

Annual Report.

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Muskrat Falls Technical Briefing

March 28 & 29, 2012

Boundless Energy



⇒ expenditure in 2012 ? still

⇒ (B) EMA ? What happens if yes or no?

⇒ (A) costs will change how much can it increase ? still be positive.

Confidential and Commercially Sensitive



- term sheet ??

- gas in NE impact.



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1. Safety Moment

Complacency

Complacency is a dangerous behaviour- here is an example and it's an actual quote.....

- “ When anyone asks me how I can best describe my experience in nearly 40 years at sea, I merely say – Uneventful- Of course there have been storms, fog and rough seas, but in my vast experience I have never been in an accident, or any worth speaking of. I have seen but one vessel in distress , I have never seen a wreck, never been wrecked nor was I in any predicament that threatened to end in disaster of any sort”
- So said Captain Edward J Smith
- Captain of RMS Titanic before the maiden voyage

Safety Message

- No matter how many times we have performed a task it does not make it any safer
- Just because we have not been in an accident does not mean we will never have an accident
- It is the routine tasks that can catch us out
- Be alert and aware at all times, in all situations
- Avoid complacency

2. Purpose & Outline

Purpose

- To provide a technical briefing on various elements of the Muskrat Falls development to government officials
- To facilitate a comprehensive Q&A on the project

Engagement Principles

- Please ask questions throughout the presentations
- Consider this to be an open forum
- Objective – to inform and educate
- Some areas very technical with significant detail

Presentation Outline – Day 1

1. Safety Moment
2. Introductions and Purpose
3. Load Forecasting
4. System Planning Criteria & Need Identification
 - Break
5. Identification of Options & Phase 1 Screening
6. Isolated Island Alternative
7. Interconnected Island Alternative
8. Cumulative Present Worth (CPW) Analysis
9. Revenue requirement

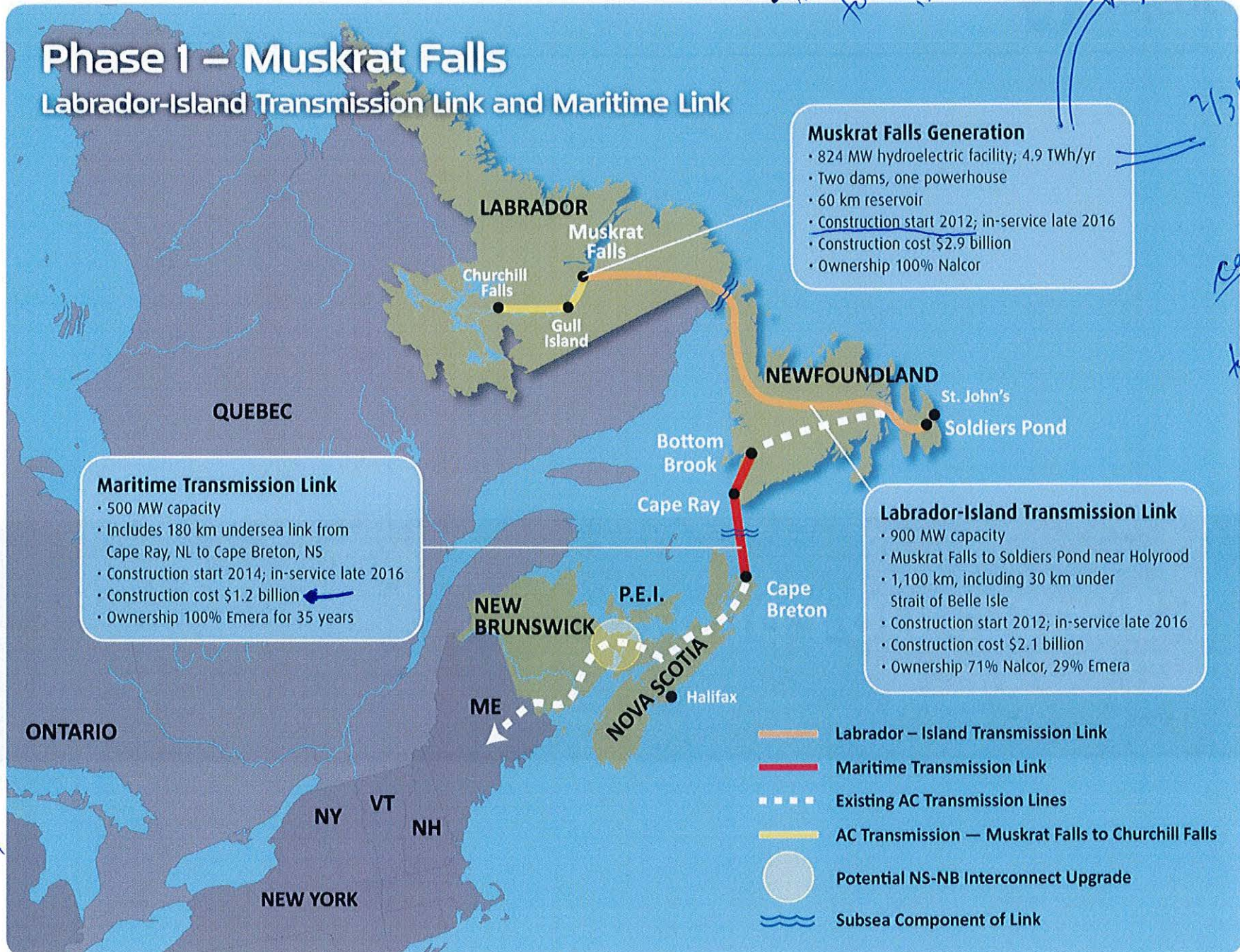
expected to be further along in EPC process

2/3rds Const usage

*Capacity 500 MW
typical production 3 hr 2200 / yr
900-900
low
when LHA comes on*

700

Collingwood





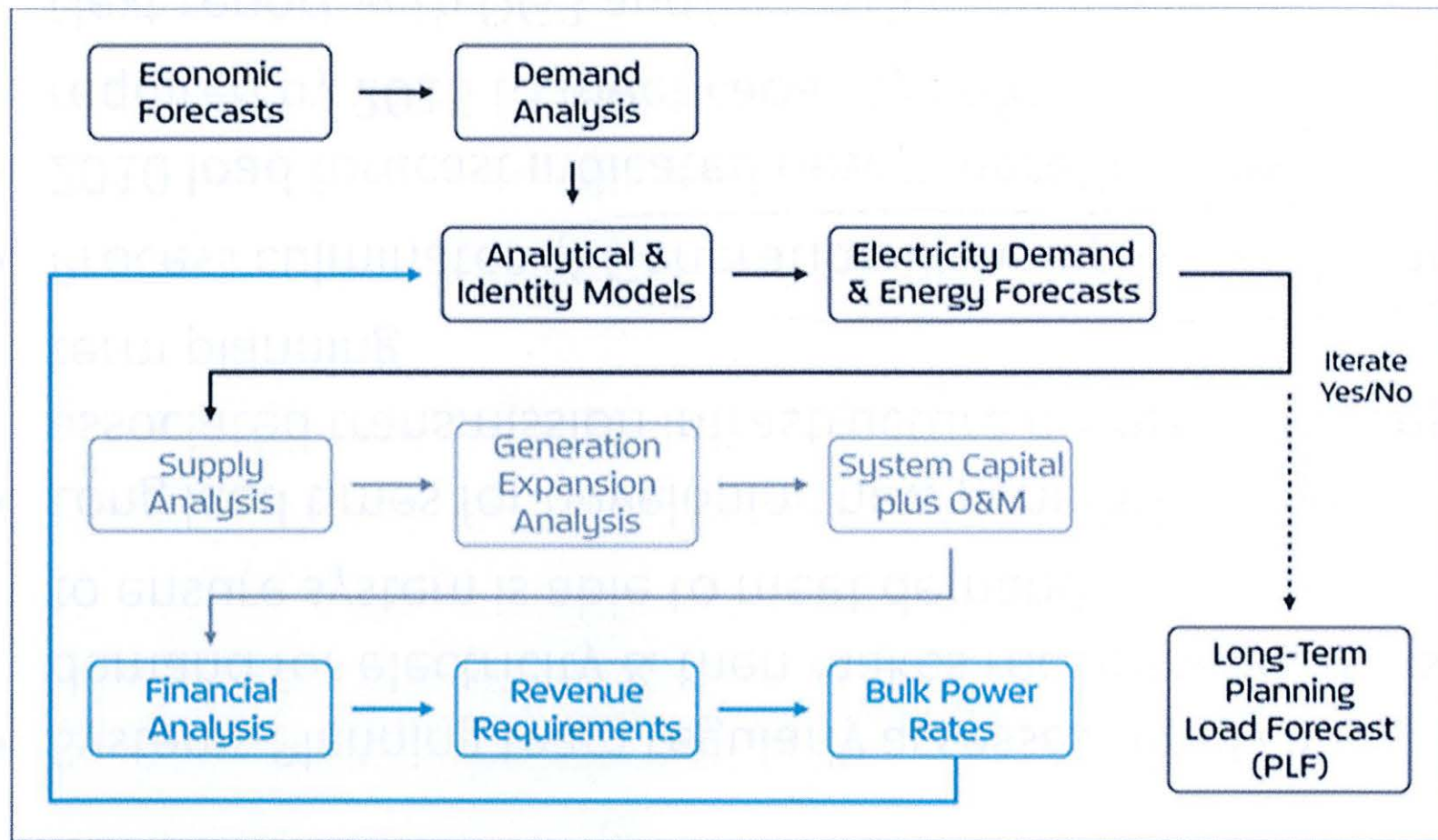
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3. Load Forecasting

