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June 16, 2026

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Mike McNiven
Board Secretary

Re: Newfoundland and Labrador Hydro – Island Interconnected System Under-Frequency Load Shedding Events – Board's Request for a Detailed Report – Hydro's Reply – Redacted Version

On April 30, 2026, Newfoundland and Labrador Hydro ("Hydro") filed its detailed analysis report for the February 2026 Under-Frequency Load Shedding ("UFLS") events.

Attachment 4 to the report was Emera Newfoundland and Labrador's ("Emera") detailed analysis of the February 27, 2026 UFLS event. Emera requested that this report remain confidential as it contains sensitive information. Treating this report as confidential is consistent with how they and the Nova Scotia Energy Board have treated similar reports. Hydro provided the Board of Commissioners of Public Utilities ("Board") with a complete version of its report, including all attachments. A version of the report excluding Attachment 4 was provided to the parties and copied to the Board.

Hydro has subsequently determined that a small amount of additional information in the report could pose a potential cybersecurity risk if disclosed publicly. These redactions are limited in scope and have been applied only where necessary to protect sensitive information. The filing itself remains unchanged.

Hydro submits that the redacted information qualifies for confidential treatment on the basis that its public disclosure could pose a risk to the security and integrity of critical infrastructure. As such, disclosure would not be in the public interest.

As noted above, Hydro has previously provided the Board with a complete version of its report, including all attachments. A version of the report excluding Attachment 4 and with the additional necessary redactions is attached hereto. Hydro requests that the Board use the redacted version for posting to its website.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

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Encl.

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February 2026 Under-Frequency Load Shedding Events

Detailed Analysis Report

April 30, 2026

A report to the Board of Commissioners of Public Utilities

newfoundland labrador hydro

Executive Summary

An Under-Frequency Load Shedding ("UFLS") event is a controlled, automatic system response to a significant deviation from the system's normal operating frequency. It serves as a critical protection mechanism on the Island Interconnected System that acts to preserve overall system stability during severe generation-load imbalances by automatically shedding customer load in response to declining system frequency. The purpose of UFLS is to prevent widespread outages by quickly bringing the system frequency back to normal operating levels.

On February 13, 2026, and February 27, 2026, the Island Interconnected System experienced two separate and unrelated events involving the Labrador-Island Link ("LIL") and Maritime Link ("ML"), respectively, resulting in UFLS and customer interruptions. In both cases, protective measures, including UFLS, operated as designed to ensure system stability and the safe and reliable operation of the power system.

The February 13, 2026 event was initiated by an electrode line fault on the LIL combined with a control system limitation, which prevented successful fault clearing and resulted in a bipole trip of the LIL. The February 27, 2026 event was caused by an issue with the ML, which resulted in underfrequency conditions followed by overfrequency conditions on February 27, 2026. The LIL is equipped with overfrequency protection, and the bipole tripped at its prescribed threshold to maintain the system frequency within acceptable limits.

In both events, the loss or rapid change in power transfer created a significant imbalance between generation and load, resulting in a decline in system frequency and activation of UFLS to maintain system stability. Approximately 69,000 customers were affected during the February 13, 2026 event, and approximately 129,000 customers were affected during the February 27, 2026 event. No equipment damage was identified as a result of either event.

Newfoundland and Labrador Hydro ("Hydro") completed a detailed engineering analysis of both events, including dynamic simulations, which confirm that system performance was consistent with expected behaviour. Corrective actions for the root causes of the events have been identified and are being implemented, including control system modifications on the LIL, telecommunications and control system improvements on the ML, and follow-up actions related to protection system performance.

Over the course of the LIL's early operation, Hydro has also implemented enhancements to the UFLS framework and system operation, including the Final UFLS Scheme. The Final UFLS Scheme is designed to increase LIL deliveries to Island customers. This scheme does not increase the likelihood of UFLS events but may influence the magnitude of load shedding under certain operating conditions. Hydro has also formalized LIL operating protocols to include conservative, economic, and elevated modes for abnormal operating conditions. These changes improve Hydro's ability to manage large system disturbances and balance reliability with economic operation.

Hydro continues to monitor system performance and implement improvements to minimize both the occurrence and impact of UFLS events while maintaining safe and reliable operation of the Island Interconnected System.

Contents

List of Attachments

1.0 Introduction

On February 13, 2026, and February 27, 2026, the Island Interconnected System experienced two separate, unrelated events on the LIL and ML, which resulted in UFLS events impacting Hydro and Newfoundland Power Inc. ("Newfoundland Power") customers.

On March 26, 2026,[1] the Board of Commissioners of Public Utilities ("Board") requested that Hydro file a detailed report by April 30, 2026, setting out the following:

- A detailed sequence of events outlining the cause and resulting effect for both the February 13, 2026 and February 27, 2026 outages, including both Hydro and Newfoundland Power generation and transmission assets;
- Details of any corrective actions or fixes that have been or will be taken as a result of these or similar events;
- An estimate of the number of UFLS events Hydro generally expects to experience each year and an explanation of how this estimate was determined;
- The impact, if any, that low reservoir levels on the Island may have had on LIL transfers and thus the UFLS;
- A load flow and transient stability analysis simulating the events of February 27, 2026;
- Details of any equipment damage experienced due to overvoltage or over frequency;
- A description of how the LIL was operated on those dates with regard to loading and the interrelationship with the UFLS scheme; and
- The current status of the UFLS system on the Island Interconnected System, highlighting any changes made in the past 12 months, including any impact these events may have had on the projected number of UFLS events expected each year.

UFLS is a critical protection mechanism on the Island Interconnected System that acts to preserve overall system stability during severe generation-load imbalances by automatically shedding customer

[1] "Newfoundland and Labrador Hydro – Island Interconnected System Under Frequency Load Shedding Events – Board's Request for a Detailed Report," Board of Commissioners of Public Utilities, March 26, 2026.

load in response to declining system frequency.[2] Hydro targets zero UFLS events on an annual basis, and system planning and operating procedures are designed to minimize the likelihood of such events to the extent practical.[3] At the same time, UFLS remains an essential tool that enables the safe and economic operation of the power system, including facilitating higher power transfers over the LIL while maintaining acceptable reliability performance.

As a result, Hydro undertakes detailed engineering analysis following such events to understand the causes and effects, and identify any necessary remedial actions. This report summarizes the results of such analysis and provides responses to the Board's inquiries.

2.0 February 13, 2026 UFLS Event

2.1 Sequence of Events

On February 13, 2026, at approximately 16:59 NST, the LIL experienced an imbalance between Electrode Line 1 and Electrode Line 2, indicative of a fault on the electrode system in Labrador. At the time of the event, the LIL was operating in "Double Monopole Distribution" mode, transferring approximately 450 MW in an intentionally unbalanced configuration to increase electrode current and mitigate ice accumulation.[4]

The LIL control and protection system responded to the detected imbalance by initiating the Electrode Line Balance ("ELB") protection sequence, which is designed to clear temporary electrode faults through operation of the Neutral Bus Ground Switch ("NBGS"). During this sequence, the protection system attempted to execute a multi-step NBGS operation intended to clear the fault; however, due to a mismatch between the configured protection logic and the physical operating characteristics of the NBGS breaker, the sequence could not be successfully completed.[5] As a result, the protection system was unable to clear the fault condition and, in accordance with its design, initiated a bipole trip of the LIL to protect the equipment.

[2] The UFLS system automatically sheds load from the system when the system load exceeds available generation, which reduces system frequency. Load shedding restores balance between load and generation, restoring system frequency to nominal levels.
[3] Prior to the interconnection to the North American Grid, Hydro forecast approximately six UFLS events per year.
[4] An imbalanced pole configuration mitigates ice accumulation by causing current on the electrode lines, increasing electrode line conductor temperature.
[5] Further detail on the cause and corrective actions is included in Section 2.3.

LIL transfer limits are set based on ML export levels and the amount of UFLS available to operate following a LIL bipole trip, which is directly proportional to total Island demand. During the event, the ML exported approximately 160 MW, resulting in a LIL limit of 683 MW. LIL and ML transfers and limits at the time of the event are presented in Table 1.

Table 1: LIL/ML Power Flow Prior to February 13, 2026 Event

Event	Island Demand (MW)	LIL (MW) @ Muskrat Falls		ML (MW) @ Bottom Brook	
		Flow	Limit	Flow	Limit
February 13, 2026	1,357	451	683	161	426

The sudden loss of approximately 450 MW of imports to the Island Interconnected System created an immediate and significant imbalance between system generation and load. This imbalance resulted in a rapid decline in system frequency to approximately 58.37 Hz.[6] The ML, which had been exporting approximately 161 MW at the time, automatically ran back to reduce export levels in response to the disturbance.[7]

Despite these actions, the magnitude and rate of frequency decline exceeded the available primary frequency response from online generation, and UFLS protections were activated. On the Newfoundland Power system, UFLS Groups 2 through 4 operated in accordance with their frequency setpoints, resulting in approximately 270 MW of load shed and approximately 69,387 customers interrupted.[8,9]

The shedding of customer load stopped the frequency decline and allowed system frequency to recover through generator governor response and reduced loading. Following stabilization, Newfoundland Power restored all affected customers within approximately 52 minutes. The LIL was returned to service later that evening in monopole metallic return configuration and subsequently restored to bipole operation the following day once inspections were completed.[10]

[6] The Island Interconnected System operates at 60 Hz nominal.
[7] A ML runback is an instantaneous decrease in ML exports following a LIL pole or bipole trip.
[8] UFLS groups refer to segments of load that are automatically shed at progressively lower system frequency trigger points in order to balance system generation and load and maintain system frequency within acceptable ranges.
[9] At the time of the event, Hydro's prescribed UFLS blocks of customers served by Transmission Lines ("TL") TL220 and TL226 were unavailable due to configuration issues. These issues have since been corrected and verified following the February 27, 2026 event. These blocks are far smaller than the Newfoundland Power blocks, and their unavailability did not have an appreciable impact on the event.
[10] Monopole metallic return utilizes the second pole as a return path, as opposed to earth return, which utilizes the earth via electrodes.

Hydro did not experience any damage to its equipment or infrastructure as a result of overvoltage or over frequency, nor did it receive any reports of customer equipment damage during or subsequent to this event. Detailed analysis of this event is provided as Attachment 1.

