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CIMFP Exhibit P-00135

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# Forensic Audit Presentation to the Commission of Inquiry Respecting the Muskrat Falls Project

## Sanctioning Phase

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# Forensic Audit

Our engagement had two distinct phases:

- Sanctioning – November 2010 - December 2012
- Construction – To be reported at a later date

*Today's Focus: Sanctioning*

# Forensic Audit

## *What is the Sanctioning Process?*

- Identification of options
- Evaluation of identified options
- Development of financial analysis
- Final Gatekeeper approval and sanction

# Forensic Audit

## *Scope of the Sanctioning Phase Audit*

- Review the options considered by Nalcor
- Review Nalcor's assumptions or forecasts
- Review Nalcor's financial analysis

# Forensic Audit

## *Summary of Findings and Observations*

1. Nalcor may have inappropriately eliminated two options
2. Nalcor may have overstated CPW for the Isolated Island Option
3. Nalcor may have understated CPW for the Interconnected Island Option

# Forensic Audit

## *Summary of Findings and Observations*

- 1. Nalcor may have inappropriately eliminated two options**
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# Forensic Audit

## *Basis for Finding One*

**Nalcor may have inappropriately eliminated two options:**

- Deferred Churchill Falls (2041): eliminated based on the uncertainty pertaining to availability of power; this assumption contradicted NSUARB findings
- Power Imports from/via Hydro Quebec: eliminated without engaging in formal discussions with Hydro Quebec

# Options Considered

## *Screening Principles*

- Security of supply and reliability
- Cost to ratepayers
- Environmental considerations
- Risk and uncertainty
- Financial viability of non-regulated elements



# Options Considered

- Combined Cycle Combustion Turbine
- Island Hydroelectric
- Labrador Hydroelectric
- Oil-Fired Generation (Holyrood)
- Simple Cycle Combustion Turbine
- Wind
- Liquefied Natural Gas
- Hydro-Quebec/New England Imports
- Deferred Churchill Falls (2041)
- Nuclear
- Coal
- Biomass (Wood)
- Solar
- Wave and Tidal
- Natural Gas

# Options Considered

- Combined Cycle Combustion Turbine
- Island Hydroelectric
- Labrador Hydroelectric
- Oil-Fired Generation (Holyrood)
- Simple Cycle Combustion Turbine
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- ~~Liquefied Natural Gas~~
- ~~Hydro-Quebec/New England Imports~~
- ~~Deferred Churchill Falls (2041)~~
- ~~Nuclear~~
- ~~Coal~~
- ~~Biomass (Wood)~~
- ~~Solar~~
- ~~Wave and Tidal~~
- ~~Natural Gas~~

# Options Eliminated

Option	Basis for Elimination
Nuclear	<ul style="list-style-type: none"> <li>Provincial legislation, capital costs and risk factors</li> </ul>
Coal	<ul style="list-style-type: none"> <li>Significant environmental risks</li> </ul>
Biomass (Wood)	<ul style="list-style-type: none"> <li>Limited biomass accessible due to undeveloped forestry infrastructure</li> </ul>
Solar	<ul style="list-style-type: none"> <li>Low insolation rates and the cost of power</li> </ul>
Wave and Tidal	<ul style="list-style-type: none"> <li>Unproven commercial viability</li> </ul>
NEISO/HQ Electricity Imports	<ul style="list-style-type: none"> <li>Price volatility, security of long term supply and transmission impediments</li> </ul>
Natural Gas	<ul style="list-style-type: none"> <li>Market too small to absorb development costs</li> </ul>
Liquefied Natural Gas	<ul style="list-style-type: none"> <li>No clear economic advantage due to capital costs and linkage to oil prices</li> </ul>

# Options Eliminated

## *Natural Gas and Liquid Natural Gas*

- **Why Option was Eliminated**
  - Domestic market too small to absorb natural gas development costs
  - No confirmed plan to bring natural gas to the island
  - No economic advantage to using liquefied natural gas given the cost of development
  - Nalcor relied on information published in a 2001 report from Pan Maritime Kenny – IHS Energy Alliance

