relationship between them** (the CPW cost difference).

Both are **critical** factors that warrant careful consideration in the formulation of an answer to the reference question.

Given that the DG2 cost estimates are within each other’s margin of error and the CPW cost difference itself is also within the DG2 margins of error, it is clear that the DG2 cost estimates are in a statistical tie.

Accordingly, there are **insufficient grounds** on which the Board can reasonably, rationally and **reliably** conclude that the Infeed Option is least-cost.

While there is a lack of clear evidence that the Infeed Option is least cost, there is clear evidence (the DG2 cost estimates and CPW cost difference) that both estimates (as well as the CPW difference) are within each others margins of error and in a “statistical tie”.

The evidence therefore before the Board (the cost estimates themselves, their quality and relationship) **is not sufficient** from which an objective and reasonable conclusion can be drawn that the Infeed Option is “least-cost”.

Instead, the evidence supports the conclusion that the Infeed Option is in fact in a

"statistical tie" with the Isolated Island Option.

Accordingly, and with respect, it is suggested that the answer to the Reference Question can be found not only in the risk and error inherent in Nalcor's 57-year magnified load forecast and cost comparison estimates, but also in Nalcor's DG2 low reliability level cost estimates (and as evidenced in Figure 3 above) --- in their margin of error and in the relationship between them.

*"Arguments which base their demonstrations on mere probability are  
deceptive, and if we are not on our guard against them  
they deceive us greatly" (Plato, "The Phaedo")*

.....



## PART II

## Give peat a chance

28 April 2011

By MAURICE E. ADAMS

Nalcor Energy (by way of a Lower Churchill Falls public "Information Sheet") claims that if Muskrat Falls is not approved, that in "the absence of Muskrat Falls ... (Newfoundland's) increase in electricity supply requirements will be met by increased thermal production from Holyrood, an additional third-party wind project, the construction of smaller-sized hydroelectric plants and combustion gas turbines."

Nalcor further states that not only is "the capital expenditures for these generation projects ... \$3.2 billion," but also, from 2017 to 2036, there will be a cumulative total fuel consumption cost for Holyrood of an additional \$7.7 billion — and with the new thermal turbines coming on stream in 2033, diesel fuel expenses for Holyrood from 2034 to 2036 will be an additional \$2 billion.

Clearly, the increased costs for such alternative generation projects are unsustainable.

Accordingly, the Muskrat Falls project, even with its estimated \$6.2 billion construction cost,

seems to make sense.

But to build Muskrat Falls, the province would have to increase its debt by billions of dollars — and for decades into the future, the province would also have to pay much, much more in debt-servicing costs.

In order to pay for such energy security, Newfoundland consumers will have no choice but to pay increased electricity rates — increases amounting to more than 50 per cent.

But is there a more practical (and perhaps more viable) alternative?

On April 22, the Power Workers Union of Ontario had a full-page advertisement in the Globe and Mail recommending that Ontario adopt "realistic solutions to address climate change and secure its economic future," and that it should do so, in part, by "using renewable ... carbon neutral agricultural and forestry-sourced biomass ... (in their electrical) generation stations."

The advertisement further suggested that using biomass for electricity generation "reduces green-

house gas emissions."

Ontario, like Newfoundland, is blessed with hundreds thousands of hectares of peat biomass resources (hundreds of millions of tons) that can be used to produce electricity.

While with Muskrat Falls, Newfoundland consumers will be paying 50 per cent higher electricity rates (about 15 cents/kwh), and with Muskrat Falls the province will have no choice but to incur substantial additional debt, peat-fuelled electricity generation plants are reported to be able to produce electricity for 8 cents/kwh (about one-half the cost of hydro-electric production from Muskrat Falls).

Furthermore, in 2006, the European Parliament adopted the Resolution on Strategy for Biomass and Biofuels (submitted by the Netherlands, Sweden and Finland) wherein "the European Parliament ... calls on the commission to include peat, with regard to the life-cycle aspect, as a long-term renewable energy source for biomass and bioenergy production."

Accordingly, not only does the European Parliament consider peat

as a renewable energy source, but countries such Ireland and Russia have used peat-fuelled electrical generation plants since the early 20th century, and Russia has used peat-fuelled electrical generation plants to supply more than 7,000 megawatts of electricity to its grid (more than the Upper Churchill and Muskrat Falls projects combined).

In Ireland, the peat-fuelled generation plant at Edenberry uses 1 million tons of peat per year to generate 120 megawatts of power, and employs 45 full-time, direct jobs, and 250 indirect jobs.

While Muskrat Falls is expected to provide only a very few additional direct, permanent, full-time jobs, peat-fuelled electrical generation can be expected to provide many hundreds of additional direct, full-time jobs in areas like Stephenville and central Newfoundland, areas that have suffered the loss of jobs from closed paper mills and the loss of other forestry-related operations.

Areas around Stephenville and central Newfoundland are reported to have sufficient peat resources to supply Newfoundland's electricity

needs well past the expiry date of the Upper Churchill contract — and for many decades into the future.

As an alternative to the continued operation of the oil-fired Holyrood generating facility, or as an alternative to the costly construction of the Muskrat Falls hydro-electric facility, electrical generation through the use of a long-term renewable peat biomass is a proven technology, and one that is able to keep Newfoundland's electricity rates at a reasonable and affordable level for decades to come.

In the alternative, Newfoundland's abundant peat biomass will one day be exported to Europe to help keep their peat-fuelled electrical generation plants in operation, to keep their electricity rates low — and for insignificant returns to this province.

Accordingly, a thorough (and independent) assessment of the viability of peat-fuelled electrical generation for the island portion of the province is warranted.

Maurice E. Adams writes from Paradise.



## The Telegram

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Commentary Editor Peter Jackson  
Story Editor Pam Frimpton  
Features Editor Ken Simmons  
Sports Editor Robin Short

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St. John's waterfront, May 24. — Photo by Gary Hebbard/The Telegram

## Nalcor and numbers

28 May 2011

Nalcor Energy (through one of its public information brochures) is reporting that "between 2017 and 2036, the average annual fuel oil expense for the Holyrood plant is projected to be \$384 million, for a cumulative total of \$7.7 billion."

Accordingly, these projected costs are being used, in part, to argue that Muskrat Falls must go ahead.

But are these "projected" costs credible?

For the 10-year period between 2001 to 2010, Holyrood's average annual fuel oil costs were not \$384 million, but instead only \$96 million, for a cumulative total over a projected 20-year period of only \$1.9 billion.

During that 2001-2010 period, the average fuel oil usage was less than 2.3 million barrels per year, with the actual fuel oil usage going down from 3.3 million barrels in 2001 to less than 1.4 million barrels in 2010.

That's a usage reduction of 59 per cent over the last 10 years.

Furthermore, the annual fuel usage for the last six years (for every year from 2005 to 2010) remained well below the 10-year average of 2.3 million barrels per year.

So, even if the cost per barrel of oil from 2017 to 2036 did increase (as they did from 2001 to 2010) by as much as 150 per cent, the past 10 years has shown that an increase in

the price of oil alone does not equate to reliable cost projections 20 years down the road.

From 2001 to 2010, while international fuel oil costs increased from \$30 to \$75 per barrel (an increase of 150 per cent over 10 years), the actual annual fuel oil cost for Holyrood increased by a total of only about two per cent over that same 10-year period — from \$98.4 million in 2001 to \$100.6 million in 2010.

If Newfoundland and Labrador's 200,000 households were to cover the entire average annual fuel oil costs for Holyrood, that would amount to an average cost per household of only about \$40 per month.

Even if the cost per barrel of oil over the next 20 years doubled, the cost of fuel oil usage at Holyrood (excluding any capital cost upgrades) would mean only a cost per household of an additional \$40 per month.

Over the next 20 years, even if Holyrood's oil costs were to increase by four times as much as the average cost over the past 10 years, a \$400 monthly electric bill would increase by only an additional \$160 per month.

If Muskrat Falls is going to mean a doubling of a \$400 monthly household electric bill from \$400 to \$800, and even if oil usage costs for Holyrood quadruples, Holyrood oil costs will only increase a \$400 per month

electric bill by an additional \$160 per month (four times \$40) — to \$560 per month.

So, even if Holyrood's oil usage costs over the next 20 years did increase by as much as 400 percent, a 400 percent increase in Holyrood's costs would still be less than half that from Muskrat Falls (an increase of \$160 per month compared to an increase of \$400 per month for Muskrat Falls).

So, is Muskrat Falls the "least cost" option? Is Nalcor's 20-year cost projections for Holyrood (at the consumer level) credible?

You be the judge.  
Maurice E. Adams  
Paradise



## By Nalcor's own numbers

23 June 2011

By MAURICE E. ADAMS

In his Weekend Telegram article "We're still not sold on Muskrat Falls," (June 18) Randy Simms writes that, according to Nalcor CEO Ed Martin, "The demand for electricity has been climbing in the province by about 2.3 per cent a year since 1970 ... (that Nalcor has been) conservative with the numbers ... (and that) history says we are seeing a growth in energy demand of 2.3 per cent a year, but for the purposes of this exercise, they pegged demand growth at just 0.8 per cent a year, going forward from 2010 to 2067."

In assessing the future need for Muskrat Falls, Nalcor uses what it says is a "conservative" compound average demand rate (not the historical rate of 2.3 per cent) but instead, a forecast rate of only 0.8 per cent (only 1/3 as much, it would seem, as history shows we have, on average, been using). How can anyone argue with such reasonableness in approach? But do Nalcor's actual numbers paint a different picture?

In fact, Nalcor's public docu-

ments outlining our historical demand for electricity cover a period of 40 years, from 1970 to 2010. And while it is technically correct to say that historical demand over the last 40 years has on average climbed about 2.3 per cent a year, of itself, this statistic is misleading, and I would suggest, not very relevant nor very informative.

Using a 40-year assessment period (and using a 40-year average growth rate) effectively hides the fact that 98 per cent of that historical increase in demand was during the first half of that 40-year period — from 1970 to 1990. So, in order to arrive at that 2.3 average increase in growth rate, Nalcor had to reach way back to 1970. Without reaching back 40 years, the numbers tell a whole different story.

That 20-year period (from 1970 to 1990) was a period when average demand rate increases were very high (I would suspect households were switching off oil and moving to electricity), and it is that early 20-year period from 1970 to 1990 that drives the 40-year average increase up to 2.3 per cent per year.

Of the 100 per cent of the increase in the demand during that 40-year period, 98 per cent of it can be attributed to the period from 1970 to 1990, and only about 2 per cent of the increase in demand from the period from 1990 to 2010.

