Presentation to the Board of Commissioners of Public Utilities

February 13, 2012

Boundless Energy

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Corporate Overview

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- NL Hydro
- Churchill Falls
- Oil & Gas
- Lower Churchill
- Bull Arm Fabrication

"To build a strong economic future for successive generations of Newfoundlanders and Labradorians"

Nalcor Team

- Gilbert Bennett – Vice President, LCP, Nalcor
- Paul Humphries – Manager System Planning, Hydro
- Paul Harrington – Project Director, LCP, Nalcor
- Steve Goudie – Manager, Economic Analysis, Nalcor
- Jason Kean – Deputy Project Manager, LCP, Nalcor
- Paul Stratton – Senior Market Analyst, Hydro

Presentation Outline

1. Load Forecasting
2. System Planning Criteria & Need Identification
3. Identification of Options & Phase 1 Screening
4. Isolated Island Alternative
5. Interconnected Island Alternative
6. Cumulative Present Worth (CPW) Analysis
7. Muskrat Falls and Labrador-Island Link
8. Decision Gate Process
9. Project Execution
10. MHI Report

1. Load Forecasting

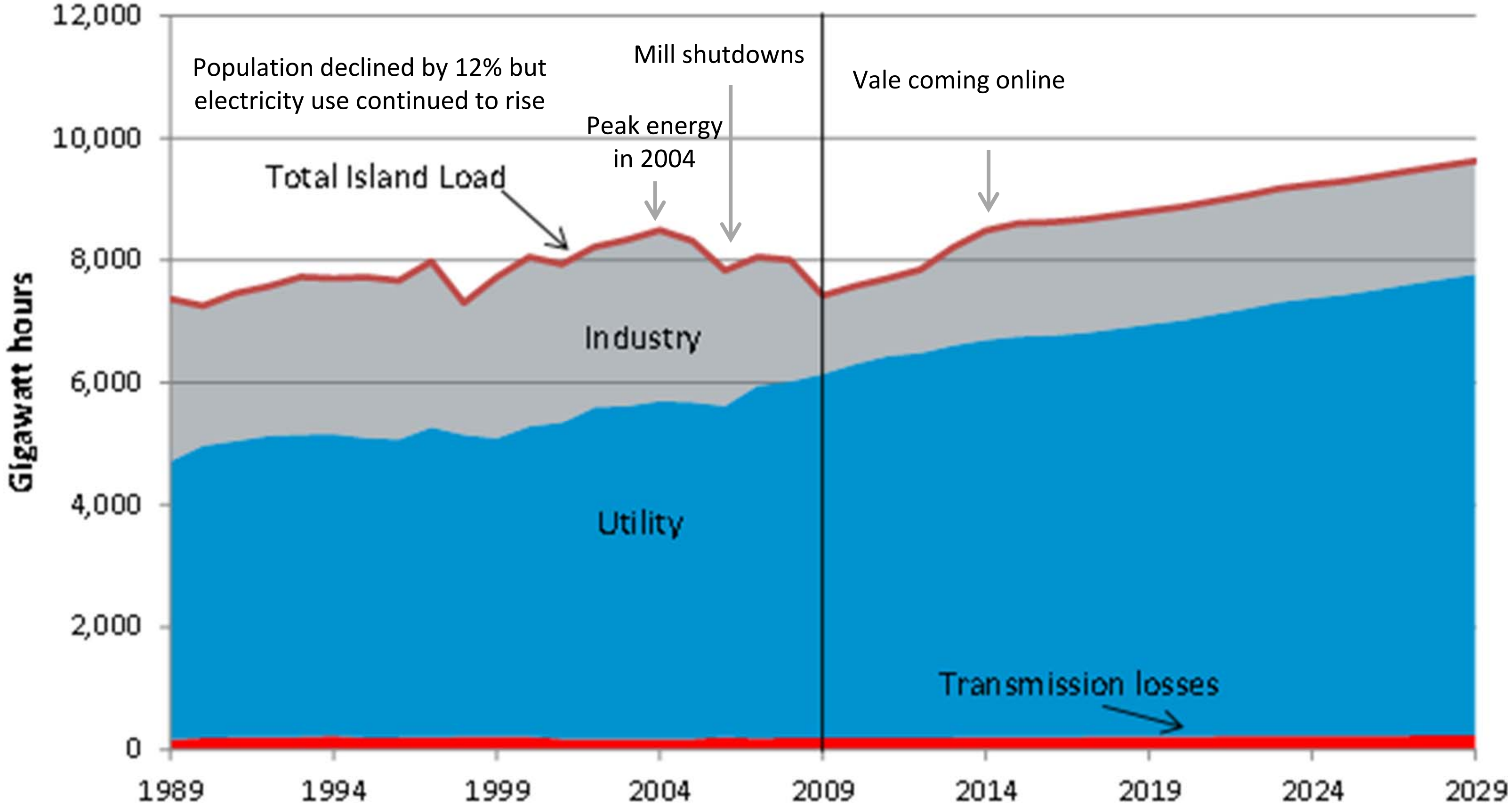
Load Forecasting

- 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.
- 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 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



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Meeting Labrador Industrial Load

- Nalcor is in continued contact with the 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

2. 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

3. 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 the 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		

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
- Nalcor 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

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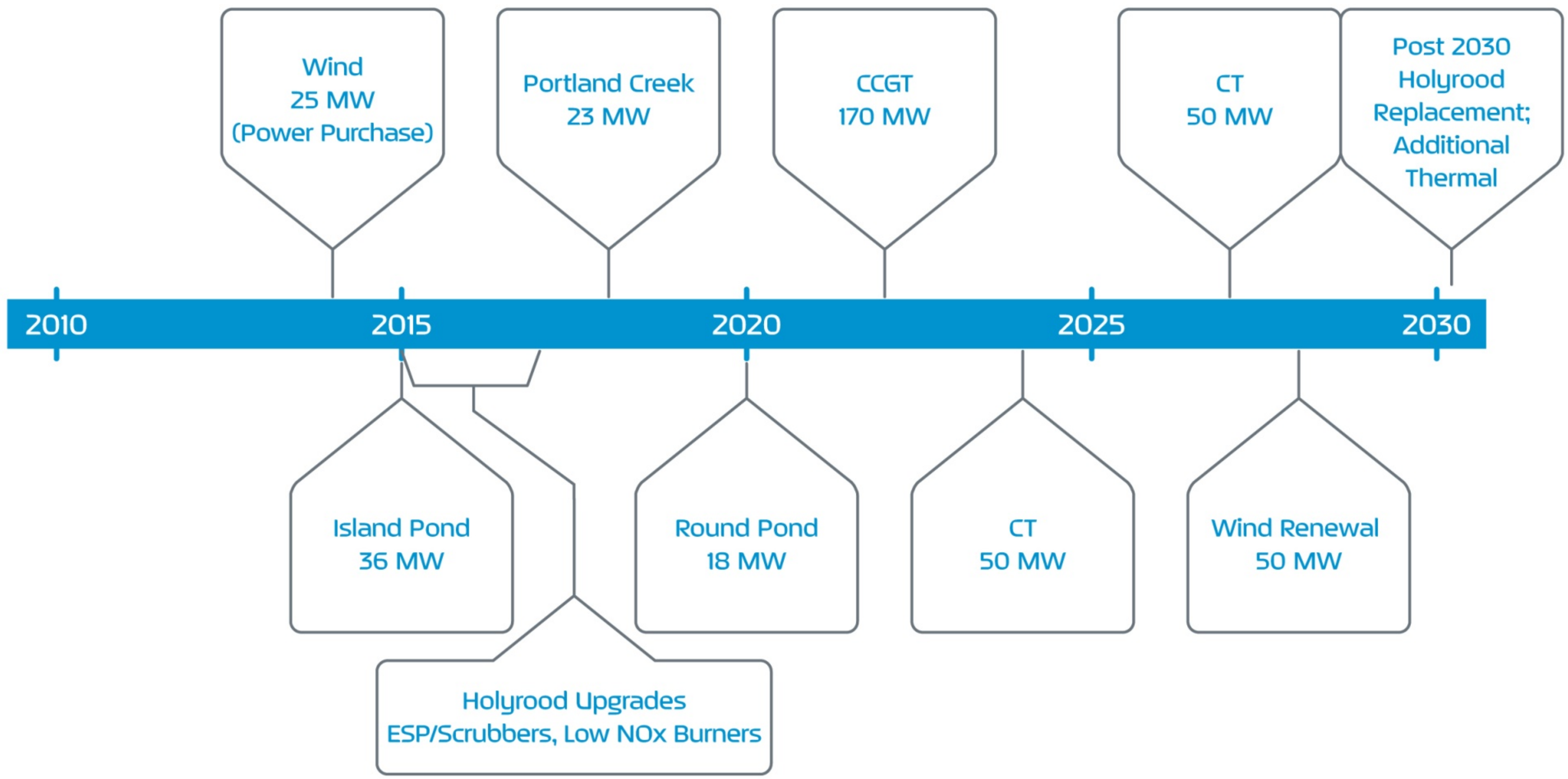
4. Isolated Island Alternative

