

# Island Interconnected System Power Outage – March 4, 2015

Public Utilities Board Briefing

March 10, 2015

Boundless Energy



# Outline

- Safety Moment
- Overview
- Background
- Prior to Event
- Sequence of Events
- System Recovery
- Coordination with Customers
- Communications
- Conclusions

# Safety Moment

- Step Back 5x5

# Overview

- Review circumstances of March 4 power outage event
- Unanticipated generation issues on the Avalon caused voltages to decline
- Power interruptions caused by low voltage are extremely rare
- At the height of the event, 80,000 customers affected
- ~50,000 customers restored within one hour, most others restored within ~3 hours, remaining restored in ~4.5 hours
- Hydro personnel responded immediately to restore power in a safe and efficient manner
- Hydro very aware of inconvenience caused by the outage and is reviewing for any necessary improvements

# Background

- Planned emergency repair to Holyrood Unit 1
- Contingency plan in place
- Avalon transmission constraints

# Days Prior to March 4

- Holyrood Unit 1 lubrication oil leak:
  - Condition monitored and identified unit had to be taken offline to be repaired
  - Planned with contractor dispatched to assist
  - Removed from service Fri, February 27, 12:00.  
Expected return Wed, March 4, 00:00
- Reserves met as required from Feb 28 to Mar 3
  - Holyrood CT – 3 days
  - Hardwoods GT – 3 days
  - Stephenville GT – 4 days

# Planning for March 4

- On Tue, March 3, reserve forecast for morning peak Wed, March 4 was 520 MW with Holyrood unit 1 and 350 MW without
- Planned to operate Hardwoods, Stephenville and Holyrood Combustion Turbines on Wed, March 4 for Avalon transmission and spinning reserve support
- Expected reserves for March 4 were well above thresholds for public communications

# Island System Supply: Prior to Event

Supply Source	Normal <u>Firm</u> Supply (MW)	March 4, 00:00 (MW)
Hydro Owned and Operated	1,692.6	1,497.6 <sup>1</sup>
Purchased	99.8	152.0 <sup>2</sup>
Corner Brook Pulp and Paper	99.1	99.1
Newfoundland Power	117.9	113.2
Total	2,009.4	1,861.9

1. Holyrood Unit 1 (170 MW) and Hardwoods End B (25 MW) unavailable.
2. Increase in purchased supply is primarily due to available wind generation at that time, which declined throughout the hours leading to the event.



# Early hours March 4

- Unit 1 delayed coming online and not available for peak

# March 4 Sequence of Events

Time	Event	Comment
05:30	Hydro requested Newfoundland Power to maximize its hydro generation and bring on standby generation units	Normal procedure <sup>3</sup>
06:10	Stephenville CT (50 MW) online	Planned
06:12	Holyrood CT initial unsuccessful start	
06:17	Hardwoods CT (25 MW) online	Planned
06:19-30	Additional unsuccessful start attempts on Holyrood CT	
06:30	Voltage <sup>4</sup> at Come by Chance 223.1 kV (97%); at Oxen Pond 67.3 kV (102 %)	Acceptable range 95-105%
06:30	Available Island reserves 410 MW	Healthy reserves

3. Hydro normally requests NP hydraulic generation on a daily basis and will request standby units if load requires.

4. Acceptable steady state voltage range 95%-105%. Emergency range of 90% to 110%.

# March 4 Sequence of Events

Time	Event	Comment
06:36	Hydro requested 20 MW block from Corner Brook Pulp and Paper Capacity Assistance	
06:45	Voltage at Come by Chance 221.4 kV (96%); at Oxen Pond 66.5 kV (101 %)	
06:45	Available Island reserves 381 MW	Healthy reserves
06:48	Holyrood Units 2 and 3 at maximum voltage support <sup>5</sup>	
06:50	Voltage at Come by Chance 220.4 kV (96%); at Oxen Pond 65.7 kV (100 %)	
06:50	Available Island reserves 374 MW	Healthy reserves
07:00	Vale Capacity Assistance requested (10 MW)	

5. Units automatically adjust to maximum voltage support.

# March 4 Sequence of Events

Time	Event	Comment
07:04	Hardwoods CT at maximum voltage support <sup>6</sup>	
07:08	Corner Brook Pulp and Paper Capacity Assistance increased to 60 MW	
07:10	Voltage at Come by Chance 209.6 kV (91%); at Oxen Pond 62.5 kV (95 %)	
07:10	Available Island reserves 348 MW	Healthy reserves
07:14	Voltage at Come by Chance 199.8 kV (87%); at Oxen Pond 61.9 kV (94 %)	
07:15	All four (4) capacitor banks at Come by Chance tripped, thereby removing voltage support	Automated equipment protection
07:15	Concurrent system issues	