So, from 1990 to 2010 (the most recent, and I would suggest the most relevant 20-year period) the compound average growth rate in demand has been only about 0.1 per cent per year (23 times lower than Nalcor's 40-year average rate of 2.3 per cent). By 2010 (after the closure of the paper mills) electricity usage in Newfoundland was almost identical to what it was in 1990 — not 2.3 per cent, not 0.2 per cent, but only a 0.1 per cent per year average increase over that 20-year period, a negligible growth rate.

Now, let's look at Nalcor's claim that it is being "conservative" in using "only" a 0.8 per cent forecast rate. Certainly, compared to Nalcor's 40-year usage rate of 2.3 per cent, 0.8 per cent going forward seems "conservative."

But is it "conservative" compared to the actual 20-year usage rate of

0.1 per cent?

I see nothing conservative about going forward with a rate that is eight times greater than our proven 20-year usage rate of 0.1 per cent.

In fact, if one looked closely at Nalcor's numbers, Nalcor is only able to claim a go-forward rate of 0.8 per cent because it reached way into the future and thereby averaged the rate down (over a very long 57-year period) from what was a 50 per cent higher, early on, 20-year growth rate of 1.2 per cent. The actual go-forward rate (by Nalcor's own numbers) for a 20-year (instead of a 57-year) period is not 0.8 per cent, but instead, 1.2 per cent.

So, to review the relevant periods — the 20 years before and the 20 years after the year 2010 — Nalcor's go-forward compound average increase in demand rate (instead of being the "conservative" 0.8 per cent, or one-third of the 40-year historical average of 2.3), is instead, over the 20-year period from 2010 to 2030, 1.2 per cent, or 12 times (1200 per cent) higher than the actual, historical 0.1 per cent

increase over the previous 20 years (1990 to 2010).

So, is Nalcor really being "conservative"? It is hard to see.

But then again, who in their right mind would borrow \$5 billion or \$6 billion to produce electricity for domestic use — when the facts over the last 20 years show clearly that there has been virtually no increase in demand (just a 0.1 per cent compound average growth rate)?

And who would support borrowing \$6 billion for a project that relies on a go-forward projection in growth that is not "conservatively" one-third below the 20-year historical usage records, but instead, whose projected growth is 12 times (or 1,200 per cent) higher than its 20-year historical average?

Some people say that there are such things as "lies, damned lies and statistics." While others, like George Orwell, say that governments tend more and more toward "doublespeak." I wonder if any of these descriptions apply here?

You be the judge.

Maurice E. Adams writes from Paradise.



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Publisher & Gen. Mgr. Charles Stacey  
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### LETTERS TO THE EDITOR

## Bad numbers from Nalcor

Nalcor says that one of the key reasons that we must move forward with the Muskrat Falls project is because that in future the cost of oil for the Holyrood thermal generating plant will be unsustainable.

In support of this position, Nalcor's forecast model predicted that for the year 2010 oil for Holyrood would cost more than \$129.2 million, and in the longer term, that between 2010 and 2036 the total cost would be more than \$9.1 billion.

But the facts (limited though they are) seem to tell a different story.

In 2010, the actual cost of oil for Holyrood was not (as forecasted by Nal-

cor) \$129.2 million, but \$100.6 million — almost 29 per cent lower than what Nalcor's forecast model claims (and this 29 per cent forecast inaccuracy occurred even though Nalcor needed to predict costs for just one year into the future). If this "year one" forecast inaccuracy were corrected and applied to the entire 27-year forecast period, then Nalcor's forecast oil cost for Holyrood over that 27-year period would be \$2.6 billion less than what Nalcor's forecast model claims.

While \$2.6 billion is far from being an insignificant amount of money, it seems to me that this inaccuracy and lack of reliability in Nalcor's forecasting

(even when looking only one year into the future) brings into question the accuracy and reliability of all of Nalcor's long-term (up to 57 year) forecasts.

If estimated (forecast) costs, project over-runs, borrowing needs, debt servicing costs, electricity demands and other project forecasts are not accurate and not reliable (and to a large extent the viability of the Muskrat Falls project is predicated on these forecasts), what does this say about whether or not this project really is needed, and what does it say about its economic viability?

Maurice E. Adams  
Paradise



# Muskrat Falls: boon or boondoggle

By MAURICE ADAMS

In the Sept. 3 Weekend Telegram letter to the editor "Looking for the downside," lawyer Janet M. Henley begins her apology for the Muskrat Falls project by stating, quite firmly, that she has "no doubt that we need the generation ... no doubt that a Labrador-island infed with a link to Nova Scotia will benefit the province, especially when the Upper Churchill contract is up for renewal in 2041."

While it has been many, many years now since French philosopher Rene Descartes suggested that having "doubt" is actually helpful in "freeing us from our preconceived opinions," as far back as the 17th century he also wrote (in a preface to his 17th century "Meditations on First Philosophy") that "the judgement of many people is so silly and weak that, once they have accepted a view, they continue to believe it, however false and irrational it may be."

But is it fair to ask whether Ms. Henley's judgement is silly and weak?

Is it fair to ask whether her view is a false and irrational one?

Or is it (as Descartes might suggest) that her absence of doubt might cause her to write what is little more than her own "preconceived opinions"?

In any event, let's take a closer look at Nalcor's own documents.

## Falling demand

A close look at Nalcor's historical load document shows that nearly all (more than 98 per cent) of the island's 40-year average growth rate in historical load occurred before

1989.

Combined with actual statistics from year 2010, the facts show that over the last 21 years (and by 2010) we have reached a point where we are now using less energy than what we did in 1989. And since 2004, demand has been going down at an even faster rate, down a total of more than 15 per cent, for an average negative growth over the last six years of more than two per cent per year.

While Ms. Henley claims that "we have dodged the bullet" on increased rates due to new generation *only because* (emphasis mine) Abitibi closed its Stephenville and Grand Falls mills, a close look at Nalcor's 2010 annual report shows that for year 2010 energy demand went down another 120 GWh, and of that 120 GWh, only 20 per cent of that reduction was due to reduced "industrial use," while 80 per cent of the reduction was due to reduced "residential" use.

Furthermore, a close look at Nalcor's Capacity/Energy Deficit — Forecast document shows that not only is the island's "existing system installed net capacity 1,958 MW", but Nalcor's 2010 annual report also shows that the island's "peak demand" averaged only 1,330 MW for the last five years, and was down to only 1,305 MW for year 2010.

In summary, the island has an existing installed net capacity of 1,958 MW — a capacity that is more than 650 MW greater than the island's 2010 peak demand of 1,305 MW.

The island therefore already has an existing excess of unused power that is more than double the 300 MW of unneeded Muskrat Falls

power that will cost ratepayers billions of dollars in debt (and debt servicing costs) to bring from Labrador. Even with Vale's Long Harbour plant, demand will increase by only a further 85 MW (only 13 per cent of our existing unused 650 MW).

While Ms. Henley further states (incorrectly) that Holyrood provides 40 per cent of the island's electricity capacity, Nalcor states categorically that Holyrood's net capacity is only 466 MW, which is only 23 per cent (not 40 per cent) of the island's 1,958 MW installed net capacity.

Furthermore, Holyrood provides on average only about 15 per cent of the island's power.

So, even with Vale's Long Harbour plant (and even without Holyrood), the island's excess, unused installed net capacity will still exceed the island's demand by more than 100 MW.

So, is there (as Ms. Henley claims) no reason to doubt the need for additional generation?

Even Rene Descartes might disagree.

On the matter of Muskrat Falls enhancing the province's bargaining position in 2041, the Upper Churchill produces 5,400 MW of power. The proposed Muskrat Falls link to Nova Scotia will not even be able to handle all of the Muskrat Falls meager 800 MW of power (at most it will be able to handle 500 MW).

Accordingly, Muskrat Falls does nothing (come 2041) to enhance the province's bargaining position with Quebec.

What Muskrat Falls will do, however, is increase electricity rates,

increase our debt, increase our debt servicing costs, provide majority ownership of our total maritime transmission links to an out-of-province private company, seek an out-of-province loan guarantor that risks the loss of ownership of Muskrat Falls to outsider interests, decrease the competitiveness of our business community (while improving the competitiveness of our neighbouring provinces), provide very little power for future export sales, do nothing to enhance the province's 2041 negotiating position with Quebec for either the Upper Churchill or Gull Island, and do nothing (post 2041) to allow for the transmission and sale of Upper Churchill or Gull Island power via Labrador-Island (and possibly Nova Scotia) maritime links.

Given Dr. Wade Locke's report that, by 2021, this province could see annual billion dollar deficits due to a decline in oil revenues and spending levels that are unsustainable, in essence, Muskrat Falls will further weaken us fiscally, and by 2041, we will again be at the mercy of Quebec, the federal government or Emera (a repeat of Brinco's weak financial position that helped cause the Upper Churchill fiasco in the first place).

## Missing revenues

While the Muskrat Falls project places Newfoundland and Labrador's economic viability at risk, it does nothing for the Upper Churchill and nothing for Gull Island.

These potentially massive revenue generators are excluded from this stand-alone Muskrat Falls option.

Any possible integration of the two larger of our three revenue generators with the Muskrat Falls project is left for future generations to solve.

The single Muskrat Falls approach offers no solutions to our post-2041 Upper Churchill and Gull Island transmission problems, and as a stand-alone project therefore, it does not constitute a comprehensive, coherent long-term energy solution.

It relies almost totally on massive revenues from Newfoundland and Labrador ratepayers and is uneconomic as an out-of-province revenue generator.

## Gives away control

Contrary to what Ms. Henley suggests, what Muskrat Falls will do, however, is ensure that out-of-province forces will continue to have a stranglehold on the Upper Churchill (and Gull Island) power and that future benefits will not accrue to the people of Labrador and Newfoundland — but to our Muskrat Falls loan guarantor, to Emera, or again to Quebec.

While the viability of the Muskrat Falls project relies almost exclusively on the credibility of Nalcor's energy demand, oil, project and debt servicing forecasts and arguments, we perhaps would do well to recall words that were written more than 2,500 years ago: "Arguments which base their demonstrations on mere probability are deceptive, and if we are not on our guard against them they deceive us greatly" (Plato, "The Phaedo").

Maurice E. Adams writes from Paradise.

By MAURICE E. ADAMS

In his Oct. 4 letter to the editor ("Nalcor considered the alternatives"), Nalcor's vice-president in charge of the Muskrat Falls project, Gilbert Bennett, wrote that "at an average cost of \$102 per megawatt hour, the cost of building enough ... small hydro projects to meet the province's growing demand ... would be higher than the cost to develop Muskrat Falls."

First of all, let me reiterate, Nalcor's own documents show that there has been zero average growth in demand for the last 21 years. Furthermore, over the last six years demand has gone down, not up, and for our most recent six year period the island has experienced a total negative growth of 15 per cent, for an average negative growth of 2.5 per cent per year.