2.2 Event Simulation

A dynamic simulation of the February 13, 2026 event was performed using Power System Simulator for Engineering ("PSSE") to replicate system conditions and evaluate the observed system response following the LIL bipole trip. The simulation incorporated the loss of approximately 408 MW[11] of LIL import, the associated ML runback, and the operation of UFLS. The simulated system frequency response closely matched the actual recorded response, with a simulated minimum frequency of approximately 58.39 Hz compared to an actual minimum of approximately 58.37 Hz.

The simulation also demonstrated strong agreement in system behaviour, including the rapid ML runback response and the operation of UFLS. The simulated load shedding of approximately 265 MW is closely aligned with the actual load shed of approximately 270 MW. The analysis indicates that the Island Interconnected System frequency recovered quickly, returning to nominal levels within approximately 11.5 seconds following the disturbance, driven by the combined response of ML runback and UFLS. Overall, the simulation confirms that the observed system performed as expected to maintain system frequency. The underlying simulation results, including load flow and transient analysis, are presented in Attachment 2.

2.3 Resulting Corrective Actions

Following the February 13, 2026 event, Hydro identified a control system limitation associated with the NBGS sequence used in the ELB protection scheme. Specifically, the configured NBGS sequence required multiple close operations within a timeframe that is not physically achievable, as the NBGS breaker requires approximately seven seconds for spring recharge following a close operation. As a result, the sequence could not complete as designed and was incapable of clearing the electrode line fault, leading to the bipole trip.

A software modification has been developed to revise the NBGS sequence logic, including removal of the reclose step, to ensure compatibility with the physical operating characteristics of the breaker and

[11] As described in Attachment 2, 408 MW is the energy delivered to Soldiers Pond.

to enable successful fault-clearing under applicable conditions. This modification has successfully completed factory acceptance testing and is scheduled for installation and commissioning during a planned outage in late June 2026.

As an interim operational measure, Hydro implemented the operation of the LIL in Conservative mode during adverse weather conditions, such as during periods of ice accretion. This operating approach involves reducing LIL power flows to the point that there would be no risk of customer impact from a bipole trip.

3.0 February 27, 2026 UFLS Event

3.1 Sequence of Events

On February 27, 2026, at approximately 11:19 NST, a complex sequence of events occurred involving the ML and broader system interactions. Earlier that morning, both primary and backup inter-station telecommunication paths between the Woodbine converter station in Nova Scotia and the Bottom Brook Converter Station in Newfoundland were lost due to a failure in the telecommunications infrastructure. With the loss of communications, system operators followed established procedures to reduce power transfer on the ML to 0 MW to place the link in a stable condition. The LIL was transferring 200 MW to the Island at the time of the event. The LIL and ML transfers, including the limits at the time of the event, are presented in Table 2.

Table 2: LIL/ML Power Flow Prior to February 27, 2026 Event

Event	Island Demand (MW)	LIL (MW) @ Muskrat Falls		ML (MW) @ Bottom Brook	
		Flow	Limit	Flow	Limit
February 27, 2026	1,190	200	598	-	202

With the ML operating at or near zero transfer, operators at the Nova Scotia System Operator adjusted operating parameters in accordance with operating practices to minimize no-load losses, consistent with established operating practices. However, due to the absence of inter-station communications, the voltage adjustment was not coordinated between converter stations. As a result, only the Woodbine station executed the voltage ramp, while Bottom Brook did not respond in a coordinated manner. This

created a voltage differential across the HVDC[12] system, resulting in an unintended and uncontrolled power flow from Bottom Brook to Woodbine, increasing to approximately 600 MW of export from the Island Interconnected System.

This sudden and significant export of power created an immediate generation-load imbalance on the Island system, causing frequency to decline rapidly to approximately 57.95 Hz. The LIL Power Frequency Controller responded by attempting to increase imports to the Island; however, it reached its operational limits and could not fully offset the imbalance. As frequency declined, UFLS protections across both Hydro and Newfoundland Power systems operated, including Newfoundland Power UFLS Groups 1 through 6, resulting in substantial load shedding.

Shortly thereafter, as current on the ML increased beyond steady state operating limits due to the uncontrolled power flow, the direct current ("DC") line overcurrent protection operated at the Woodbine terminal. At the same time, the Bottom Brook terminal was blocked due to abnormal alternating current voltage conditions, all resulting in a bipole outage of the ML. The sudden loss of this export caused a rapid reversal in system conditions, with frequency increasing sharply to approximately 65 Hz, creating a severe over-frequency condition.

This over-frequency event led to a cascade of additional protection operations across Hydro assets. Multiple generating units, including those within the Exploits Generation System as well as Granite Canal and Upper Salmon facilities, tripped, as designed, on over-frequency or associated mechanical protections. The LIL converter transformers also tripped on over-frequency protection. Concurrently, the loss of the ML STATCOM reduced dynamic voltage support on the west coast, contributing to elevated voltages and resulting in the operation of TL protections, including TL209, TL211, TL233, and TL269, which resulted in the loss of supply to portions of western Newfoundland.

Hydro transmission UFLS protections operated during this event, including TL220, TL226, and other feeder protections, along with additional under-frequency protection at Massey Drive Bus 4, which contributed to transmission outages in the Corner Brook area.

[12] High-Voltage Direct Current ("HVDC").

Additional distribution impacts occurred as a result of transmission outages and transformer protection operations on the west coast of the island. In particular, the trip of TL209 resulted in a loss of supply to Stephenville and interruptions to Newfoundland Power feeders supplying Stephenville Crossing, St. George's, Rose Blanche, and associated substations. Newfoundland Power also reported transformer protection lockouts at several substations, including Walbourne's, Bayview, and Humber, due to overvoltage conditions, as well as lockouts on generation units at Lookout Brook (2 Units), Lockston (1 Unit), Port Union (2 Units), Rattling Brook (2 Units), Seal Cove (1 Unit), Tor's Cove (1 Unit), and West Brook (1 Unit), resulting in a combined loss of approximately 25 MW. Newfoundland Power did not experience any TL trips as a result of this event.

The combined under-frequency and over-frequency conditions, along with transmission and voltage-related protection operations, resulted in approximately 404 MW of load shed on the Newfoundland Power system due to UFLS, with an additional 44 MW of Newfoundland Power load lost due to overvoltage protection operations. Total load loss approached approximately 600 MW when including Hydro's Industrial customers. Approximately 128,692 Newfoundland Power customers were affected.

System restoration proceeded in a staged manner following stabilization of frequency and system conditions. Load restoration began immediately after the completion of UFLS actions and continued as transmission and voltage conditions were normalized and generation was returned to service. Newfoundland Power restored all affected customer feeders within approximately 71 minutes of the initial event. The LIL was returned to service later the same day once system conditions permitted. Restoration of the ML required re-establishment of inter-station communications and implementation of corrective control system measures; the ML was subsequently returned to service later that evening.

Hydro did not experience any damage to its equipment or infrastructure as a result of overvoltage or over-frequency conditions, nor did it receive any reports of customer equipment damage during or subsequent to this event.

Hydro's detailed analysis and Emera Newfoundland and Labrador's detailed analysis of this event is provided in Attachment 3 and Attachment 4, respectively.

3.2 Event Simulation

A dynamic simulation of the February 27, 2026 event was performed using PSSE to replicate system conditions and evaluate the observed system response. The simulation incorporated the sequence of events associated with the unintended ML ramp, subsequent UFLS, and the over-frequency condition following the ML trip. The simulated system frequency response closely matched the actual recorded response, with a simulated minimum frequency of approximately 58.08 Hz compared to an actual minimum of approximately 57.97 Hz, and a simulated maximum frequency of approximately 65.05 Hz compared to an actual maximum of approximately 65.04 Hz.

The simulation also demonstrated good agreement in system behaviour, including the staged operation of UFLS Groups 1 through 6 and the response of generation and frequency controls. The simulated UFLS load shedding of approximately 430 MW closely aligned with the actual load shed of approximately 425 MW, with additional load loss due to over-frequency effects also reflected in the simulation. Minor differences were observed in the rate of frequency response, with the simulated response appearing slightly faster than the actual system response, which is attributed to small differences between model parameters and field settings. Overall, the analysis confirms that the observed system performance during the event was consistent with the expected dynamic behaviour of the Island Interconnected System. The underlying simulation results, including load flow and transient analysis, are presented in Attachment 5.

3.3 Resulting Corrective Actions

Following the February 27, 2026 event, several corrective actions were identified by Emera to address both the initiating causes and contributing factors associated with the disturbance.

Corrective actions related to the ML included assessment of protection system performance through review of Transient Fault Recorder data, system operator event records, and control and protection logic. A key corrective measure was the implementation of interlocks to prevent DC voltage ramping when inter-station telecommunications are unavailable, ensuring coordinated control between converter stations. Inter-station telecommunications continuity was restored, and physical path diversity was re-established to address the root cause of the communication failure. In addition, the loss optimization protocol was removed. The telecommunications service provider is also progressing actions

to ensure that future changes to the ML telecommunications system are communicated directly to relevant operating entities, including Hydro.

Hydro also identified follow-up actions related to system performance during the event. These include review of UFLS performance, including coordination with Newfoundland Power regarding UFLS group performance, assessment of under-frequency protection operation at Massey Drive Bus 4, and evaluation of generator protection settings and system dynamic response to ensure appropriate coordination under similar system conditions.

4.0 Discussion

4.1 Status of the UFLS System

Over the past 12 months, Hydro has implemented two key changes that have the potential to influence the characteristics of UFLS events on the Island Interconnected System—these include: (i) the implementation of the Final UFLS Scheme, and (ii) the introduction of conservative, economic, and elevated LIL operating conditions under certain system states, further described herein.

4.1.1 Implementation of Final UFLS Scheme

Hydro has implemented the Final UFLS Scheme as developed through the Stage 4F Operating Study, which establishes the current framework for managing under-frequency events on the Island Interconnected System.[13] The updated scheme modifies both the total quantity and distribution of load shed across frequency setpoints, with greater load assigned to higher-frequency blocks and the introduction of a backup UFLS block at approximately 57.7 Hz. The total available UFLS under the final scheme is approximately 756 MW, excluding an additional back-up block of approximately 105 MW, designed to operate only under extreme or unanticipated system conditions.