6. Units automatically adjust to maximum voltage support.

# Concurrent System Issues 07:15

- Equipment protection systems operated to remove:
  - Generating units :
    - Star Lake (18 MW)
    - Hardwoods CT (25 MW)
    - Stephenville CT (50 MW)
    - Holyrood Unit 3 (150 MW)
  - Transmission line – TL 208, supplying Vale

# Concurrent System Issues 07:15, con't

- Newfoundland Power transmission in Gander, Clarenville, and Carbonear areas tripped on 'under-voltage' protection
- North Atlantic Refining partial load
- Fermeuse Wind and Newfoundland Power Southern Shore generation separated from system
- **At height of event, 450 MW of load or 80,000 customers affected**

# Customer Restoration

- Commenced immediately
- Hydro ECC coordinated with NP Control Centre to restore customers power
- Within first hour, ~ 50,000 customers restored
- By 10:30, approximately 7,000 customers remaining to be restored
- **All customers restored by 11:53**

# System Restoration: Generation

Time	System
07:23	Hawke's Bay started
07:25	Holyrood CT started
07:40	Stephenville GT re-started
07:47	NP Greenhill started (tripped 08:00)
07:52	Fermeuse and NP Southern Shore – re-started
08:04	St. Anthony started
08:44 – 09:16	Vale generation
09:13	Holyrood Black Start diesels started
09:13	NP Wesleyville started
09:27	Hardwoods CT re-started
10:14	Holyrood Unit 3 re-started
15:17	Star Lake re-started
16:00	Holyrood Unit 1 – back in service



# System Restoration: Transmission

Time	System
07:31/07:32	Come by Chance Capacitor Banks 2 and 3
07:37/07:39	Come by Chance Capacitor Banks 1 and 4
07:42 - 07:57	NP Clarenville and Gander
07:44	TL208 (Vale restored)
08:29 – 10:04	NP Blaketown and Carbonear
08:44	Vale capacitors placed in-service

# Island System Supply: Post Event

Supply Source	Normal <u>Firm</u> Supply (MW)	March 4, 16:00 (MW)
Hydro Owned and Operated	1,692.6	1,667.6 <sup>7</sup>
Purchased	99.8	118.0
Corner Brook Pulp and Paper	99.1	99.1
Newfoundland Power	117.9	113.2
Total	2,009.4	1,997.9

7. Holyrood Unit 1 available. Hardwoods End B unavailable.

# Post–Event: Initial Findings

- Unanticipated generation issues on the Avalon caused delivery point voltages to decline.
- Holyrood CT: delayed start due to a minor fuel valve adjustment requirement. Had regularly started with no issue. Adjustment occurred and unit was online 07:25.
- Holyrood Unit 1: delayed return to service.
- The Come By Chance capacitor banks tripped on 85 percent under voltage, causing a further decline of the delivery point voltages on the Avalon.

# Post-Event: Preliminary Findings to-date

- The under-voltage condition resulted in operation of the under-voltage protection and the tripping of Newfoundland Power transmission lines in the Gander, Clarenville and Carbonear areas and NP transmission lines 80L (Blaketown) and 17L (Goulds).
- Hydro directed load shed by NP Control Centre to restore voltage to acceptable levels.
- Causes of trips under investigation for the following:
  - TL208, Hardwoods, Stephenville, Holyrood Unit 3, Star Lake

# Coordination with Customers

## Newfoundland Power: Normal Activities

- Daily system coordination meeting on equipment status and reserves.
- Routine communication between control centres regarding system requirements for generation and voltage control.
- Recent enhancement is sharing real time data, including the Available and Spinning reserves.

# Coordination with Customers

## Newfoundland Power: Event Activities

- Hydro and NP coordinate the restoration following the disturbance event.
- Hydro and NP execute the conservation effort and associated customer messaging to reduce system demand.
- Hydro requested NP interrupt curtailable customers.

# Coordination with Customers

## Corner Brook Pulp and Paper: Normal and Event Activities

- Request to maximize their hydro generation to assist in meeting system peak demands.
- Requesting Capacity Assistance through load curtailment as per agreement with Hydro.

# Coordination with Customers

## **Vale: Event Activities**

- Capacity Assistance through operation of standby diesel generation as per agreement with Hydro.
- Use of Vale capacitor banks to support the transmission voltages.
- Coordinated restoration of TL208 to return primary supply to Vale.