In addition, the province's population is expected to decline through to year 2025 (residential energy usage went down a further

95 gigawatt hours last year) and the demand from Vale's Long Harbour plant represents only 4.5 per cent (92 megawatts) of the island's existing installed net capacity of 1,958 megawatts (MW).

On average, the island has not used 33 per cent (630 MW) of its already existing installed net capacity of 1,958 MW for each of the last five years, and Vale's additional demand represents not only just 4.5 per cent of the island's existing net capacity, but represents only 1.4 per cent of our already existing yearly average of 630 unused MW of power.

How is it then that Nalcor keeps finding a way to say that demand is going up, when the numbers say that it is actually going down?

As to Mr. Bennett's claim that small hydro projects (at an average cost of \$102 per megawatt hour) would be higher than the cost to develop Muskrat Falls, I would remind readers that Premier Kathy Dunderdale was quoted in a Dec. 7, 2010 Telegram article as saying in

the House of Assembly that in order "to bring power from Muskrat Falls ... we arrive at the sum of \$143 per megawatt hour."

Now taking into account that at this time we have no clear need for additional energy, and taking into account that even the premier's cost of \$143 per megawatt hour for Muskrat Falls power may be very low, especially if it has been arrived at based on the 824 MW per unit cost instead of a 330 MW per unit cost (the amount that Nalcor says we need), then our actual cost of Muskrat Falls power could be as high as \$400 per megawatt hour (40 cents/kWh), or even much higher if these costs have been "blended" with already existing, much cheaper island generation.

## Other option

In any event, it seems to me that small island hydro at \$102 per megawatt hour (when funded and developed only as needed) makes more sense and is certainly a lot

cheaper than \$400 per megawatt hour for Muskrat Falls power, and may even be less, according to my math, than Premier Dunderdale's own quoted cost of \$143 per megawatt hour.

Furthermore, for the period when we start paying off the Muskrat Falls project (year 2018) to year 2041 (the year when near-zero cost Upper Churchill power comes back to the province), and even though there will still be 25 years left on our Muskrat Falls mortgage, Newfoundland ratepayers will be contributing almost \$600 million per year to help finance and operate Muskrat Falls.

In comparison, (and based on the most recent 11-year average cost of oil for Holyrood) oil for the fully paid for Holyrood generating plant costs Newfoundland ratepayers an average of \$92 million/year (Muskrat Falls costing therefore six times more).

While Nalcor's cash flow model shows that Muskrat Falls "least

cost" (?) power will cost Newfoundland ratepayers almost \$600 million per year up to year 2041 (or \$1.8 million per megawatt per year for our 330 MW of power), and about \$700 million per year even for the 25 years after the return of the near-zero cost Upper Churchill power — for Nova Scotians, power from Muskrat Falls will cost only about \$200,000 per megawatt per year (or between nine and 10 times less than the per unit cost for Newfoundland ratepayers).

Notwithstanding these facts, and even without adding unexpected cost overruns and borrowing cost increases, I would expect that Nalcor can still be relied on for at least one thing — to find a way to continue to put forth the view that what will actually cost Newfoundland ratepayers a whole lot more (an unbelievable \$35 billion over the next 50 years), is still Newfoundland's "least cost option."

Maurice E. Adams writes from Paradise.

## By the numbers

THE TELEGRAM  
15 Oct. 2011



17 DEC. 2011  
TELEGRAM

# The danger of long-term forecasts

By MAURICE E. ADAMS

In a Dec. 2 Telegram article ("Minister says he can't explain Emera comments on energy rates"), Natural Resources Minister Jerome Kennedy is quoted as saying that "people should focus on two basic questions, does the province need the power, and is this the cheapest option to get it?"

First of all, Nalcor says that if we exclude the increase in demand from Vale's Long Harbour plant, Nalcor is using a conservative demand forecast growth rate of 0.8 per cent per year.

But is 0.8 per cent truly conservative, when over the last 20 years the island's actual growth rate has been near zero?

In fact, 0.8 per cent is eight times more than the island's 20-year historical growth rate of 0.1 per cent (demand in 2010 has again shown no growth, and was on par with demand in 1989).

Notwithstanding these facts, Nalcor argues that their experts at Newfoundland and Labrador Hydro have 40 years' experience in demand forecasting, and therefore, their 0.8 per cent growth rate for the next 50 years, can be relied on.

But can they?

## Very long-range

The facts, from Nalcor's November, 2011 Final Submission to the Public Utilities Board (PUB), show that instead of experience in conducting 50-year demand forecasts, Nalcor's "long term" forecasting experience (for the last 40 years) has not been in conducting 50 year forecasts, but instead it has been in conducting

20-year forecasts — forecast periods that are less than half the 50-year forecasting period that Muskrat Falls relies on (and needs) to show a good business case (or that Muskrat Falls needs to be in the running for a possible "least-cost" option).

Not only has Nalcor admitted (in its final submission to the PUB) that its 40-year demand forecasting experience has been limited to doing 20-year forecasts, but provincial legislation (the Hydro Corporation Act, section 12), the very legislation that Newfoundland and Labrador Hydro is bound by, expressly prohibits Newfoundland and Labrador Hydro from requiring from its clients demand forecast periods that exceed 20 years.

Now why would Newfoundland and Labrador Hydro's own legislation discourage (and even prohibit) demand forecasts that exceed 20 years if not in recognition that 30, 40, 50 and 60-year forecasts are unreliable at best, and perhaps that they should therefore not be used as a primary reason for multi-billion-dollar investment decisions?

To look backward for just one moment.

Isn't it more correct to say that the Upper Churchill project/contract was flawed — not because it failed to have an "escalator clause," but because the project proponents were at that time (like they are today) relying on their expectations and forecasts — 40 and 70 years into the future?

Academic papers have previously argued that nuclear technology was at that time coming into its own and that the Upper Churchill

proponents were expecting that as nuclear technology matured, electricity rates would actually decline rather than increase.

So why would Newfoundland need an escalator clause when expectations were that electricity prices would go down? Hence, the folly — not of failing to have an escalator clause, but of basing major decisions on "expectations," on unforeseeable, long-term 40, 50, or 60-year "forecasts."

But aren't we again, with Muskrat Falls, forecasting 40, 50 and 60 years out? As if these expectations/forecasts were a given?

This time around however, we are forecasting not that rates will decline, but that oil prices (and energy demand) will both continue to increase. To protect ourselves this time around then, how do we include a "decelerator" clause?

## One wrong move

How are we protected if both, or even just one, of these expectations/forecasts turns out — just like the Upper Churchill — not to be so? Who will pay the price for that? Who will protect the ratepayers and taxpayers from that?

The error is (as alluded to in the Hydro Corporation Act) not in whether we are forecasting that rates (and oil prices) will rise or fall, but whether any forecasts beyond 20 years should be relied on, used and considered as a sound basis, and particularly, as a primary basis, for large-scale development and multi-billion-dollar borrowing decisions. It is in this way (with respect to the Muskrat Falls project) that we must not repeat the errors of the

Upper Churchill project. Instead, we must learn from, and this time around, avoid them.

We especially need to avoid making multi-billion-dollar decisions based primarily, or even largely, on unsubstantiated 30, 40, 50 and 60-year forecasts and expectations.

## Only to 2025

Furthermore, and in apparent recognition of the problems associated with forecasting beyond 20 years, we should note that Nalcor's own consultants (PIRA Energy Group) provides oil price forecasts only up to year 2025.

For year 2025 onward, Nalcor's 50-year oil forecast is little more than an extrapolation of PIRA's last 2020-2025 forecast period (combined with an estimated inflation factor).

Also noteworthy is the fact that both of PIRA's last two updated forecasts showed what seem to be the beginning of the end of its upward oil price forecast.

Both its May and August 2011 forecasts have oil prices beginning to trend downward.

Furthermore, Canada's own National Energy Board (NEB), in its "Canada's Energy Future: Energy supply and demand projections to 2035, November 2011" report, also forecasts oil prices only out to year 2035.

For year 2035, the NEB forecasts that oil prices will be only about one-half Nalcor's most recent year 2035 forecasts.

If the public utilities board used NEB (instead of Nalcor's) oil price forecasts, the likelihood that Muskrat Falls would ever be shown

to be the lowest possible cost would be substantially reduced.

Furthermore, if even just 20 years into the future Nalcor's oil price forecasts therefore are 100 per cent too high, how much in error are they likely to be 30, 40 or 50 years out?

When there is such a difference in expert opinion and forecasts just 20 years out, what does that say about the sense, about the feasibility and reliability of the PUB doing a 50-year cost comparative analysis — especially when it appears that the industry norm (and our own legislation) appears to point to a 20-year maximum as being reasonable for demand forecasting?

Minister Kennedy is correct (but only in part) when he says that Newfoundlanders and Labradorians need to focus on the question "does the province need the power?"

Equally, and perhaps even more importantly, Minister Kennedy, the government, the PUB and Nalcor all need to focus less on what might be — some unforeseeable 60, 50, 40 and even 30 years out.

What they need to do is to focus more on the question of "what power does the province need now, and for the next 20 years?"

Only then can the people (or the PUB) answer the minister's second question.

And the second question should not be "what is the cheapest option?" but "what is the cheapest option — for the most reasonable (and foreseeable) demand forecast period?"

Maurice E. Adams writes from Paradise.

TELEGRAM  
09 JAN. 2012

By MAURICE E. ADAMS

# Peat and power

There is nothing sexy about using peat biomass to generate electricity. Unless, of course, peat-fuelled power generation can save residential customers (and local businesses) hundreds, thousands and perhaps even tens of thousands of dollars a year in electricity costs.

And, unless, of course, peat biomass is carbon neutral, low in sulphur, low in mercury, long-term renewable, has the BTUs per pound energy equivalency of coal, can create hundreds (and perhaps even thousands) of full- and part-time jobs in rural parts of the province, and exists in sufficient quantities in the Stephenville and Gander areas (and on the Avalon Peninsula) to ensure a security of supply (and stable electricity rates) many, many decades into the future.

Peat biomass is so abundant on the island portion of the province that the rights to develop 130,000 hectares of this undeveloped energy resource have been granted by the province's Department of Natural Resources (the same department that supports the Muskrat Falls project) to Peat Resources Ltd. of

Toronto, a reportedly clean energy company that trades on the Toronto Venture Exchange.

Not only is the development of this resource supported by the province (as a potential \$40-billion export industry), but peat biomass is also identified in the province's Energy Plan as a potential source of undeveloped energy. The Energy Plan estimates that there is 1.4 billion cubic metres of peat biomass in the province (enough to generate hundreds of megawatts of electricity well past year 2041).