Isolated Island Alternative

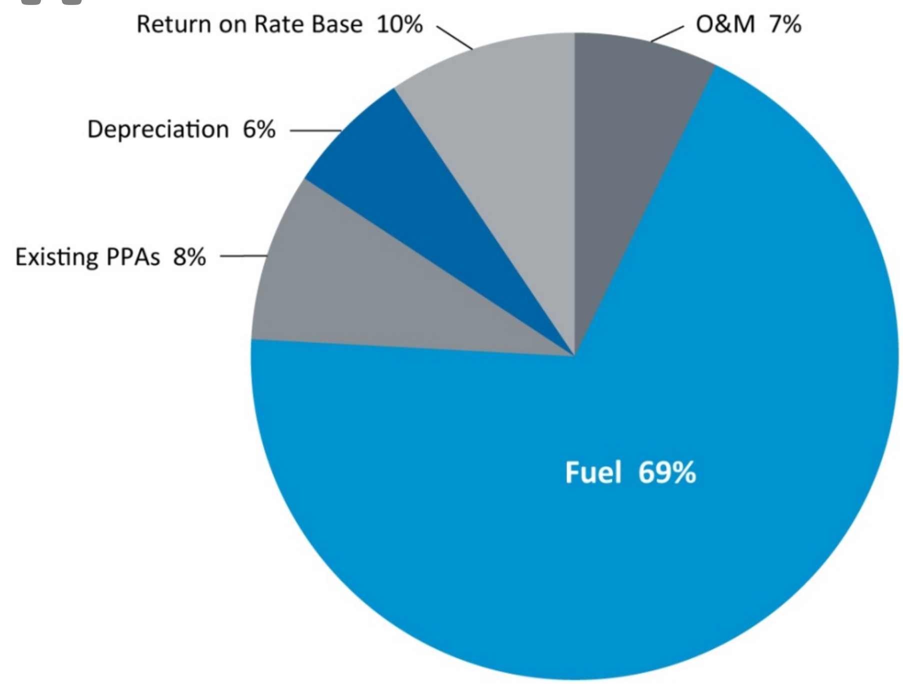
- Involves proven technologies and supply options that:
  - Passed initial screening
  - Have been sufficiently engineered to ensure they can meet reliability, environmental and operational requirements
- Heavily dependent upon thermal generation
- High level of certainty that elements can be permitted,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

Isolated Island Alternative
(2010-2030+)



Isolated Island CPW
(2010$, millions)

Alternative primarily driven by fuel



	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

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Fuel Forecast

- Beyond PIRA forecast (20 yrs), fuel price held constant in real terms.
- 2010-2025, Compound Annual Growth Rate (CAGR) ranges from 3.5-4.5% 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 SOx, and particulate - $582M
- To address nitrous oxide (NOx) emissions, low NOx burners included - $20M
- These measures - total cost $602M - will not address greenhouse gas (GHG) emissions
- Life extension costs from 2016-2029 - $233M

