Lower Churchill Project – Muskrat Falls

Technical Briefing

Boundless Energy

nalcor energy
LOWER CHURCHILL PROJECT

Summary of Decision Process - Two Steps

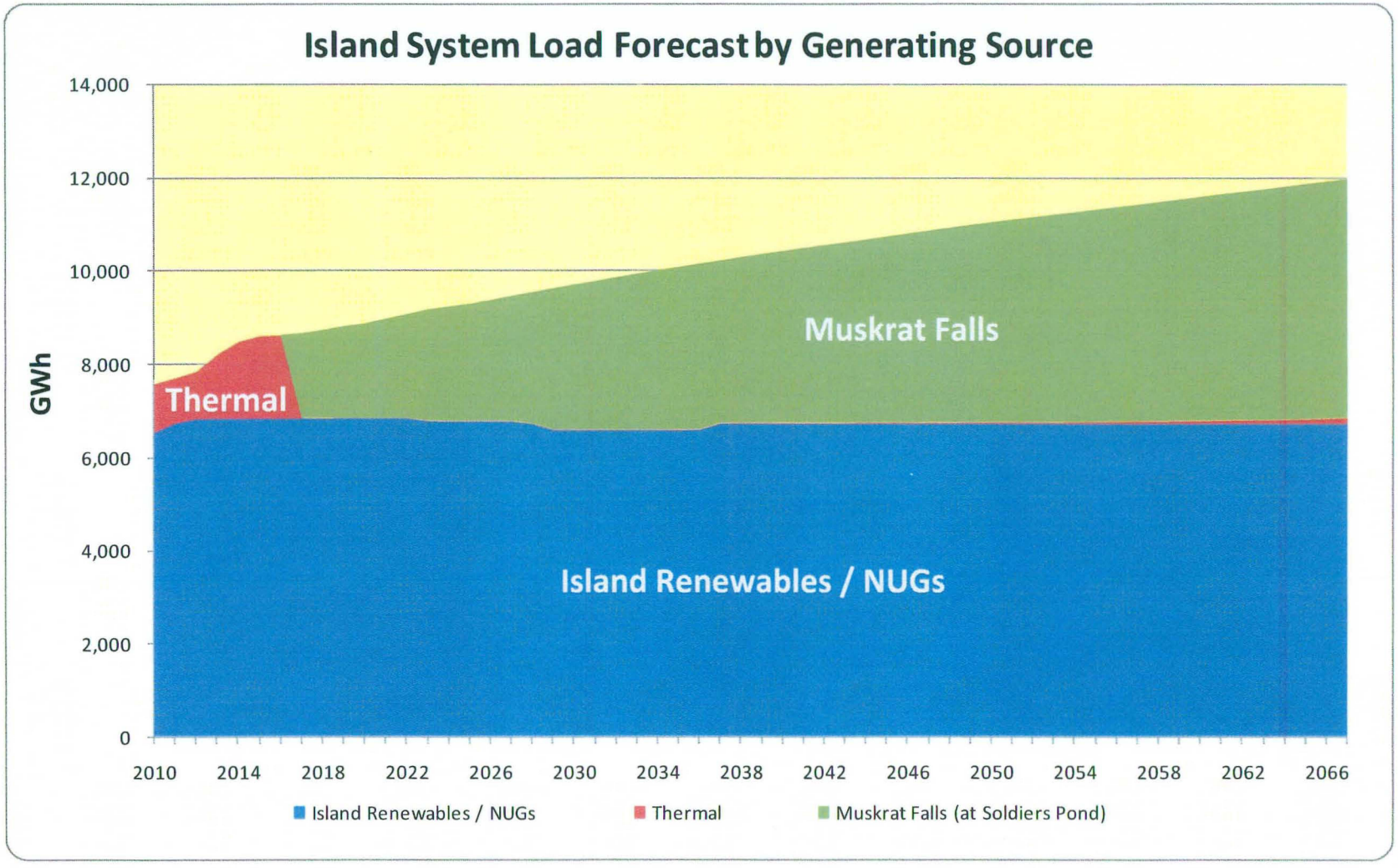
- Step 1: Next Generation Source for the Island
  - A decision is required on the next generation sources to meet Island demand
  - Muskrat Falls with an Island Link is the preferred option
  - This analysis assumes that there is no sale of power which is surplus to domestic needs and it will be spilled and not utilized (flow over the dam)

- Step 2: Maximizing Value of Spilled Water
  - What is best approach to obtain value for the spilled water

Next Generation Source

- A capacity deficit will emerge in the province by 2015, and an energy deficit will emerge by 2019.
- Nalcor has evaluated alternatives to develop new generation sources to avoid this deficit.
- Nalcor assessed five alternatives and found the Muskrat Falls project with a transmission link to the Island to be the least cost alternative, even if surplus energy is spilled.