## **North Atlantic Refining: Event Activities**

- Co-ordinated restoration of customer load.



# Communications

## Communications principles grounded by our core values:

- Open Communication
- Honesty and Trust
- Respect and Dignity
- Teamwork

## Communications objective

- to be transparent and accessible, providing timely information to all stakeholders

Alert Levels	Generation Reserves <sup>2</sup>	Stakeholder Notifications	NLH Actions	NP Actions	Customer Notifications
<b>Normal Conditions</b> (T-001 <sup>3</sup> Level 0)	7-Day Generation Reserve Forecast indicates available reserves greater than the largest generating unit plus minimum spinning reserves	Daily Supply and Demand Status Report and 7-Day Forecast for the <i>Island Interconnected System</i> sent to Public Utilities Board (PUB) and Newfoundland Power.	Normal Operations	Normal Operations	None
<b>Stage 1</b> <b>Power Advisory</b> (T-001 Level 1)	7-Day Generation Reserve Forecast indicates available reserves less than the largest generating unit plus minimum spinning reserves	<b>Stage 1 - Power Advisory Notifications:</b> Hydro System Operations notifies Newfoundland Power System Operations.	Follow System Operating Instruction T-001 as required to maintain minimum spinning reserves	Support Hydro with implementing T-001 measures	None
<b>Stage 2</b> <b>Power Watch</b> (T-001 Level 2)	24-Hour Generation Reserve Forecast indicates available reserves less than the largest generating unit	<b>Stage 2 - Power Watch Notifications:</b> Hydro System Operations notifies Newfoundland Power, Hydro Regulatory Affairs notifies PUB and Hydro Communications notifies Newfoundland Power Communications and FES.	Follow System Operating Instruction T-001	Support Hydro with implementing T-001 measures	NP gives advance notification to its curtailable customers Utilities <u>may</u> issue <sup>4</sup> press release, update website, engage social media (or other communications tools) stating: <b>"Power Watch in Effect - Conservation Request Likely"</b> -Specify when conservation may be required. -Indicate what is the most effective ways for customers to conserve.
<b>Stage 3</b> <b>Power Warning</b> (T-001 Level 3)	Current Day Generation Reserve Margin less than half the largest generating unit	<b>Stage 3 - Power Warning Notifications:</b> Hydro System Operations notifies Newfoundland Power, Hydro Regulatory Affairs notifies PUB and Hydro Communications notifies Newfoundland Power Communications and FES.	Follow System Operating Instruction T-001	Support Hydro with implementing T-001 measures	Utilities <u>will</u> issue press release, update website, engage social media (or other communications tools) stating: <b>"Power Warning in Effect - Customers Requested to Conserve Electricity: Rotating Outages Likely"</b> -Request NP curtailable customers to curtail. -Specify when conservation is required. -Indicate the most effective ways for customers to conserve.
<b>Stage 4</b> <b>Power Emergency</b> (T-001 Level 4)	<sup>5</sup> Generation Shortfall Imminent - No reserves margin	<b>Stage 4 - Power Emergency Notifications:</b> Hydro System Operations notifies Newfoundland Power, Hydro Regulatory Affairs notifies PUB and Hydro Communications notifies Newfoundland Power Communications and FES.	Follow System Operating Instruction T-001	Support Hydro with implementing T-001 measures and implement Newfoundland Power SRP-001 <sup>6</sup> for Rotating Power Outages	Customers to be notified immediately if a generation shortfall is anticipated. Utilities <u>will</u> issue press release, update website, engage social media (or other communications tools) stating: <b>"Power Emergency in Effect - Conserve Electricity-Rotating Power Outages in Effect"</b> - Inform customers of the actual impact (MW) conservation efforts are having on the electricity system. -Indicate what are the most effective ways for customers to conserve.

<sup>1</sup> Island Interconnected Supply Shortfall refers to **all** Firm Generating Capacity on the Island Electricity System.

<sup>2</sup> Operating Reserves = ((Island Interconnected System Available Generation / Island Interconnected System Forecast Peak) - 1) x 100%

<sup>3</sup> NLH System Operating Instructions for Generation Reserves

<sup>4</sup> Where desirable, utilities may undertake joint communications; however, each utility will communicate with its respective customers and key stakeholders directly according to its established protocols.

<sup>5</sup> In the event of an immediate loss of supply (unanticipated and unable to be forecast) this protocol will eliminate Stages 1-3 and begin with Stage 4: this applies to both a generation and transmission issue. Exception may be an underfrequency load trip that would result in a prompt power restoration.