Load Forecasting

- Systems Planning team regularly assesses supply and demand for electricity & then makes recommendations to ensure system is able to meet demand
- Long lead times for developing new generation and associated transmission infrastructure necessitates long-term planning
- Process culminates in Generation Planning Issues Report *update later*
- 2010 load forecast indicated new generation was required by 2015 to meet capacity deficit
- Next report with DG3 and/or 2013 capital budget process

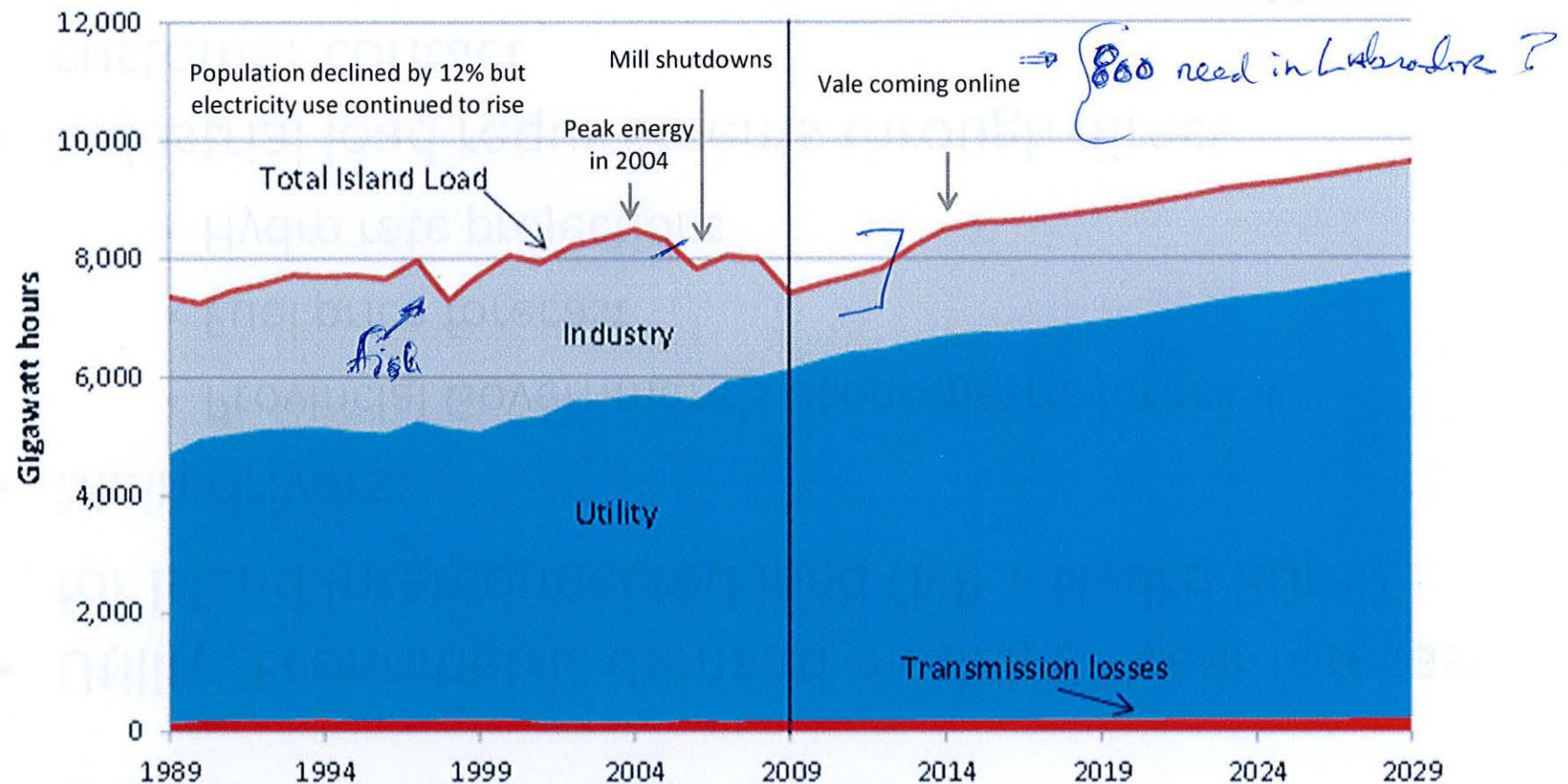
Load Forecast Cycle



Load Forecasting

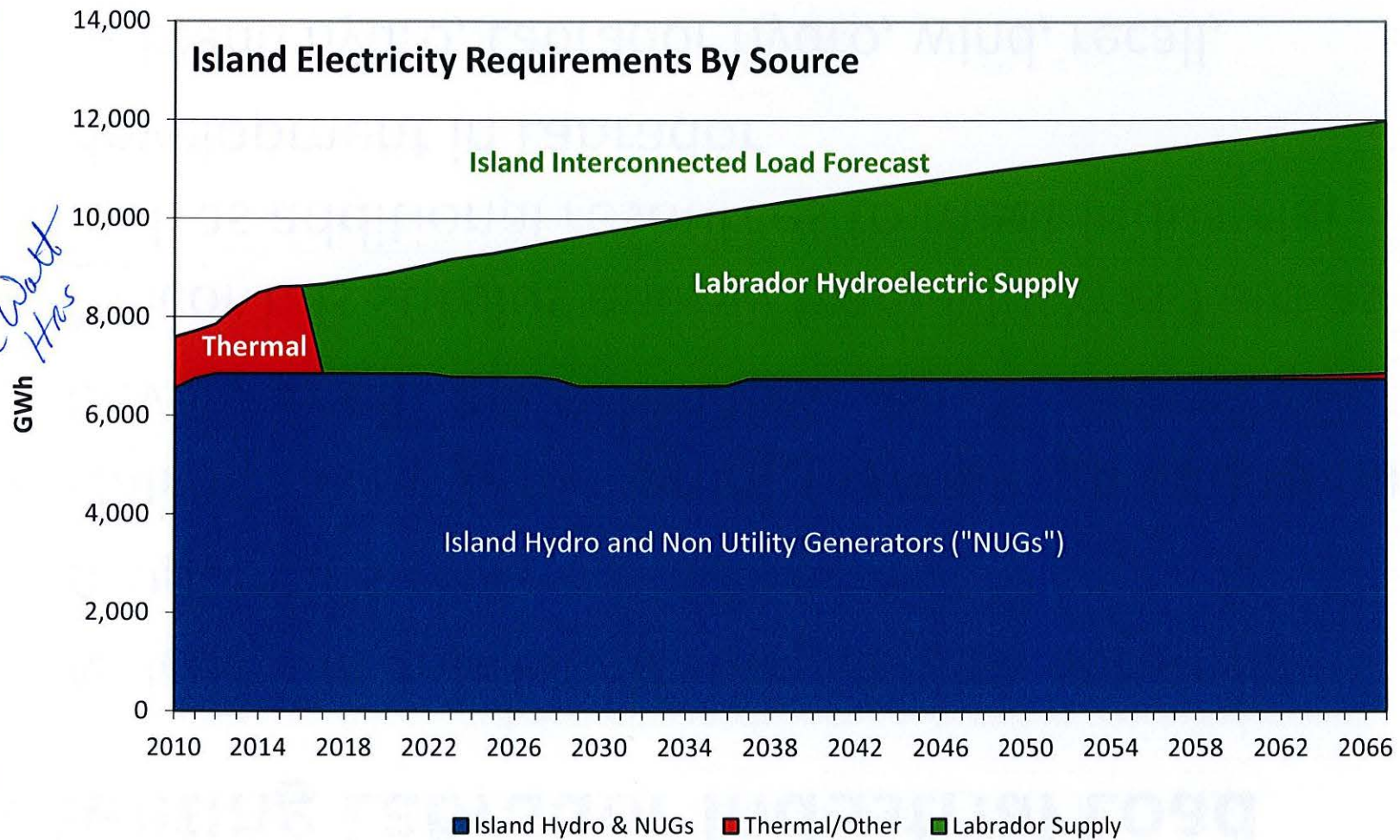
- Utility: Econometric demand model, 20 year forecast for Island Interconnected load (NP + Hydro Rural)
- Main drivers:
 - Provincial Government's econometric forecast
 - Fuel price forecast
 - Hydro rate projections
- Industrial load requirements through direct customer contact
- Post 2029 forecast by trend with growth adjustments for electric heat saturation