While the province has supported a pilot plant/project which has successfully supplied peat fuel to the Corner Brook pulp and paper mill, it appears that since other jurisdictions use peat biomass to help them reduce their energy costs and reduce their carbon footprint, both the province and the company's main focus has been to develop this valuable energy resource — not to meet our own domestic electricity generation, economic development and greenhouse gas reduction needs, but as a multi-billion dollar export industry.

While Peat Resources Ltd. reports that it has produced peat-

fuelled electricity in Ontario for eight cents per kWh (using a more modern harvesting and drying technology, the same technology that it is successfully using in Stephenville), this fact seems to have had no impact whatsoever on the Muskrat Falls debate.

In fact, according to Nalcor's final submission to the Public Utilities Board (PUB), only "forest" biomass (not peat biomass) was screened out of Nalcor's Muskrat Falls energy generation alternatives (forest biomass being screened out because there is an insufficient supply of "forest" biomass on the island to meet the power generation needs of the province). The word "peat" does not even come up.

Even though (for the purposes to the Muskrat Falls project), Newfoundland and Labrador Hydro (NLH) has been exempted from the Electrical Power Control Act (the Act which requires NLH to provide power at the "lowest possible cost"), Nalcor Energy, in its final submission to the PUB concerning the PUB's review of the Muskrat Falls project, states that Nalcor's mandate is in fact driven by both — the "lowest possible cost" provision of

the Electrical Power Control Act and the requirements of the province's Energy Plan (which identifies peat biomass as one of the island's key undeveloped "energy" resources).

But how can Nalcor Energy, in its final submission to the PUB, say that it is mandated by the Electrical Power Control Act (ECPA) to provide "lowest cost power," when Nalcor Energy knows that Newfoundland and Labrador Hydro has been exempted from the ECPA for all activities associated with the Muskrat Falls project (including its legal requirement under the Act to provide lowest cost power)?

And why then does it seem that Nalcor Energy is also not committed to the requirement of the province's Energy Plan — which identifies peat biomass as a major, undeveloped, potential, island-based energy resource?

If peat-based biomass energy is suitable (environmentally) for harvesting and export to other jurisdictions, why isn't it being properly assessed for domestic power generation and economic development purposes?

Furthermore, if peat biomass has

not been properly assessed with respect to its potential for domestic power generation, what confidence can Newfoundland and Labrador consumers have in Nalcor's claim that natural gas has in fact been credibly screened out as a possible lowest cost option?

Given that natural gas and peat biomass options have both been excluded from the review process being conducted by the PUB, what confidence can consumers have that either the Muskrat Falls option, or Nalcor's isolated island option, is in fact, the lowest possible cost option?

Or to address the matter in terms of "giveaways": which is the bigger giveaway?

A high cost, unaffordable Muskrat Falls option, where heavily subsidized power is exported to Nova Scotia, or a \$40-billion peat biomass export industry, where the energy resource is exported to Europe, to the United States or to China to help them meet their low cost (and low carbon) energy needs?

You be the judge.

Maurice E. Adams writes from Paradise.



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## Nalcor's faulty forecasts

TELEGRAM  
21 APRIL 2012

By MAURICE E. ADAMS

From reading James McLeod's April 5 Telegram article ("Ball, MacDonald closer than ever on Muskrat Falls"), it seems clear that Premier Kathy Dunderdale is pleased not only that she has Navigant, Manitoba Hydro, economist Wade Locke, Premier Daryl Dexter of Nova Scotia and others in the Muskrat Falls camp, but now she is also touting that she has Dean MacDonald.

In addition, it seems that all of these Muskrat Falls supporters now also agree, based on Nalcor's forecasts, that Newfoundland "needs more power."

But do we need more power? While Nalcor's own documents (filed with the Public Utilities Board) confirm that the island's existing installed net capacity is 1,958 megawatts (MW), Nalcor's 2010 forecast (the forecast on which the very viability of the proposed Muskrat Falls project depends) also predicts that by year 2015 the island's peak demand will have breached a 1,683 MW buffer line and that if more power is not generated, the island will be in danger of not meeting its peak demand requirements by year 2015.

But can Nalcor's forecasts be relied on?

As far back as 2001, Newfoundland and Labrador Hydro forecast that the island's 1,683 MW buffer line would be breached (and that therefore the island would need more power) by 2007.

And again, in 2005 (and again in 2007) Hydro forecast that the

island's 1,683 MW buffer line would be breached (and that the island would need more power), this time by 2011.

And again, in the years 2002, 2003, 2004 (and again in 2006) Hydro forecast that the island's 1,683 MW buffer line would be breached (and that therefore the island would need more power) by 2012.

Of course, we have long since passed 2007 and 2011 and we are now into 2012 — with no breach of the island's 1,683 MW buffer line in sight.

In fact, as of 2010, the island's actual peak demand was only 1,478 MW, still more than 200 MW below Nalcor's 1,683 MW buffer line, and almost 500 MW below the island's existing installed net capacity of 1,958 MW.

Notwithstanding these facts, Nalcor's latest (2010) forecast (the forecast on which the very viability of the proposed Muskrat Falls project depends and the latest forecast on which the PUB was expected to rely) still predicted that the island's peak demand would breach the island's 1,683 MW buffer line and that more power would be needed by 2015.

But as the facts show, Nalcor's forecasts (dating back to 2001) have been significantly in error (much too high) every year, year over year, since 2001.

How, then, can island ratepayers (as well as the provincial government, Navigant, Manitoba Hydro, Dean MacDonald and others) rely on yet another Nalcor forecast that again says that the island needs

more power by 2015?

Not only is Nalcor's 2010 forecast significantly in error, but Nalcor's historical forecasts have been significantly (and systematically) in error since 2001.

In 2010, actual peak demand once again proved to be significantly lower than Nalcor's 2010 forecast — 41 megawatts lower (1,478 MW vs. 1,519 MW) for an error rate of 2.8 per cent — an error rate, just one year out, that is almost three times more than what Manitoba Hydro International says is the industry standard of plus or minus one per cent annually.

Furthermore, if Nalcor's own forecast model were applied to year 2010's "actual" demand of 1,478 MW instead of to Nalcor's "forecast" demand of 1,519 MW, 2015 (the year that we are supposed to need more power) would again be pushed back — this time to 2019.

### Not new

While Nalcor's lack of accuracy and reliability (even short-term) is clear, for Nalcor, such inaccuracy and unreliability is neither new nor unusual.

If one were to look at Nalcor's forecast years 2001 through to 2010, one would see that Nalcor/Hydro over-forecast the island's peak demand for 2010 significantly, every year (year over year) since 2001.

Since 2001, over-forecasting for 2010 has ranged from 273 MW too high in forecast year 2001 to 41 MW too high in forecast year 2010, for a total forecast error exceeding 2010's actual peak demand itself (1,486 MW vs. 1,478 MW).

Nalcor/Hydro's total peak demand forecasts error for 2010 (added up over the 2001 to year 2010, 10-year forecast period) is cumulatively more than 100 per cent too high — on average 10 per cent per year too high.

An analysis of Nalcor's PUB Exhibit 103 shows that Nalcor/Hydro's over-forecasting error for 2010 (from each of the years 2001 through to 2010) was 263, 184, 176, 186, 196, 138, 124, 122, 56 and 41 megawatts too high respectively, for a total error of 1,486 MW. That is an error rate ranging from 17.8 per cent too high (in the 2001 forecast) to 2.8 per cent too high in the 2010 forecast.

If Nalcor's average historical record of systemic forecast error were factored into Nalcor's Muskrat Falls 2010 forecast, and if that corrected forecast were used to determine when the island would actually need more power (or even if the island's actual historical 10-year average rate of growth of about 0.3 per cent annually between 2001 and 2010) were used to forecast when the island actually needed more power, the island's 1,683 MW buffer line would be shown not to be breached and the island would be shown not to need more power in 2015 (as Nalcor again claims) — but instead, not until 2041.

To reflect then, once again, on Minister Jerome Kennedy's first question, "does the island need more power?"

Manitoba Hydro International, Navigant, Wade Locke, Dean MacDonald (and others) all seem to have accepted, relied on and based

their decisions on Nalcor's load forecasts.

Perhaps however, before doing so, they should have taken a closer look at Nalcor's forecast accuracy and reliability track record.

If, therefore, Manitoba Hydro International did not have reasonable, rational and reliable grounds on which to base its advice to the PUB, how can the province (and, more importantly, how can ratepayers) now rely on and have confidence that Manitoba Hydro International can objectively, rationally and reliably make recommendations using Nalcor's new Decision Gate 3 numbers and on which government will have to, through necessity, base a sanction or no sanction decision?

It is time that our provincial government paid more heed and gave more weight to the findings and recommendations of the only two independent reports that have been done to date — the Joint Federal-Provincial Review Panel Report and our own PUB report, both of which concluded that Nalcor had not adequately shown that the island needs more power.

Why rely, once again, on Manitoba Hydro International, a company that has already relied on and supported inadequate, inaccurate and incomplete information?

It is your grandchildren's, your children's and your future.

So you be the judge.

Maurice E. Adams writes from Paradise. A copy of his brochure "Muskrat Falls: Do We Need the Power?" can be obtained by email at [adamsmuricee@gmail.com](mailto:adamsmuricee@gmail.com).

## Another option to meet our energy needs

June 23, 2012

By MAURICE E. ADAMS

In the House of Assembly on May 3, Natural Resources Minister Jerome Kennedy said that the government would only sanction the proposed Muskrat Falls project if it were in the best interest of the province.

And in an earlier letter to The Telegram, Gilbert Bennett (vice-president of Nalcor) agreed that it is precisely because Newfoundland and Labrador needs a long-term energy production that "Muskrat Falls is the best option to meet the province's energy needs."

Muskrat Falls, however, is not that vision.

### All alone

The Muskrat Falls project is not a comprehensive, coherent vision — it is a single, stand-alone project.

Muskrat Falls totally ignores the fact that Newfoundland and Labrador already has a fully paid for, sustainable and renewable 5,200 megawatt (MW) Upper Churchill hydroelectric generation facility — a facility that is already ours — lock, stock and barrel, a facility that 29 years from now (by 2041) can provide this province with almost seven times as much power as Muskrat Falls. Upper Churchill power will be practically free of charge and unencumbered — long before the proposed Muskrat Falls project can ever be paid for and owned (unencumbered) by the people of Newfoundland and Labrador.

While the Upper Churchill generation facility is already paid for, Nalcor (through this Muskrat Falls project) wants to again put this province many more billions in debt — and for many decades into the future.

Muskrat Falls may appear to be

least-cost, but only because Nalcor uses long-term forecast periods extending 57 years into the future, to a time (2067) that is more than 25 years past year 2041 — the year that 5,200 MW of almost zero-cost power comes back to this province.