The revised UFLS design supports updated LIL transfer limits by enabling the system to withstand a larger loss of supply, including the loss of the LIL bipole, while maintaining system frequency within established planning criteria. Specifically, the UFLS scheme is designed such that, following a worst-case

[13] "LCP Operational Study: Final LCP Operational Study ("Stage 4F") Report," TransGrid Solutions Inc., June 26, 2025. Provided in "Final LCP Operational (Stage 4F) Study – Overview," Newfoundland and Labrador Hydro, August 11, 2025, att. 1.

contingency, system frequency does not decline below approximately 57.8 Hz and remains below over-frequency limits during recovery.

As a result of the Final UFLS Scheme, Hydro has established updated LIL transfer limits of up to approximately 900 MW, depending on system conditions, including Island demand levels and ML operating state. These limits reflect the improved ability of the Island Interconnected System to manage larger supply losses through coordinated operation of UFLS, ML runback, and generator response.

The implementation of the Final UFLS Scheme and associated LIL transfer limits does not increase the likelihood of UFLS operation; rather, it enables operation of the system at higher transfer levels, which may influence the magnitude of load shedding required during a contingency event.

4.1.2 Introduction of Conservative, Economic, and Elevated LIL operation

Hydro has formalized operating protocols for the LIL that define three distinct modes of monopole operation: conservative, economic, and elevated, to balance system reliability, operational flexibility, and economic efficiency under varying system conditions.

Under conservative operation, LIL power flows are limited such that, in the event of a pole trip, there is no risk of UFLS. This mode is applied during conditions that increase the likelihood of a LIL outage, including adverse weather, maintenance or testing activities, or other circumstances where the risk of customer interruption is not acceptable.

Economic operation represents the default mode, where LIL transfers may be increased to optimize system efficiency or support outage management, provided overall system conditions are stable. Under this mode, a contingency involving a pole trip during monopole operation may result in UFLS; however, operating limits are established such that the severity of load shedding is limited (i.e., avoiding deeper UFLS blocks). Operational protocols include real-time indication to Newfoundland Power and defined notification requirements during higher-risk periods.

Elevated operation is applied under more constrained system conditions, such as maintaining reserve requirements or serving customer load when other resources are limited. In this mode, higher LIL transfer levels are permitted, and the potential loss of supply following a pole trip during monopole operation is explicitly considered in day-ahead and real-time reserve assessments. While UFLS may

occur under this operating state, limits are set to maintain overall system stability and avoid cascading outages, and enhanced notification protocols are implemented.[14]

The introduction of these protocols provides Hydro with a structured framework to manage the trade-off between reliability and efficiency. While these changes do not inherently increase the frequency of contingency events, operation in economic or elevated modes can increase the likelihood and potential magnitude of UFLS in the event of a LIL contingency, as compared to conservative operation.

4.2 Impacts of Low Reservoir Levels on LIL Operation

At the time of the February UFLS events, reservoir levels were healthy and were not being supplemented by increased LIL; therefore, system energy storage levels were not a factor in the UFLS events of February 2026.

Throughout the spring and summer of 2025, Hydro experienced persistent below-average inflows into its hydraulic reservoirs as the entirety of the Island portion of the province experienced some level of drought conditions. These low inflows resulted in a draw-down of Hydro's reservoirs to at or below its minimum system energy storage target by the fall of 2025. To mitigate low system energy storage, Hydro implemented thermal generation and energy purchases. Inflows recovered through the fall, and system energy storage levels at the beginning of February 2026 were 1,574 GWh, or approximately 200% of minimum energy storage targets, and 64% of maximum energy storage targets.

As system energy storage levels were healthy, Hydro was not supplementing reservoir energy storage levels via increased LIL transfers during the UFLS events on February 13, 2026, and February 27, 2026.

5.0 Conclusion

The February 13, 2026 and February 27, 2026 events were the result of distinct and unrelated issues affecting the LIL and ML, respectively. In both cases, the Island Interconnected System responded in a manner consistent with design expectations, with UFLS operating to preserve overall system stability following large and rapid system frequency excursions.

[14] These modes of operation may be applied during bipole operation when there is an elevated risk that a single pole trip could result in customer interruption, such as when a submarine cable is out of service.

Subsequent analysis, including dynamic simulation, confirms that system performance during both events aligned closely with expected behaviour. Hydro and its partners have identified and are implementing targeted corrective actions to address the specific causes and contributing factors associated with each event, including control system modifications, telecommunications improvements, and protection system reviews.

Hydro has also implemented enhancements to system operation and planning, including the Final UFLS Scheme and formalized LIL operating protocols, which provide greater flexibility to balance reliability and economic operation while maintaining system security. These changes do not increase the likelihood of UFLS events but may influence the magnitude of load shedding under certain operating conditions.

Hydro remains committed to minimizing the occurrence and impact of UFLS events through ongoing monitoring, analysis, and continuous improvement of system operations and protection schemes.

Attachment 1

Surge and Trouble Report Analysis

February 13, 2026 Event

SURGE AND TROUBLE REPORT ANALYSIS

Report No: 9609
Event Description: Island Under Frequency Load Shed
Event Date & Time: February 13, 2026, at 16:58:47

Sequence of Events:
On February 13th, 2026, the Labrador Island Link (LIL) experienced a bipole protection trip at the Muskrat Falls Converter Station (MFACS) because of a fault on the Electrode Line in Labrador.

The trip caused the island frequency to drop to approximately 58.37 Hz, which activated the under frequency load shed (UFLS) protections. At this time there was 450 MW of power flowing on the LIL from MFACS. The trip also resulted in a complete runback of the 161 MW flowing on the Maritime Link (ML).

This event resulted in Groups 2-4 under frequency protection trips at Newfoundland Power resulting in a load loss of 270 MW, with 69,387 customers affected. All Newfoundland Power feeders were restored within 52 minutes. The total system load at the time of the incident was 1,357 MW, including the 161 MW of ML exports.

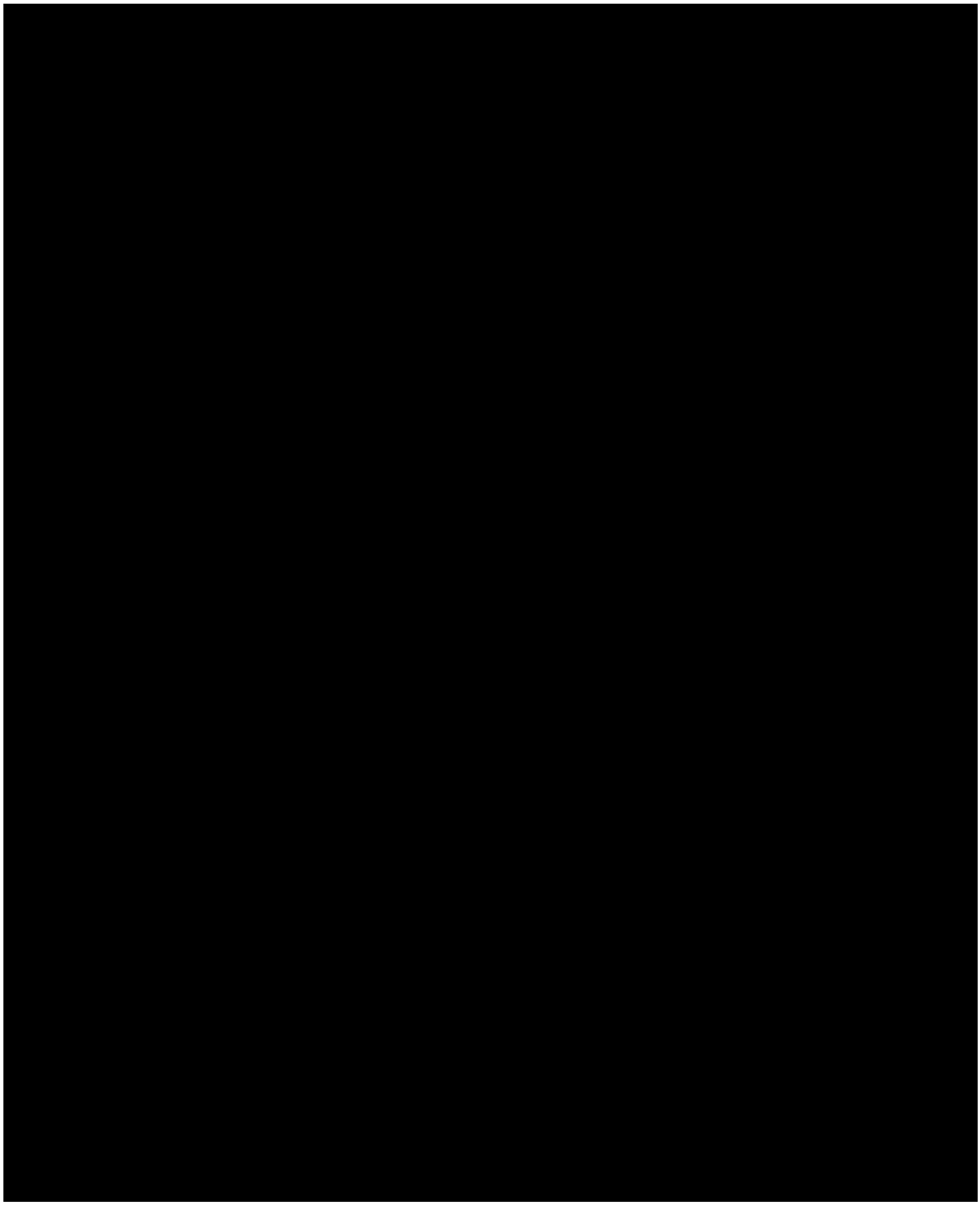
The LIL was returned to service in Monopole Metallic Return at approximately 22:09 hours on February 13, 2026. The LIL was returned to bipole operation at approximately 1722 hours on February 14, 2026.

Protection Information:

Relay Targets:	UFLS		
Fault Type:	N/A	*Permanent*:	No
Clearing Time:	N/A	*Reclosing:*	*N/A*

Analysis and Conclusions:

[redacted]



Attachment 2

TP-TN-304 – PSSE Dynamic Simulation of UFLS Event

February 13, 2026

Doc #: TP-TN-304
Issue Date: 2026/01/19
Document Type: Technical Note

TP-TN-304

PSSE Dynamic Simulation of UFLS Event (February 13, 2026)

1. Purpose

To perform and evaluate a PSSE dynamic simulation of the LIL bipole trip that occurred on February 13, 2026, to confirm that the observed system response aligned with expected performance.