20 Year Forecast to 2029



Island Supply Projections (2010 – 2067)

Too
2 Term Watt
Has



Meeting Labrador Industrial Load

- Nalcor is in continued contact with potential proponents
- Nalcor has no firm commitments from additional development opportunities
- Nalcor has surplus energy from Muskrat Falls as well as additional resources to meet industrial development in Labrador
 - Island hydro, Labrador hydro, wind, recall, imports

4. System Planning Criteria & Need Identification

Generation & Transmission Planning

- Hydro has existing generation planning criteria designed to meet both capacity and energy requirements
- Transmission planning criteria focuses on bulk electricity system, terminal and sub-stations considering contingencies, back ups and emergencies
- Existing criteria optimized with minimal adaptations for isolated system

Strategist

- Software used by many utilities including Hydro to enable decision making
- Performs generation system reliability analysis
- Projection of costs simulation and generation expansion analysis
- Produces the least-cost generation expansion plans and Cumulative Present Worth (CPW)
- CPW is the present value of all incremental utility capital and operating costs incurred to reliably meet a specified load forecast given a prescribed set of reliability criteria.

Key Inputs to Strategist

- Planning load forecast
- Time period
- Load shape
- Escalation
- Fuel prices
- WACC/Discount rate
- Capital cost estimates
- PPAs
- Service Life/Retirements
- O&M costs
- Thermal heat rates
- Generation capacity & energy capability
- Asset maintenance schedules
- Forced outage rates

5. Identification of Alternatives & Screening

Identification of Alternatives

- Considered a broad portfolio of supply options to meet future needs
- Included indigenous resources, fuel imports, and importing energy from outside NL
- Proper planning of the province's electricity system must be based on proven technologies where the risks are reasonable and the probability of success is high.

Identification of Alternatives

- Phase 1 - Screening
 - Initial screen of options with highest potential to ensure effective expenditure of ratepayers' money
- Phase 2
 - Development of optimized least-cost generation expansion plans in Strategist for the supply options that have advanced through phase 1 screening

Phase 1 Screening Principles

Five key criteria used to evaluate generation supply options

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

Phase 1 Screening Results

- Alternatives that passed screening grouped into two broad categories:
 - **Isolated Island:** Electrical system on the island continues to operate in isolation of NA grid. New generation capacity limited to what can be developed on the island
 - **Interconnected Island:** Utilizes generation sources predominantly off the island and depends on at least one transmission interconnection

Phase 1 Screening Results

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

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NE market with entry into Long term Forecasts.

More can be done if interconnected?

Phase 2

- Strategist was used to optimize generation alternatives in each category
- The optimized, least-cost expansion plans are finalized for each category as determined by Strategist:
 1. Isolated Island Alternative
 2. Interconnected Island Alternative

Conservation and Demand Management (CDM)

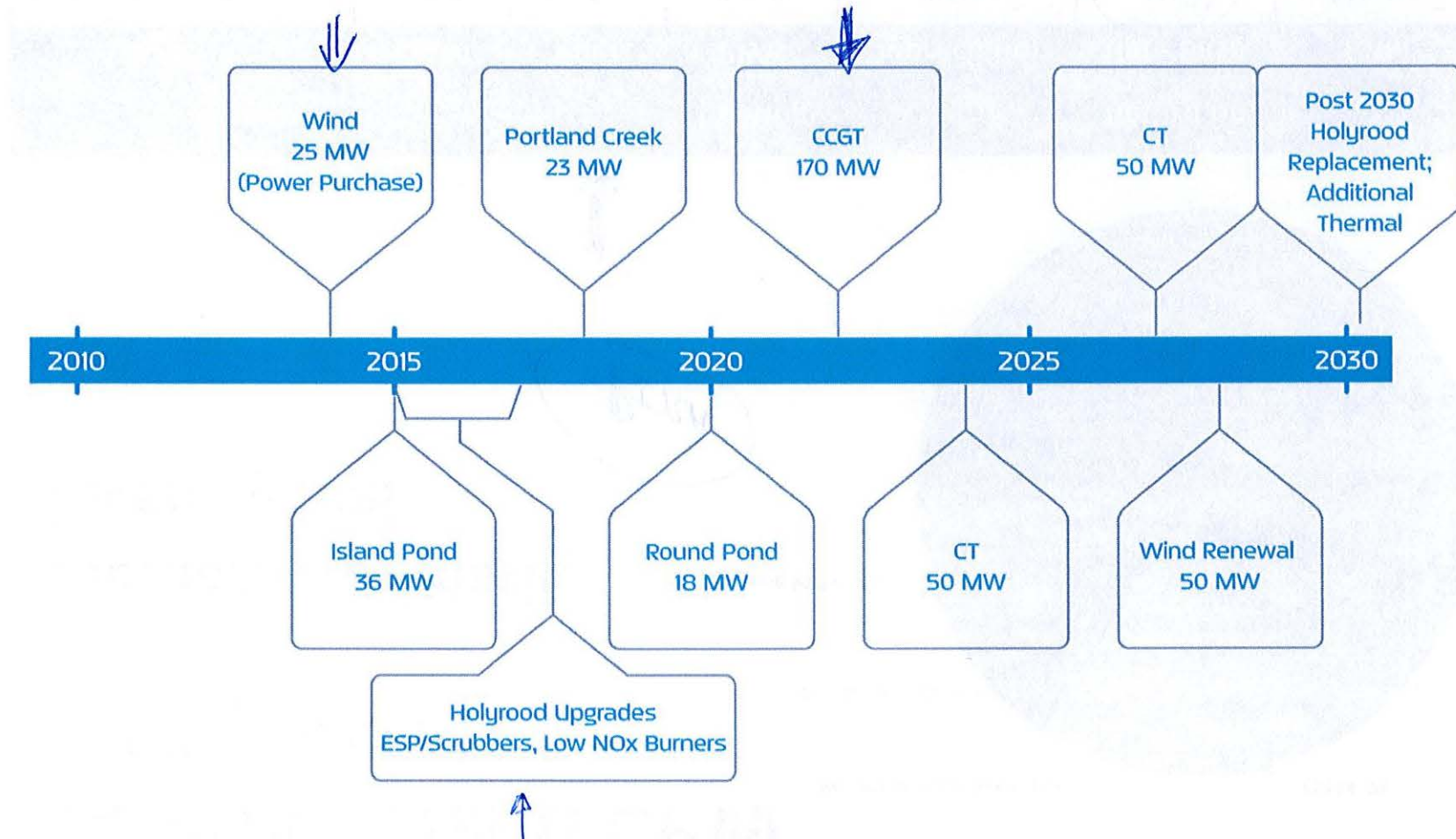
- Response to CDM programs and initiatives to date modest and lagging targets
- Hydro will continue pursuing conservation and energy efficiency measures
- Due to uncertainty of outcomes, Hydro has not incorporated CDM savings targets into its load forecast, or considered it as an alternative to a new source of generation
- Completed sensitivities due to early stage of CDM programs