5. Interconnected Island Alternative

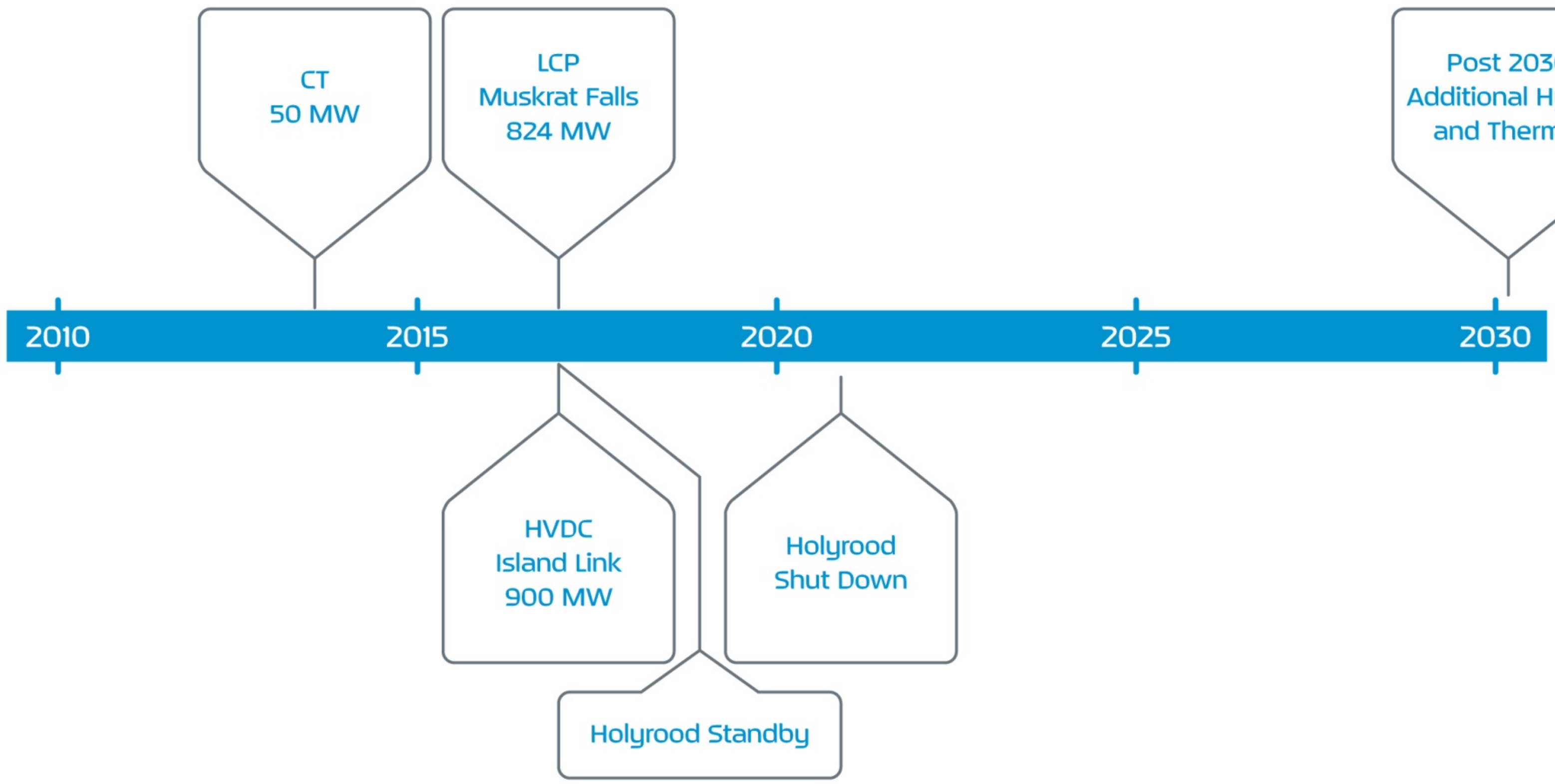
Interconnected Island Alternative

- 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

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
- Conversion of Holyrood generators to synchronous condensers
- Analysis shows need to replace circuit breakers at Bay d'Espoir, Holyrood, and Hardwoods

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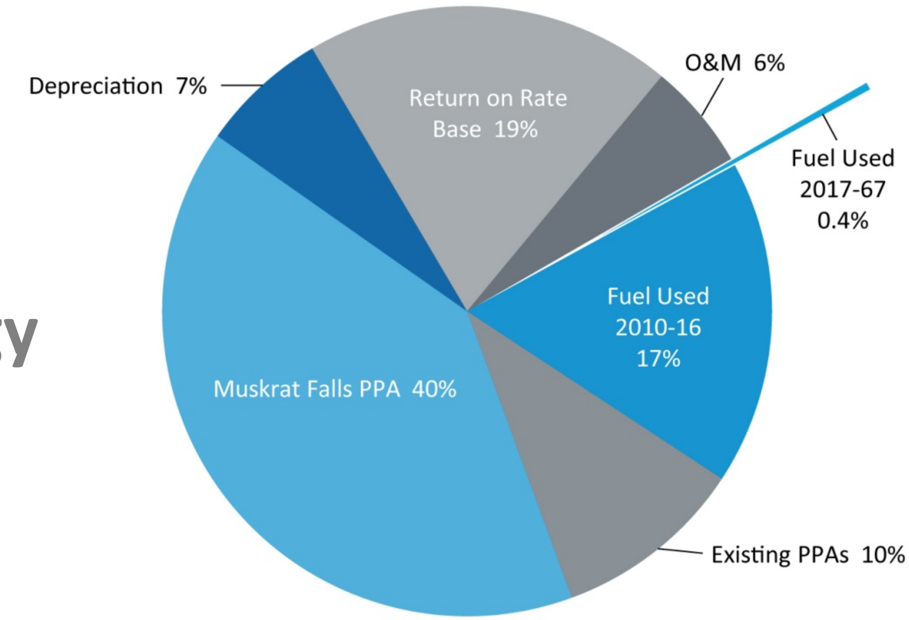
Interconnected Island CPW

(2010$, millions)

Alternative primarily driven by renewable energy



	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%

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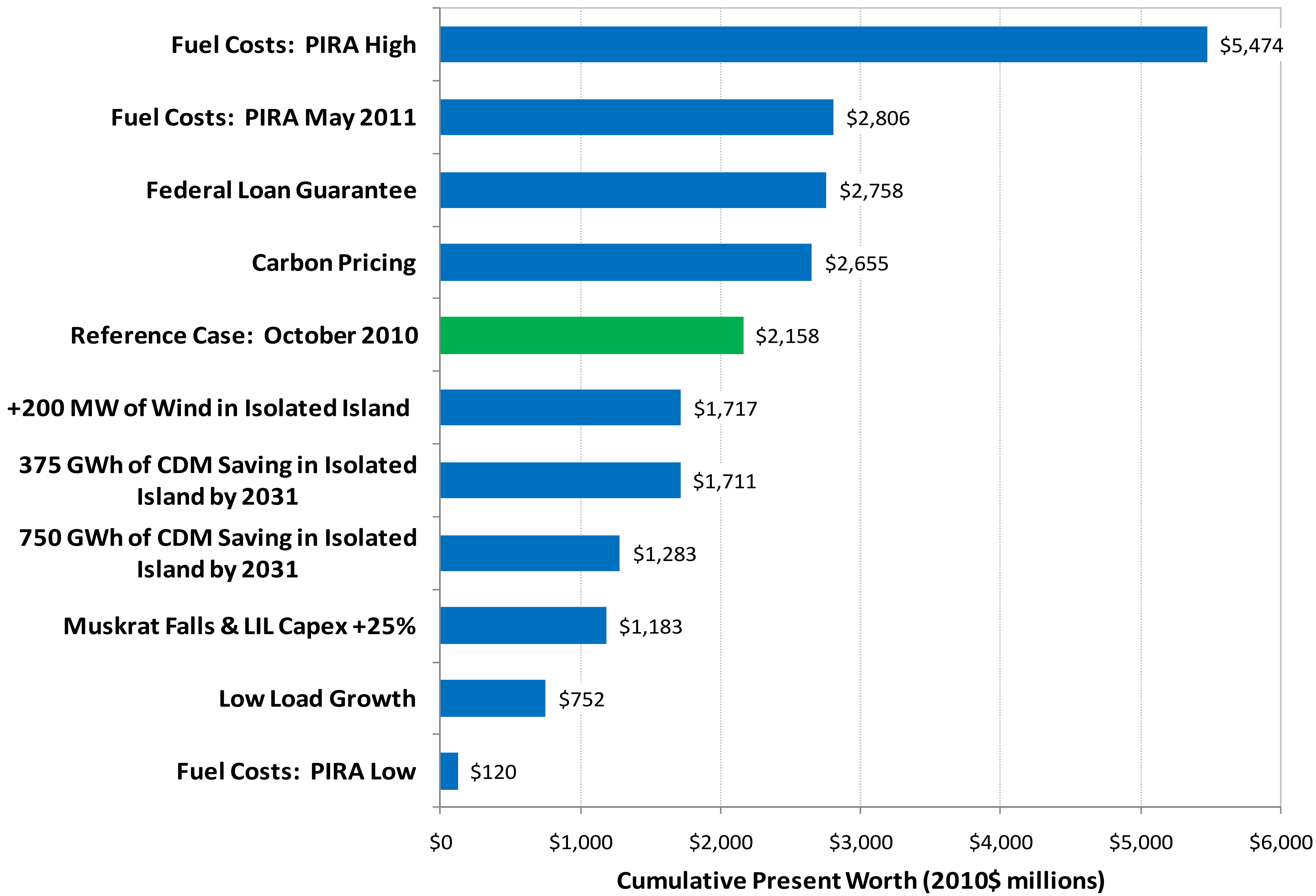
6. Cumulative Present Worth Analysis