# Options Eliminated

## *Natural Gas and Liquefied Natural Gas*

February 2012  
Dr. Bruneau Report

October 2012  
Ziff Energy Group Report

November 2012  
Wood Mackenzie Report

# Options Eliminated

## *Natural Gas and Liquefied Natural Gas*

- **Various Positions**

- Dr. Bruneau concludes Grand Banks gas is likely the cheapest source of long-term energy for island electricity generation
- Ziff Energy Group concludes neither natural gas nor liquefied natural gas are viable replacements for oil-fired Holyrood electric generation facility
- Wood Mackenzie concludes Ziff's analysis and conclusions are reasonable

- **Grant Thornton's Findings**

- Nothing came to our attention that the elimination was unreasonable

# Options Eliminated

## *Deferred Churchill Falls (2041)*

- **Why Option was Eliminated**

- Difficulty in determining environmental and policy frameworks 30+ years out
- Risk of maintaining reliable supply through Holyrood until 2041
- Rates tied to highly volatile fossil fuel prices for the first 30+ years
- Remain dependent on fossil fuel generation for 30+ years
- Prospect of additional investment in Holyrood increases probability that this option will be more expensive than projected

# Options Eliminated

## *Deferred Churchill Falls (2041)*

- **Grant Thornton's Findings**
  - Nalcor's finding contradicts a Nova Scotia Utility and Review Board (“NSUARB”) finding
  - NSUARB states  
*“...there should be no shortage of Market-priced Energy when the Churchill Falls arrangement with Hydro Quebec comes to a conclusion in 2041.”*



# Options Eliminated

## *Power Imports from/via Hydro Quebec*

- **Why Option was Eliminated:**
  - Additional costs such as tariffs and contract premiums
  - QC import option estimated to be over \$1 billion more expensive than Muskrat Falls
  - Limited employment, income and business opportunities for the province
- **Grant Thornton's Findings:**
  - Nalcor made assumptions regarding the purchase price of power without engaging in formal discussions with Hydro Quebec

# Forensic Audit

## *Basis for Finding One*

**Nalcor may have inappropriately eliminated two options:**

- Deferred Churchill Falls (2041): eliminated based on the uncertainty pertaining to availability of power; this assumption contradicted NSUARB findings
- Power Imports from/via Hydro Quebec: eliminated without formal discussions with Hydro Quebec

# Options Analyzed

## *Least Cost Option Selection*

Comparison of CPW Estimates for the Two Supply Options		
	Interconnected Island Option	Isolated Island Option
CPW	\$8.4B	\$10.8B

# Forensic Audit

## *Grant Thornton's Findings*

1. Nalcor may have inappropriately eliminated two options
- 2. Nalcor may have overstated CPW for the Isolated Island Option**
3. Nalcor may have understated CPW for the Interconnected Island Option

# Forensic Audit

## *Basis for Finding Two*

**Nalcor may have overstated CPW for the Isolated Island Option:**

Domestic	General	Industrial
<ul style="list-style-type: none"> <li>• CDM initiatives excluded</li> <li>• Certain economic data relied upon by Nalcor was different from CBOC data</li> </ul>	<ul style="list-style-type: none"> <li>• Price elasticity excluded</li> <li>• CDM initiatives excluded</li> </ul>	<ul style="list-style-type: none"> <li>• Prior period loads overstated</li> <li>• Price elasticity excluded</li> <li>• CDM initiatives excluded</li> <li>• Potential decrease in industrial load excluded</li> </ul>

# CPW

## *What is CPW?*

- CPW is the "cumulative present worth" of a project
- Present value of all incremental utility capital and operating costs to reliably meet a load forecast
- CPW was used to determine the least-cost option

# CPW

## *CPW: How is it calculated?*

### Inputs

- Existing Generation Capacity
- Load Forecast
- Capital Cost Estimates
- Fuel Cost
- Operating and Maintenance Expense
- Discount Rates
- Other

Calculation

**CPW**

# CPW

## *CPW: How is it calculated?*

### Inputs

- Existing Generation Capacity
- **Load Forecast**
- Capital Cost Estimates
- Fuel Cost
- Operating and Maintenance Expense
- Discount Rate
- Other

