# Island Interconnected System Supply Disruptions – January 2014

## Public Utilities Board Update Briefing

January 13, 2014 - 2:00PM

Boundless Energy

newfoundland labrador hydro
a nalcor energy company

The following presentation was prepared by NL Hydro to provide an overview to the Board of Commissioners of Public Utilities on the current power system situation on the Island Interconnected System. The information presented represents an interim analysis of events as of January 13, 2014. As further investigation and analysis are completed the information presented in this report may be subject to updates or changes.

**Background :**

**Power System Equipment Outages**

The  presentation provides a summary of on-going system conditions related to grid equipment. Generation and transmission equipment outages for running and corrective maintenance are included. These are not unusual for power system operations. They generally do not impact customer supply. The power system operators schedule outages to system equipment whenever possible to coincide with periods when customer demands are low and sufficient supply reserves are available. However, from time to time equipment outages are necessary and reserves may be impacted.

Also, due to the Island Interconnected System being isolated from the larger North American grid, when there is a sudden loss of large generating units some customer's load must be interrupted for short periods to bring generation output equal to customer demand. This automatic action of power system protection, referred to as underfrequency load shedding, is necessary to ensure the integrity and reliability of system equipment.  Underfrequency events typically occur 5 to 8 times per year on the Island Interconnected System and the resultant customer load interruptions are generally less than 30 minutes.

**Background:**

**Island Interconnected System Generation Capacity and Demand Reporting**

The Island Interconnected System generation includes generation owned by NLH, purchased by NLH and generation owned by Newfoundland Power (NP) and Corner Brook Pulp and Paper (CBPP) to supply their needs. The total power produced and purchased by NLH is referred to as the NLH System Supply.

When carrying out the long term planning for the reliable generation supply to the Island Interconnected System, NLH considers all available generation on the Island Interconnected System including that owned by NP and CBPP. Therefore long term planning analysis reports and forecasts the entire Island Interconnected System demand. The Island Interconnected System demand where reported in those reports is therefore higher than the NLH System Supply by the amount of demand typically supplied by Newfoundland Power and Corner Brook Pulp and Paper.

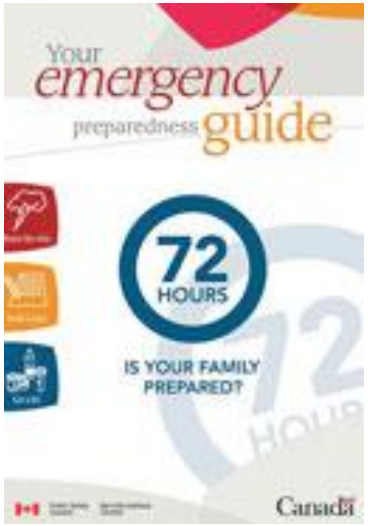
The following presentation is reporting the power system demand supplied by NLH exclusively. It does not include the demand supplied by NP and CBPP to meet their demands.

# Outline

1. Safety Moment
2. Current System Status: Generation & Transmission
3. Daily & Weekly Outlook
4. Progress on repairs
5. Progress on Incident Analysis
6. Winter Outlook
7. Short term action plan

# 1. Safety Moment

- Water – at least two litres of water per person per day; include small bottles that can be carried easily in case of an evacuation order
- Food that won't spoil, such as canned food, energy bars and dried foods (replace food and water once a year)
- Manual can-opener
- Crank or battery-powered flashlight (and extra batteries). Replace batteries once a year.
- Crank, battery-powered radio (and extra batteries) or Weatheradio
- First aid kit
- Extra keys to your car and house
- Some cash in smaller bills, such as $10 bills and change for payphones
- A copy of your emergency plan and contact information
- If applicable, other items such as prescription medication, infant formula, equipment for people with disabilities, or food, water and medication for your pets or service animal (personalize according to your needs)



# 2. Current System Status: Generation[1]

- All hydroelectric plants available at rated capacity

| | |
|---|---|
| Bay d'Espoir | 604 MW |
| Cat Arm | 130 MW |
| Upper Salmon | 84 MW |
| Hinds Lake | 75 MW |
| Granite Canal | 40 MW |
| Paradise River | 8 MW |