Comparison of CPWs

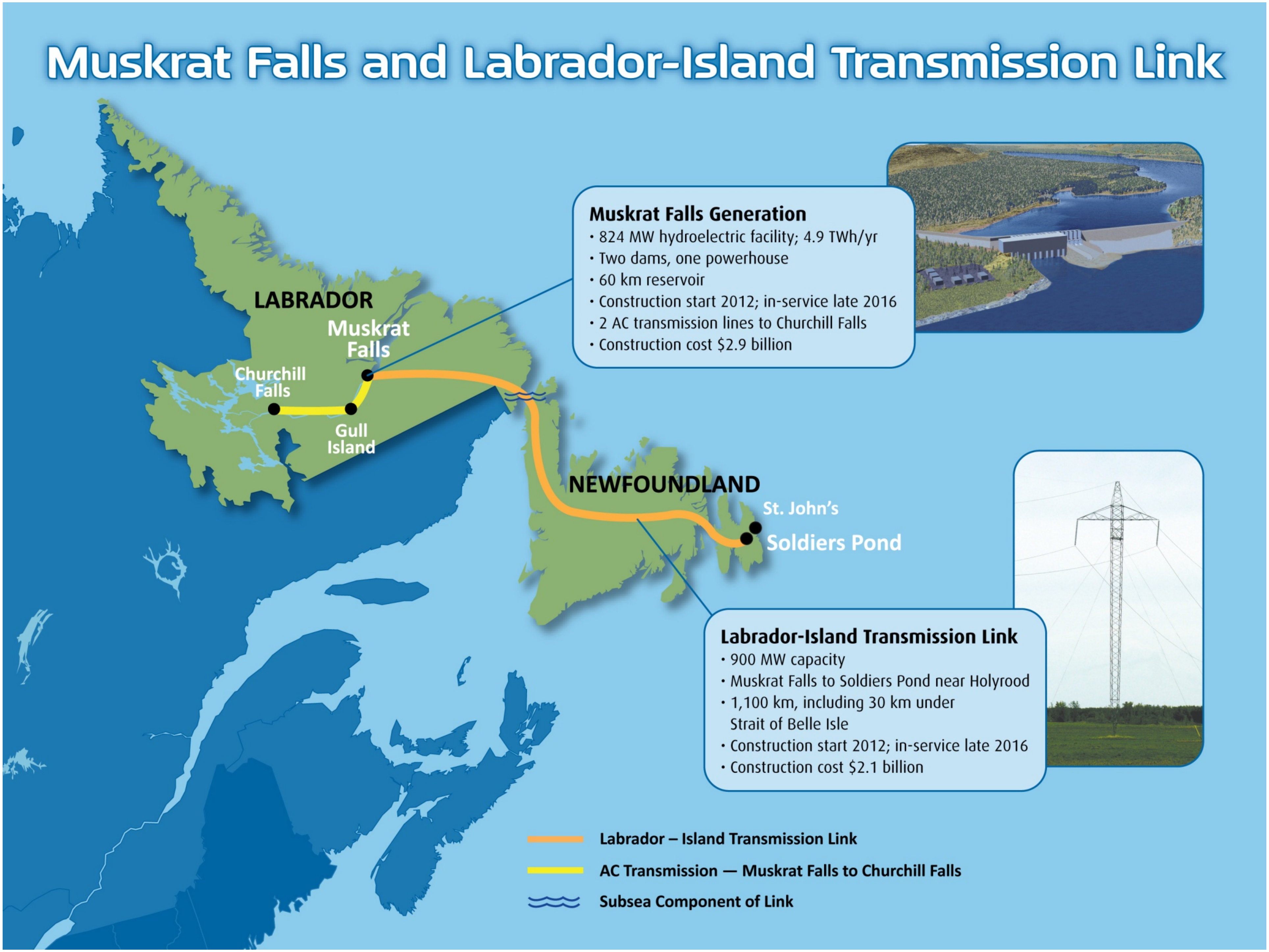
CPW Component	Isolated Island	Interconnected Island	Difference
Operating and Maintenance	$634	$376	($258)
Fossil Fuels	$6,048	$1,170	($4,878)
Existing Power Purchases	$743	$676	($67)
Muskrat Falls Power Purchases	NA	$2,682	$2,682
Depreciation	$553	$450	($103)
Return On Rate Base	$831	$1,297	$466
Total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