2. Background

On February 13, 2026, at 1659 hours, the Labrador Island Link ("LIL") experienced a bipole protection trip at the Muskrat Falls Converter Station due to an imbalance between Electrode Line 1 and Electrode Line 2 indicative of a fault on the Electrode Line in Labrador. The LIL was delivering 408 MW to Soldiers Pond (SOP) prior to the bipole trip. This LIL bipole trip event resulted in under-frequency load shedding (UFLS) totalling 270 MW that affected 69,387 customers. The total system load at the time of the incident was 1,357 MW, including the 161 MW of ML exports. As designed, the LIL Bipole event triggered an immediate ML runback of the entire 161 MW to arrest the sudden drop in system frequency. The minimum system frequency following the event was recorded to be 58.37 Hz (or a decrease of 1.66 Hz from 60.03 Hz). Figure 1 is the actual system frequency response following the LIL bipole event. The frequency dropped from 60.03 Hz to 58.37 Hz, which is a difference of 1.66 Hz.

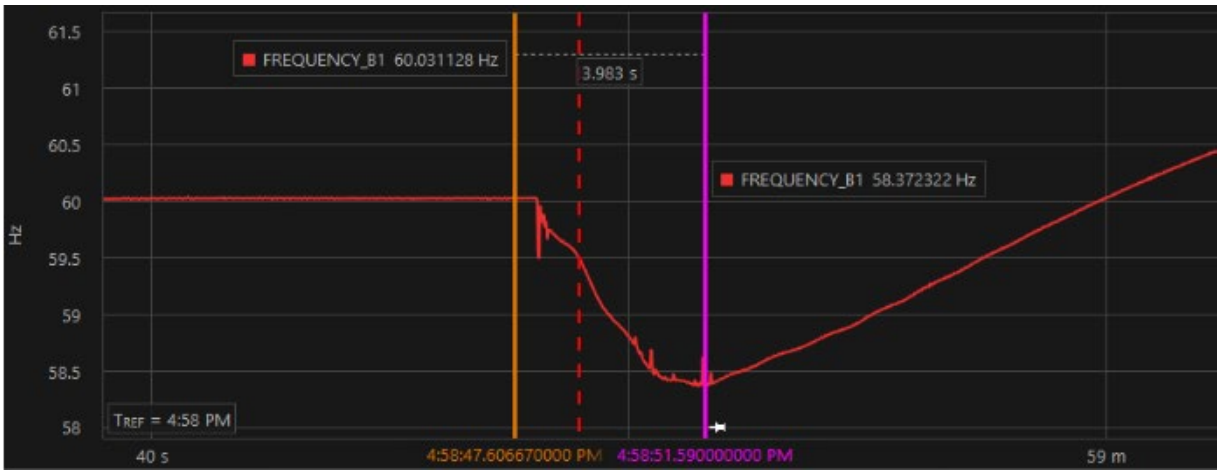


Figure 1 - Actual System Frequency Response - LIL Bipole Trip (Feb 13, 2026)

3. PSSE Simulations - System Dispatch Prior to Event

3.1 Load Flow Analysis

In support of the dynamic simulations (or transient stability analysis), load flow analysis was completed to reproduce system conditions immediately prior to the LIL bipole trip on February 13, 2026 at 16:59. The corresponding system dispatch and power flow on the 230 kV system are shown in the load flow diagram in Figure 2.

3.2 Dynamic Stability Analysis

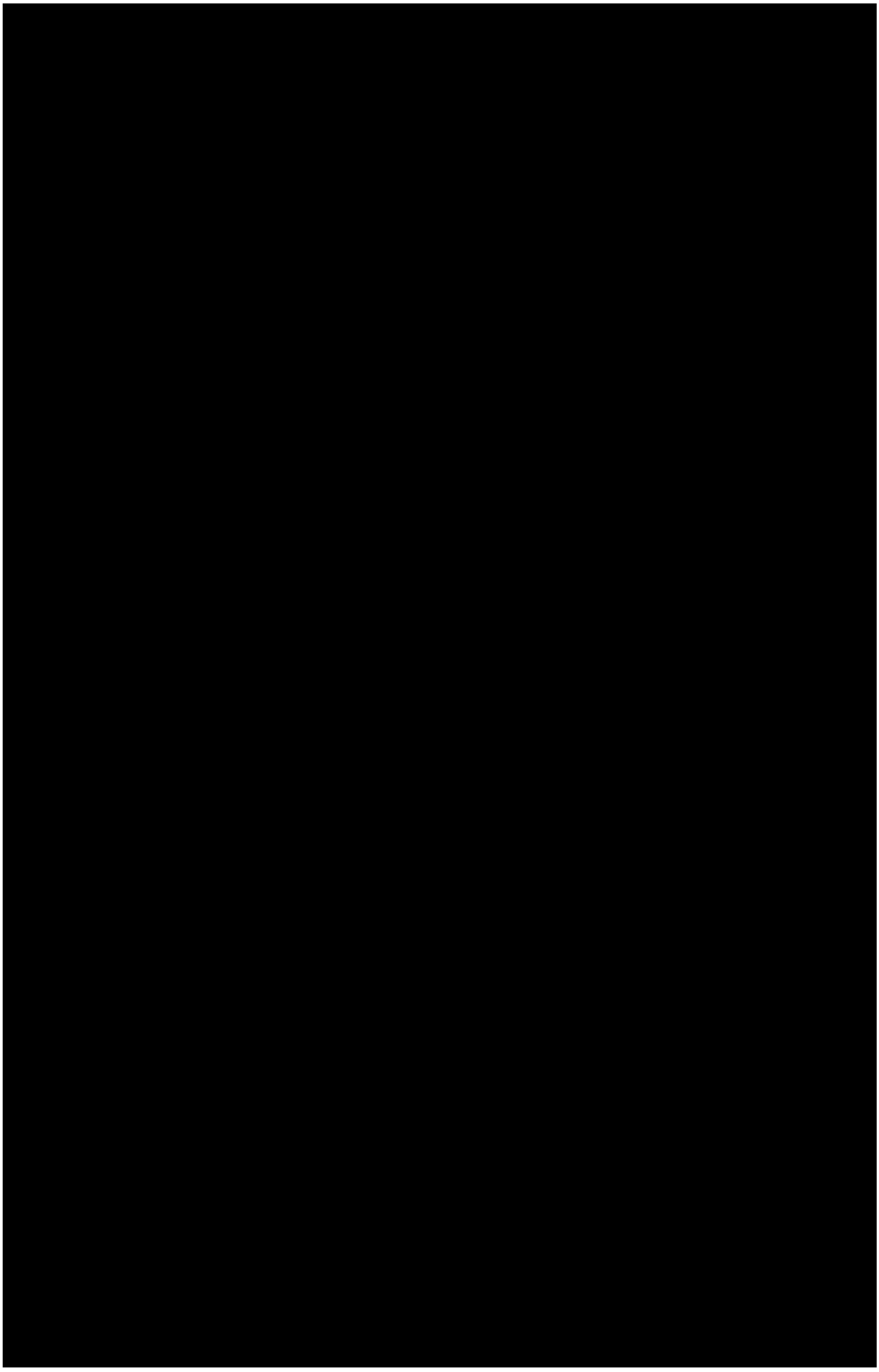
A PSSE dynamic simulation was conducted in which the LIL bipole (408 MW at SOP) was tripped to assess the frequency response of the Island Interconnected System (IIS). The simulation was run for 15 seconds to capture the post-disturbance frequency recovery. The first plot shows the LIL power order at SOP, confirming that the LIL bipole tripped in the simulation at the 1-second mark. The second plot shows the ML runback response of each pole, with the total exports reducing by the full 160 MW approximately 250 ms after the bipole trip. The third plot shows the IIS frequency response (Hz), which reaches a minimum of 58.39 Hz which is only marginally higher than what was observed in the actual event, as shown in Figure 1.

The simulation and actual frequency readings demonstrates that following the LIL bipole trip, the IIS frequency demonstrated strong system performance, recovering rapidly and returning to nominal 60 Hz within approximately 11.5 seconds. This recovery was driven by the coordinated response of the ML runback and approximately 265 MW of UFLS.

4. Conclusion

The following can be concluded from performing the PSSE dynamic simulations replicating the events of February 13, 2026:

- The observed system response was consistent with the PSSE simulation results.
- The simulated frequency response (Figure 3) closely matches the actual frequency response (Figure 1).
- The simulated load shedding was 265 MW versus 270 MW during the actual event, representing a close match.