- Holyrood undergoing typical thermal plant operating season running maintenance – see next sheet
- Gas Turbine plants as per following sheet

1. Status as of 1200 h January 13, 2014.

# 2. Current System Status: Generation[1]

| GENERATION | STATUS |
|---|---|
| Holyrood Unit 1 (170 MW) | Removed from service to repair a cooling water leak . Return to service scheduled for 6:00 PM January 13[2]. |
| Holyrood Unit 2 (170 MW) | Operating with minor de-rating to 165 MW |
| Holyrood Unit 3 (150 MW) | Currently undergoing load testing. Operated to 90 MW. On-hold to correct a fuel oil leak. Return to full service scheduled during afternoon of January 13[2]. |
| Hardwoods GT (50 MW) | In-service as synchronous condenser. Available for 25 MW. Tested to 50 MW. End B thermocouples being replaced today. |
| Stephenville GT (50 MW) | In-service as synchronous condenser. Available for 25 MW. End “B” became unavailable and being assessed . |
| Exploits (nom 63 MW) | Going through ongoing process of removing impact of severe ice around the Grand Falls plant. Capacity restored to 55 MW. |

1. Status as of 1200 h January 13, 2014.

2. Subsequent to update briefing unit 1 and 3 restored to normal on January 13/14.

# 2. Current System Status: Transmission[1]

## Entire System in service with the following exceptions:

- TL203 tripped during high winds on Sunday afternoon. Crews completed helicopter patrol this morning. Phase down and crews undertaking repairs. Expected back in service later today[2].
- Sunnyside Transformer T1, 138 KV bus B2 and transmission line TL212 currently out of service. Burin Peninsula customers supplied via TL219.
- Sunnyside 230 kV breaker, B1L03, out of service for assessment
- Western Avalon Transformer T5, out of service – On-load tapchanger failed. Manufacturer assisting with repair.
- Holyrood 230 kV breaker, B1L17, out of service for assessment by ABB
- Holyrood 230 kV breaker B2L42, out of service pending an outage to Holyrood unit 2

1. Status as of 1200 h January 13, 2014.

2. Subsequent to update briefing TL203 restored to normal on January 13.

# 3. Daily Outlook

| 13-Jan-2014 | NLH System Outlook[1] | |
|---|---|---|
| Available NLH System Capacity:[2] | **1,645** | **MW** |
| Current St. John's Temperature: | 0 | °C |
| Current St. John's Windchill: | -8 | °C |
| NLH System Peak Demand Forecast: | 1,250 | MW |

1. As of 0800 Hours
2. Gross output including station service at Holyrood (24.5 MW) and improved output due to water levels (35 MW). Also includes CBPP Capacity (60 MW). Excludes wind generation.

# 3. Weekly Outlook

| Five-Day Forecast | Temperature (°C) | | NLH System Load (MW) | |
|---|---|---|---|---|
| | Morning | Evening | Morning | Evening |
| Monday, January 13, 2014 | -2 | -2 | **1,250** | **1,200** |
| Tuesday, January 14, 2014 | -4 | 1 | 1,250 | 1,175 |
| Wednesday, January 15, 2014 | 6 | 8 | 1,070 | 1,025 |
| Thursday, January 16, 2014 | 1 | 8 | 1,260 | 1,200 |
| Friday, January 17, 2014 | 8 | 2 | 1,175 | 1,125 |

# 4. Repair Progress

## Holyrood Unit 3 FD fan motor

- ✓ Motor repaired and returned to service January 12

## Hardwoods Gas Turbine

- ✓ Failed fuel flow control valve replaced
- ✓ Unit thoroughly tested to 50 MW
- ❑ Temperature sensors on End “B” being replaced before full release

# 4.Repair Progress (cont'd)

## Stephenville Gas Turbine

- End "B" examined by OEM – identified requirement for further examination

## Holyrood Breaker B1L17

- Manufacturer arriving this week for assessment

## Sunnyside Transformer T1

- Undergoing assessment (ABB on site tomorrow)
- Replacement options being assessed

# 4. Repair Progress (cont'd)

## Sunnyside 138 kV bus B2 – Smoke and soot damage

- ✓ Two instrument transformers replaced
- ✓ Bus work cleaned
- ✓ Ready for return to service

