Report on Inter-Utility System Reliability Committee's 2001 Review

NEWFOUNDLAND POWER
A FORTIS COMPANY

Inter-Utility System Reliability Committee's

2001 Review

February 27, 2002

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1.0 Committee Mandate

The Committee was established in December, 1999, by the Chief Executive Officers of Newfoundland Power and Newfoundland and Labrador Hydro with the objective of improving service to the customers of both utilities. In particular the key objectives are to reduce outages arising from underfrequency load shedding, set targets, and to monitor and initiate activities to improve the System Average Interruption Frequency Index (SAIFI) and the System Average Interruption Duration Index (SAIDI).

At the beginning of the year the Committee consisted of:

T. D. Collett - Executive Vice President Production
Newfoundland and Labrador Hydro

J. Evans - Vice President Engineering & Energy Supply,
Newfoundland Power

E. Ludlow - Vice President Operations
Newfoundland Power

D. Reeves - Vice President Transmission and Rural Operation
Newfoundland and Labrador Hydro

In April of 2001 the committee members were changed due to the departure of J. Evans from Newfoundland Power and the retirement of T.D. Collett from Newfoundland & Labrador Hydro. The new committee members are:

R. J. Henderson - Manager, System Operations
Newfoundland & Labrador Hydro

S. LaCour Manager, Engineering & Energy Supply
Newfoundland Power

The Committee meets monthly to review each utility's performance to date, and identify necessary remedial action(s) to be taken. The Chair of the Committee alternates monthly between the two utilities.

2.0 Performance Targets

In February 2001, the targets for performance improvements were set to the following:

2.1 Underfrequency Load Shedding Incidents Target

TARGET: A maximum of 8 incidents affecting Newfoundland Power in 2001.

2.2 Interruption Frequency and Duration Targets.

TARGET: 25% reduction in 1999 indices by the end of 2001.

2001 Utility specific targets for Frequency and Duration are as follows:

	SAIFI	SAIDI
Newfoundland Power Service Continuity	**4.95** customer interruptions per year	**7.27** hours per customer per year
Newfoundland & Labrador Hydro Delivery Point Interruptions	**1.79** delivery point interruptions per year	**68.85** minutes per delivery point per year

3.0 Performance Indices in 2001

Newfoundland and Labrador Hydro
Delivery Point Performance Report
2001

SAIFI

Region	Num. Of Delivery Pts	Interruptions per Delivery Pt. 1999	2000	2001	Target By 2001 (75% of 1999)
Avalon	9	0.00	0.00	0.56	
Burin	4	2.00	1.75	1.50	
Central	14	0.10	0.07	0.21	
South Coast - Central	4	4.50	6.50	1.50	
GNP	12	5.93	10.29	3.50	
Labrador East	1	15.00	13.00	6.00	
South West Coast	3	1.33	4.67	3.00	
West Coast	4	0.00	1.00	0.00	
South Coast - West	3	0.00	1.67	2.00	
White Bay	4	0.00	0.75	0.00	
TOTAL	58	2.30	3.88	1.43	1.79

SAIDI

Region	Num. Of Delivery Pts	Minutes per Delivery Pt. 1999	2000	2001	Target By 2001 (75% of 1999)
Avalon	9	0.00	0.00	1.89	
Burin	4	129.50	135.50	228.50	
Central	14	7.90	0.70	35.14	
South Coast - Central	4	125.75	611.00	29.75	
GNP	12	209.14	94.00	50.92	
Labrador East	1	771.00	338.00	56.00	
South West Coast	3	102.00	440.67	109.33	
West Coast	4	0.00	13.25	0.00	
South Coast - West	3	0.00	72.67	5.00	
White Bay	4	0.00	0.75	0.00	
TOTAL	58	91.16	111.48	44.00	68.85

Underfrequency Events[1]

	Year to Date 1999	2000	2001	Target
No. of Events Affecting Nfld. Power	18	7	9	8
Intensity (MW-minutes)	5,392	1,456	2,895	
Total Number of Events	19	10	10	
Intensity (MW-minutes)	11,029	4,402	8,278	