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

Sensitivities



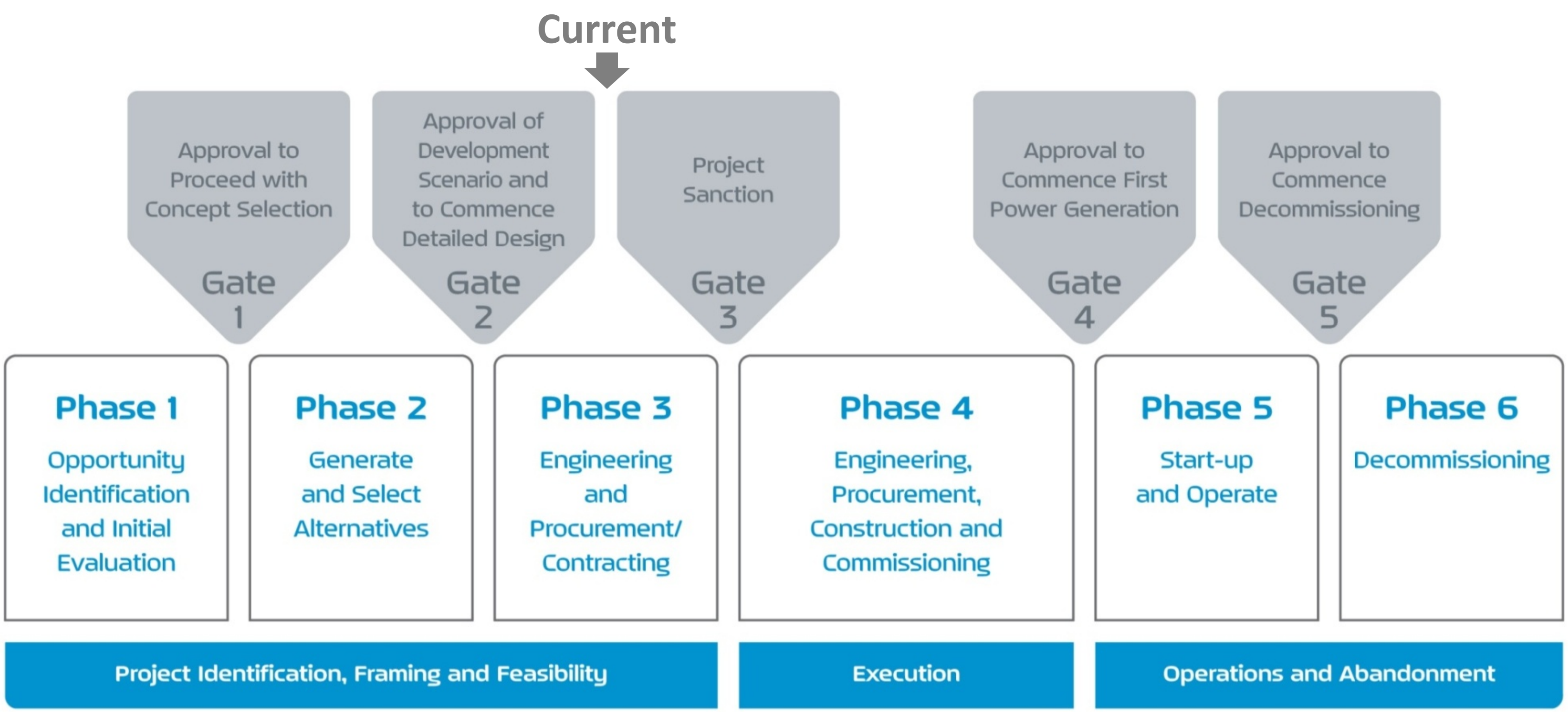
7. Muskrat Falls Project Overview


Muskrat Falls and Labrador-Island Transmission Link
LABRADOR
Muskrat Falls
Churchill Falls
Gull Island
NEWFOUNDLAND
St. John's
Soldiers Pond
Muskrat Falls Generation
• 824 MW hydroelectric facility; 4.9 TWh/yr
• Two dams, one powerhouse
• 60 km reservoir
• Construction start 2012; in-service late 2016
• 2 AC transmission lines to Churchill Falls
• Construction cost $2.9 billion
Labrador-Island Transmission Link
• 900 MW capacity
• Muskrat Falls to Soldiers Pond near Holyrood
• 1,100 km, including 30 km under Strait of Belle Isle
• Construction start 2012; in-service late 2016
• Construction cost $2.1 billion
Labrador – Island Transmission Link
AC Transmission — Muskrat Falls to Churchill Falls
Subsea Component of Link

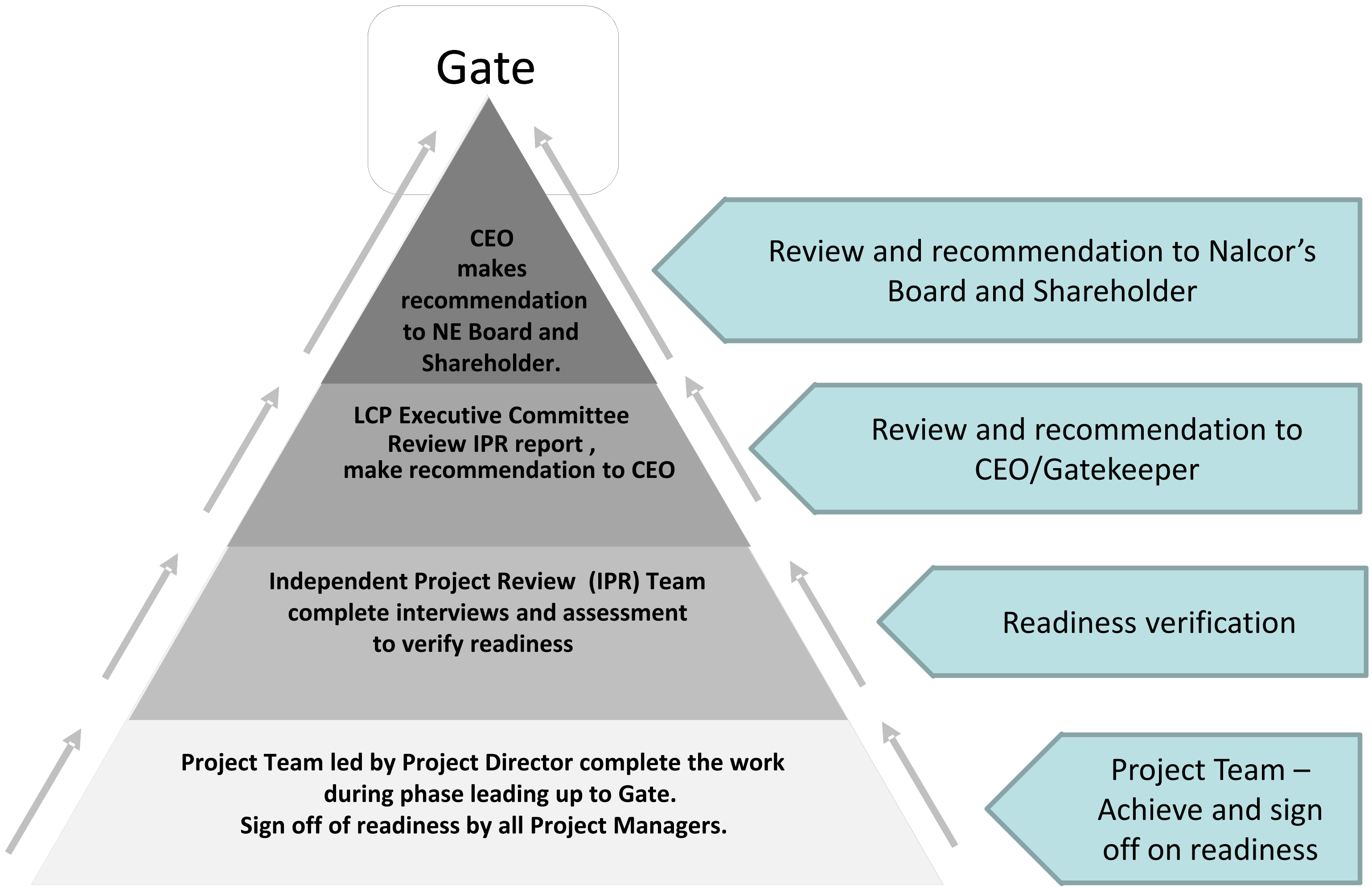
8. Decision Gate Process

Decision Gate Process

Purpose: provides checks and balances that Decision Makers require to demonstrate an acceptable level of readiness has been achieved.



Decision Process



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Project Readiness

- Reviewed in the following areas:
  - Business: Formal agreements, financing, governance, funding, CPW, system planning, system integration, facility operations
  - Project Execution: Project management and controls, technical/engineering and design, construction execution, contracting and procurement, health safety and environment, operations and maintenance
  - External: Regulatory, environmental, authorizations and, aboriginal, independent and other reviews

Activities Leading to DG3

- Engineering to increase the project definition and obtain a Class 3 estimate
- Procurement and contracting of long lead items
- Aboriginal consultation and agreements
- Environmental release
- Commercial and financing terms
- System integration planning
- Operations, reliability and regulatory compliance