Calculation

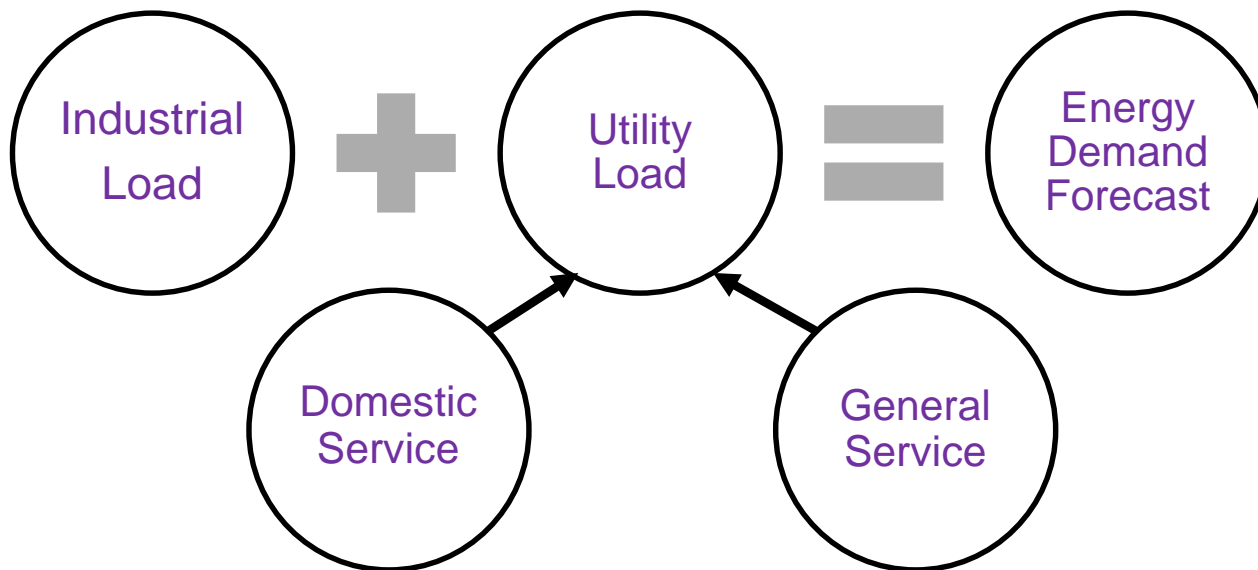
**CPW**



# Load Forecast

## *What is a Load Forecast?*

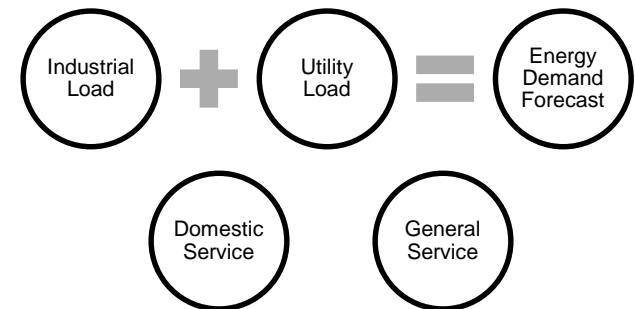
- Estimates the energy requirements for Newfoundland and Labrador
- Prepared by NLH system planning department annually



# Load Forecast

## *Conservation and Demand Management Programs*

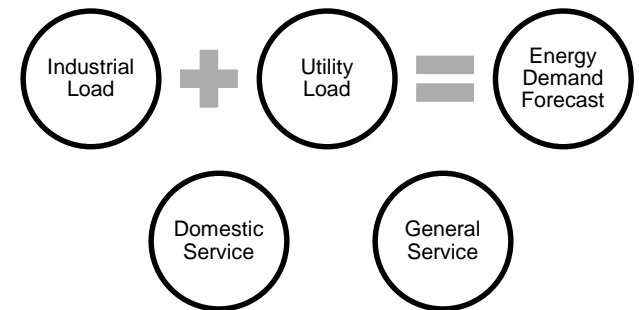
- Incentive programs designed to help consumers reduce energy consumption
- Third parties suggested Nalcor include CDM initiatives
- Other jurisdictions and Newfoundland Power considered CDM programs in their forecasts
- Nalcor did not appear to consider CDM programs in its load forecast for all customers