(1) Discussion provided in Section 4.1

Newfoundland Power
Customer Service Continuity Report
2001

SAIFI

Region	Number [1] Customers	Interruptions per Customer			2001 Target
		1999	2000	2001	
St. John's	81,295	4.32	3.90	3.70	
Avalon	31,352	5.02	3.77	3.56	
Burin	10,811	7.93	9.66	4.47	
Bonavista	14,584	6.54	3.67	3.64	
Gander	17,905	6.08	5.92	3.34	
Grand Falls	19,005	7.69	5.67	5.02	
Corner Brook	18,559	9.76	3.89	4.16	
Stephenville	14,809	16.70	10.12	5.76	
Total	**208,320**	**6.60**	**4.93**	**3.96**	**4.95**

SAIDI

Region	Number [1] Customers	Hours Per Customer			2001 Target
		1999	2000	2001	
St. John's	81,295	7.31	4.89	2.00	
Avalon	31,352	15.85	4.39	3.75	
Burin	10,811	9.97	12.00	8.74	
Bonavista	14,584	5.80	3.51	4.99	
Gander	17,905	12.53	7.83	4.23	
Grand Falls	19,005	10.13	6.78	5.67	
Corner Brook	18,559	5.85	3.27	3.37	
Stephenville	14,809	14.87	13.04	6.07	
Total	**208,320**	**9.70**	**5.92**	**3.72**	**7.27**

LOSS OF SUPPLY

	1999	2000	2001
SAIFI	1.33	0.84	1.06
SAIDI	0.35	0.61	0.34

(1) These are numbers as of December 31 2001.

3.1 Major Events Affecting System Performance

Newfoundland and Labrador Hydro

Weather continued to have a major impact on delivery point performance in 2001. In combination with other problems weather resulted in three major interruptions.

- On April 3, TL 212 (Sunnyside to Linton Lake) was forced out of service due to high winds and ice build-up on the line due to a severe winter storm which caused the line to flashover to trees which had encroached on the line, which were subsequently removed. Customers supplied by the Bay L' Argent Terminal Station were interrupted for 3 hours 20 minutes while a crew travelled to the Bay L'Argent T. S. to isolate the station from the problem area. Customers supplied from the Monkstown T.S. were interrupted 8 hours 28 minutes while the storm abated enabling the line to be restored. The restoration of service was greatly impaired by the severe weather conditions and the public service strike causing the roads to be blocked, thus preventing repair crews to get to the site.
- On September 19th, major 230kV transmission lines TL 217, TL 201, TL 218 and TL 236, and the Holyrood plant (Units 2 and 3) tripped due to an extended fault on Newfoundland Power's 66 kV system in the St. John's area. The fault on the Newfoundland Power system was initiated by high winds and rain from Tropical Storm Gabrielle but was extended due to a protection system failure. The line outages and loss of Holyrood resulted in widespread outages on the Avalon Peninsula, and triggered a number of underfrequency events elsewhere on the Island. Customers on the Avalon Peninsula were without power for between three and twenty-six minutes.
- Severe winds and salt spray on November 8th, in combination with damaged insulators, caused transmission line TL 214 (Bottom Brook to Doyles) to reclose or trip for short durations 54 times. Most Newfoundland Power customers served from the Doyles and Port aux Basques areas were affected. Newfoundland Power separated some customers from the line via their Rose Blanche hydro unit.

Equipment damage also caused some significant disturbances.

- On February 10th, problems with the high voltage fuse assembly on the transformer at the South Brook terminal station caused an open phase. Customers were without power for roughly 8 hours and 12 minutes while repairs were made.

- Transformer T1 at Bottom Brook tripped and locked out as a result of a defective gas relay on June 10th. This resulted in an extended power outage to many customers in the Doyles and Port aux Basques distribution systems.
- On October 15th, Unit 2 at Holyrood tripped while carrying 155 MW of load when a pipe on the general service cooling water line was inadvertently damaged. This resulted in a break in the line causing large amounts of water to be sprayed over sensitive electrical components in the plant. The trip caused widespread underfrequency load shedding action and customer outages of between 2 and 14 minutes.

Newfoundland Power

The major events affecting Newfoundland Power's Service Continuity performance can be broken down into unscheduled outages and planned interruptions. Unscheduled outages accounted for 77% of total SAIFI performance and 61% of SAIDI performance in 2001. The vast majority of events impacting the unscheduled SAIFI performance were caused by severe weather, equipment failure or loss of supply. The following highlights the major outages experienced in 2001.