<sup>6</sup> NP System Restoration Plan for Rotating Power Outages

# Public Communication

- First statement was made on social media at 07:45
- Followed by subsequent posts identifying Notification Level – Power Emergency and requesting conservation.
- Information posted to Hydro website on Power Emergency, how to conserve and details of event.
- Interviews conducted with media outlets (radio, print) throughout the morning and into mid-day.
- Press conference (joint with NP) held at 13:30
- Ongoing information on social media throughout the day
- Evening news – CBC Here & Now live and hosted NTV for remotes from lobby.

# InterUtility Communications

- Hydro and NP Control Centres communicating well in advance of peak and throughout event.
- Followed the new Joint Storm/Outage Communication Plan.
- Hydro and NP had several discussions deciding upon Advance Notification Level: resulted in classifying as Power Emergency (this is level three communications response in the joint plan).
- Hydro and NP worked together to deliver on all communication activities as outlined in the plan.
- Timelines outlined in the joint plan were met.
- Through an event debrief, Hydro identified several adjustments to some of the communication targets.

# Communications Timeline Details

Time	Activity
07:18	Hydro Corporate Relations (Comms) notified
07:20	Remote engagement of Comms team
07:25	Initial Comms contact with Newfoundland Power Comms (System Control Centres in contact 24-7)
07:30	System status update from Hydro ECC to Hydro Comms
07:53	Hydro initial holding statement on social media
08:00	Power emergency and conservation posts on social media
08:09	Hydro representative interview with VOCCM
08:25	Hydro representative interview with CBC
09:00	Power Emergency infographic posted to website

# Communications Timeline Details

Time	Activity
09:00-13:30	Continued Comms coordination with Newfoundland Power
09:18	Jointly drafted and approved advisory posted to internet and sent to provincial media
10:14	Holyrood Unit 3 back online, Newfoundland Power advised
10:36	Social media updated with Unit 3 status
11:34	Notice on social media that 'Power Emergency' lifted
09:30-12:30	Interviews with VOXM, CBC and Telegram
13:30	Joint press conference with Newfoundland Power
throughout the event	In addition to that described above, a number of other social media updates were posted

# Regulator Communication

Communication	Timeline Target
Stakeholder relations (as required)	Minimum of twice daily in the a.m. and p.m.

*See Page 15 of Joint Storm/Outage Communication Plan*

Communication	Timeline Target	Met Y/N	Adjustments Proposed?
<b>Initial social media acknowledgment</b>	Within 30 minutes for a confirmed Level 2 or Level 3 event.	Y	Shorten target to holding statement within 15 minutes
<b>Media holding statement</b>	Within 1 hour for a Level 3 event. For Level 2, use discretion.	Y	Holding statement within 15 minutes
<b>Internal communication</b>	Within 1 hour for a confirmed Level 2 or 3 event if required.	Y	Within 30 minutes depending on situation
<b>Media release</b>	Within 1.5 hours of mobilizing the communication team for a Level 3 crisis. For a Level 2 crisis, use discretion.	Y	Within one hour for a level 3 following holding statement, depending on situation and availability of information
<b>Media conference (if required)</b>	Before end of business day for a Level 3 event (use discretion). Ideal timing would be prior to the noon news (11:00 a.m.) or early afternoon.	Y	Adjust depending on situation.
<b>Formal updates for prolonged events (as required): News releases, internal updates, media conferences, social media</b>	As new information comes in: <ul style="list-style-type: none"> <li>• Media updates via interviews or media release as substantial information changes are confirmed – use discretion.</li> <li>• Internal updates (as needed).</li> <li>• Social media/website (ongoing).</li> </ul>	Y	
<b>Stakeholder relations (as required)</b>	Minimum of twice daily in the a.m. and p.m.	Y	Clarify expectations and appropriate notification window for Regulator

*See Page 15 of Joint Storm/Outage Communication Plan*



# Conclusions

- Hydro very aware of the inconvenience caused by the outage to customers
- Outage resulted from Avalon transmission constraints
  - This was a rare low voltage event
  - Protection systems operated as they should have, for low voltage conditions, which caused customer interruptions
  - ~50,000 customers restored within one hour, most others restored within ~3 hours, remaining restored in ~4.5 hours
  - Hydro personnel responded immediately to restore customers in a safe and efficient manner
  - Systems analysis ongoing
  - Communication plan and Advanced Notification Protocol are being reviewed and will evolve considering the nature of this event

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