6. Isolated Island Alternative

Isolated Island Alternative

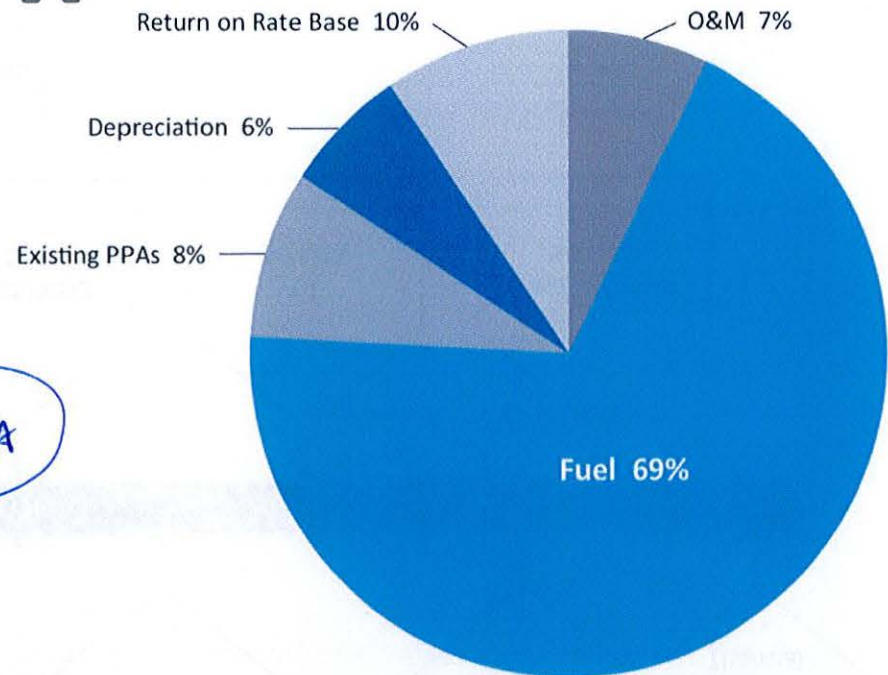
- Involves proven technologies and supply options that:
 - Passed initial screening
 - Have been sufficiently engineered to ensure they can meet reliability, environmental and operational requirements
- Heavily dependent upon thermal generation
- High level of certainty that elements can be permitted, constructed and integrated successfully with existing operations

Isolated Island Alternative (2010-2030+)



Isolated Island CPW (2010\$, millions)

Alternative primarily
driven by fuel



PIRA



	O&M	Fuel	Existing PPAs	Depreciation	Return on Rate Base	Total
Isolated Island	\$634	\$6,048	\$743	\$553	\$831	\$8,810
% of Total CPW	7.2%	68.7%	8.4%	6.3%	9.4%	100%

Source: Nalcor response to MHI-Nalcor-1

Fuel Forecast

- Beyond PIRA forecast (20 yrs), fuel price held constant in real terms
- 2010-2025, Compound Annual Growth Rate (CAGR) ranges from 3.5 to 4.5% depending on fuel
- NEB and EIA forecasts which extend to 2035 are consistent with our forecast
- MHI tested at 1% above and 1% below with no material change in the CPW

Holyrood Thermal Generating Station

- 40+ year old oil fired facility does not have environmental control equipment
- Energy Plan environmental commitments for electrostatic precipitators and scrubbers for SO_x, and particulate - \$582M
- To address nitrous oxide (NO_x) emissions, low NO_x burners included - \$20M
- These measures - total cost \$602M - will not address greenhouse gas (GHG) emissions
- Life extension costs from 2016-2029 - \$233M

7. Interconnected Island Alternative

Interconnected Island Alternative

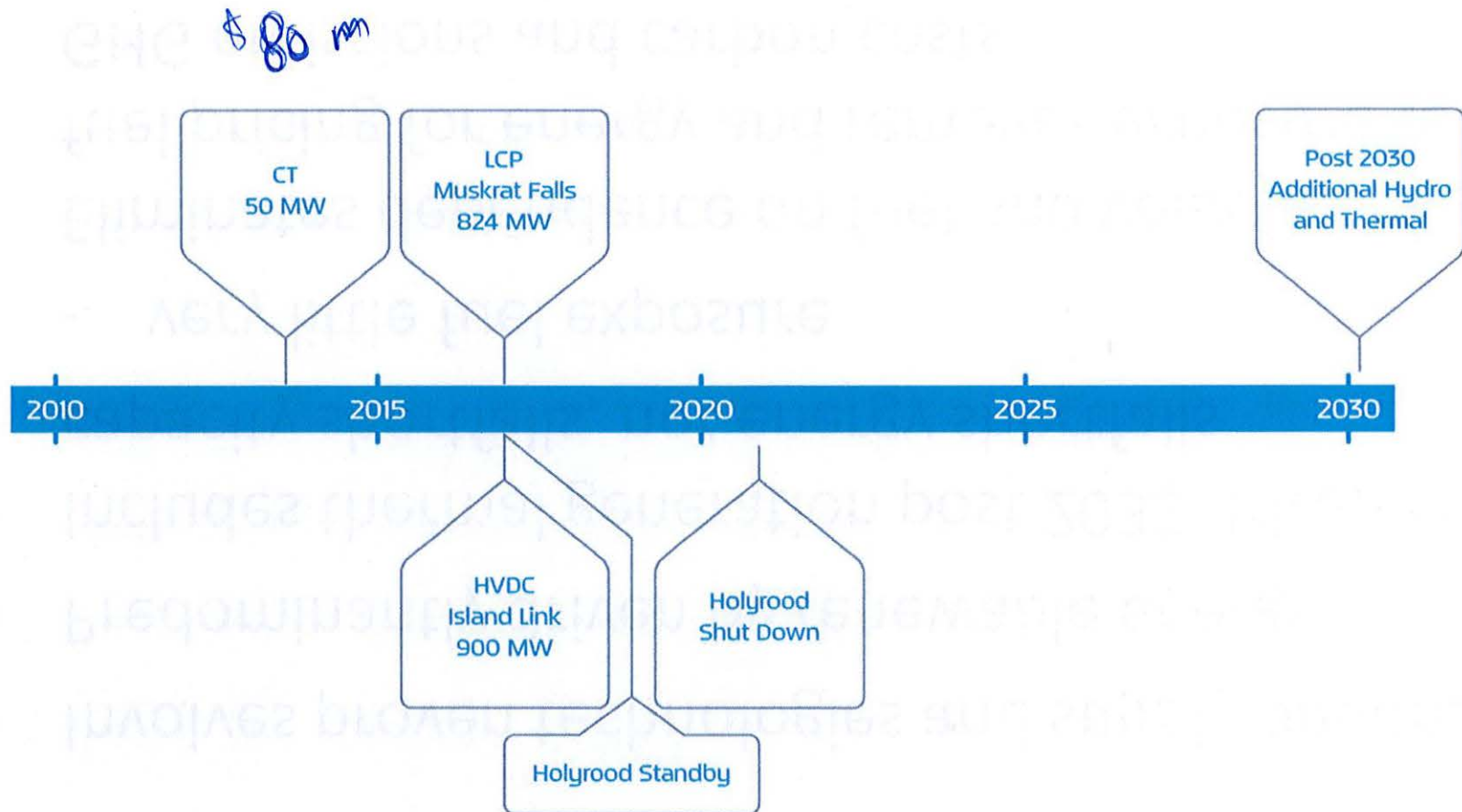
- Muskrat Falls hydroelectric generating facility (824 MW) and 900 MW Labrador-Island Transmission Link
- Average annual production of 4.9 TWh
- Holyrood production displaced by 2021 and generators will operate as synchronous condensers, providing voltage support on the eastern Avalon Peninsula

2017
to decommission
standby.