# Load Forecast

## *Price Elasticity*

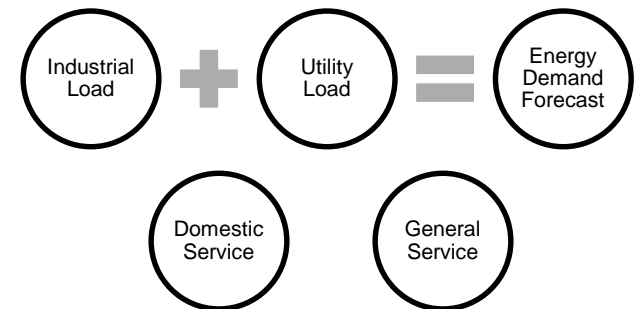
- What is it: Effect of electricity price on electricity demand
- As the price of electricity goes up, demand goes down
- Nalcor excluded price elasticity from general/commercial and industrial customers



# Load Forecast

## *Nalcor's History*

- Nalcor's prior load forecasts were subject to volatility
  - 10-year history of overstating load forecasts by an average of 8.9% for all customers
  - 10-year history of load forecast variances from -5% to +60% by customer



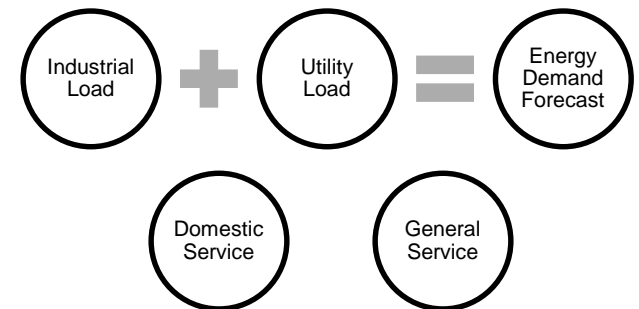
# Load Forecast

## *Economic Forecasts*

Conference Board of Canada's economic forecasts were different from Nalcor's forecast:

- CBOC projected larger decrease in housing starts than Nalcor
- CBOC projected decrease in population; Nalcor held constant

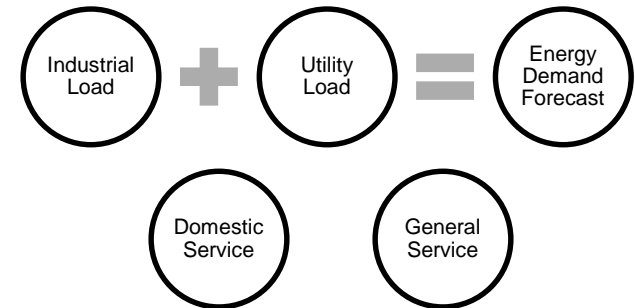
Certain economic data relied upon by Nalcor was different from CBOC economic data, hence domestic load forecast may be overstated.



# Load Forecast

## *Customer Information*

- No potential increase/decrease in industrial load included
- Voisey Bay's mine closing in 2023 was not factored into Nalcor's load forecast
- Potentially overstates industrial load forecast



# Forensic Audit

## *Basis for Finding Two*

**Nalcor may have overstated CPW for the Isolated Island Option:**

Domestic	General	Industrial
<ul style="list-style-type: none"> <li>• CDM initiatives excluded</li> <li>• Certain economic data relied upon by Nalcor was different from CBOC data</li> </ul>	<ul style="list-style-type: none"> <li>• Price elasticity excluded</li> <li>• CDM initiatives excluded</li> </ul>	<ul style="list-style-type: none"> <li>• Prior period loads overstated</li> <li>• Price elasticity excluded</li> <li>• CDM initiatives excluded</li> <li>• Potential decrease in industrial load excluded</li> </ul>

# Forensic Audit

## *Grant Thornton's Findings*

1. Nalcor may have inappropriately eliminated two options
2. Nalcor may have overstated CPW for the Isolated Island Option
3. **Nalcor may have understated CPW for the Interconnected Island Option**



# Forensic Audit

## *Basis for Finding Three*

### **Nalcor may have understated CPW for the Interconnected Island Option**

- Nalcor excluded \$500 million of strategic risk from the capital cost estimate
- Nalcor selected a P50 in calculating tactical contingency which may have understated CPW
- Operating and Maintenance cost estimate increased from \$34 million to \$109 million annually