Island System Load Growth Projection



Step 1 - Island Alternatives Decision Criteria

1. Reliability
   - Need to meet minimum system reliability standards
2. Cost
   - Based on Cumulative Present Worth (Consistent with standard utility practice)
3. Security of Supply
   - Control within the province and subject to NL laws and regulations
4. Other Considerations
   - Benefits to the Province
   - Level of GHG reduction & potential economic benefits
   - Long term strategic value

Options Considered – Island Alternatives

1. Isolated Island
   - No interconnection with Labrador or Maritimes
   - Holyrood remains in operation
   - Hydro developments (2015 – 2020)
     - Island Pond – 36 MW, Portland Creek - 23MW, Round Pond – 18 MW
   - 170 MW Combined Cycle Gas Turbine (2022)
   - 50 MW of Combustion Turbine (2024)
   - Further thermal additions (post 2029)

Options Considered - Island Alternatives

2. Muskrat Falls & Labrador-Island Link
   - 824 MW; 4.9 TWh
   - 1,100 km HVdc line
   - 2.0 TWh growing to 3.9 TWh until 2041
   - Unused water assumed to be spilled

Options Considered – Island Alternatives

3. Gull Island & Labrador-Island Link
   - 2,250 MW; 11.9 TWh
   - 1,100 km HVdc line
   - 2.0 TWh growing to 3.9 TWh until 2041
   - Unused water assumed to be spilled

Options Considered

4. Imports via Hydro Quebec
   - Completion of an HVdc transmission link from the Labrador border to the Island
   - No new generating capacity in Labrador
   - Energy needs are met by importing energy and capacity via Hydro Quebec
   - Power would be procured on the open market