Given the availability by 2041 of our paid-for 5,200 megawatts of low-cost power, any project or vision that does not address this issue is neither comprehensive nor coherent.

Muskrat Falls will increase electricity rates, increase our debt, increase our debt servicing costs, provide partial ownership of our maritime transmission links to an out-of-province private company, seek an out-of-province loan guarantor that risks the loss of ownership of Muskrat Falls to outside interests, decrease the competitiveness of our business community (while improving the competitiveness of our neighbouring provinces).

It will provide very little power for future export sales, do nothing to enhance the province's 2041 negotiating position with Quebec for either the Upper Churchill or Gull Island and do nothing (post 2041) to allow for the transmission and sale of Upper Churchill or Gull Island power via Labrador-Island (and possibly Nova Scotia) maritime links.

### Project will hurt province

In essence, Muskrat Falls will weaken us fiscally, and by 2041, we will again be at the mercy of Quebec, the federal government or Emera.

Accordingly, Muskrat Falls is not the best long-term, sustainable and coherent power option.

Even if it were low-cost, low-cost does not equate to best value. A stand-alone project does nothing to facilitate a comprehensive, coherent

vision. A coherent vision must include not only enhanced provincial economic development but also the out-of-province sale of power from the already existing Upper Churchill and future Gull Island facilities.

With Muskrat Falls, even after 2041, our long ago paid for, high revenue generator (the Upper Churchill), and our potential revenue generator (Gull Island), will both remain stranded sources of electrical energy.

Furthermore, Nalcor's long-term energy demand and oil cost forecasts (on which the need for Muskrat Falls is based) are not credible. Nalcor's year 2010 energy demand and oil cost forecast increases were both substantially higher than what was experienced.

In 2010 our total island peak demand was almost 500 megawatts (MW) below the island's existing installed net capacity of 1,958 MW, and in 2011 total island peak demand was a further 0.2 per cent below our 10-year historical average of 1,547 MW.

Accordingly, if Nalcor's short-term forecasts are unreliable, their long-term, up to 50-year debt servicing, energy demand and oil cost forecast models (all of which are critical to the project's viability) are not a basis on which to put this province a further \$5 billion or \$10 billion in debt.

While Nalcor's forecasts may not be sufficiently reliable, what we can rely on (what we do know) is that the Upper Churchill is already paid off and can provide both Labrador and Newfoundland with low-cost (not higher cost), long-term, stable, sustainable and potentially massive profit-generating electricity well into the future.

What we also know is that we already have an \$8-billion debt, a

debt that, if not paid off, will cost us billions (and possibly tens of billions) more in debt servicing charges.

What we do know is that between now and 2041 we can pay off our existing debt and thereby save billions in debt servicing charges.

What we also know is that by not doing an unneeded Muskrat Falls project we can save at least \$5 billion more (more than enough to do a combination of island-based small hydro, wind, solar and other projects) that can meet our energy needs up to 2041.

### Looking ahead

Taking this more rational, step-by-step (yet comprehensive), pragmatic, coherent, integrated, fiscally responsible, 29-year vision approach — with the goal of being fiscally strong leading up to 2041, we will also know that by then we will be in the financial position to build our own 5,200 MW line from the Upper Churchill to Newfoundland — and beyond.

Going this Vision 2041 route, power for both Labrador and Newfoundland will be less (not more) expensive. Emera will be beating down our doors for access, provincial revenues will be high, and we will then be in the position to build Gull Island and Muskrat Falls — but only when we are ready — and on our terms.

With Vision 2041, there will be no multi-billion-dollar burden of debt for our children, for our grandchildren or for their grandchildren.

Muskrat Falls, therefore, is primarily a stand-alone project — not a coherent, comprehensive vision.

Muskrat Falls will not move Newfoundland and Labrador from being an energy warehouse to an energy powerhouse.

While the Muskrat Falls project places Newfoundland and Labrador's economic viability at risk, it does nothing for the Upper Churchill and nothing for Gull Island.

Accordingly, the Muskrat Falls single-project approach contains no solutions for the Upper Churchill and Gull Island. These potentially massive revenue generators are excluded from this Muskrat Falls option (vision). There is no coherent linkage between the Upper Churchill, Gull Island and Muskrat Falls. Any possible integration of the two larger of our three revenue generators with the Muskrat Falls project is left for future generations to solve. These projects are excluded from the Muskrat Falls vision.

The single Muskrat Falls approach offers no solutions to our post-2041 Upper Churchill and Gull Island transmission problems. Muskrat Falls, as a stand-alone project, therefore, does not constitute a comprehensive, coherent, long-term energy solution. It relies almost totally on massive revenues from Newfoundland and Labrador ratepayers and is uneconomic as an out-of-province revenue generator.

What Muskrat Falls will do, however, is ensure that out-of-province forces will continue to have a stranglehold on the Upper Churchill (and Gull Island) power and that future benefits will not accrue to the people of Labrador and Newfoundland — but to Quebec, to our Muskrat Falls loan guarantor or to Emera.

Then later, when it is much too late, we will all be asking — whatever happened to "no more giveaways"? Whatever happened to "have not will be no more"?

Maurice E. Adams writes from Paradise. View his Muskrat Falls website at [www.vision2041.com](http://www.vision2041.com).



TELEGRAM

## Looking for proof of increasing electrical demand 06 October 2012

By MAURICE E. ADAMS

During the Public Utilities Board's Muskrat Falls review, Nalcor stated that it did not forecast any increase in electricity demand from the island's industrial sector after year 2015.

Accordingly, when Nalcor states that Muskrat Falls is viable, it does so based largely on its claim that the island's residential electricity use has increased (and will continue to increase) and that furthermore, the island's total demand will continue to increase at an average compound annual growth rate of 0.8 per cent for the next 50 years.

**Growing need**

To bolster its own argument, and notwithstanding that "domestic" demand accounts for only half of the island's total demand, Nalcor points to Manitoba Hydro International's (MHI) report to the PUB, wherein MHI says that Nalcor's 10-year historical "domestic" demand forecast track record was within the industry standard of error of plus or minus one per cent annually, and that since its forecast track record was on the low side, it could have therefore (over that 10-year historical period) been annually one per cent higher.

Nalcor also claims that the island's residential electricity usage is increasing largely because there is an increase in the number of new and larger homes and also due to

the increased use of electric heat and home appliances. Bolstered also by MHI's statement that Nalcor's 10-year historical forecast track record for domestic demand could have been higher, government and Nalcor both claim therefore that the island does indeed need the power, and that Muskrat Falls is therefore viable.

But let's take a closer look at what that means.

**Shrinking numbers**

The province's Energy Efficiency Action Plan 2011, (section 5.2, Households) states that "Between 1990 and 2008, the number of homes in Newfoundland and Labrador increased by 19 per cent, while the total energy consumption has declined by approximately 17 per cent" — a 19-year average decrease of 0.9 per cent annually (a downward trend that is even greater than, and in the opposite direction from, Nalcor's 50-year average upward total demand forecast of 0.8 per cent annually).

Furthermore, the province's Climate Change Action Plan 2011 also states, both clearly and firmly, that "New homes are becoming more energy efficient over time and this is having an impact on energy demand in the province. For example, the total amount of energy used by the housing sector has declined since the early 1990s by approximately 17 per cent, while the total volume of housing stock has

increased by 19 per cent."

While it is true that over the last 19 years there has been (both in real and in percentage terms) an average increase in electricity use by island residents, that increase has not been due to the an increase in the size of the total residential energy sector (the residential energy pie, so to speak).

Instead, the actual size of the residential energy market (as confirmed by government's own documents) has decreased (that is, the total energy demand from the residential sector has decreased) from the period 1990 to 2008 by 17 per cent (and Figure 6 of government's Energy Efficiency Action Plan shows that from 1993 to 2008, over the more recent 15-year period, the residential energy sector has decreased by an even greater amount — by 25 per cent, an average rate of 1.7 per cent annually (a downward trend that is more than double, and in the opposite direction from, Nalcor's 50-year average upward total island forecast).

**Where's the growth?**

But how, then, can it be said that electricity usage by the residential sector has increased? And if it has, does that really mean that the island needs more power and that Muskrat Falls is viable?

While over the 1990 to 2008 period, electricity increased its share of the residential energy sector, it did so by moving into and taking over

that portion of the residential energy sector that was previously occupied by the petroleum (oil) industry, and over that 19-year period the electricity sector increased its share of the residential energy sector by cutting the oil industry's market share by more than half (from 42 per cent to 18 per cent) — a rate of 1.3 per cent annually.

**Shrinking opportunities**

So, the size of the residential energy sector (market) has not, and is not, growing, but instead, is getting smaller.

When Nalcor speaks of growth in the use of electricity by island residents, it is growth that is obtained from the oil industry's market share — a market that is not only rapidly becoming smaller (year over year), but Nalcor's growth in residential electricity use is from oil's much smaller and now very limited share of the market.

At the 19-year historical rate that Nalcor has been displacing the oil industry's small and limited share of the residential energy market (by 1.3 per cent annually), any potential that Nalcor has for further growth in the residential electricity market will be virtually non-existent (and eliminated) by about year 2022 (less than five years after Muskrat Falls comes on stream).

So, while residential electricity use has increased (and may continue to increase) for about 10 more years, the facts (the historical

record) shows that with no forecast in island industrial demand after 2015, with a 19-year track record that confirms that the residential energy sector/market is continuing to get substantially smaller (not larger), and that at Nalcor's proven success rate of moving into and eliminating the oil industry's share of the residential energy market, where is the evidence-based rationale for residential electricity growth past year 2022?

How then can it be said (based on what evidence can it be said), that "the island needs more power" — not for 10 years, but for the required 50 years?

After all, it is Nalcor that claims that Muskrat Falls is viable — not over a 10-year period, but over a 50-year forecast period.

It is over this same 50-year (not 10-year) forecast period that Nalcor predicts, and that Muskrat Falls needs (must have) a guaranteed, locked-in, multi-billion-dollar cash flow/revenue stream, a cash flow/revenue stream sufficient to say that Muskrat Falls, over the long term, represents a solid business case.

When there is no evidence to suggest that there is any long-term growth in island energy demand past year 2022, on what evidence-based grounds can government (and Nalcor) rationally conclude that Muskrat Falls is viable?

Maurice E. Adams writes from Paradise.

TELEGRAM 13 October 2012

## You can't have it both ways

In his Oct. 6 letter to the editor "Wangersky left experts off his (st)" Nalcor's expert, Ed Martin, wrote that "We're using industry best practices ... for hydroelectric developments."