Interconnected Island Alternative

- Involves proven technologies and supply options
- Predominantly driven by renewable energy
- Includes thermal generation post 2033 driven by capacity shortfalls, not energy shortfalls
 - very little fuel exposure
- Eliminates dependence on fuel and volatility of fuel pricing for energy and removes exposure to GHG emissions and carbon costs

Interconnected Island Alternative

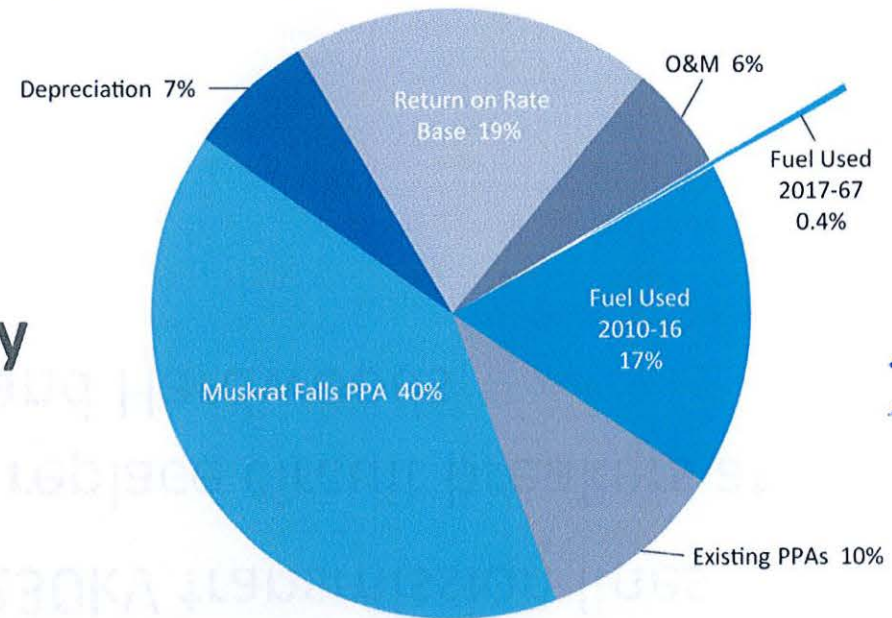


Interconnected Island Transmission

- Construction of 900MW HVdc transmission line from Labrador to the island
- Installation of converter station at Soldiers Pond avoids construction of 230kV transmission lines
- Analysis shows need to replace circuit breakers at Bay d'Espoir, Holyrood and Hardwoods

Interconnected Island CPW (2010\$, millions)

Alternative primarily
driven by renewable energy



IPA projects

	O&M	Fuel 2010 - 2016	Fuel 2017- 2067	Existing PPAs	Muskrat Falls PPA	Depreciation	Return on Rate Base	Total
Interconnected Island	\$376	\$1144	\$25.5	\$676	\$2,682	\$450	\$1,297	\$6,652
% of Total CPW	5.7%	17.2%	0.4%	10.2%	40.3%	6.8%	19.5%	100.0%



8. Cumulative Present Worth Analysis

Cumulative Present Worth (CPW)

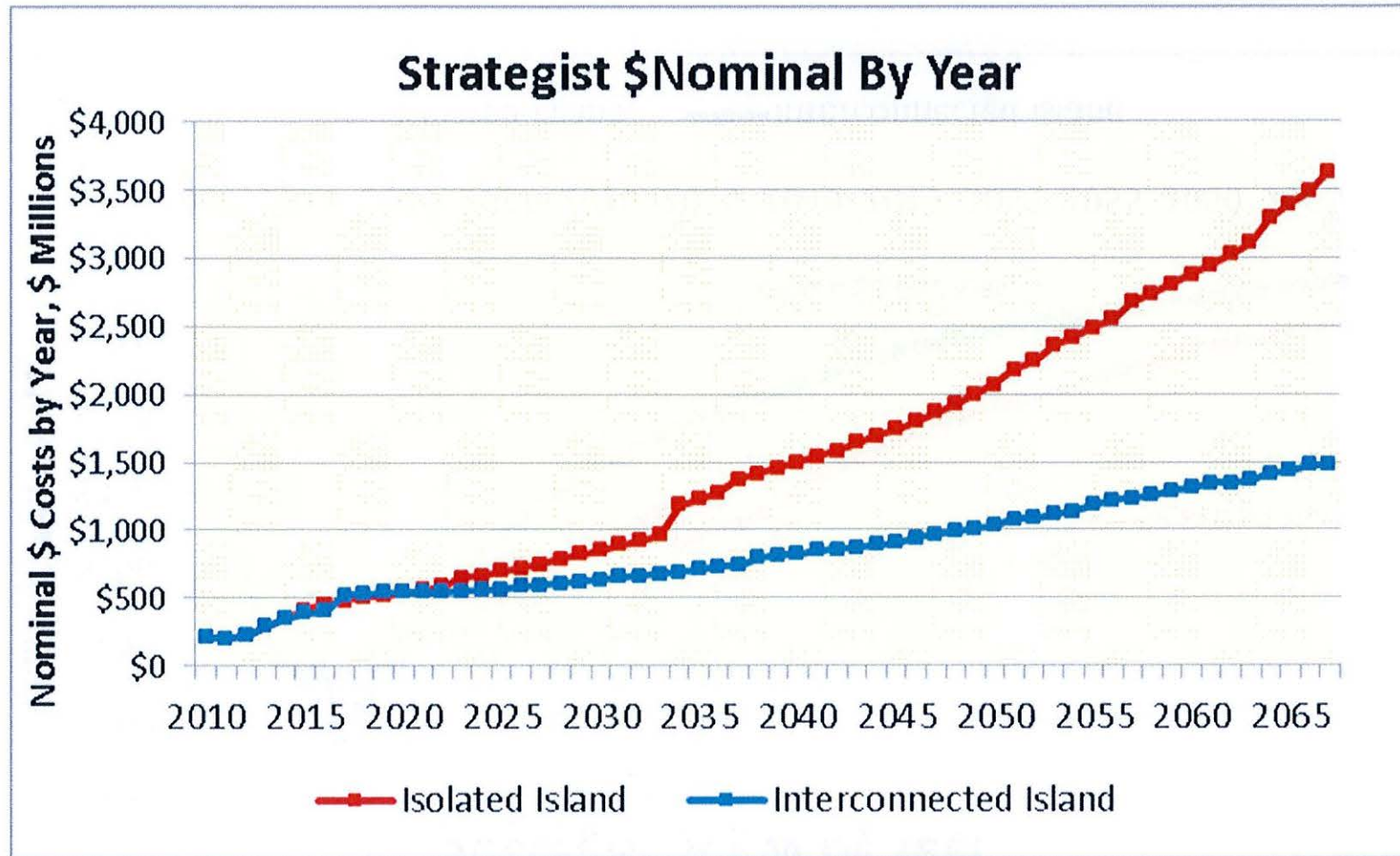
- CPW provides that point of comparability between generation expansion alternatives.
- CPW is:
 - An (engineering) economic analysis
 - A present value/discounted cost analysis of future nominal estimated costs
 - Only needs to be concerned with cost side because in regulated monopoly:
 - costs = revenues,
 - NPV = 0 and IRR = WACC