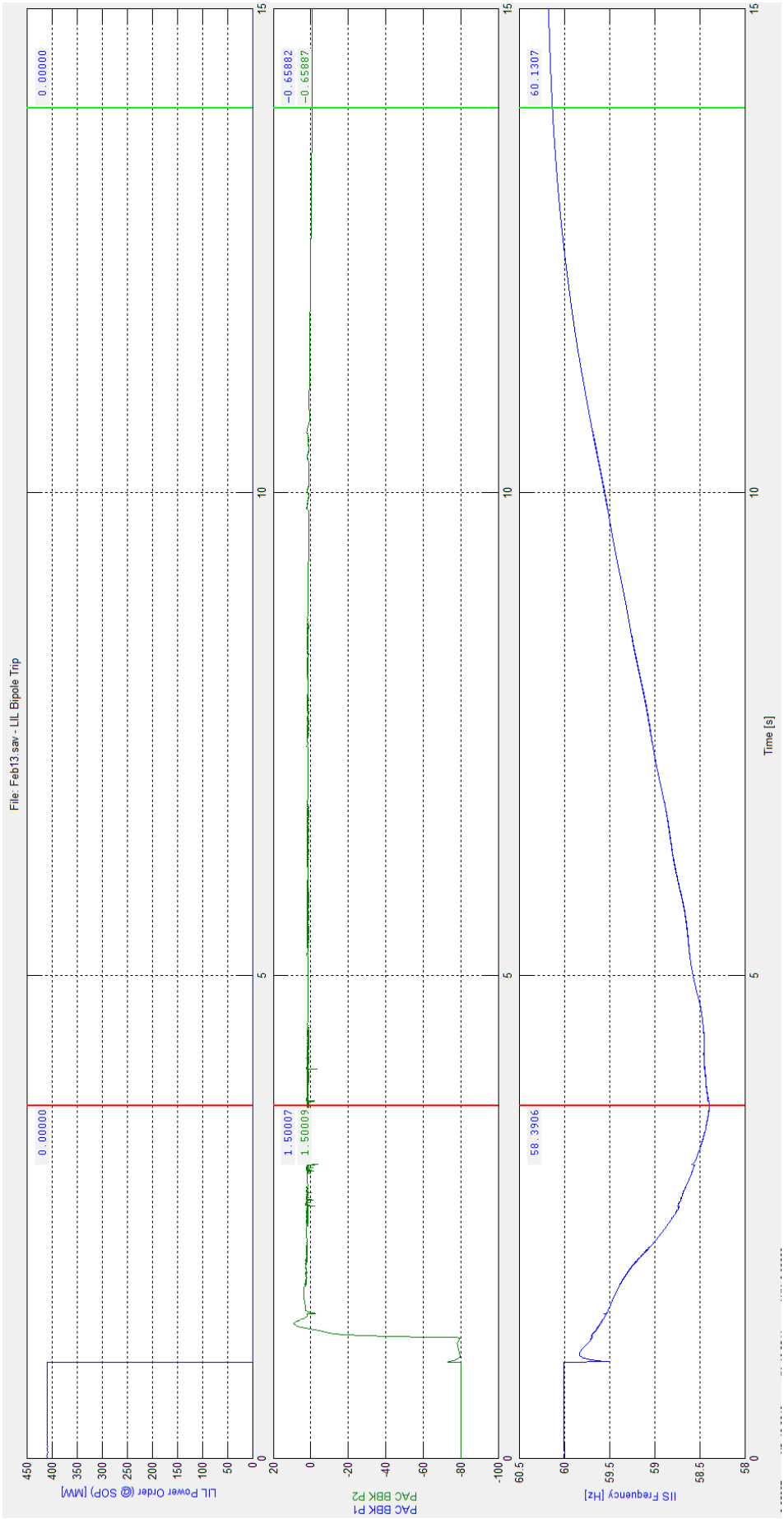


Figure 3 – Dynamic Simulation (15 Seconds after LIL Bipole Trip)

Document Summary

Document Owner:	Transmission Planning & Integration Support
Document Distribution:	

Revision History

Revision	Prepared by	Reason for change	Effective Date
0	M.Carter	Issue for review	2026/04/01

Document Control

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Attachment 3

Surge and Trouble Report Analysis

February 27, 2026 Event

SURGE AND TROUBLE REPORT ANALYSIS

Report No: 9617
Event Description: Island Under Frequency Load Shed
Event Date & Time: February 27, 2026, at 11:20:38

Sequence of Events:
On the morning of February 27th, 2026, the Maritime Link (ML) lost both inter-station communication paths between its Woodbine and Bottom Brook Converter Stations. The ML was ramped to 0 MW as per their operating procedures. At approximately 11:20, the ML rapidly ramped unintentionally from 0 MW to approximately 600 MW in Bottom Brook. The Labrador Island Link (LIL) frequency controller at Soldiers Pond (SOP) responded to the sudden load increase, however, due to the rapid imbalance in system load vs. generation the island frequency dropped to 57.95 Hz, which activated both Newfoundland Power and Newfoundland Hydro under frequency load shed protections at 11:20:28.

All generator governors on the island reacted by increasing the MW output of each generator to help correct the under frequency. While the island frequency was recovering from this event, the ML "Pole 1 DC Line Overcurrent Protection" operated at 11:20:42 and the "Pole 2 DC Line Overcurrent Protection" operated at 11:20:49 resulting in a bipole outage to the ML and the loss of the ML Statcom[1].

With the sudden loss of ML exports, this caused a frequency increase and abnormally high voltages on the island. All generator governors on the island reacted to decrease the MW output of each generator to help correct the over frequency. Star Lake G1 shutdown due to over frequency at 11:20:50. The rest of Exploits Generation System (Grand Falls and Bishop's Falls) was also shut down because of the over frequency.

The 66 kV Bus, Bus 2, in Buchans had overvoltage and over frequency protection operations which resulted in the loss of transmission line TL264 and TL280 at 11:50:51. The high voltage on the West coast resulted in overvoltage protection operations on transmission lines and the loss of TL209, TL211, TL233 and TL269 at 11:20:52. The outage to TL209 caused a loss of supply to Stephenville and a loss of Newfoundland Power feeders in Stephenville Crossing, St. George's, Rose Blanche, Gallant Street, Harmon, and Abrahams Cove Substations. Newfoundland Power also reported transformer protection lockouts in Walbournes, Bayview and Humber Substations on the West Coast due to over voltage protection.

The frequency reached 65 Hz and the LIL transformer protection tripped on over frequency at 11:20:54 on T5 and 11:20:55 on T4.

Due to the underfrequency, Granite Canal (GCL) G1 and Upper Salmon (USL) G1 both increased to maximum output of 45 MW and 88 MW respectively. Once the frequency began climbing as high as 65 Hz, both units rapidly ramped down to 0 MW. GCL G1 mechanical protection initiated an emergency shutdown at 11:21:51. USL G1 had a generator vibration alarm at 11:21:37 and a generator lockout on

1 A Static Synchronous Compensator (STATCOM) is a fast-acting, power-electronics-based FACTS device that provides dynamic reactive power compensation to transmission grids. It stabilizes voltage by acting as an AC current source, injecting or absorbing reactive power.

at 11:29:30. Some of Newfoundland Power's generators[2] also experienced lock outs which resulted in a loss of 25 MW of generation.

The activation of the UFLS protection caused a Newfoundland Power load loss of 404 MW and a Newfoundland Hydro load loss of 21 MW. Newfoundland Power lost an additional 44 MW of load due to the over voltage trips on the West Coast. Between the UFLS and over voltage events Newfoundland Power had 128,692 customers affected. An additional loss of 131 MW of the industrial customers Equinox, Vale, Linde, Braya, Duck Pond Mine, Valetine Lake Mine and Corner Brook Pulp and Paper contributed to the total loss of load approximately 600 MW. All Newfoundland Power feeders were restored within 71 minutes. The total Island system load at the time of the incident was 1,180 MW.

Protection Information:

Relay Targets:	UFLS, Over voltage (59), Over Frequency (81)		
Fault Type:	N/A	*Permanent*:	No
Clearing Time:	N/A	*Reclosing:*	*N/A*

Analysis and Conclusions:

Maritime Link

Emera NL (ENL) Engineering informed NL Hydro that the Maritime Link had lost both inter-station telecommunication paths via fibre break(s) in Cape Breton. As per operating procedures, the ML was ramped to 0 MW and the NS system operator reduced the DC voltage from 200 kV to 160 kV to reduce the no-load losses of ML. The operator entered the DC voltage ramp and the ramp began. Because of the loss of inter-station communications, the ramp only occurred at the Woodbine end. This resulted in a sudden and un-commanded power flow from Bottom Brook to Woodbine peaking at 600 MW causing the Woodbine end of ML to trip offline because "DC Line Overload" protection, and the Bottom Brook end Blocked because of "Abnormal AC voltage." Following these events, ENL made a software change to interlock DC voltage ramps against inter-station communications so that this situation can't happen again. The ML was re-energized at 6:45 pm once inter-station communications was re-established. A detailed breakdown of this event is provided in ENL's report of the event.

Island Response

As the ML began ramping, the island frequency declined with the ramp and the LIL Power Frequency Control (PFC) correctly activated when the frequency reached the PFC Lower Band, 59.7 Hz, at 11:19:57. The LIL began its PFC response but ultimately reached its upper offset limit of 100MW (50MW/pole). The LIL PFC delayed the UFLS holding the frequency steady at 59.6 Hz, however as the ML continued to ramp and with the LIL upper offset limit reached it could no longer provide additional frequency support, and the island frequency reached a low of 57.95 Hz.

Groups 2 through 6 of the UFLS shed instantaneously at 58.8 Hz, 58.6 Hz, 58.4 Hz, 58.2 Hz and 58.1 Hz respectively. As the frequency began to lower all groups activated between 11:20:28 and 11:20:35 at their corresponding settings. Group 1 activates on a 15 second time delay once the frequency falls below 59 Hz and activated at 11:20:43. Once customers were dropped the frequency began to rebound. The ML Pole 1 DC Line Overcurrent protection operated at 11:20:42 and the frequency increased to the LIL PFC Upper Band, 60.3 HZ, at 11:20:45. A -450 MW offset per pole was requested (lower offset minimum) and the LIL reduced to minimum power, 45 MW per pole.

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2 Generators in Lookout Brook, Lockston, Rattling Brook, Seal Cove, Tors Cove, West Brook and Port Union were locked out.

The ML Pole 2 DC Line Overcurrent protection operated at 11:20:49 which resulted in a full bipole loss of the ML. With the loss of exports on the ML, the LIL was reduced from 300 MW to minimum power, and at that point the PFC could do no more to correct the frequency. All island generator governors responded, and all units began to lower their MW output, however the frequency climbed from 61.3 Hz to 65 Hz and activated transformer over frequency protection on Converter Transformers T4 and T5 at 11:20:54.

Group 1 of the UFLS is designed to trip when the frequency is below 59 Hz for over 15 seconds. Analysis of the frequency trace, Figure 1 below, shows this was indeed the case as the frequency was below 59 Hz for approximately 15.64 seconds.

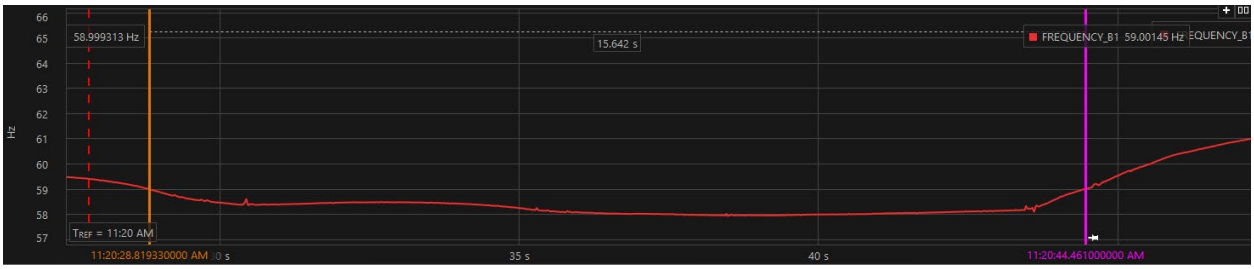


Figure 1 - Frequency Below 59 Hz

Figure 2 below shows the frequency hit a low of 57.95 Hz and a high of 65.03 Hz. Six of the seven NL Power UFLS groups responded to the frequency drop. Group 7 operates at 57.7 Hz and did not operate so all groups worked as intended.