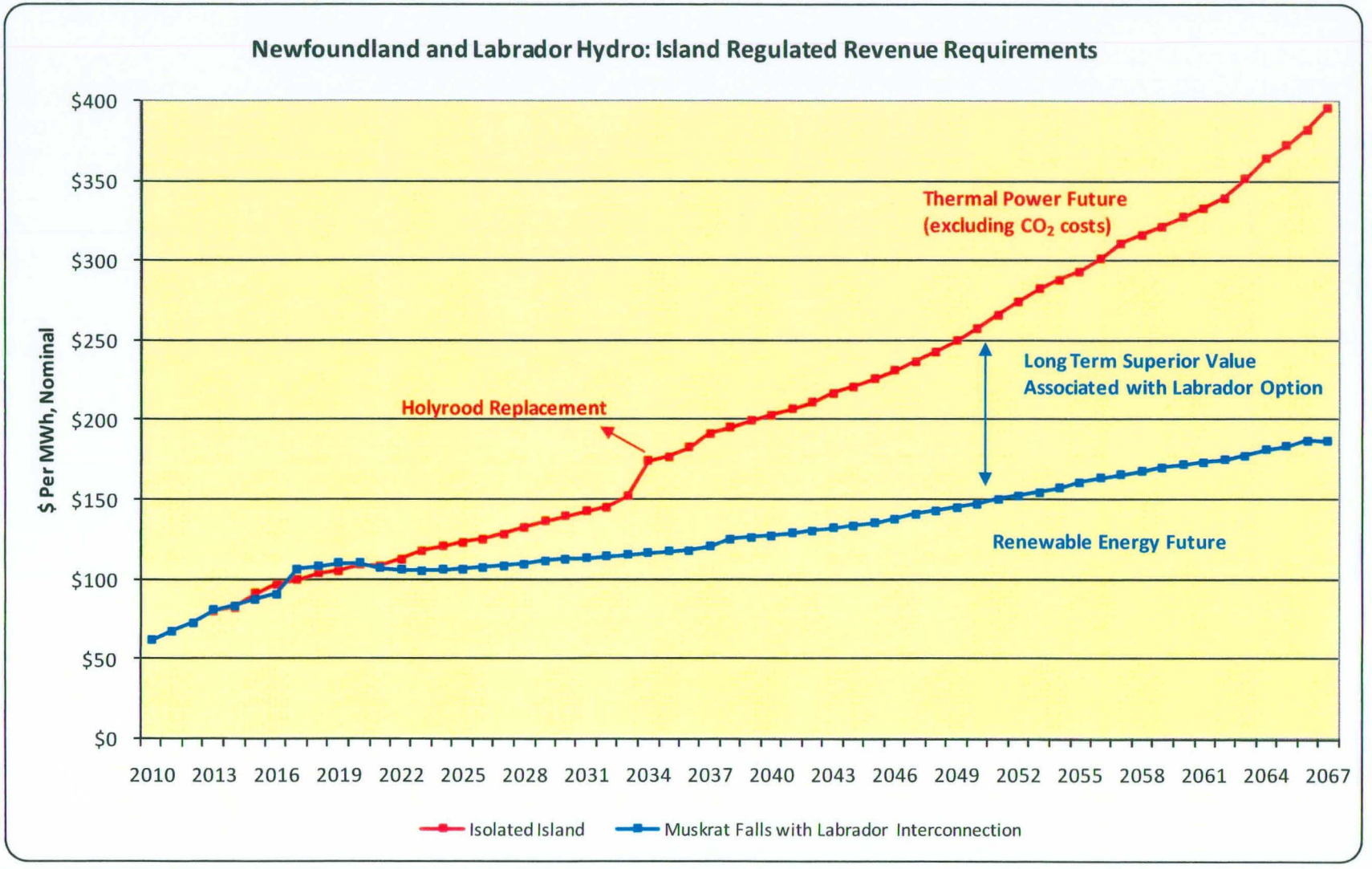
Options Considered

5. Imports from New England Independent System Operator (NEISO) via HVdc Maritime Link
   - Completion of an HVdc transmission link from Nova Scotia to the Island
   - No new generating capacity on the Island
   - Energy needs are met through the importation of power via Nova Scotia

Summary - Next Generation Source

- Muskrat Falls and Link to the Island is best solution
  - Most economic over the long-term
  - Provides necessary system reliability
  - Rate stability
  - Generates a positive rate of return
  - The Holyrood plant will be taken off-line (capital upgrades and replacement are avoided)
- Electricity demand growth in the province up to 2041
- Electrical generation will be >98% greenhouse gas emissions free

Electricity Rates



Step 2: Maximizing Value of Spilled Water

- Focused on how to best optimize the value of excess power
- Decision criteria included:
  1. Value Creation
     - Net Present Value (NPV) & Internal Rate of Return (IRR)
  2. Reliability Improvement
     - Enhancement of grid through NA interconnection
  3. Strategic Value
     - Enhances future options & offers flexibility

Options Considered

1. Sales through Quebec to the Maritimes, New England, Ontario and Quebec markets

- Muskrat Falls power would be sold via surplus transmission capacity on the Hydro-Quebec (HQ) transmission system.
- Utilize excess capacity from Recall transmission booking
- Based on expected Recall sales, approximately 1 TWh of production from Muskrat Falls may be sold on a firm basis.
- Potential of selling additional power by purchasing non-firm transmission rights on a short-term basis in the future.

Options Considered

2. Sales into the Maritime Provinces and through to New England via a Maritime Link connecting the Island of Newfoundland with Nova Scotia

- Arrangements with Emera to sell 1 TWh of energy in NS at renewable energy prices and achieve access through NS to NB, PEI and New England
- Enables the option to explore sales arrangements with NB and PEI

Preferred Option: Maximizing Value of Spilled Water

- **The preferred option is agreement with Emera to sell power in NS and achieve access through NS to NB, PEI and New England**
  - This agreement will generate value for both companies and builds on Nalcor's existing relationship with Emera for the marketing of a portion of Recall power from the Upper Churchill in the United States.
  - For the first time in history, the Island will no longer be an isolated grid, but instead linked via two routes into the North American grid.