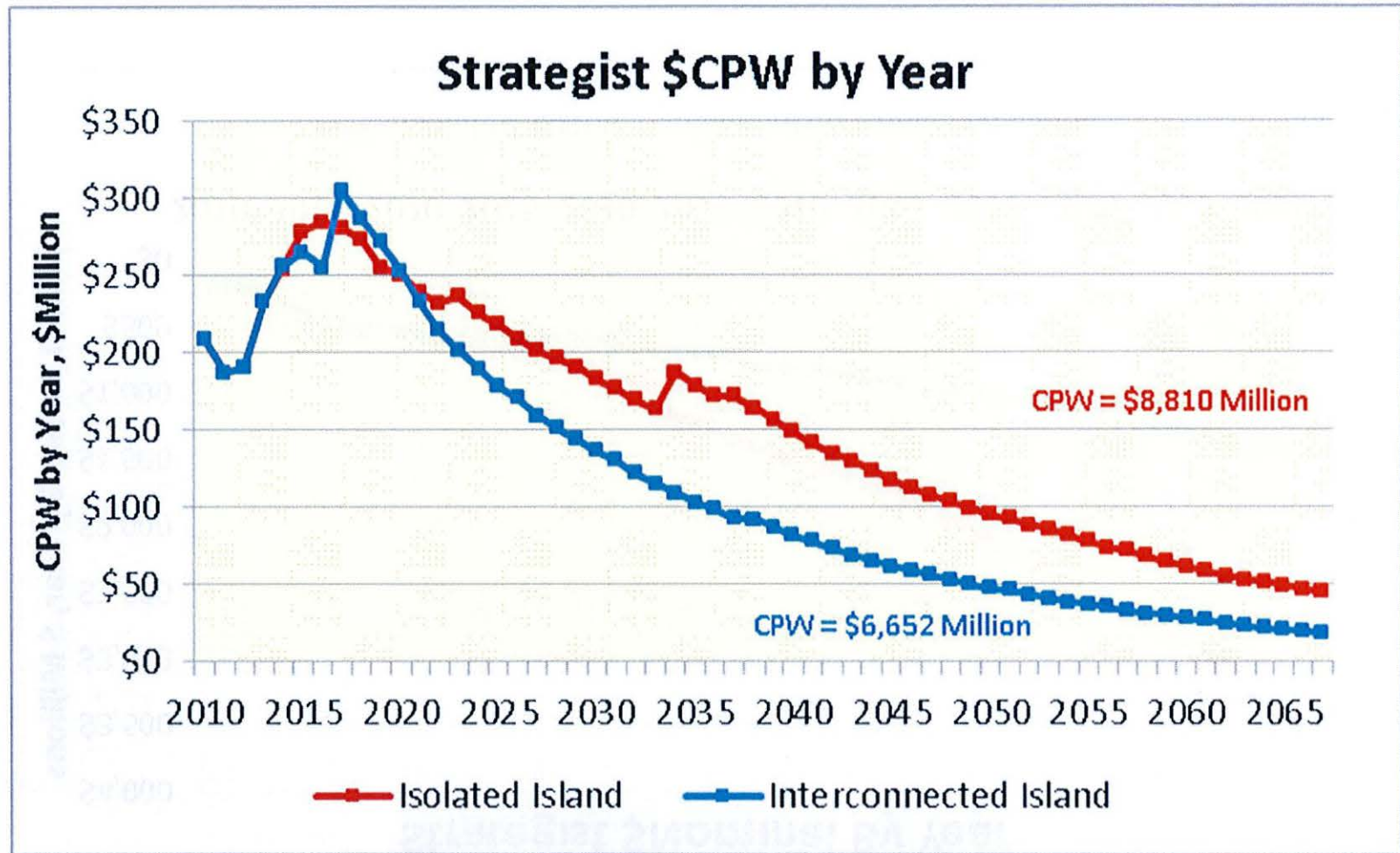
8.7%

Weighted
average

cost of capital

ME
4%



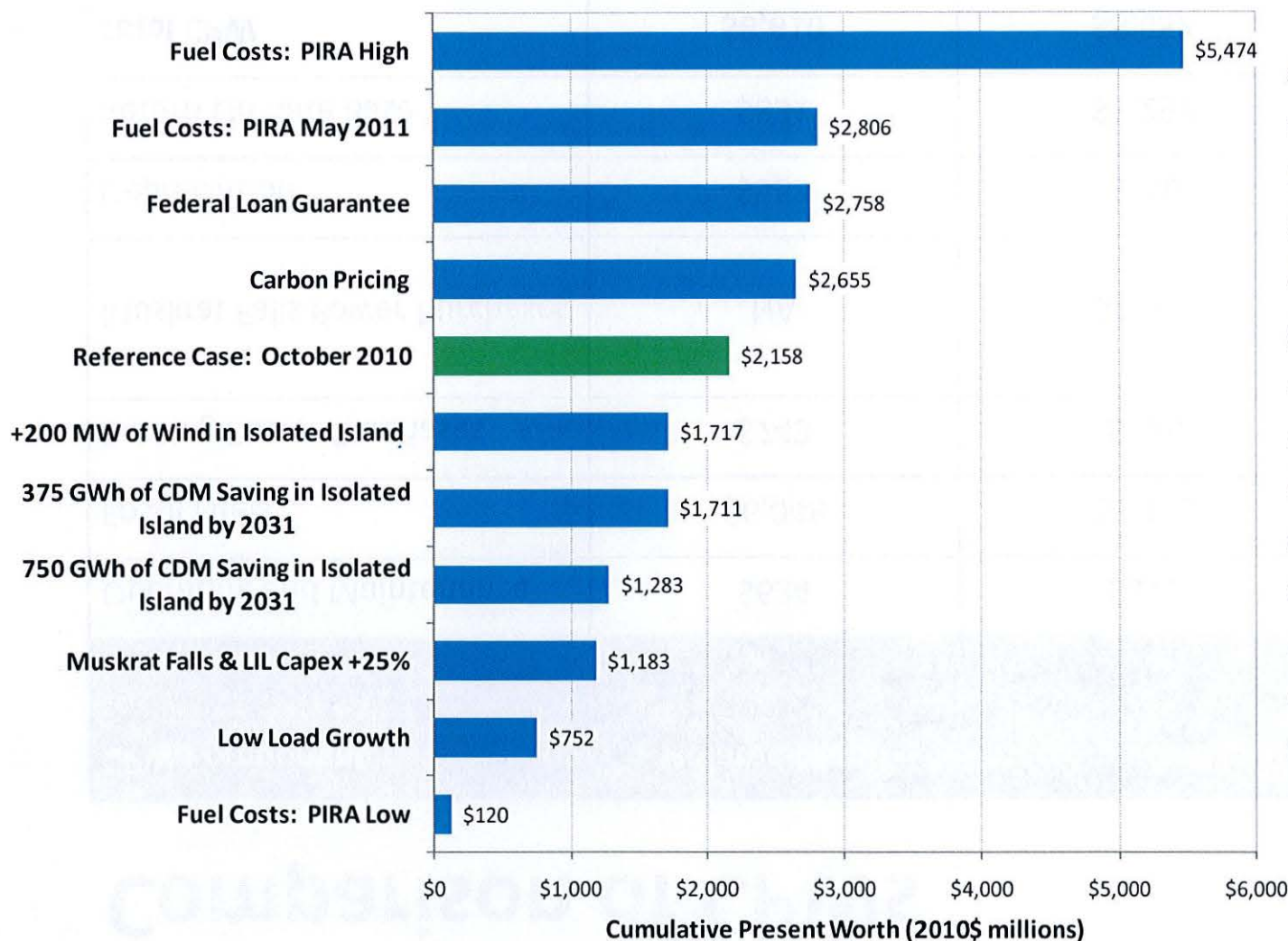


Comparison of CPWs

CPW Component	Isolated Island	Interconnected Island	Difference
Operating and Maintenance	\$634	\$376	(\$258)
Fossil Fuels	\$6,048	\$1,170	(\$4,878)
Existing Power Purchases	\$743	\$676	(\$67)
Muskrat Falls Power Purchases	NA	\$2,682	\$2,682
Depreciation	\$553	\$450	(\$103)
Return On Rate Base	\$831	\$1,297	\$466
Total CPW	\$8,810	\$6,652	(\$2,158)

Source: Nalcor response to MHI-Nalcor-1: Figures are present value 2010\$M

Robustness of Island Supply Decision



All of the sensitivity cases run by Nalcor and Navigant resulted in a Cumulative Present Worth preference for the Interconnected Island alternative clearly indicating the robustness of the DG2 decision given the underlying risk and uncertainty in key assumptions.