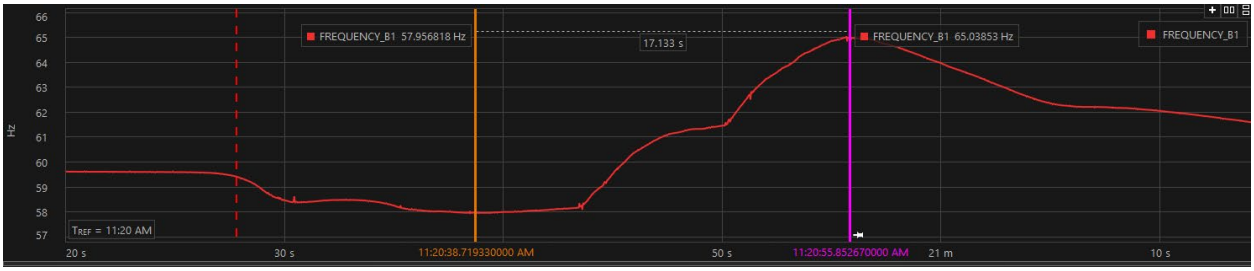


Figure 2 - Frequency High and Low Points

The total MW's shed from the NL Power groups can be seen in Figure 3. Group 2 and Group 5 appear to have not shed the full amount of load as needed. NL Hydro will contact NL Power on this to see if any changes need to be made to correct this.

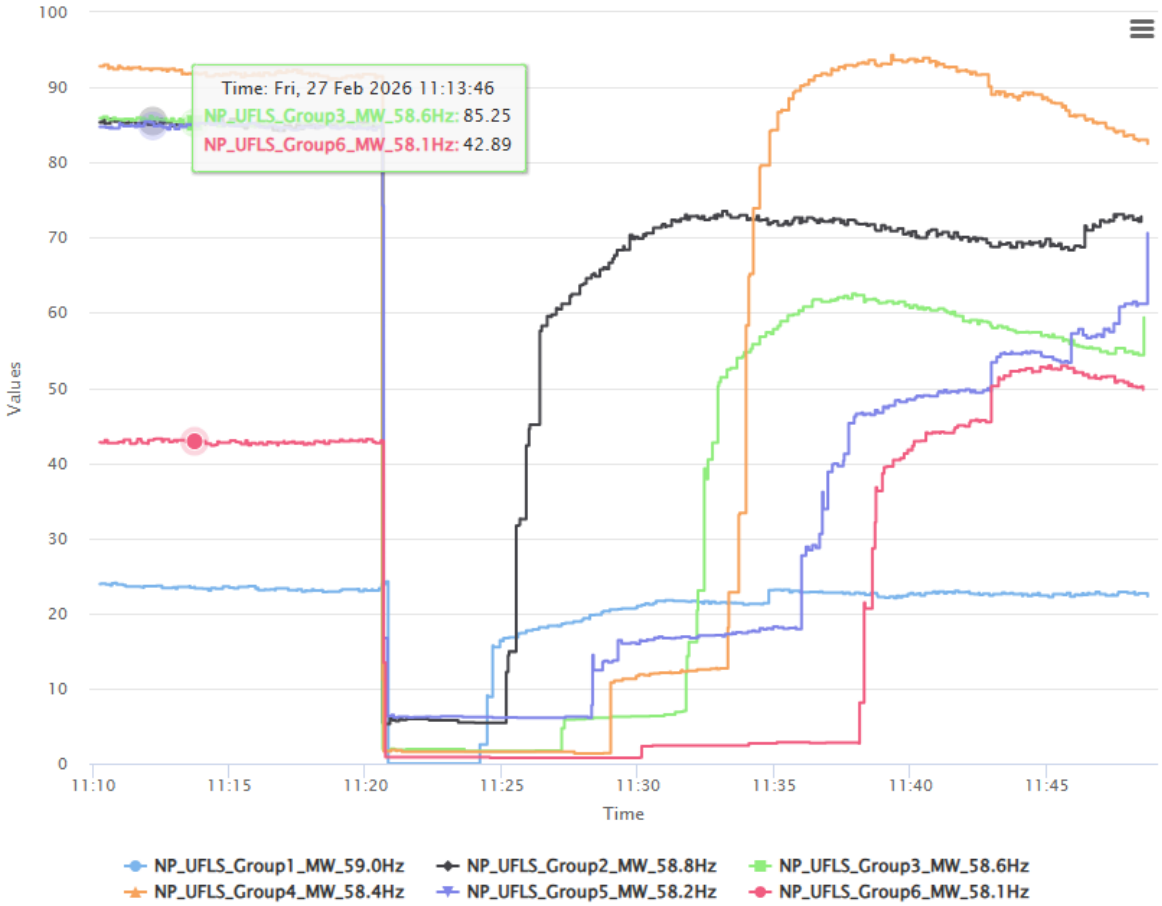


Figure 3 - UFLS Group MW Readings

NL Hydro also saw the UFLS protection operate for TL220, TL226 and Grandy Brook Feeders L1 and L5. NL Hydro also had an additional under frequency trip on Massey Drive Bus 4. According to documentation the Massey Drive Bus 4 protection is supposed to operate at 57.5 Hz and in conjunction with a reverse power permissive. This protection opened breaker B4T1 in Massey Drive and resulted in the loss of Line 1 (Marble Mountain), and Lines 16 and 17 to the Corner Brook Frequency Converter. Transmission Planning should review this to see if it is still required and Protection and Control Engineering should review the relay settings to ensure it operates properly in the future.

The Buchans Bus 2 overvoltage and over frequency protection operated as expected.

<u>Generation Response</u>

All generators responded by lowering output, however there were some notable responses. Figure 4 shows GCL G1 began to increase MW production when the UFLS happened and got to full load. Once this happened and the frequency began rising to 65 Hz it began to rapidly drop MW's in response to the high frequency. Figure 5 shows the MW's cross zero and at 11:21:51, the GCL mechanical protection initiated an emergency shutdown.

Figure 4 - GCL MW's

USL G1 responded similarly to GCL G1, an increase in production followed by a rapid decrease, which can be seen in Figure 5. USL G1 experienced a generator vibration alarm at 11:21:37 and a generator lockout at 11:29:30.

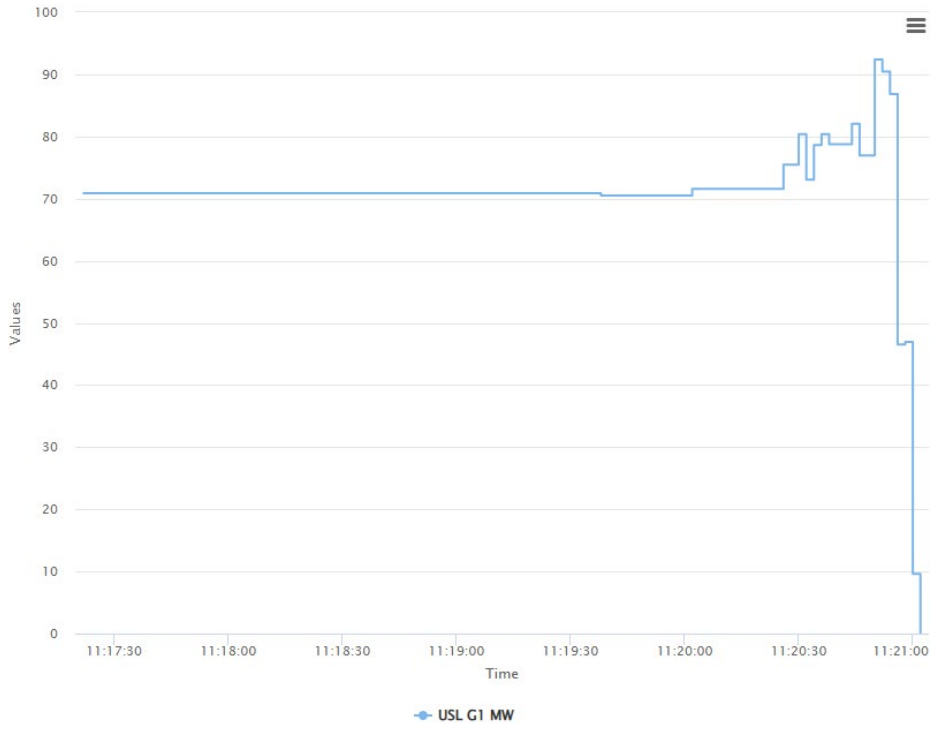


Figure 5 - USL MW's

HRD Generators also saw a rapid drop in load, Figure 6 below, but they did not shut down. All HRD units were able to ride through the event and resumed normal production.

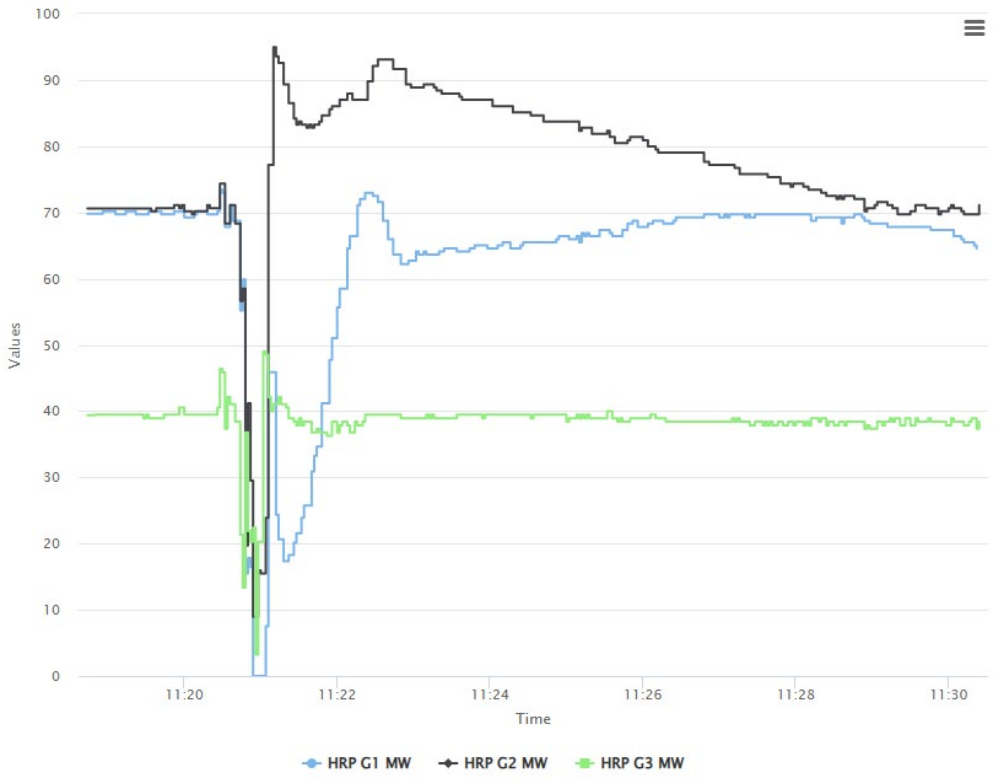


Figure 6 - HRD G1-G3 MW Output

The PI data, Figure 8, confirms the loss of EXP G1, GFC G5 and G6 and SLK G1. A review of the protection settings of SLK G1 confirmed it has an over frequency protection of 62 Hz on a 2 second delay. EXP G1 has a setting of 63 Hz after a ½ second delay. Grand Falls has two settings - 62 Hz after a five second delay and 63 Hz after a one second delay. Transmission Planning will evaluate the settings on these generators and provide any necessary changes to Protection and Control Engineering and Hydro Generation.