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9. Project Execution

Overview

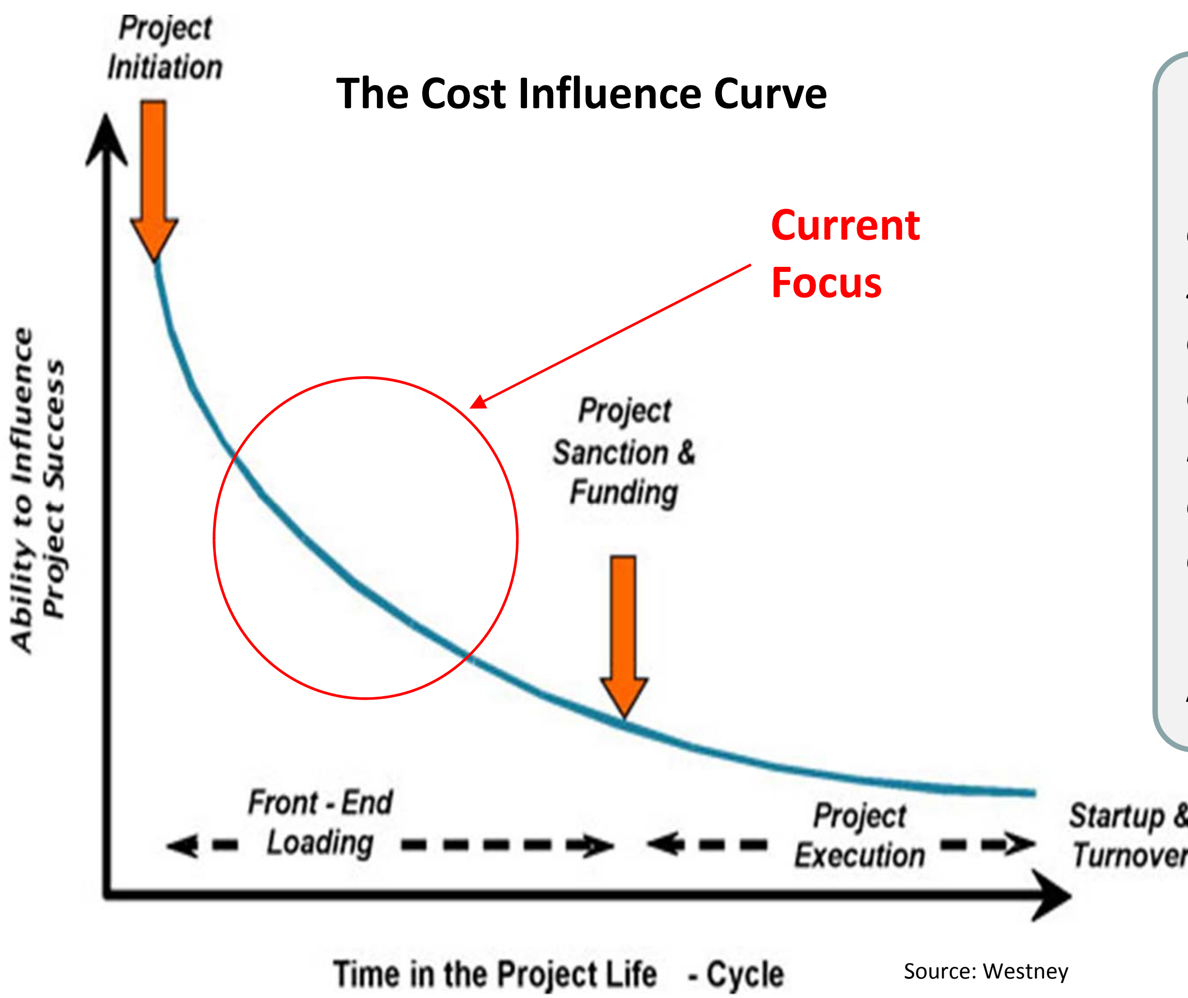
- Experienced Team
  - Significant Canadian and international project execution experience on Nalcor MF/LIL Owner Team (100+)
  - Supplemented by experienced international EPCM contractor (SNC-L)
  - Combined with 35 years hydro generation and transmission operational experience at Nalcor
- Using Proven Practices
  - Front End loading improves the project cost and schedule predictability
  - Independent reviews by IPA, IPR, Navigant and MHI confirm use of best practices

Project Success Factors

- Clear project scope definition
- Solid Project Execution Plan
- Realistic cost estimate basis
- Optimal contracting strategy
- Use of proven technology
- Strong owner team applying project controls

Front-end Loading

Highest ability to influence project success occurs early in the process



Source: Westney

"Project is better prepared than a typical megaproject at end of Front-End Loading (FEL) 2," and the "Project has clear objectives and a well-developed project team that has closed the project scope and achieved optimal project definition."

Independent Project Analysts,
August 2010

MF capital cost is driven by favourable construction characteristics

Key Element	Muskrat Falls Site Characteristics
Geotechnical Conditions	• Competent bedrock (Canadian Shield) exposed / near surface • Minimal overburden to remove and dispose • Conditions validated by comprehensive site investigations, thus limited exposure with respect to quantity growth
Constructability	• All construction materials primarily sourced from site excavations • Very good material balance leading to minimal excess material / spoils • Mostly conventional concreting methods and equipment, in dry conditions

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MF capital cost is driven by favourable construction characteristics

Key Element	Muskrat Falls Site Characteristics

Physical Layout	• No peripheral structures (i.e. dykes) required to create the Reservoir, leveraging Churchill Falls reservoir – no land purchase issues
	• Reliable, predictable flows leading to smaller variations in operating water levels
	• All power structures located at one main site
	• Robust / conventional designs for major permanent structures (Intake , Powerhouse, Spillway, Aux. Dams)
	    • Conventional or roller-compacted concrete founded on bedrock
	    • Generally low-profile dam structures (30 to 40 m high)
	• No underground works (MF has surface powerhouse)
	• No temporary spillway facilities to be constructed
	• Diversion uses existing topography & permanent structures (i.e. Spillway) rather than expensive temporary structures (e.g. Diversion Tunnels)
	• Conventional equipment (T&G sets, gates, cranes)
	• Access by road from Trans-Labrador Highway

Strategic De-risking

Achieved	Going Forward
• Selection of robust LCC HVdc technology with overload capacity • SOBI consists of 3 cables including a redundant or spare cable each in separate seabed routes • Secured SNC-L, a world class EPCM contractor • Extensive geotechnical baseline • IBA and Land Claims with Innu Nation • Pilot program for Horizontal Directional Drilling to confirm production rates prior to bid • Turbine model efficiency testing program in order to guarantee turbine efficiency and power output	• Using geotechnical results from Bulk Excavation to achieve firmer prices on Powerhouse contract • Physical Model Testing to confirm MF plant layout and hydraulics • Contracting that optimizes competition and synergies • Early award of Bulk Excavation Contract to protect schedule • Confirming long-lead deliveries and prices • Cost certainty through EPC/EPCI and fixed unit price contracts • Project Labour Agreements • System Engineering / Integration Focus

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Proven Technology

Proven technology, no first offs, no scale ups ensures operational integrity

MF

- Low-head, no penstocks concrete powerhouse founded on Canadian Shield
- Proven, model tested Kaplan turbines well within flow and head raqnge
- Design philosophies based on over 40 years of hydro-electric and transmission engineering, construction and operations
- Conservative efficiency targets supported by equipment redundancy
- Core Nalcor capability

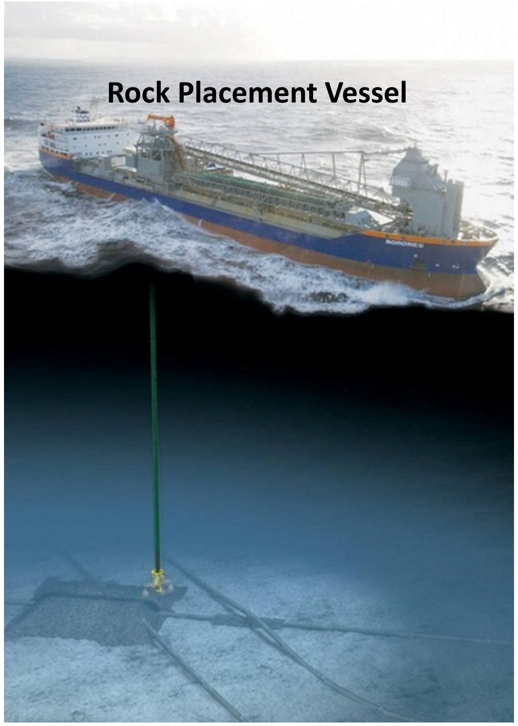
Transmission

- LCC HVDC technology used in Canada for 40+ years
- Mass Impregnated submarine cables
- SOBI cable protection methods proven offshore East Coast
- Typical HVdc Overland transmission
- Standard HDD technology well with the boundary of design for size and distance
- Conventional AC technology
- Extension of existing Labrador transmission system
- Core Nalcor capability – existing lines up to 735 kv