Mid 2012

*invest. site ??
only workers*

How and how much?

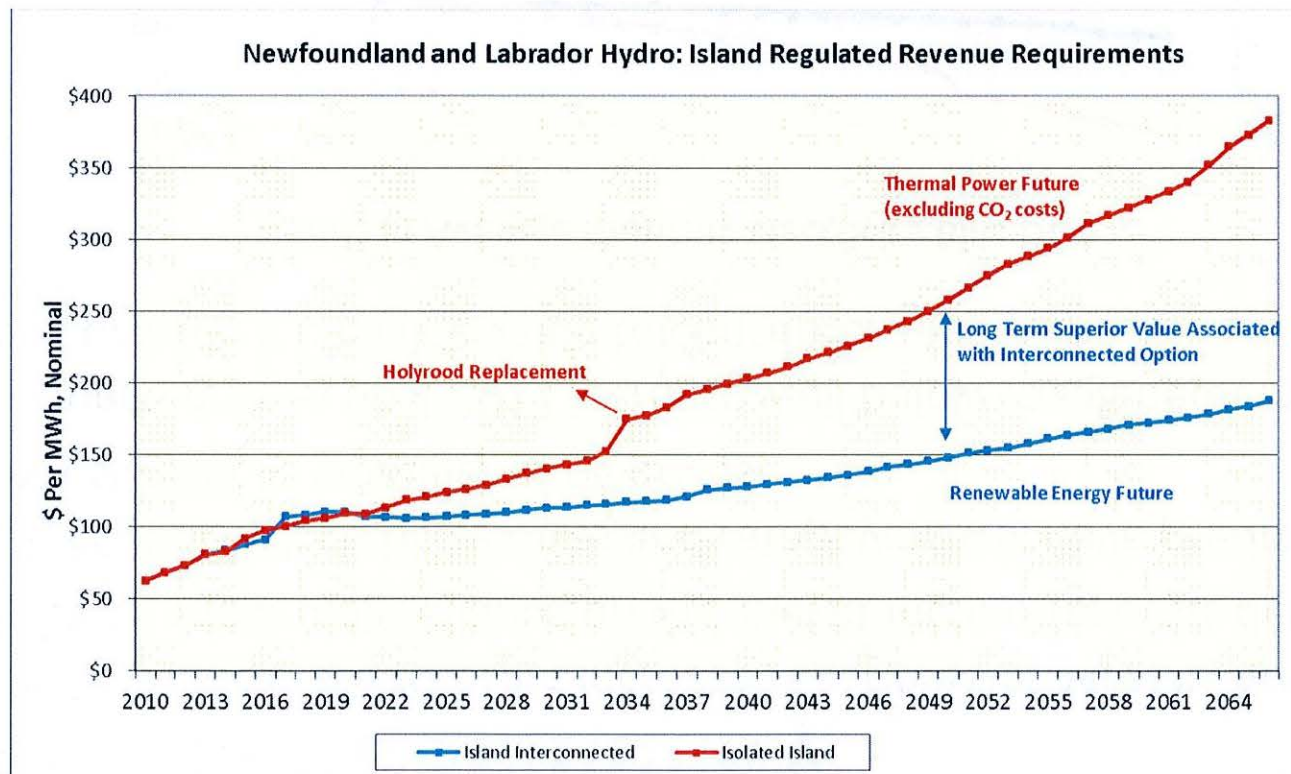
9. Revenue Requirement

Revenue Requirement

- Hydro's wholesale Revenue Requirement is the amount of revenue required annually to recover all utility costs for each alternative, including:
 1. Depreciation, return on ratebase and O&M for all existing generation and transmission assets
 2. Depreciation, return on ratebase and O&M for all incremental generation and transmission assets (i.e., new capital in Strategist)
 3. All other non-capital incremental costs (also included in Strategist) relating to fuel expenses and power purchases

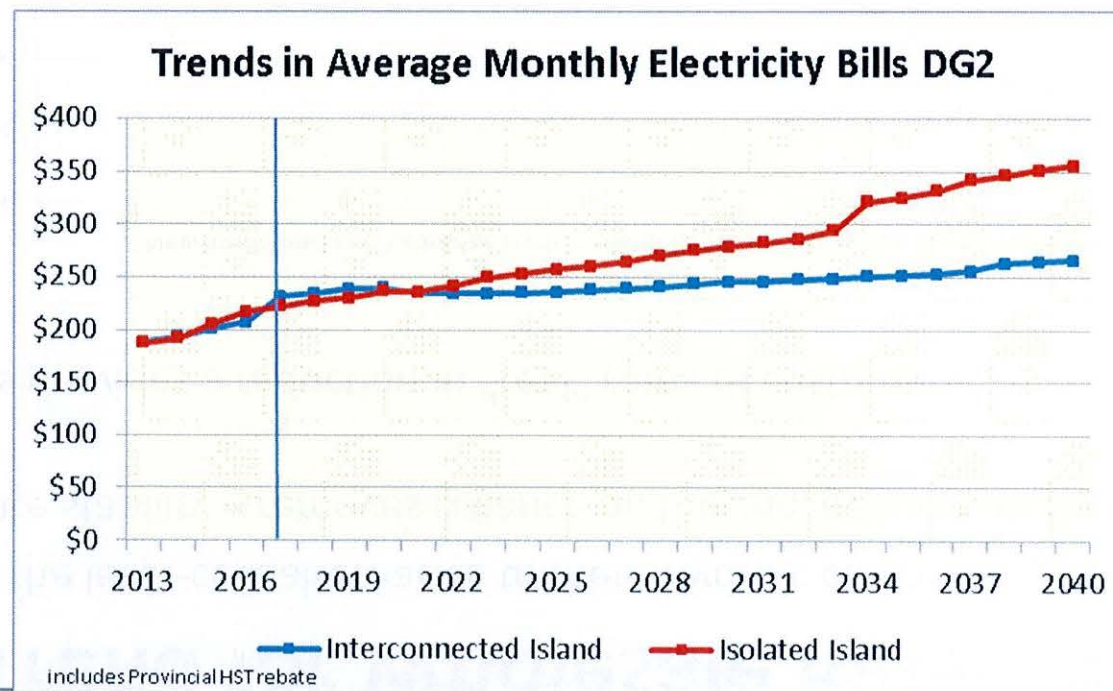
Hydro Trend for Wholesale Rates on Island

- MF provides the least-cost alternative to meet Hydro's customer demand for power
- Long-term rate stability – removes reliance on thermal generation & global fuel prices
- Muskrat Falls provides a reduction in “real” rates to customers



Retail Trends Summary

- Prior to 2017, rates are forecast increase regardless of MF+LIL, driven largely by an expanding reliance on thermal at increasing costs demand.
- In 2017, MF+LIL will stabilize rates and ratepayers will have predictable rates not subject to volatility of oil prices.
- Interconnected rates post 2017 increase well below the general inflation and thus provide increasing value to consumers over time.