# CPW

## *CPW: How is it calculated?*

### Inputs

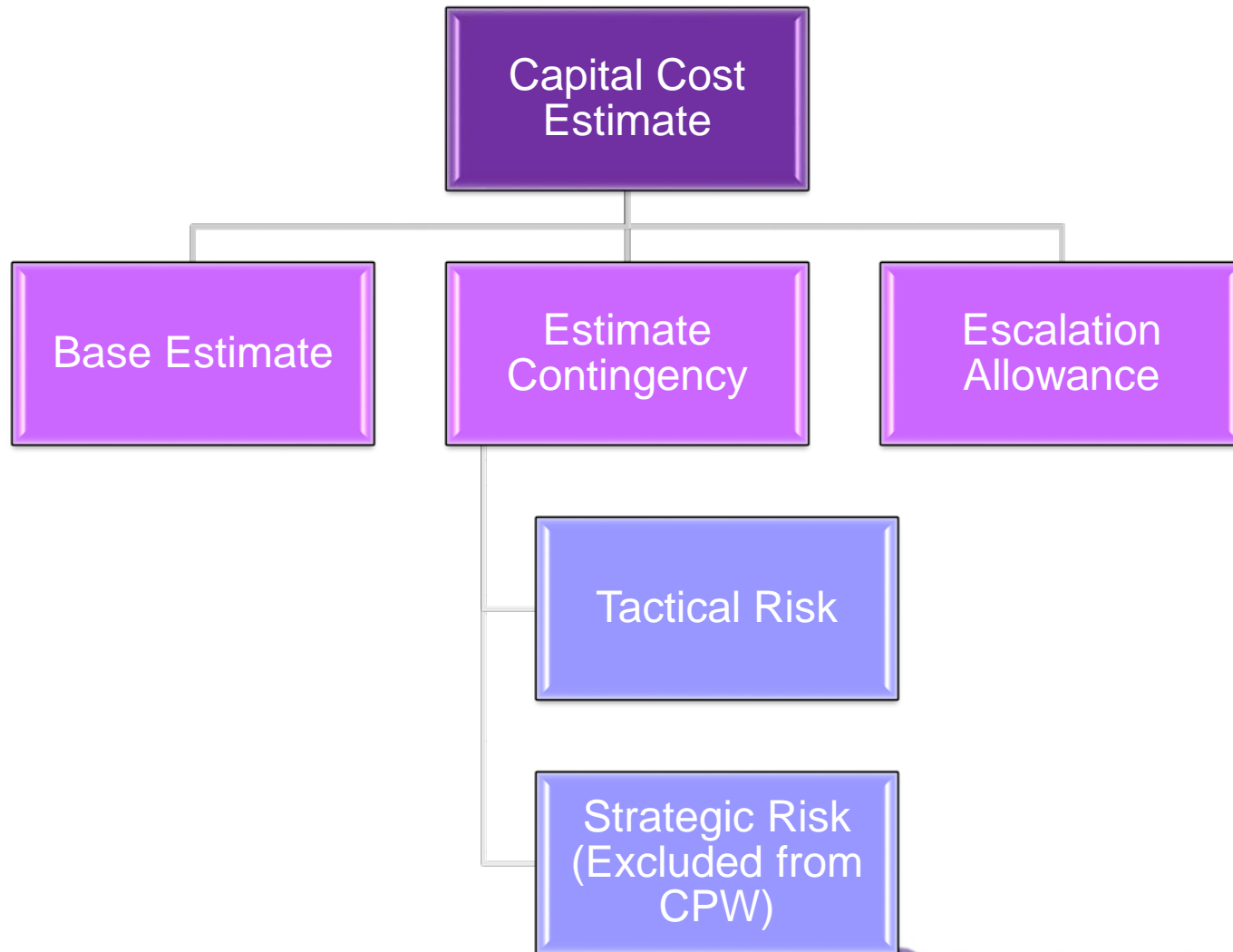
- Existing Generation Capacity
- Load Forecast
- Capital Cost Estimates
- Fuel Cost
- Operating and Maintenance Expense
- Discount Rates
- Other