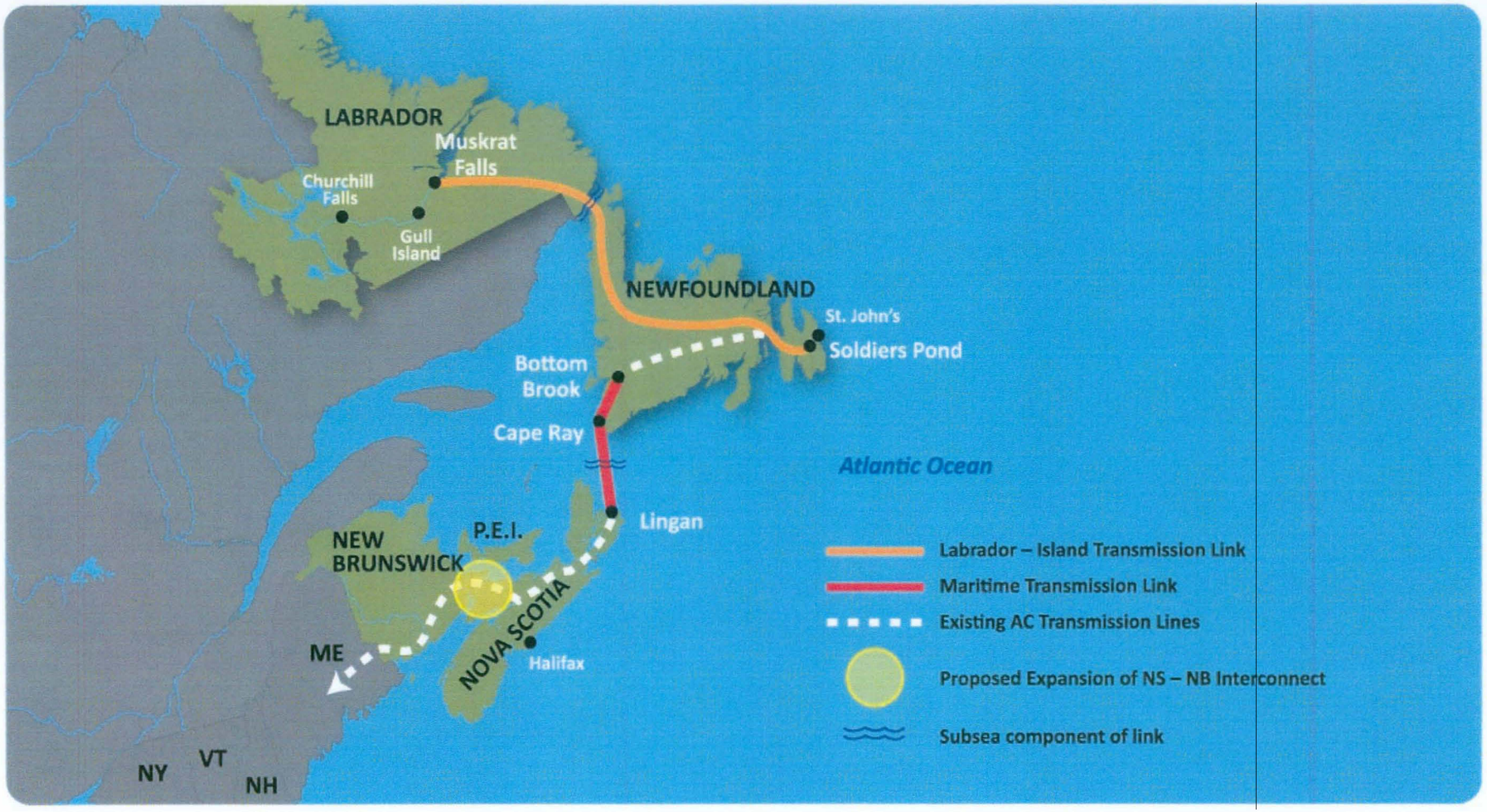
Emera Deal

- Nalcor builds and owns 100% of Muskrat Falls
- Nalcor builds Island Link and has ownership of 71%
  - Ability to acquire 100% at our option
  - Opportunity to invest in other Emera projects
- Emera owns Maritime Link 100%
  - Ownership reverts to Nalcor for $1 following termination of delivery of the NS Block
- Nalcor always retains at least 51% controlling interest in overall transmission system

Emera Deal

- Nalcor makes sales arrangements with NS and gains access to NS transmission through to NB, PEI and New England
  - System coordination in NS
  - Transmission rights in NB
  - Transmission rights in Maine
- Nalcor has decision making control on all elements of the project

Transmission Overview



Project Readiness

- Project planning and execution is following a Decision Gate / Gateway Process
- All key deliverables associated with Decision Gate 2 have been achieved and a business case has been confirmed.
- Three reviews to test the adequacy of Nalcor readiness to proceed to the next phase of development conducted:
  - Internal Review – Gateway Process Deliverables
  - External Review - Independent Project Analysis (IPA)
  - External Review - Independent Project Review (IPR)

Economic Benefits - Construction

- Employment
  - Total NL direct employment of 8,600 person years
  - Peak Direct NL employment 2,700 in 2013
  - Total Labrador direct employment of 5,400 person years
  - Total Canadian employment – direct, indirect and induced of 47,841 person years
- Income impact
  - Total NL income to labour and business of $1.4 billion from Phase 1; $220 million per year
  - Canada-wide income to labour and business of $3.49 million; $537 million per year
- Taxation impact
  - Over $212 million in taxes to the NL government
  - Over $525 million in taxes to the Federal Government

Generation Expansion Summary

- Generation
  - Muskrat Falls 824 MW (4.9 TWh/yr)
  - Construction start 2011
  - In-service 2016
  - Capex $2.9 billion
- Island Link
  - HVDC link (Labrador to Soldier's Pond) 1100 km
  - Capacity 900 MW
  - Capex $2.1 billion

Maximizing Value of Spilled Water

- Maritime Link
  - New transmission and upgrades on the Island
  - Submarine HVDC line 180 km
  - Capacity 500 MW
  - Capex $1.2 billion

Summary

- Newfoundland and Labrador
  - Least cost generation expansion plan
  - Provincial power needs met to 2041 and beyond
  - 98% non-GHG emitting generation
  - Island no longer isolated from North America

- Surplus Energy From Muskrat is Exported
  - Direct market access to Maritimes and New England
  - Significant sales at full market value