## Sunnyside Breaker B1L03

- ✓ Some components replaced
- ❑ Undergoing assessment

## Western Avalon transformer T5

- ❑ Undergoing assessment with OEM

# 5. Incident Analysis (to-date)

## January 4 & 5 Disturbances

### Sunnyside Transformer T1 Fault

- The 125 MVA transformer was lightly loaded at the time of the incident (55 MW)
- Root Cause Investigation well underway
- Transformer replacement options are being assessed.
- 230 kV breaker B1L03 may be a contributing factor to fire as it failed to trip. Breaker has been examined and requires repairs. Further assessment is being undertaken to determine replacement or repair.

# 5. Incident Analysis (to-date) cont'd

## Sunnyside 230 KV Bus Lockout

- Occurred during the restoration of T4 transformer at the Sunnyside terminal station following the T1 transformer fault earlier in the day
- The failure of breaker B1L03 and potential control wiring fire damage are being assessed as contributing factors

# 5. Incident Analysis (to-date) cont'd

## Western Avalon Transformer T5 (125 MVA) 230/138 kV

- Occurred  12:25 January 4
- Tap-changer fault identified.
- Tap-changer manufacturer on site to assist with investigation

# 5. Incident Analysis (to-date) cont'd

## Holyrood Switchyard Fault and B1L17 Breaker Failure

- Occurred during the run-up of Holyrood Unit 1 immediately after closing the Unit disconnect switch B1T1 in the switchyard
- B1L17 is source of failure – OEM being brought in to assess damage
- Inspection of other 230 KV equipment associated with Unit 1 completed with no issues and have been returned to service.

# 5. Incident Analysis (to-date) cont'd

- Holyrood Generating Station
  - All units safely shutdown with some emergency shutdown impacts
  - Some repair work was required on unit 2 on first restart. A ruptured disk on a valve was replaced.
  - Unit 1 experienced some vibration issues on initial restart. These have been resolved through careful start-up processes under the guidance of turbine contractor. No sustained damage.
- Hydroelectric Stations
  - Shutdown safely with some emergency shutdown impacts
  - Workers on site provided quick response
  - No sustained damage

# 6. 2014 Winter Outlook

- Peak NLH Demand Forecast 1,454 MW[1]
- Current Available NLH Supply 1,585.5 MW[2]
  - NLH Generation 1,447.5 MW
  - Purchases 78 MW
    - Grand Falls, Bishop's Falls, Star Lake and CBK P&P Co-Gen
  - Short term curtailable load 60 MW from CBK P&P

1. **Planning basis which is net of Holyrood station service which at full plant load equals 24.5 MW**
2. **Firm dependable supply net of Holyrood station service and excludes wind and run of river hydro output as of 0800h January 13, 2014**

# 6. 2014 Winter Season Supply Plan

## Next Steps

- Establish Available NLH Supply at 1,653.5 MW
  - Restore the following generation
    - Hardwoods Gas Turbine
      - Restore remaining 25 MW
    - Stephenville Gas Turbine
      - Restore remaining 25 MW
    - Holyrood De-ratings
      - Restore 10 MW as planned outages and conditions permit
    - Exploits – Grand Falls
      - Restore remaining 8 MW as mild weather permits*
  - Extend Short Term CBK P&P 60 MW Arrangement

*** Requires ice melt to channel flow to plant**

# 6. 2014 Winter Season Supply Plan

## Next Steps (cont'd)

- Install Holyrood 16 MW blackstart diesel
  - Continue expediting installation
  - Late February in-service target
- Actions will give Available NLH Supply of 1,669.5 MW
- Estimated Total NLH Supply reserve at peak[1]
  175 – 216 MW[2]

1. **Reserve margins excludes contribution from the wind generation. Also this winter the hydroelectric has been producing 35 -40 MW higher than firm levels due to water levels and is expected to continue.**
2. **Range reflects uncertainty of peak timing with respect to time of Stephenville GT 25 MW and Blackstart plant 16 MW in-service.**