Calculation

**CPW**

# CPW

## *Capital Cost Estimate*



# CPW

## Capital Cost Estimate

### Capital Cost Estimate for Interconnected Island Option

Item	Amount (\$ in MM)
Commitment Packages (CH0007, CT0327, etc.)	\$4,588
EPCM Services	\$352
General Conditions (insurance, bonding, etc.)	\$314
Other (owner's cost, IT equipment, etc.)	\$219
<b>Subtotal</b>	<b>\$5,473</b>
Escalation	\$361
Contingency	\$368
<b>Total</b>	<b>\$6,202</b>

# CPW

## *Strategic Risk*

- Defined by Nalcor as risks that are outside of the control of the project team
  - Competition for resources
  - Performance risk due to weather and remote location
  - Schedule risk
- Validation Estimating stated "most of these risks have 100% probability of occurring and some money is expected to be spent"

# CPW

## Strategic Risk

- Validation Estimating stated “...strategic risk will appear in every risk analysis in a mega project and yes it should be funded.”
- When asked if you would get a skewed result if strategic risk wasn't included, Validation Estimating stated that “You would get a wrong result. I mean you don't not fund a risk that you have 100% probability of occurring. I put that in my report in 2012 – I was concerned that they were not including risks.”

# CPW

## *Strategic Risk*

- Nalcor calculated \$500 million in strategic risk exposure using P50
- Excluded from capital cost estimate and CPW for Interconnected Island Option (Muskrat Falls)
- The exclusion of \$500 million in strategic risk exposure may have resulted in understated CPW

## *Why did Nalcor leave out Strategic Risk?*

### Nalcor Employee Interview:

- "... view was that he did not want to include additional funding in the project estimate. He did not want to be telegraphing that there was lots of funding"
- "The message to us and everyone was that if the issue arises we would make the funds available in order to complete but would not simply put the funding within the control of the project team"



# CPW

## *Tactical Risk*

Tactical risks are associated with the base capital cost estimate as a result of uncertainty with the following:

- Project definition and scope omission
- Construction methodology and schedule
- Performance factors
- Price (excluding escalation)

# CPW

## *Contingency – P-factor*

- P-factor is the probability of the event occurring
- Nalcor chose P50:
  - 50% chance project cost will be over/under budget
- The higher the P-factor:
  - Higher capital cost estimate, lower risk of overruns
- Example:
  - P75: 75% chance project cost will be less than budget, 25% chance project cost will be over budget

# CPW

## *Contingency*

- Nalcor selected a P50 to calculate tactical contingency
- P50 contingency was calculated to be \$368 million
- Had Nalcor selected a P75, total contingency (tactical and strategic) and capital cost estimate would have been \$1.3 billion higher
- Capital cost estimate would have been \$7.5 billion

# CPW

## Contingency

Is P50 consistent with best practice? Validation Estimating says:

- *"P50 is extremely aggressive"*
- *"I don't know any company who will fund a single major project like that at a P50"*
- *"[Best practice is] somewhere between P70 and P90 for these big mega-projects"*

## Grant Thornton's Findings

- Selection of P50 potentially understated contingency and ultimately understated CPW for Interconnected Option

# CPW

## *CPW: How is it calculated?*

### Inputs

- Existing Generation Capacity
- Load Forecast
- Capital Cost Estimates
- Fuel Cost
- Operating and Maintenance Expense
- Discount Rates
- Other

Calculation

**CPW**

# CPW

## *Operating and Maintenance Costs*

2017: Nalcor estimated operating and maintenance costs for Muskrat Falls would **increase from \$34 million to \$109 million annually** starting in 2020 due to the following:

- Industry benchmarks
- New Nalcor organizational structure
- New operating philosophy
- New knowledge of maintenance requirements

## *Operating and Maintenance Costs – Grant Thornton's Findings*

- The projected operating and maintenance costs for Muskrat Falls may have been understated at the time of Sanctioning
- The potential operating and maintenance cost understatement may have resulted in an understated CPW for Muskrat Falls
- A higher CPW for Muskrat Falls may have led to a different sanctioning decision

# Forensic Audit

## *Basis for Finding Three*

### **Nalcor may have understated CPW for the Interconnected Island Option**

- Nalcor excluded \$500 million of strategic risk from the capital cost estimate
- Nalcor selected a P50 contingency factor which may have understated CPW
- Operating and Maintenance cost estimate increased from \$34 million to \$109 million annually



# Forensic Audit

## *Grant Thornton's Findings*

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