- On February 27, an insulator failure on feeder BOT-01 serving 1,563 customers in the Northern Arm, Point Leamington, Leading Tickles and Cottrell's Cove area caused a 6 hour and 22 minute outage.
- On April 3, a severe snowstorm caused power outages to sections of the Burin Peninsula and the Eastport Peninsula. Newfoundland Power experienced local feeder damage due to snow and high winds. Newfoundland & Labrador Hydro experienced an outage on transmission line TL212 affecting the Bay L'argent area where restoration was hampered by the public service strike causing slow snow clearing. In total, up to 3,010 customers were without power for between 7 to 18 hours.
- On June 10, Newfoundland & Labrador Hydro experienced a failure of a transformer at Bottom Brook Substation causing an outage to the Southwest Coast affecting 5,048 customers for 2 hours and 7 minutes.
- On August 18, an insulator failure on 407L between Stephenville and Stephenville Crossing caused a 2 hour 51 minute outage to 3,088 customers in the Bay St. George South area.
- Also on August 18, a lightning strike on 18L near Gould's Substation caused a 1 hour 29 minute outage to 6,285 customers in the Gould's and Southern Shore area.

- On September 19, high winds from tropical storm Gabrielle caused a fault on several transmission lines in the downtown St. John's area that was not cleared by primary line protective relaying. This set off a chain of events resulting in loss of the Holyrood Generating Station and the main infeed to the Avalon Peninsula. A total of 107,552 customers were affected for up to 26 minutes.
- On November 2, transmission line 102L tripped causing a power outage to the Lewisporte area affecting 3850 customers for 1 hour 18 minutes. The outage was caused by a broken crossarm on the transmission line.
- On Dec 4, power transformer GBS-T1 faulted at Grand Bay substation interrupting service to 3579 customers in the Port Aux Basques area for 2 hours 57 minutes. The GBS-T1 tap changer preventative auto transformer failed.

In addition, Newfoundland Power's customers experienced 9 underfrequency load shedding events during the year. The number of customers interrupted during these unscheduled outages ranged between 1,554 and 38,209 and the duration between 6 and 20 minutes.

The more significant planned interruptions occurred in the Avalon and Grand Falls areas. In the Avalon area upgrading was performed on a number of radial transmission lines including:

- 94L/95L on September 30, for 4 hours 18 minutes affecting 2393 customers in the St. Mary's Bay and Trepassey areas.
- 43L on November 4, for 5 hours 20 minutes affecting 889 customers in the New Chelsea and Old Perlican areas.
- 65L on November 18, for 3 hours 49 minutes affecting 885 customers in the Old Perlican and Bay de Verde areas.
- 55L on December 3, for 3 hours 28 minutes affecting 2732 customers in the Placentia area.

The upgrading of Blaketown substation required several outages to customers in the St Mary's Bay and Placentia areas. The most significant occurred on December 9, for 2 hours that affected 2393 customers.

On October 16, there was a scheduled power outage at Seal Cove Road substation to replace a broken pole on the Baie Verte Highway that affected 960 customers for 2 hrs and 15 minutes.

On June 26, an interruption jointly planned by Newfoundland Power and Newfoundland & Labrador Hydro affected 1025 customers in the Baie Verte and Sheppardsville areas for 6 hrs 30 minutes. The purpose of this interruption was to carry out maintenance at Indian River and Seal Cove Rd substations and on transmission line 363L.

On February 11, there was a scheduled outage to Lewisporte Substation to take T1 out of service to replace the transformer bushings that became overheated. This outage affected 2727 customers for 3 hrs 15 minutes.

4.0 Achievement of 2001 Targets

4.1 Newfoundland and Labrador Hydro Underfrequency Events

The operation of the Newfoundland interconnected power system requires a balance between generation and load. When there is a large imbalance, system frequency moves away from the 60 Hz nominal frequency very rapidly. In cases when a generating unit trips while supplying load, the frequency falls substantially. In these instances, in order to maintain the integrity of the system load is shed to restore the balance. This is essential to curtail a total system collapse. Most large users share in the load shedding.

In 2001, Hydro exceeded the maximum number of trips set as the goal for the year. There were 9 underfrequency events affecting Newfoundland Power, including the event caused by the Newfoundland Power protection failure during Tropical Storm Gabrielle. This was above the goal of a maximum of 8. There was one additional event that affected only the industrial customers.

The intensity of all the events was higher in 2001 as there were 8,278 megawatt-minutes of unsupplied energy compared to 4,402 megawatt-minutes in 2000.