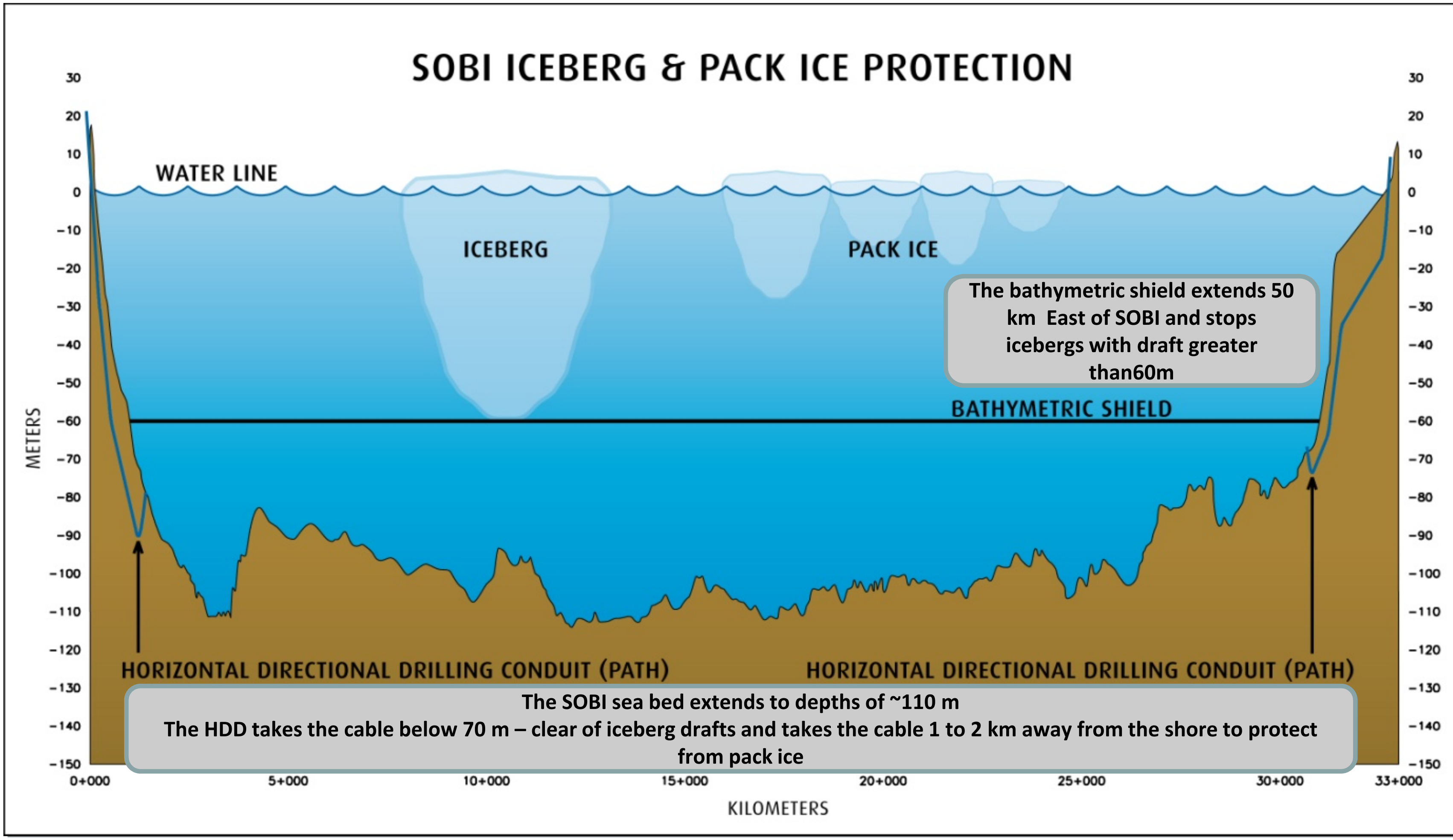
SOBI Crossing

SOBI cable crossing builds upon team's extensive experience in the design and installation of subsea infrastructure in harsh environments combined with learnings from global cable projects.

- Each of the 3 submarine cables will each have a dedicated horizontally directionally drilled (HDD) conduit to protect the cable from shore and pack ice at the landfall points.
- The conduits will take each cable to a water depth of between 60 to 80m, thus avoiding iceberg scour.
- The cables will then be laid on the sea bed and each protected with a separate rock berm which will protect against fishing gear and dropped objects