Incremental Cost of Power (a.k.a. 143)

- It is the blend of all existing and future generation and transmission costs which comprises the total revenue requirement for Hydro wholesale costs. This is what is relevant for consumers.
- MF and LIL is only **one** component of the overall system cost.
- But there has obviously been great interest in MF + LIL incremental cost.
- The nominal delivered cost of power for the incremental components of each alternative will be different each year to reflect constantly changing inputs such as inflation and changes in rate base

Incremental Cost of Power

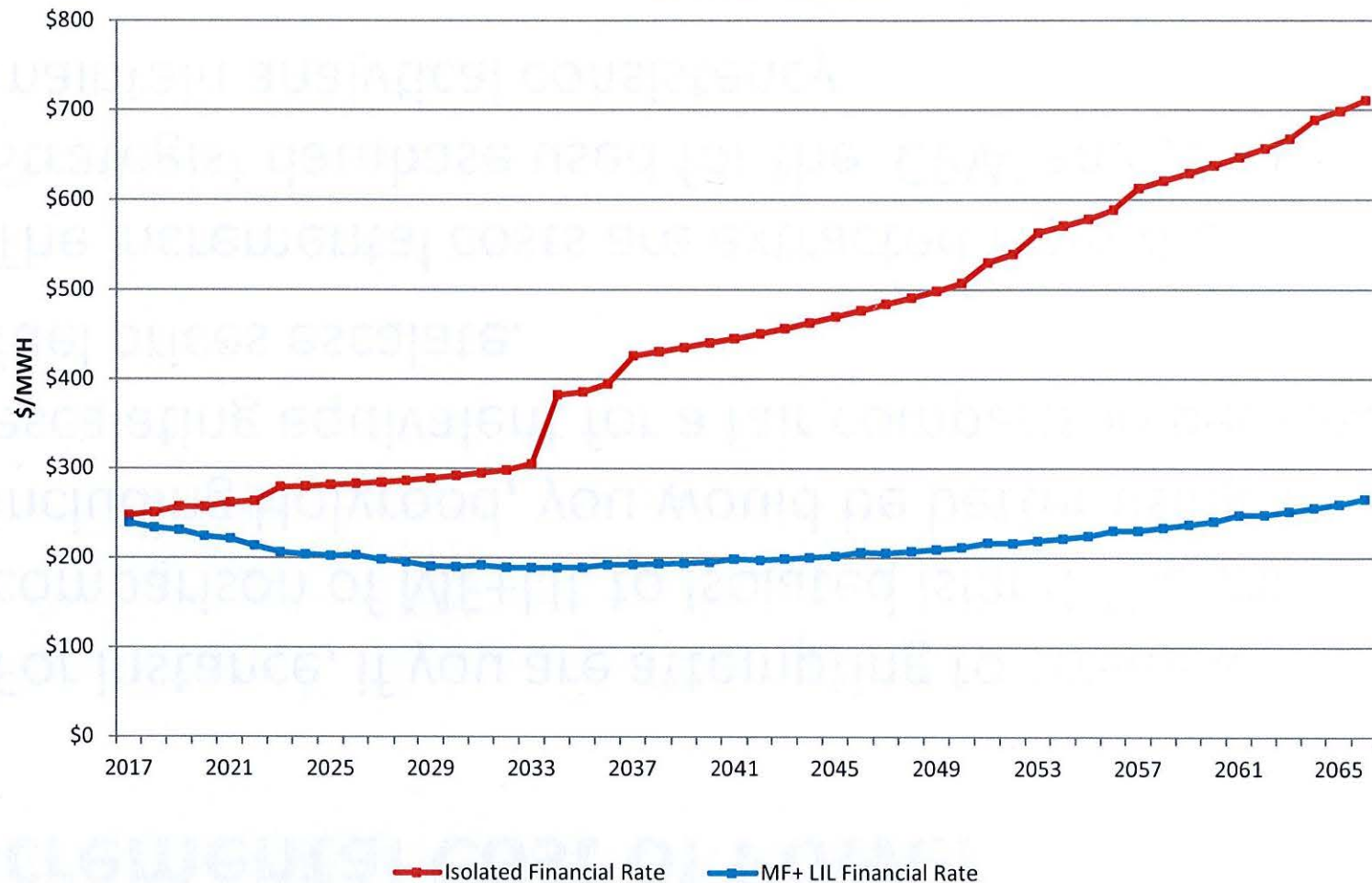
- Therefore, when comparing the incremental cost it is important to:
 - Compare to alternative.
 - Compare across the planning period.
- There are different ways to represent the annual nominal costs in order to understand the economic message contained in the data.
- The use of different representations of identical costs will depend on the circumstance.



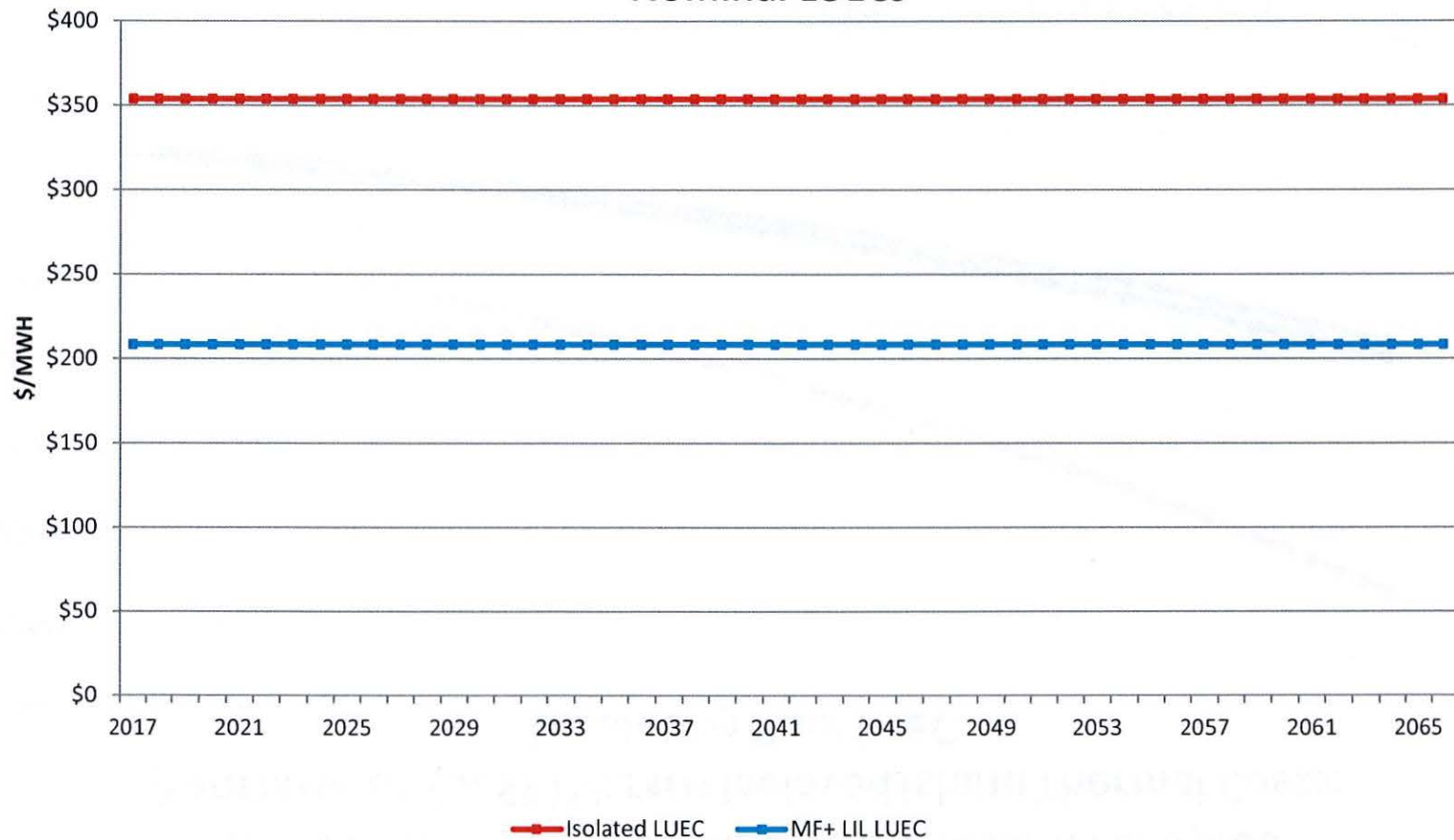
Incremental Cost of Power

- For instance, if you are attempting to create a comparison of MF+LIL to Isolated Island Thermal including Holyrood, you would be better using an escalating equivalent for a fair comparison because fuel prices escalate.
- The incremental costs are extracted from the Strategist database used for the CPW analysis to maintain analytical consistency.

Incremental Hydro Costs DG2: Muskrat Falls plus Transmission (at SP) Versus Isolated Island Thermal Costs: Financial Rates



**Incremental NLHydro Costs DG2: Muskrat Falls plus Transmission
(at SP) Versus Isolated Island Thermal Costs:
Nominal LUECs**



**Incremental NLHydro Costs DG2: Muskrat Falls plus
Transmission (at SP) Versus Isolated Island Thermal Costs:
Escalating Real LUEC**