The primary contributor to the underfrequency trips was the Holyrood Thermal Generating Station. It caused 6 of the 9 trips and 5,169 of the 8,278 megawatt minutes of unsupplied energy caused by underfrequency load shedding.

The increase in number of trips and the amount of unsupplied energy is related to the greater use of the Holyrood Thermal Generating Station in 2001. In 2001 the plant operated at a 71% operating factor as opposed to 49% in 2000 resulting in considerably higher exposure to unit trips. In addition, the plant was operating at a much higher load, an average of 120 MW per unit, compared to an average of 80 MW per unit in 2000. The higher loading resulted in more load having to be shed due to a unit trip at Holyrood. The higher operating load is a result of significantly lower than average inflows during 2001.

4.2 Newfoundland and Labrador Hydro - Delivery Point Performance

Hydro's delivery point performance improved significantly in 2001. The delivery point SAIFI of 1.43 interruptions per delivery point was a decrease of 63.1% from 2000 and was 20.1% better than the target. The SAIDI decreased to 44.0 minutes per delivery point, a 60.5% improvement from 2000 and 36.1% better than the target.

The areas experiencing significant improvement in delivery point interruption frequency over the previous year were the Connaigre Peninsula, the Great Northern Peninsula, and Labrador East where there were 76.9, 66.0 and 53.8 percent reductions in sustained outage frequency respectively. The major contributors of these improvements are improvements to the operation of the Happy Valley Gas Turbine during line outages and less severe lightning activity in the year.

The areas experiencing significant improvement in duration of delivery point interruptions were the Connaigre Peninsula, Labrador East and the South West Coast where there were 95.1, 83.4 and 75.2 percent reductions respectively in duration of interruptions in 2001. These improvements can be attributed to the Happy Valley gas turbine improvements, less severe weather and the absence of the severe vandalism damage that occurred on the Connaigre Peninsula in 2000.

The reliability to Newfoundland Power delivery points improved significantly in 2001. Regions with the greatest improvement in SAIFI were the West Coast and Port aux Basques areas. No delivery point outages were experienced in the West Coast region in 2001, and the outage frequency to the Port aux Basques area dropped by 36%. Overall, the outage frequency dropped by 24% from 2000. The average duration of outages to Newfoundland Power also improved in 2001. On average, Newfoundland Power delivery points were without power for a total of 52.5 minutes per delivery point in 2001, down roughly 53% from 2000. Areas with the greatest improvement were the West Coast (no outages) and the Port aux Basques area (75% reduction).

4.3 Newfoundland Power – Service Continuity

In 2001, the number of interruptions were reduced by 20% and the duration of outages were reduced by 37% compared to 2000. Contributing factors to this significant improvement have been the focus on substation and distribution system upgrading, the replacement of failure prone insulators and transformers, continued progress with vegetation control and improved inspection and maintenance programs.

Newfoundland Power's interruption frequency and duration targets were surpassed in 2001. The SAIFI for 2001 was 3.96 customer interruptions compared to the target of 4.95 representing a 20% improvement over the target. The SAIDI for the year was 3.72 hours per customer compared to the target of 7.27 representing a 49% improvement over the target.

Planned interruptions to allow system maintenance and upgrading accounted for 39% of total SAIDI performance in 2001. This is a 39% decrease over the year 2000.

Newfoundland & Labrador Hydro's impact on Newfoundland Power's reliability performance stems from loss of supply to delivery points as well as underfrequency load-shedding events. In 2001, the contribution to Newfoundland Power's SAIFI performance was 0.30 from loss of supply to delivery points and 0.76 due to underfrequency load-shedding events for a total impact on SAIFI of 1.06. This represents 27% of total SAIFI performance and is a significant increase over 2000. The impact on SAIFI performance from system underfrequency events continues to be a major concern.