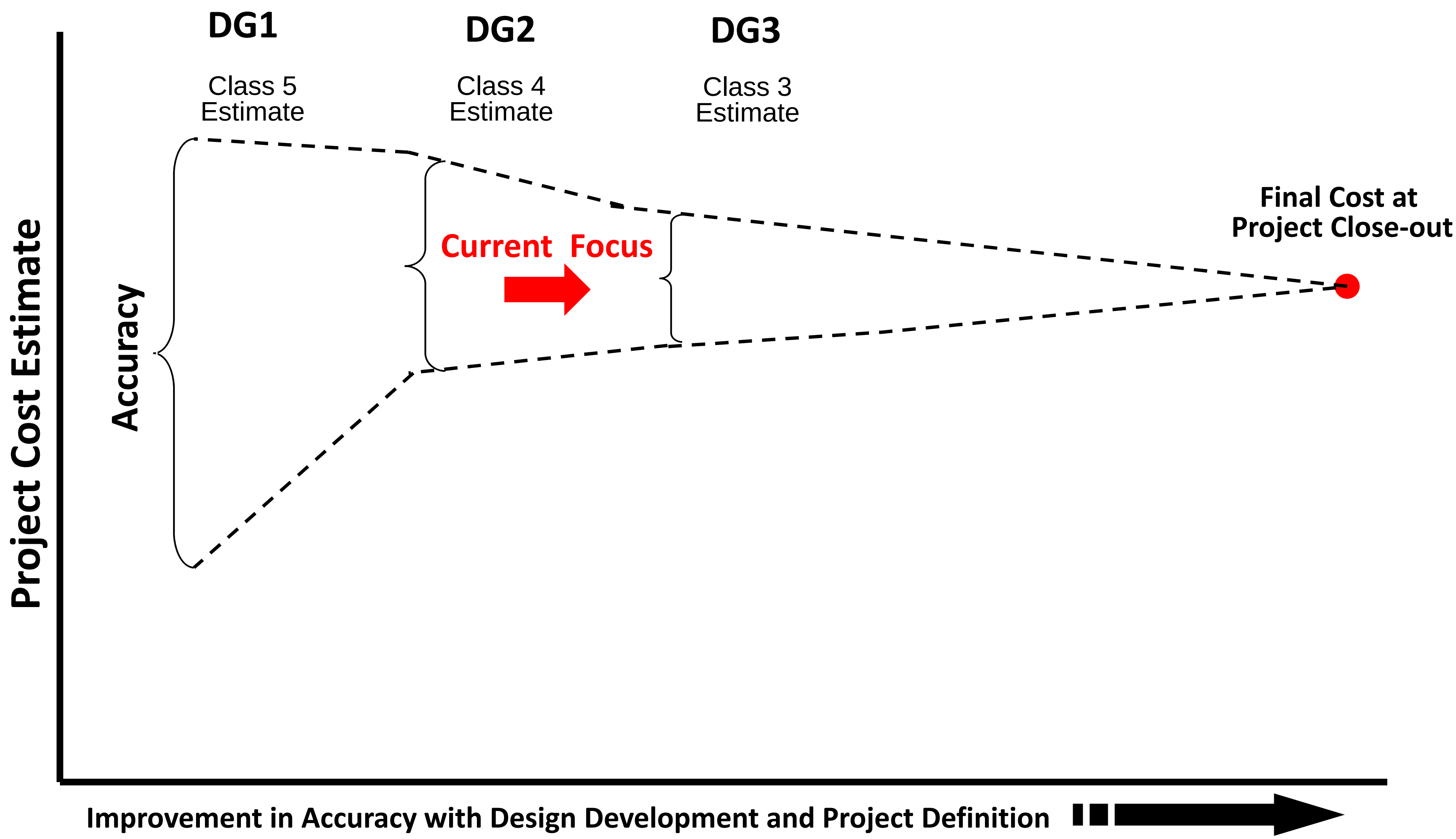
SOBI - Iceberg and Pack Ice Protection



DG2 Cost Estimate Summary

- Detailed bottom-up estimate carried out
- Capital Cost Estimate Report issued at DG2 – documents assumptions, pricing, risks and contingency
- Estimate included quotes from suppliers and equipment manufacturers
- Estimate validated by independent, expert, external consultants
- Escalation factors validated by external consultants
- Detailed engineering work is underway and base estimates, escalation and contingency will be updated at DG3

Establishing a sound cost basis



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DG3 Estimate Preparation

Input 1		Input 2		Input 3		Input 4		Output
Definition Factors (Scope)	+	**Construction Methodology & Timeline Factors**	+	**Price Factors**	+	**Performance Factors**	=	**Base Estimate**

Input 1 – Definition Factors (Scope)

- Design Criteria & Specifications
- General Arrangements & Layouts
- Design Drawings for major components – towers and hardware
- MF rock and concrete quantities from 3D CAD
- Master Equipment List
- Cable List
- Material Take-offs for Construction Bulks
- Equipment Specifications
- Geotech surveys
- WBS & Cost Codes

Input 2 – Construction Methodology & Timeline Factors

- Construction Philosophies
- Construction Execution Plan
- Constructability Reviews
- Construction Schedule
- Logistics and Access, incl. freight forwarding & marshaling yards
- Contract Package Dictionary
- Org. Design and Staff Plans
- Construction Equip. Types
- Labor Demand
- Labor Demarcation
- In-directs Strategies
- Site Services
- Pre-Fabrication Plans
- Crane & Access Studies
- Support Facilities
- Material Sourcing Strategies
- Seasonality Constraints
- Permit Register

Input 3 – Price Factors

- Labor Agreement
- Construction Equip. Rates
- Bid Analysis – T/G, SOBI Cable, Tower Steel, Accommodations, Road
- Budgetary Quotes – various equipment
- Site Services Costs – catering, air transport
- Construction Bulks Prices – Rebar, Cement, Diesel, etc.
- Helicopters and Aircrane
- Contracting Market Intelligence – overhead and profit
- Foreign Exchange Rates

Input 4 – Performance Factors

- Crew Make-up and Assignments
- Task durations
- Workface Restrictions
- Labor Productivity & Benchmarks
- Mobilization Constraints
- Work Front Stacking
- Seasonality Impacts
- Equipment Productivity
- In-Directs Usage
- Offsite Fabrication

Output – Base Estimate

- Estimate organized by Project, Physical Component and by Contract Package
- Documented Basis of Estimate
- Foreign Currency Demand
- Person hours
- Trade demands
- Cash flows

10. MHI Report

MHI Report

- Nalcor respect MHI's assessment and expertise
- Nalcor values all input and actively seeks issues and risks it needs to consider
- MHI concluded that Nalcor's analysis was reasonable, appropriate and was performed largely in accordance with industry best practices

Key Areas Identified by MHI

1. Transmission Line Design Criteria
2. System Reliability
3. AC integration
4. NERC standards

1. Transmission Line Design Criteria

- Objective: to ensure reliability remains, at a minimum, consistent with historical experience
- Fundamental principle: will not advance an alternative that does not meet an acceptable level of reliability

Transmission Line Design Criteria

- Nalcor complied with the CSA Standard for "*Design criteria of overhead transmission lines*"
- LIL was designed to a 1:50 return period, reliability will be consistent with current island system
- System reliability tested for compliance against Hydro's current generation and transmission planning criteria

Transmission Line Design Criteria

- Increasing return period of LIL design to 1:150 reduces probability of failure, but should failure occur, the same number of customers will be without electricity
- Increasing return period solves only one aspect of customer impact – the probability but not the impact of the outage
- Reducing the impact of the outage would have a much higher customer benefit

Transmission Line Design Criteria

- Therefore, if enhancements were deemed necessary, the better cost/benefit option for rate payers is the addition of 50MW CTs.
- Reliability will improve with construction of 230kV line between Bay d'Espoir and Western Avalon – line required in both alternatives
- The addition of the Maritime Link further enhances reliability

2. System Reliability

- Transmission planning criteria is evaluated based on deterministic modeling
- Generation planning criteria is evaluated based on probabilistic modeling
- LIL treated as part of the generation analysis because it enables delivery of MF power
- Forced Outage Rate (FOR) is probability that a generating unit or transmission line will not be available for service because of an unplanned event.

System Reliability

- For the Labrador Island Transmission Link (LIL), Nalcor assumes a FOR of 0.89% per pole
- Nalcor is implementing a more advanced and comprehensive reliability model that incorporates all components of the LIL HVdc system for DG3

System Reliability

- The LIL probabilistic model for DG3 will incorporate:
  - Transmission line design criteria
  - Continuous overload capability
  - Spare cable in the Strait of Belle Isle crossing
  - Spare converter transformers and smoothing reactors at each converter station

3. AC Integration Studies

- For DG2 Nalcor analyzed Teshmont's 1998 integration studies (Exhibit CE 31) for a 800 MW point-to-point HVdc link from Gull Island to Soldiers Pond
- Nalcor also compared the 1998 study to the 2007 study for Gull Island and a 1600 MW, 3-terminal HVdc system to Soldier's Pond and New Brunswick
- Analysis determined point to point link will have similar characteristics, regardless of change in generation source, provided there is a line to Churchill Falls
- As a result, Nalcor had sufficient input data to move through DG2, with the intention of completing full integration studies for DG3

4.NERC Standards

- North American Electric Reliability Corporation:
  - NERC is the electric reliability organization certified by the Federal Energy Regulatory Commission to establish and enforce reliability standards for the US bulk-power system
  - NERC develops and enforces reliability standards under the definition of "good utility practice"

NERC Standards

- Nalcor has instituted a System Integration Team to investigate all technical, system operations and reliability and regulatory implications for the integration of Muskrat Falls, LIL and the Maritime Link.
- Nalcor is engaging stakeholders including neighbouring jurisdictions and the Northeast Power Coordinating Council to plan its future operating structure, including any requirement for NERC standards
- Objective is to balance requirements with ratepayer interests

Summary

Summary

- NL requires new generation to meet load growth
- Muskrat Falls and Labrador Island Transmission Link is least cost solution
  - Most economic and least-cost option
  - Holyrood thermal plant coming off-line and thermal replacement avoided
  - Enhances system reliability and security of supply with interconnection
  - Rate stability for customers over long term