On the other hand, government's own expert, Manitoba Hydro International (MHI), at page 20, volume 1 of its report to the Public Utilities board, wrote that Nalcor's "domestic (demand) forecast methodology

is acceptable, but does not meet the requirement of utility best practice ...". So which is it?

Accurate and reliable forecasting is an essential, foundational building block underlying Natural Resources Minister Jerome Kennedy's Muskrat Falls first question (do we need the power?). Yet, even at this basic level, two of the

most influential experts advising government on Muskrat Falls disagree on whether or not Muskrat Falls is being planned according to industry's best practice.

Government and ratepayers should be very concerned.

On one hand, it seems that Mr. Martin is conveying incorrect information to the public, while on the other hand, the government (when

it argues that the island needs the power) is relying on MHI's expert opinion, an opinion derived at using Nalcor's methodology, a methodology that MHI has already described as "not meet(ing) the requirement of utility best practice."

More than 2,500 years ago, Socrates is reported to have said that "the first step towards knowledge is recognizing one's own ignorance."

Accordingly, when experts fail to recognize the error in their own words, have they arrived at even the very first step towards knowledge?

And if not, should the government rely on such advice to sanction Muskrat Falls?

Maurice E. Adams  
Paradise



# The need for power isn't proven

TELEGRAM

31 Oct.  
2012

I write concerning The Telegram's Oct. 23 front-page story, "Danny Williams' Top 10 reasons for Muskrat Falls."

For brevity's sake, I will address only several of Danny's 10 reasons for proceeding with Muskrat Falls.

First of all, according to Danny, "it has been demonstrated that we need the power."

Isn't it interesting that for someone who has spent the better part of his life presenting rational, well-thought-out arguments before the courts (all necessarily supported by facts and law), that when it comes to the most important and risky venture in the last 60 years facing his fellow Newfoundlanders and Labradorians, Danny Williams offers nothing more than rhetorical statements and unsubstantiated claims, poorly disguised as "facts."

There are no facts, as Danny claims, supporting his position that "there is a demonstrated need for more power."

There are no facts, as Danny claims, that "clearly show increased industrial and residential demand."

The facts actually say otherwise.

In its written submission to the Public Utilities Board (PUB), and contrary to Danny's claim, Nalcor itself states that there is no increase in industrial demand forecast past year 2015.

Furthermore, the province's own two 2011 energy-related plans (its Energy Efficiency Action Plan and its Climate Change Action Plan) both state clearly (and factually) that between 1990 and 2008, residential energy demand did not increase, but instead, actually decreased by 17 per cent.

Accordingly, Danny's facts do not support his first and most important reason for proceeding with Muskrat Falls — that is, that according to Danny, it has been demonstrated that we need the power.

Instead, the facts actually support the conclusions of the only two independent reviews to date, the federal/provincial review panel and the

province's PUB reports, both of which have already previously concluded that Nalcor had not "demonstrated" that we need the power.

At best, Danny's argument is reduced, not to a "demonstration" that we need the power, but to an irrational, unsupported, non-evidence-based, rhetorical statement based on Nalcor's 50-year "forecast," a forecast similar to its 10-year forecasting accuracy track record error, which (even after just 10 years) has historically been so large as to equal almost half of the average output rating of Muskrat Falls itself.

If Nalcor's historically proven track record error rate were extended

There are no facts, as Danny claims, supporting his position that 'there is a demonstrated need for more power.'

over the entire 50-year Muskrat Falls forecast period, the over-forecasting error alone would more than double the average forecast output of Muskrat Falls.

Furthermore, it is Nalcor's "forecast" on which the very economic viability of Muskrat Falls depends.

It is also important to remember that only two options were presented to the PUB for review, and both were crafted by the proponent — Nalcor.

Nalcor not only crafted both options, the proponent also crafted and set out the parameters of the review itself, and by doing so limited what otherwise could have been an extensive, comprehensive and more objective process.

Such an approach, which included an unheard of 50-year forecasting and cost comparison process, effectively biased the entire process in favour of Muskrat Falls, while, at the same time, worked to the clear disadvantage of the only other option.

In summary, while Danny quotes an unnamed wise man as having once said that, "The sure way to miss success is to miss the opportunity," I rely on both the facts and on the words of Mahatma Gandhi, who once said that "Even if you are a minority of only one, the truth is still the truth."

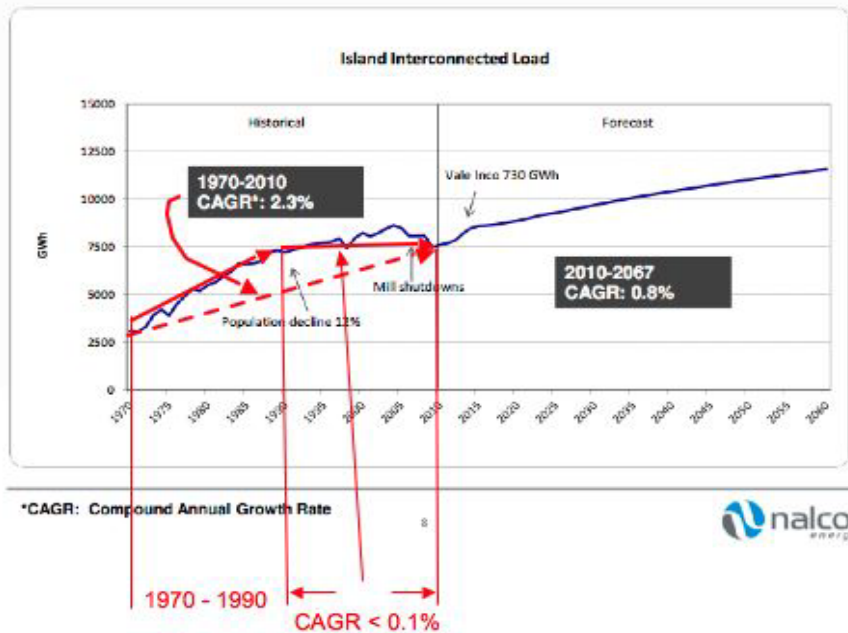
Maurice E. Adams  
Paradise

## PART III

Excerpts, graphics from [www.vision2041.com](http://www.vision2041.com) website:

**Nalcor's info-graphic may be technically correct, but is it ethical if it misleads?**

### Historical Load and Forecast Demand



More than 95% of Nalcor's 40-year 2.3% CAGR occurred in the first half (1970-1990) of our historical load period. During the second (and more relevant) half (1990-2010) the historical load CAGR was less than 0.1% (accounting for less than 5% of the 40-year 2.3% CAGR).

Accordingly, when Nalcor claims that it's 50-year 0.8% CAGR Forecast Demand is "conservative", it does so by knowingly comparing 0.8% to the 40-year CAGR of 2.3%.

However, when compared to the more recent and more relevant 20-year Historical Load 0.1% CAGR, ratepayers can see that Nalcor's 50-year 0.8% forecast CAGR is NOT at all "conservative", but eight (8) times MORE THAN our most recent Historical Load compound annual growth rate of 0.1% annually.

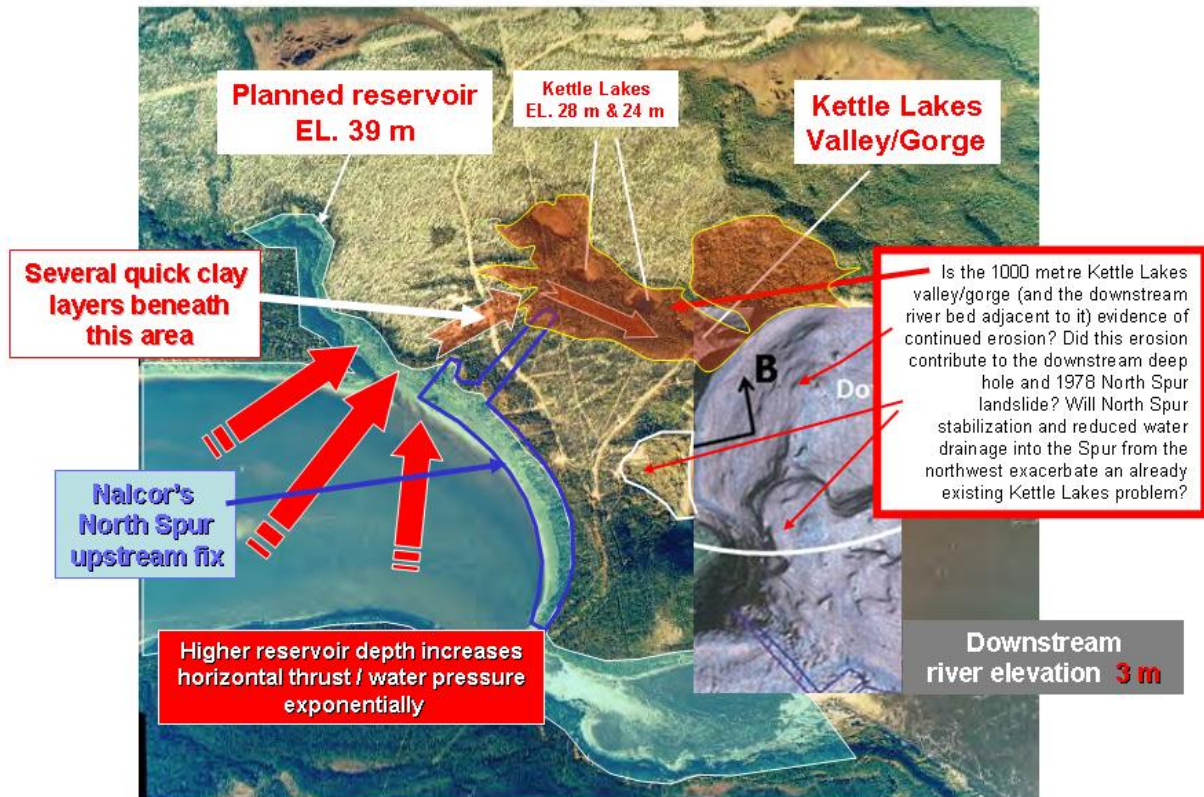
**NOTE:** With the exception of everything in RED (which has been added by M.E. Adams) the info-graphic is unaltered and copied from Nalcor's original.

Original (black and blue portions) of graphic is from a Nalcor 2011 presentation and comments in red were added in 2012.