5.0 System Enhancements

5.1 Newfoundland and Labrador Hydro

The following major activities, which should improve future performance, were initiated or were near completion in 2001:

	ACTIVITY	STATUS
1.	Upgrading of TL 237 for heavier ice loading.	Completed
2.	Installation of remaining 50% of the lightning arrestors on TL 206.	Completed
3.	Replacement of remaining 50% of the insulators on TL 240.	Completed
4.	Year 5 of the 5 year program to upgrade 230 kV line backup protection.	Completed
5.	System Underfrequency load shedding study	95% Complete
6.	Replacement of deteriorated wood pole structures on TL 215.	2001 Program Completed

7.	Initiated Engineering assessment of TL 214 reliability.	50% Complete

5.2 Newfoundland Power

	ACTIVITY	STATUS
1.	Construct new substation at Lawn, Burin Peninsula	Completed
2.	Upgrade of Lewisporte Substation	Completed
3.	Rebuild of Blaketown Substation	Completed
4.	Transmission line protection upgrades in St John's	Completed
5.	Upgrade of OPL-02 feeder Old Perlican to Northern Bay	Completed
6.	Upgrade of HOL-01 feeder along Salmonier Line	Completed
7.	Upgrade of LAU-02 & BLA-01 feeders on Burin Peninsula	Completed
8.	Upgrade 5km section of 124L near White Hills Clarenville	Completed
9.	Feeder rebuilds SJM-05 and SLA-13 in St. John's	Completed
10.	Reconductor and upgrade of 410L Port Au Port Peninsula	Completed
11.	Upgrading of DOY-01 & ROB-01 on the West Coast	Completed
12.	Rebuilding of 403L from Lookout Brook to St Georges	Completed
13.	Replace insulators 51L/ 52L Chamberlains to Seal Cove	Completed

6.0 Committee Achievements

In addition to each organization exceeding the reliability targets established for 2001, the Committee achieved the following:

- Provided additional communications to employees to raise awareness of importance of system reliability and the activity of the committee.
- Enhanced reporting to the PUB for greater understanding and clarity.

- Improved reporting by Newfoundland Power to Hydro of outages originating on the Newfoundland Power system that affects Hydro's distribution customers.

- Coordination of planning improvements to the Little Bay distribution system in the Springdale area.

- Initiated a formal exchange and familiarization program between utility control center staff.

- Newfoundland Power made a presentation to the joint committee of their planned improvements to transmission and terminal station protection systems in the St. John's/Avalon area.

- A joint study on critical clearing time for the transmission system was initiated and targeted for completion in June of 2002.

- Each major system disturbance was reviewed and actions initiated to prevent similar problems.

7.0 2002 Targets

A review was made of the 2001 reliability performance and consideration of alternatives for target setting were discussed as the two year target set in early 2000 for the end of 2001 must now be reviewed. In particular the high degree of variability of weather related outages was considered and the need for some normalization was identified. Therefore the targets set for 2002 have been set on 5 year rolling average performance.

In addition to this change, it was decided that the focus of the discussions between the two utilities in 2002 should be on Newfoundland Power's reliability performance and the impact Hydro has on that performance. Therefore, the targets for 2002 are Hydro's delivery point performance to Newfoundland Power, system underfrequency events affecting Newfoundland Power, Newfoundland Power's overall performance and the impact on Newfoundland Power's performance caused by Hydro's loss of delivery point supply and underfrequency load-shedding events.

7.1 Newfoundland Power Targets

Newfoundland Power proposes that its five year average Service Continuity SAIFI and SAIDI performance be improved by 10% in 2002. For the five year period 1997 through 2001 the average annual SAIFI was 5.02 and SAIDI was 6.28. The impact of Newfoundland & Labrador Hydro's operation on Newfoundland Power's Service Continuity indicators was 1.39 on SAIFI and 0.94 on SAIDI.

Targeting a 10% improvement and recognizing the impact that both utilities have on customer reliability, the new Service Continuity targets for 2002 are:

	Nfld. Power	Nfld. Hydro	Total
Service Continuity SAIFI (interruptions per customer)	3.27	1.25	4.52
Service Continuity SAIDI (hours per customer)	4.80	0.85	5.65

7.2 Newfoundland and Labrador Hydro Targets

Hydro also proposes to improve its share of the Newfoundland Power Service Continuity SAIFI and SAIDI by 10%. This will be achieved by improving the five year average Delivery Point Performance by 7.5% and by reducing the 5 year average number of underfrequency events by 20%.

The five year average (1997-2001) delivery point SAIFI to Newfoundland Power is 1.54 interruptions per delivery point per year. The five year average delivery point SAIDI is 62.4 minutes per delivery point per year. The five year average number of underfrequency events per year is 10.

Newfoundland and Labrador Hydro Targets for 2002

Delivery Point SAIFI (interruptions per delivery point)	1.42
Delivery Point SAIDI (minutes per delivery points)	57.7
Maximum number of Underfrequency Events	8