Labrador – Island - Link Overview

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newfoundland labrador hydro
a nalcor energy company

HVdc LIL - Historical

- 1974-75 Teshmont – Zinder Studies
  - Two ±400 kV, 800 MW bipoles
    - Gull Island to Soldiers Pond (near St. John's)
    - Gull Island to Stony Brook (central NL)
    - Ability to connect Gull Island Converters and HVdc lines at Stony Brook for reliability
    - Assumptions 11% annual growth rate in load

HVdc LIL - Historical

- 1980 SNC-Lavalin HVdc Study - LCDC
  - Single ±400 kV, 800 MW bipole (920 MW winter)
    - Gull Island to Soldiers Pond
    - 3 x 100 MVAR or 2 x 150 MVAR synchronous condensers Soldiers Pond
  - Second ±400 kV, 800 MW bipole (for load growth)
    - Gull Island to Stony Brook (central NL)
    - Ability to connect Gull Island Converters and HVdc lines at Stony Brook for reliability
    - 4 x 100 MVAR synchronous condensers Stony Brook

HVdc LIL - Historical

- 1982 SNC-Lavalin HVdc Study – LCDC
  - Two ±400 kV, 800 MW bipoles
    - Gull Island to Soldiers Pond (near St. John's)
    - Gull Island to Onslow, NS
    - Taylors Brook Switching Station (west coast of NL) for paralleling of poles for reliability

HVdc LIL - Historical

- 1982 SNC-Lavalin HVdc Study – LCDC (variant)
  - ±400 kV, 800 MW bipole
  - Muskrat Falls first with 345 kV transmission to Churchill Falls
  - Labrador converter located at Gull Island
  - Newfoundland converter at Soldiers Pond

HVdc LIL - Historical

- 1988 – 89 Hydro-Québec System Studies
  - ±400 kV, 800 MW bipole
  - Gull Island to Soldiers Pond
  - HQ system
    - Minimal impact for loss of HVdc
  - NL system
    - UFLS for loss of pole
    - Loss of bipole to be studied

HVdc LIL - Historical

- 1998 – 99 Joint NLH HQT Integration Studies
- 1998 – 99 Teshmount HVdc Studies
  - ±400 kV, 800 MW bipole
    - Gull Island to Soldiers Pond
    - 800 MW (2 pu) rating per pole for 10 minutes
    - 600 MW (1.5 pu) rating per pole continuous
    - Prevent load shedding for transient and permanent pole outages
    - 3 x 150 MVAR synch condensers at Soldiers Pond

HVdc LIL - Historical

- 2008 DC1010 RSW Voltage and Conductor Optimization
  - 800 MW Gull Island to Soldiers Pond with O/L
    - ±400 kV, single 50.4 mm diameter conductor
  - 1600 MW multi-terminal Gull Island, Soldiers Pond, Salisbury NB with O/L to NL only
    - ±450 kV, single 58 mm diameter conductor

HVdc LIL - Historical

- 2008 TransGrid Multi-terminal HVdc Study
  - Gull Island, Soldiers Pond, Salisbury NB
  - ±450 kV transmission voltage
  - Gull Island 1600 MW converter
  - Soldiers Pond 800 MW converter with O/L
  - Salisbury 800 MW converter with no O/L
  - Focus on Island upgrades

HVdc LIL - Historical

- 2008 TransGrid Multi-terminal HVdc Study
  - Case included new 300,000 bbl/day oil refinery
  - 5 x 50 MW combustion turbines
  - 4 x 300 MVAR high inertia synch condensers
  - 50% series compensation of 2 x 230 kV lines
  - Upgrade of 4 x 230 kV lines
  - Modify existing UFLS
  - Implement an SPS

HVdc LIL - Historical

- 2009 NBSO SIS Multi-terminal HVdc at Salisbury, NB
  - Extension of 2008 TransGrid Study
  - ±450 kV, 1600 MW with 800MW converter at Salisbury
  - Deliveries through NB to Maine border
  - 2 x 125 MVAR sync condensers (ESCR and voltage control)
  - 345 kV transmission reinforcement for firm NB to NL transactions
  - Sudden power reversals must be controlled
    - Potential for NE instability

HVdc LIL - Historical

- 2010 Hatch/TransGrid HVdc System Sensitivity and VSC Risk Analysis (DC1210)
  - Cursory evaluation of VSC technology
  - Cancellation of new refinery
  - VSC ratings acceptable for Soldiers Pond and NB
  - 3 x 150 MVAR high inertia sync condensers
  - New 230 kV line BDE – WAV instead of 50% series compensation

HVdc LIL - Historical

- DC1240 Proximity Study
  - Hatch/Manitoba Research Center
  - Proximity of ±450 kV HVdc to existing 66 kV, 138 kV and 230 kV AC transmission lines
  - Recommended minimum separation distance

LIL Project Shift in 2010

- 1974 – 2009
  - Gull Island followed by Muskrat Falls
  - ±400 kV, 800 MW Gull Island to Soldiers Pond, or
  - ±450 kV, 1600 MW Gull with multi-terminal HVdc
- Early 2010
  - ±450 kV, 1600 MW Gull with multi-terminal HVdc less than optimal finance/economics

LIL Project Shift in 2010

- Mid 2010
  - Muskrat Falls first 824 MW, 4.9 TWh
  - Meets NL requirements to near 2041
  - ±320 kV, 900 MW Muskrat Falls to Soldiers Pond potential VSC vs LCC
  - ±200 kV, 500 MW VSC based system Bottom Brook (NL west coast) to Cape Breton (Lingan, NS)
  - Potential to reduce O/L requirements to NL
  - Path to market for excess power and energy

LIL Project Shift in 2010

- Siemens HVdc PLUS Feasibility Study
  - ±450 kV, 1600 MW Multi-terminal with VSC at Gull Island and Soldiers Pond
  - Single base case, limited contingencies
  - VSC technology no issue with 230 kV ac faults
  - VSC technology slower recovery for dc faults
    - Need for high inertia sync condensers

LIL Integration Studies - Ongoing

- VSC Screening Study
  - ±320 kV, 900 MW Island Link, Island model
  - ±200 kV, 500 MW Maritime Link with thev equiv
  - Four base cases, limited contingencies
  - Verify east and west converter interactions
  - ABB PSS/E modeling followed by PSCAD
- SLI integration studies for converter spec's
- Joint Integration studies for ML

LIL Electrodes

- 1998 Teshmont
  - Sea electrode Lake Melville (Labrador)
  - Sea electrode Conception Bay (Newfoundland)
- 2007/08 WTO DC 1110 Statnett
  - Sea electrodes without substantial justification to eliminate other types
- 2009 WTO DC 1250 panel of 5 experts
  - Shoreline pond electrode for Newfoundland
  - Further work for Labrador

LIL Electrodes

- 2010 WTO DC 1500 Hatch
  - Shoreline Pond electrodes both sites

Questions?