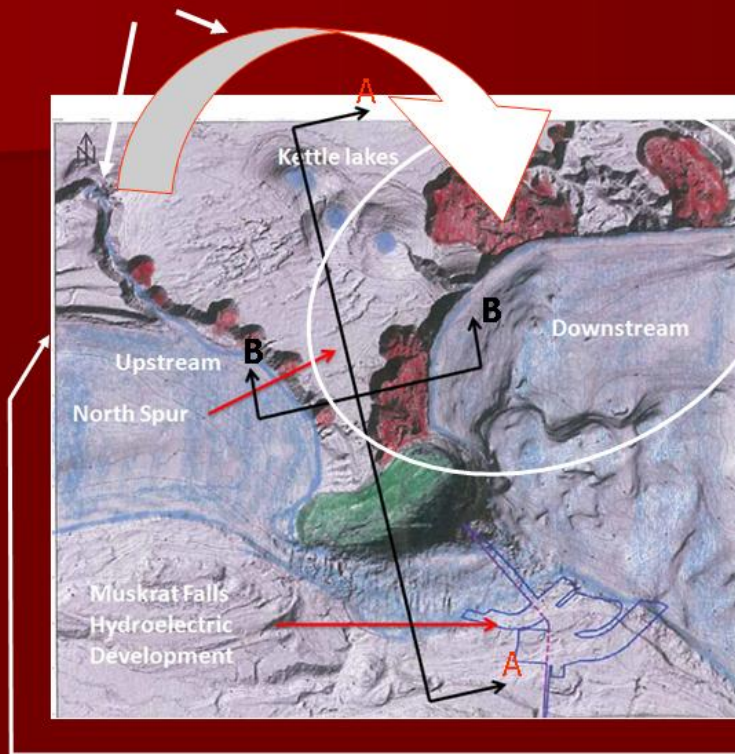
**Summary concerns about the North Spur, Kettle Lakes and downstream sub-surface deep hole risks:---**

**Potential Impact AFTER Muskrat Falls is Commissioned**



M. E. Adams  
2014.09.06

Evidence of the river's north bank erosion/weakness? Possible alternative river flow?



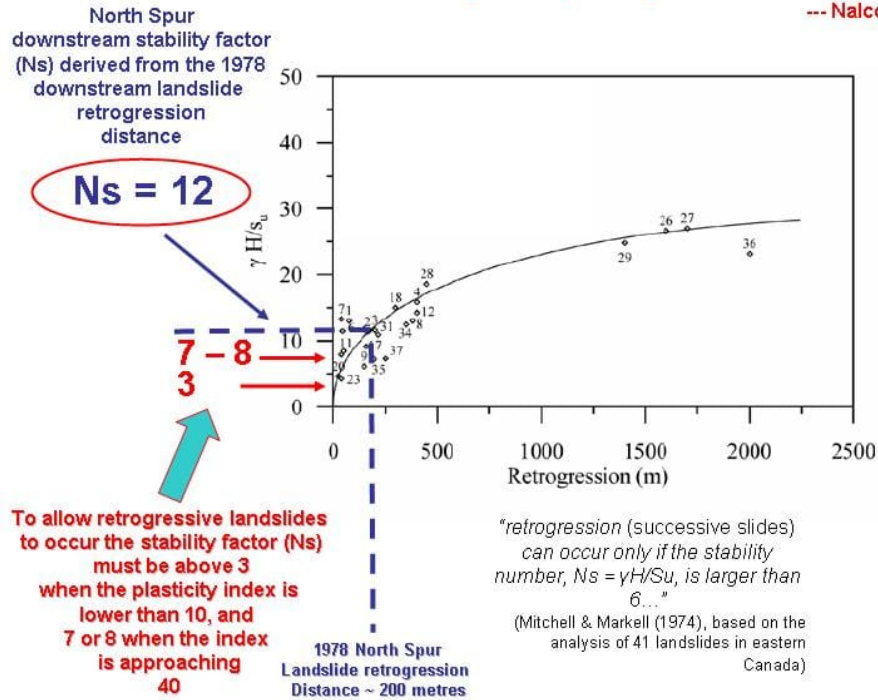
#### Notes

- Most major downstream landslides are adjacent to the Kettle Lakes area (NOT the North Spur area)
- While the slides below show that the existing UPSTREAM river elevation is BELOW the top 2 (upper) quick clay layers, the Kettle Lakes area is ABOVE the highest (upper) quick clay layer
- Yet, Nalcor's proposed stabilization plan is almost exclusively on the upstream (west) side of the North Spur (see following slides)
- As the reservoir rises in elevation (more than 20 metres higher), will the increased pressure just re-route the water infiltration NORTH around the North Spur and thereby increase the risk of Quick Clay landslides in the Kettle Lake downstream area?
- The horizontal pressure on the north bank increases according to the **SQUARE** of the depth of the water in the much higher elevated upstream reservoir

Source: Nalcor graphics (oval, white arrows and notes added by M. E. Adams)

**For large retrogressive (successive, multiple failure surface) landslides to occur**  
**“...in Eastern Canada clays the stability factor ( $N_s$ )...must be larger than about 3 in clays with a plasticity index of 10 or less, increasing to about 7 or 8 in a clay with a plasticity index of 40.”**

--- Nalcor, Progressive Failure Study



**All 123 North Spur lower clay layer plasticity index tests range from a low of 7 to a high of 25. The derived downstream safety factor ( $N_s = 12$ ) is up to 4 times what corresponds to Nalcor's lower clay layer plasticity index results and exceeds what is required to allow successive (multiple failure surface) landslides to occur**

M.E. Adams  
2016.12.05



## Slope height, angle, ratio (% inclination) relationships (1997 height/angle vs. 1984 height/inclination)

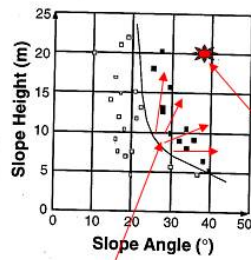


Figure 4. Geometry considerations for failed (black squares) and unfailed (open squares) slopes in the St. Ambroise area, Québec.

Source: Jacques Locat and Serge Leroueil, 1997

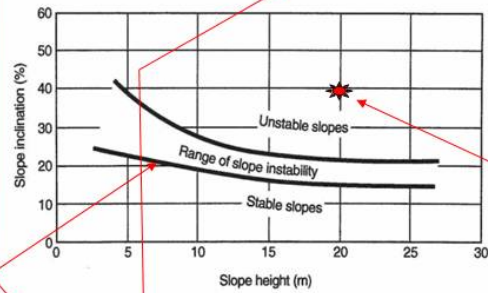


Fig. 26 Height - inclination relationships for unstable slopes in eastern Canada. (after Tavenas, 1984)

North Spur lower clay layer steepest downstream sub-surface slope inclination:  
(80 %)  
(39 degrees)

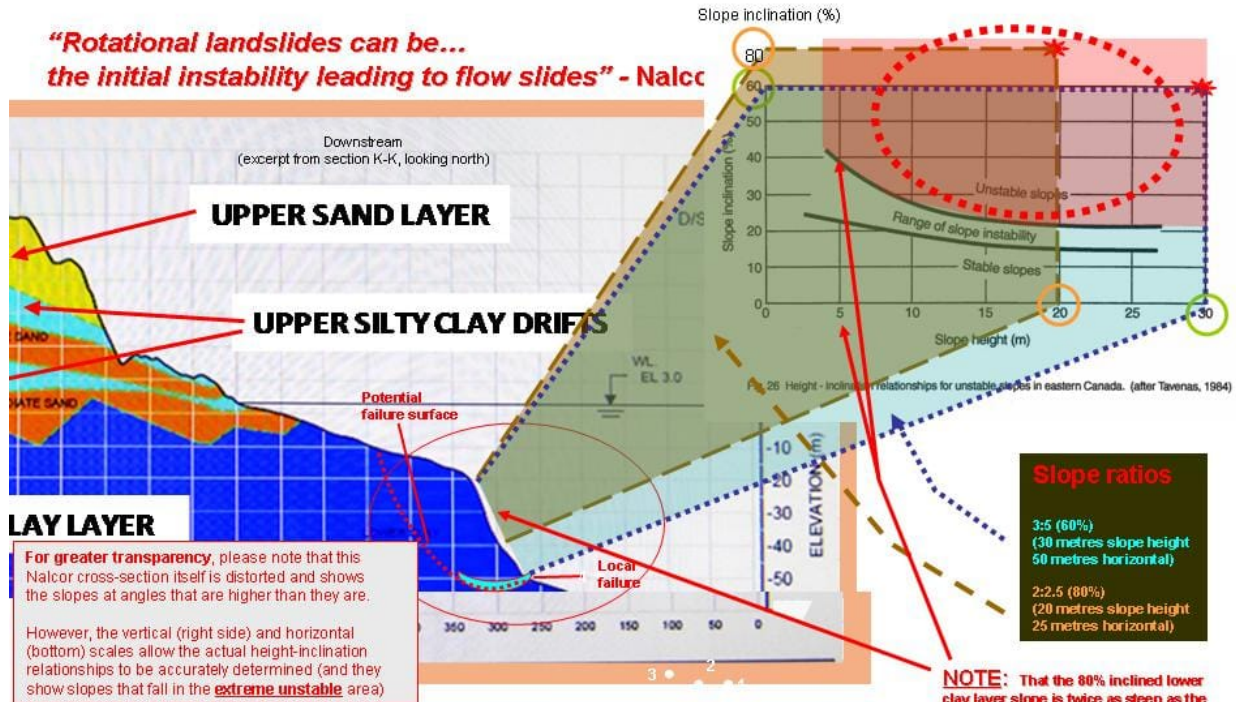
- Generally, both analyses show that slope angles just higher than 20 degrees and with heights greater than 5 metres:
- show failure (1997 graph, left) and
  - fall within the range of instability, or unstable slopes (1984 graph, right)

★ Steepest North Spur lower clay layer downstream sub-surface slope (vertical 20 metres, horizontal 25 metres) is well within the failure and unstable areas of the above graphs

M.E. Adams  
2016.12.28



**“Rotational landslides can be...  
the initial instability leading to flow slides” - Nalco**



## Height - inclination relationships

- ★ (downstream lower clay layer slopes are in the **EXTREME OUTER SECTION OF THE UNSTABLE AREA**)

Sources:

North Spur lower clay layer slope: - Nalco

Height - inclination relationship graph: - Natural Resources Canada

M. E. Adams  
2016.12.22

## SLOPE

*"quick-clay land-slides generally occur in Norway ...  
if the natural sloping terrain is steeper than 1:15.... landslides in sensitive clay in Norway usually have dimension less  
than 15 times the height of the slope"*

*A study of the retrogressive behaviour...*  
J.S. L'Heureux, 2012

## NORTH SPUR

### Downstream deep hole

**Slope 1:1.7**  
**60% grade**

(Grade almost 9 times higher than that where risk of retrogressive landslides begin in Norway)