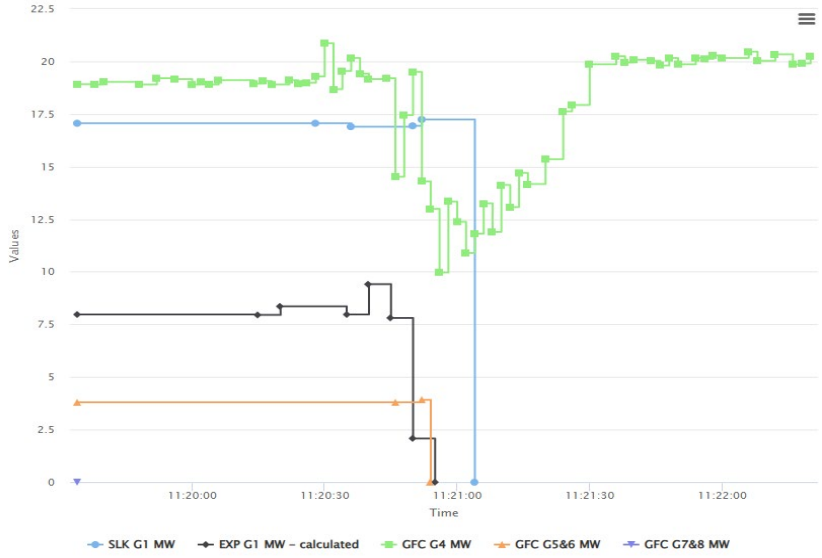


Figure 7 - Exploits Generation

Transmission Planning performed a simulation of the event using its PSSE software and overall, the Island Interconnected System responded as expected. The frequency reached a minimum of 58.08 Hz, while the governors of the generating units continue to provide frequency regulation to the system. The actual minimum frequency was 57.95 Hz, which closely aligns with the simulated minimum. The simulated response appears slightly quicker than the actual response, which may be due to minor differences in model parameters and field setpoints. Transmission Planning will investigate this minor discrepancy.

Remedial Actions:
NLSO will contact NL Power on this to see if any changes need to be made to correct the UFLS Group 2 and Group 5 telemetry.

Transmission Planning should review Massey Drive Bus 4 to determine if it is still required.

Protection and Control Engineering should check settings on Massey Drive Bus 4 to ensure it is set at 57.5 Hz.

Transmission Planning will evaluate the generator frequency settings and provide changes (if necessary) to Protection and Control Engineering and Hydro Generation.

Transmission Planning will investigate if there are any differences in model parameters and field setpoints of generator governors.

Issued By:	Brad Smith, P. Eng. System Operations and Integration Support
Issue Date:	2026/04/20
Checked and Approved By:	Jason Tobin

Attachment 4

D-000OP-0-950-05-328 – Maritime Link Bipole Trip – February 27, 2026

Redacted in Full

Attachment 5

TP-TN-305 – PSSE Dynamic Simulation of the UFLS and Over-Frequency Event on February 27, 2026

newfoundland labrador hydro

Doc #: TP-TN-305
Issue Date: 2026/01/19
Document Type: Technical Note

TP-TN-305

PSSE Dynamic Simulation of the UFLS and Over-Frequency Event on February 27, 2026

1. Purpose

To perform and evaluate a PSSE dynamic simulation of the under-frequency load shedding (UFLS) and over-frequency event triggered by a sudden and significant ramp-up of the Maritime Link (ML), followed by an ML trip on February 13, 2026, in order to confirm that the observed system response aligned with expected performance.

2. Background

On February 27, 2026, at 11:19 hours, the ML suddenly and unexpectedly[1] began ramping up power transfer from Newfoundland to Nova Scotia. The ramp initially increased gradually; however, after approximately 40 seconds, it jumped to 600 MW (as measured at Bottom Brook). The sudden increase drove system frequency down to 57.96 Hz and initiated UFLS Groups 1 through 6, shedding a total of approximately 425 MW of customers. As system frequency was recovering from the UFLS event, the ML issued a “Bipole Block” at approximately 11:20:49 and subsequently tripped, resulting in a sharp increase in system frequency that peaked at 65.04 Hz, at which point the Labrador Island Link (“LIL”) bipole tripped. The actual system frequency response is provided in Figure 1. It should also be noted that the two ML poles did not begin ramping or trip simultaneously, as reflected by the distinct humps in the frequency trace during the under-frequency and over-frequency events, respectively.

The loss of the ML and its STATCOM resulted in over-voltages on the West Coast, which in turn led to transmission line trips and several generating units tripping on over-frequency. This resulted in an additional loss of approximately 175 MW of customer load, which includes the loss of industrial customers tripping on over-frequency protection. The load loss exacerbated the over-frequency condition, whereas the subsequent loss of generating units and LIL provided a counteracting effect.

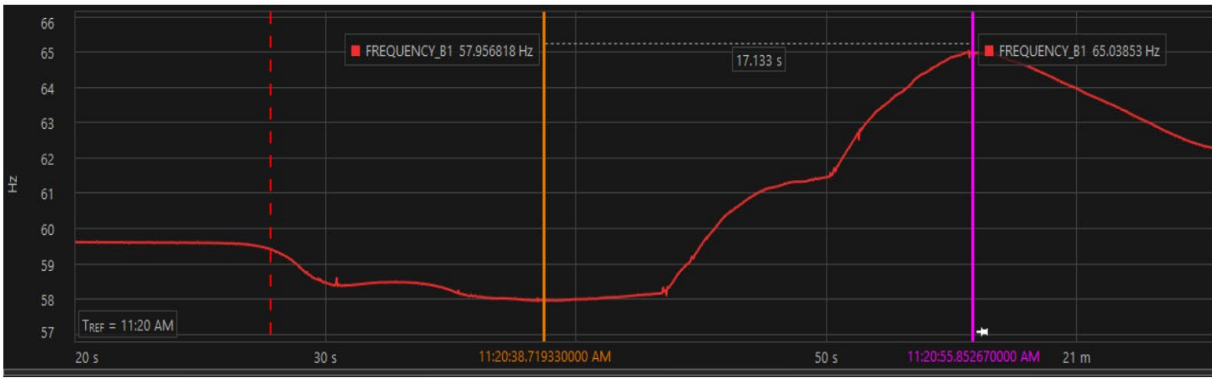


Figure 1 - Actual System Frequency Response – Feb 27, 2026

3. PSSE Simulations - System Dispatch Prior to Event

3.1 Load Flow Analysis

In support of the dynamic simulations (or transient stability analysis), load flow analysis was completed to reproduce system conditions immediately prior to the unexpected response of the ML on February 27, 2026 at 11:19. The corresponding system dispatch and power flow on the 230 kV system are shown in the load flow diagram in Figure 2.

3.2 Dynamic Stability Analysis

A PSSE dynamic simulation was conducted for the series of events that occurred on February 27, 2026. Figure 2 shows the PSSE-simulated system frequency for the full sequence, annotated to indicate the key events. A summary of the plot labels is provided below:

A. **A gradual increase in each ML pole output resulted in a corresponding decline in system frequency to a minimum of 59.6 Hz.** LIL frequency control responded at 59.7 Hz to offset the increased ML exports and support frequency recovery. This behaviour is shown in Figure 4, which extends Figure 3 to include the ML and LIL responses.

B. **ML Pole #1 Increases to 300 MW.** This caused system frequency to rapidly decrease, triggering UFLS Groups 2 and 3, after which frequency began to recover.

C. **ML Pole #2 Increases to 300 MW.** While the system is recovering the second ML trips, causing the frequency to drop even further, triggering UFLS Groups 4 to 6.

D. **Hydro Generation Responds.** The frequency reaches a minimum of 58.08 Hz, while the governors of the generating units continue to provide frequency regulation to the system. The actual minimum frequency was 57.97 Hz, which closely aligns with the simulated minimum. The simulated response appears slightly quicker than the actual response, which may be due to minor differences in model parameters and field setpoints. Hydro plans to investigate this

minor discrepancy. UFLS Group 1 eventually sheds once frequency has been below 59.0 Hz for 15 seconds.

E. **ML Pole #1 Trips.** This causes system frequency to increase above 60.0 Hz. The LIL frequency controller provides frequency support as shown in Figure 4.

F. **ML Pole #2 Trips.** This causes system frequency to increase further which ultimately caused some generating units[1] and industrial customers[2] to trip on over-frequency. The load loss exacerbated the over-frequency condition, whereas the subsequent loss of generating units and LIL provided a counteracting effect. The total loss of the ML also resulted in over-voltages on the West Coast, leading to trips of TL209, TL211, TL233, and TL267 and a loss of supply (approximately 50 MW) to all customers served from the Bottom Brook Terminal Station (i.e., Stephenville). The LIL frequency controller provides frequency support as shown in Figure 4.

G. **Maximum Over-Frequency / LIL Bipole Trip:** At 65.0 Hz, the LIL bipole tripped, after which system frequency began to recover. The actual maximum frequency recorded was 65.04 Hz, while the simulated maximum frequency was 65.05 Hz.