# 6. 2014 Winter Season Supply Plan

## Next Steps Summary

| Available NLH Supply (MW) - Net Planning Basis | | | | | |
|---|---|---|---|---|---|
| Source | Current Status | Planned Restoration | Current & Restoration | Capacity Addition | Total |
| NLH Generation (Hydro, Holyrood, GT, Diesel) | 1,447.5 | 60.0 | 1,507.5 | 16.0 | 1,523.5 |
| Purchases (Grand Falls, Bishop's Falls, Star Lake, CBKP&P Co-Gen) | 78.0 | 8.0 | 86.0 | - | 86.0 |
| Corner Brook P&P Curtailable Load | 60.0 | - | 60.0 | - | 60.0 |
| Total | 1,585.5 | 68.0 | 1,653.5 | 16.0 | 1,669.5 |
| NLH Peak Supply Forecast | 1,454.0 | | 1,454.0 | | 1,454.0 |
| Reserve at NLH System Peak | 131.5 | | 199.5 | | 215.5 |

**Notes**

Status as of 0800 h January 13, 2014

NLH Generation Capacity Restoration is Hardwoods 25 MW, Stephenville 25 MW and Holyrood de-rating 10 MW

Purchases Restoration is Grand Falls 8 MW

Addition is 16 MW Blackstart Plant at Holyrood

All figures reported for both daily actual and planning purposes come from a single data set but are presented in different formats due to different inclusions/exclusions of capcity for actual versus planning reporting. Appendix A provides a representative reconciliation for information purposes, based on January 13, 2014 data.

# 7. Ongoing Near Term Actions

- Executive Review Team overseeing restoration & investigation
- Storm watch & crew management
- Ongoing coordination with NP & other generators
- Fuel supply management
- Adaptive operating protocols for GTs

# Executive Review

Purpose: Review early January events and identify things that went well and areas for improvement

- Initial areas identified for review include:
  - Planning
    - Generation Planning Criteria and Load Forecasting
      - includes assessment of additional generation options and timing of acquisition in case required following this review
    - Asset Management Planning Practices and Procedures
  - Execution
    - Protection and control systems work, including station breakers
    - Hardwoods and Stephenville outage scheduling
    - Emergency response effectiveness
    - Review Holyrood O&M and Capital programs execution
    - Effectiveness of Communications
- Timing for review completion identified once scope finalized

# Appendix A
# Actual vs Planning Capacity Reconciliation

# Appendix A
# Actual vs Planning Capacity Reconciliation

- All reporting information comes from the same data set, presented in different format for various reasons
- When reporting daily information, the following guidelines are used
  - Available capacity does not net off the consumption of power for station service at Holyrood
  - Daily system peak demand does not net off station service at Holyrood
  - Available capacity includes short term improved hydro output due to water levels.
  - Available capacity includes CBPP capacity (60 MW) but excludes wind and run of river output, due to lack of supply firmness.

# Appendix A
# Actual vs Planning Capacity Reconciliation

- When reporting longer term planning information, the following guidelines are used:
  - Available capacity nets off the consumption of power for station service at Holyrood
  - Daily system peak demand nets off station service at Holyrood
  - Available capacity does not include short term improved hydro output due to water levels because this is not a longer term benefit that can be depended on.
  - Available capacity, the same as daily reporting, includes CBPP capacity (60 MW) but excludes wind and run of river output, due to lack of supply firmness.
- The following table provides a simple summary of the different reporting basis, for January 13, 2014.

# Appendix A
# Actual vs Planning Capacity Reconciliation

| NLH System Demand and Capacity (MW) | | | |
|---|---|---|---|
| | | | |
| | January 13, 2014 Daily Outlook | Estimated Holyrood Stn Service[2] | Net Planning Basis |
| Firm Available NLH System Capacity | 1,610.0 | (24.5) | 1,585.5 |
| Short term hydroelectric increase[1] | 35.0 | - | N/A |
| Available NLH Supply | 1,645.0 | | 1,585.5 |
| | | | |
| NLH System Peak Demand | 1,250.0 | (24.5) | 1,225.5 |
| | | | |
| | | | |
| 1. Short term improved hydroelectric output due to current water levels | | | |
| 2. Holryood station service power usage varies with the output of the plant | | | |