**Deepest section  
1:1.25 (80% grade)**

## NORWAY

**Slope 1:15**  
**7% grade**

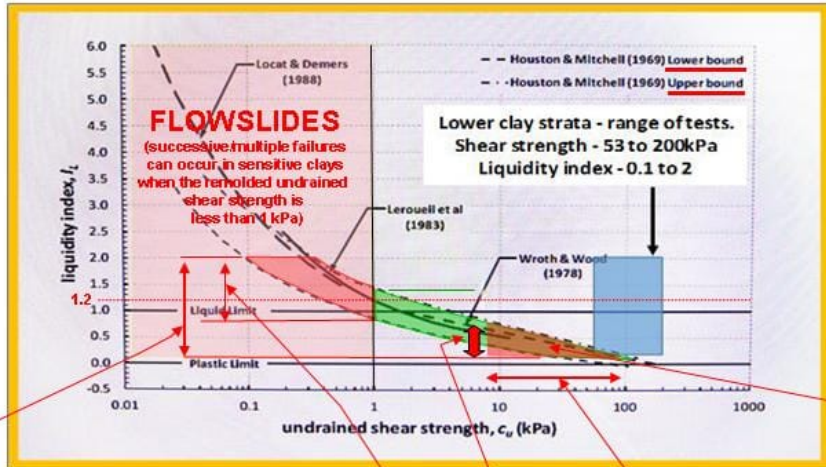
Risk of retrogressive failure (multiple/successive landslides) increases

M.E. Adams  
Updated 2016.11.18

## NORTH SPUR DATA CONFLICTS

(Further comments by Maurice Adams)

Nalcor's Progressive Failure Study states that "To get a flowslide (successive slides) in sensitive clays...(and in addition to other factors) ... the clay must be able to flow out of the crater. This is possible when the remoulded shear strength is ....less than 1 kPa or a liquidity index ... greater than 1.2"



Nalcor's reported lower clay shear strength values

are incompatible with Liquidity Indices

This is much more than an "anomaly"

Liquidity Indices 0.1 – 2.0 (range 1.9)

The greater portion [63% (from 0.8 – 2.0)] of the lower clay layer Liquidity Index range of 1.9 (the portion that is ABOVE the Lower Liquidity Index boundary) shows that Liquidity Index values at those levels can have a corresponding shear strength value less than 1 kPa. At the Lower Liquid Index boundary of 0.8 or when remolded shear strength values are below 1 kPa, flowslides (successive slides/multiple surface failures) can occur. Accordingly, North Spur lower clay Liquidity Index values fall well within those risk parameters.

Nalcor's reported remolded undrained shear strength values range from 8 - 96 kPa

Remolded shear strength values ranging from 8 to 96 kPa are much too high to be compatible with Nalcor's lower clay Liquidity Index tests. The Liquidity/Shear strength relationship shows that if the lower clay layer's lowest shear strength value is 8 then there should be little or no corresponding Liquidity indices above 0.8.

NOTES: Nalcor does not say how many shear tests were conducted  
???????

Nalcor also states that lower shear values were detected near the southern downstream toe, but that the Section C-C data/analysis was "not retained"

M.E. Adams  
2016.11.25

# NORTH SPUR

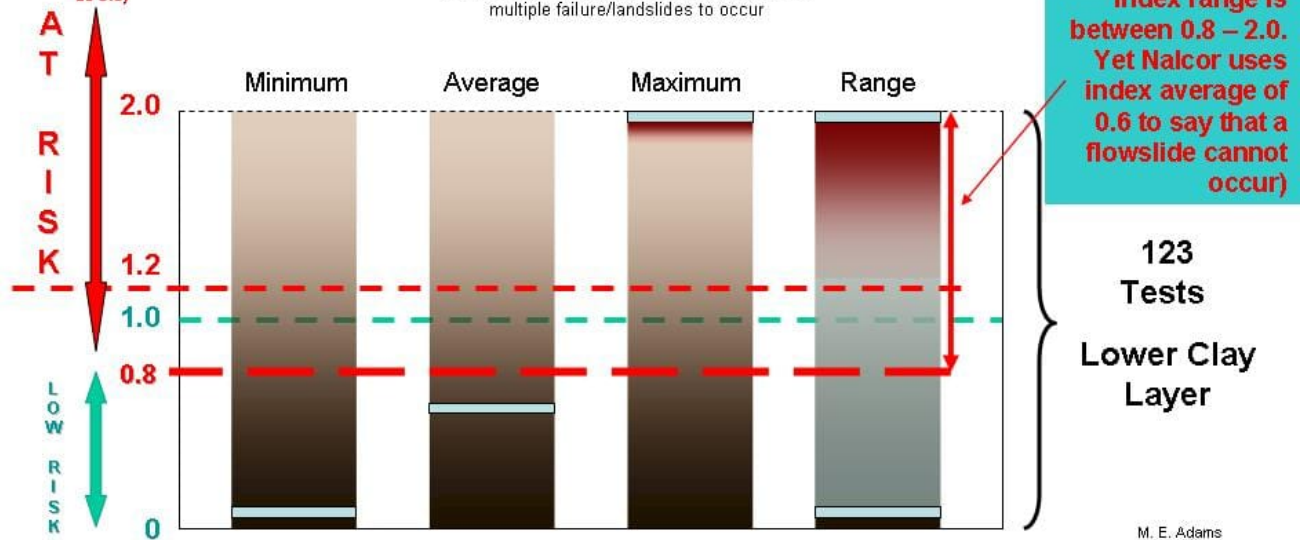
## Lower Clay Layer

### Liquidity Index Test Results

**Liquidity Index**  
multiple failure surfaces/ successive landslides may occur when index is above 1.2 (and as low as 0.8)

The **liquidity Index (LI)** is the ratio of the difference between a soil's natural water content, its plastic (flexibility) limit, and its liquid limit (mathematically, as many as 43% of Nalcor's tests may have shown Liquidity Index levels above 1.2 --- the level required to allow large, retrogressive, multiple failure/landslides to occur

Houston & Mitchell (1969) shows Liquidity Index values as low as 0.8 could have remolded shear strength values less than 1 kPa - values that could allow large, retrogressive, multiple failure/ landslides to occur  
(see next slide)



M. E. Adams  
2016.11.19



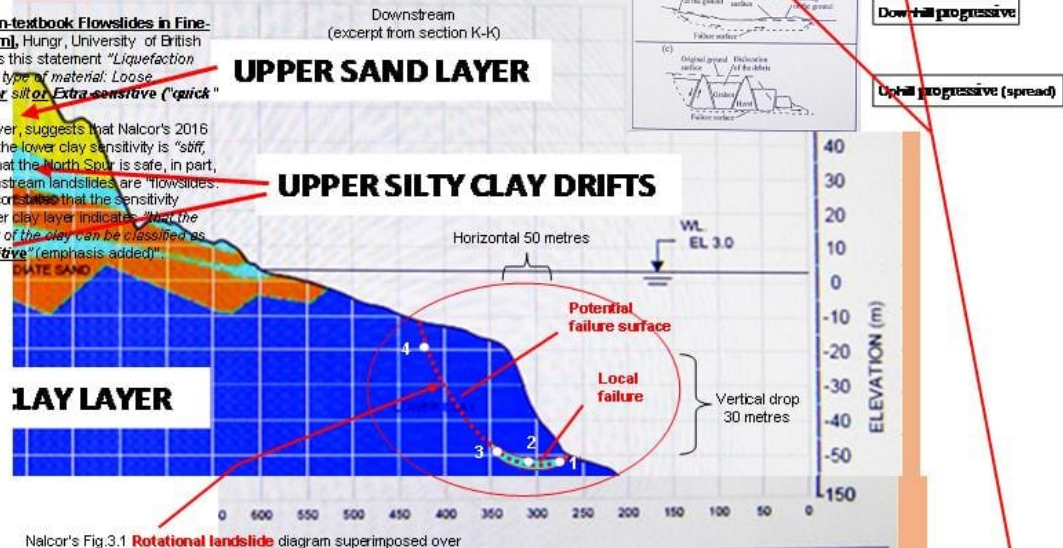
## “Rotational landslides can be...the initial instability leading to flow slides” - Nalcor

Nalcor's **Progressive Failure Study** states that “*Flowslides in sensitive clays result from a succession of slides...*” (emphasis added), and “*To get a flowslide in sensitive clays...there must be an initial failure...*”, enough potential energy for remoulding the clay. Once remoulded, the clay must be able to flow out of the crater. (“A common feature of the previous slides on the North Spur is that very little slide debris remained in the slide bowl which is an indication of the sensitive nature of the soils involved in the slide” - Nalcor). This is possible when the remoulded shear strength is...less than 1 kPa or a liquidity index... greater than 1.2, (emphasis added) (and)...there must be topography which permits the evacuation of the liquefied debris”

Nalcor reports that 123 tests of the lower clay layer shows a Liquid Index ranging from 0.1 to 2.0, with an average of 0.6. Mathematically, this means that 43% of the tests could exceed the Liquid Index needed to trigger a flowslide (successive slides). However, Nalcor uses the average liquid index of 0.6 to conclude that a flowslide will not occur.

**Presentation [Non-textbook Flowslides in Fine-grained Colluvium]**, Hungr, University of British Columbia, contains this statement: “*Liquefaction requires a special type of material: Loose ‘collapsible’ sand or silt or Extra sensitive (‘quick’ clay)*”

Jim Gordon however, suggests that Nalcor's 2016 report states that the lower clay sensitivity is “*stiff, to very stiff*” and that the North Spur is safe, in part, because the downstream landslides are “*flowslides*”. When in fact, Nalcor states that the sensitivity values for the lower clay layer indicate “*that the class of sensitivity of the clay can be classified as low to extra sensitive*” (emphasis added).



Nalcor's Fig.3.1 **Rotational landslide** diagram superimposed over the steep downstream sub-aerial slope

Contrary to Mr. Gordon's narrow definition of Progressive Failure, Nalcor's 2015 North Spur Stabilization Works Progressive Failure Study states:

### Section 3.1 (Progressive Failure)

Section 3.1.1 (Single Rotational Landslide) — “*Rotational landslides can be...the initial instability leading to flow slides...*” (and) “*Figure 3-1: (with the following caption) — “Progressive Failure along a circular surface (from Locat et al, 2011)”*”

Also, “*Figure 3-1 illustrates how the shear strength along a potential failure surface may vary from peak shear strength to large-deformation shear strength. The soil in the potential sliding mass is therefore subjected to local failure when it reaches its peak shear strength (points 1 to 3 along the potential failure surface in Fig. 3-1, prior to global failure taking place when the entire failure surface is formed (Locat et al, 2011)”*”

M.E. Adams  
2016.11.13

What, at the time, was reasonable about Muskrat Falls?

At the time, when asked by a CBC reported what I thought of the proposed Muskrat Falls Project.

I paused for about two seconds, and replied:

“We don’t need it, we can’t afford it, and it’s too high a risk”

-- Maurice E. Adams, 2011