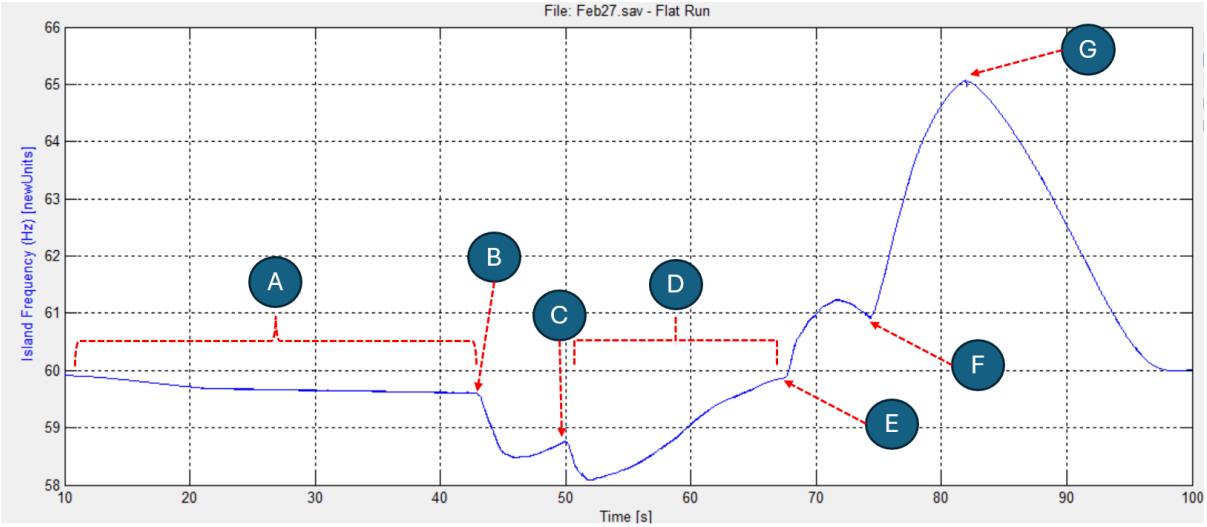


Figure 2 - Simulated Frequency Response of Event

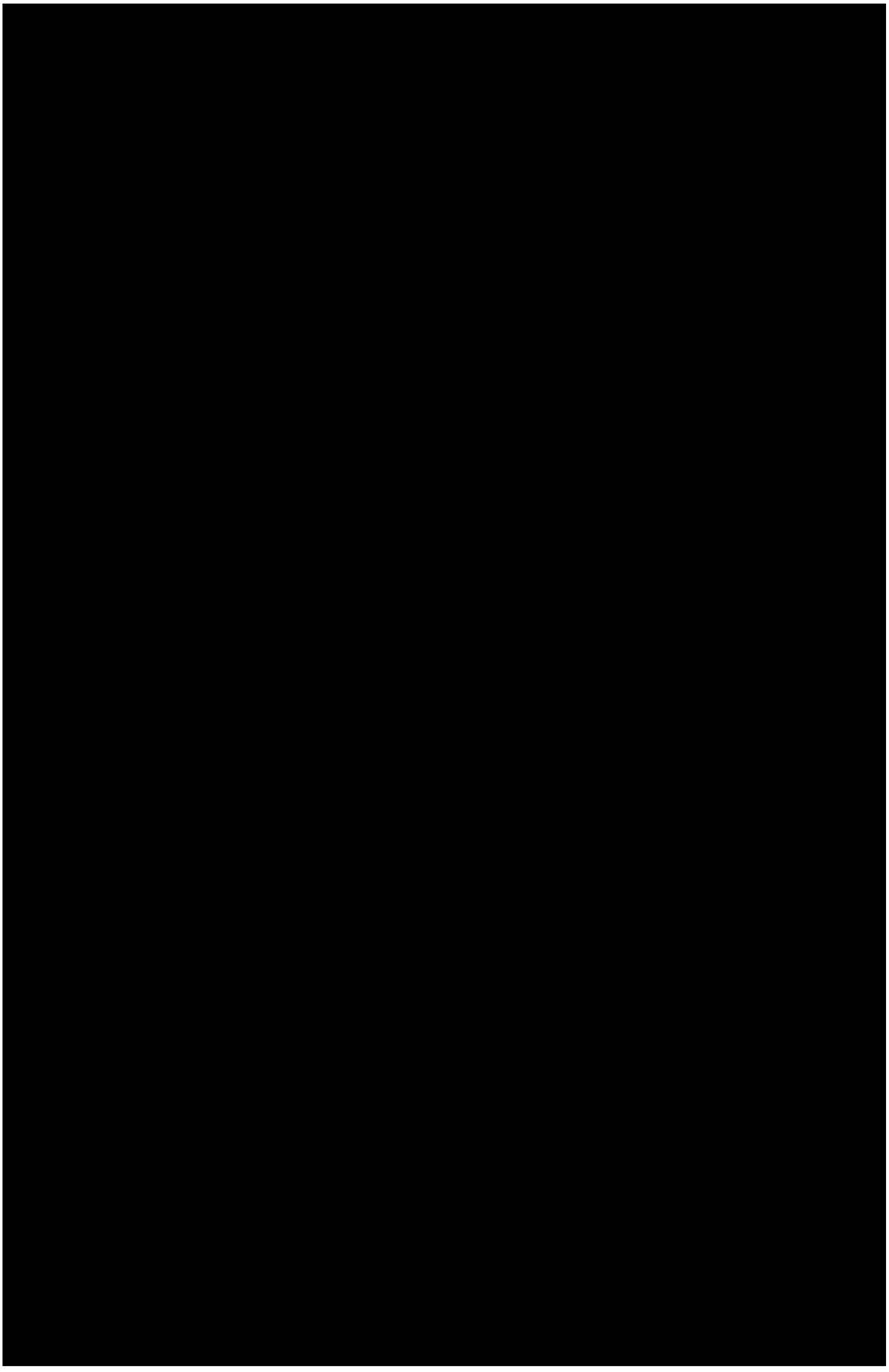
[1] Star Lake and Exploits Generation

[2] Equinox (14 MW), Vale (52 MW), Linde (2 MW), Braya (1.5 MW) and Corner Brook Pulp and Paper (29 MW)

4. Conclusion

The following can be concluded from performing the PSSE dynamic simulations replicating the events of February 27, 2026:

- The observed system response was consistent with the PSSE simulation results.
- The simulated frequency response (Figure 2 and 4) closely matches the actual frequency response (Figure 1). Hydro to further investigate the slight difference in frequency response provided by the Hydro generating units (See 'D' in Figure 2).
- The simulated load shedding was approximately 430 MW versus 425 MW during the actual event, representing a close match. An additional 175 MW shed due to over-frequency, which was also considered in the simulated.



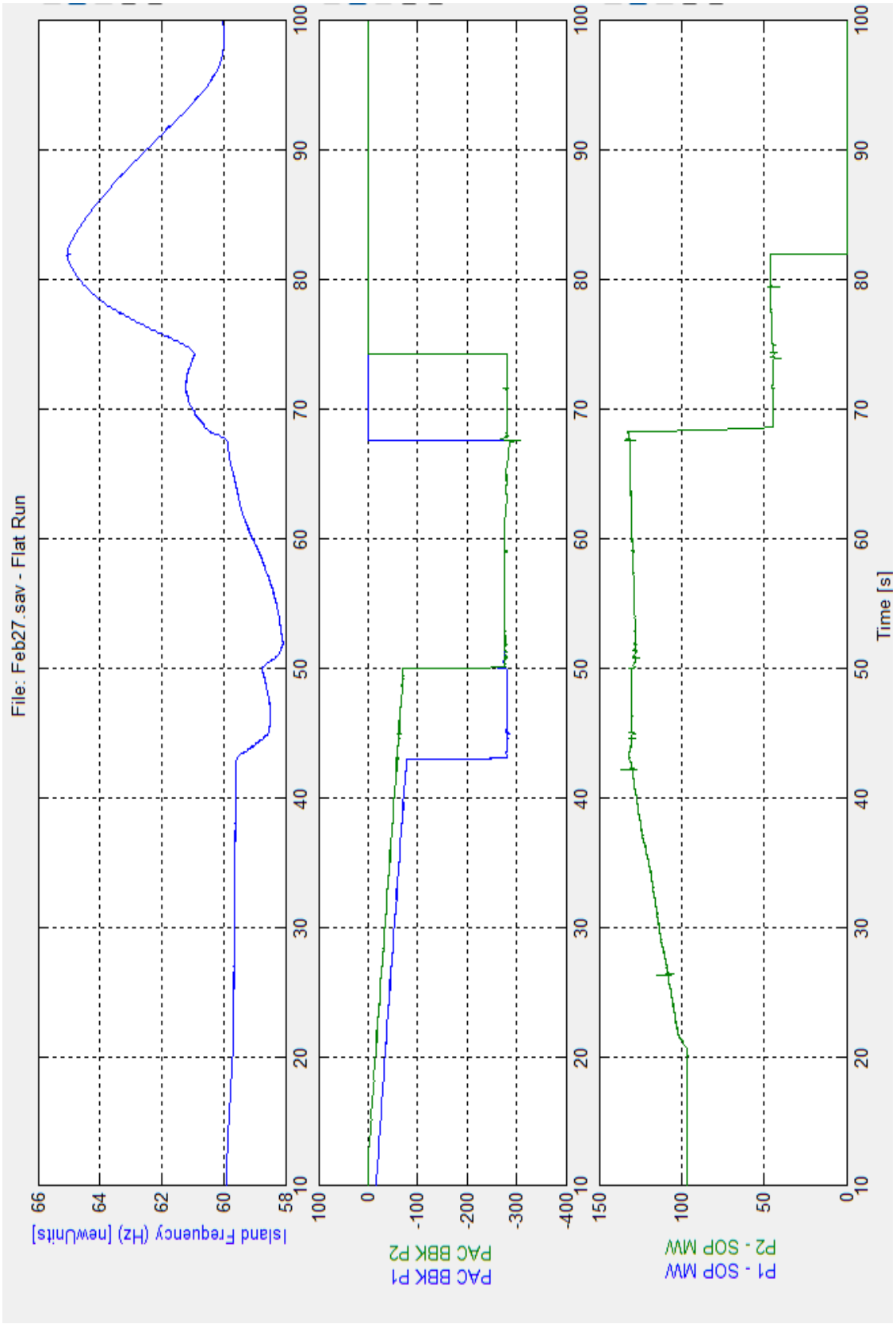


Figure 4 – Dynamic Simulation (100 seconds after Initial Event)

Document Summary

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Revision History

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0	M.Carter	Issue for review	2026/04/01

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