Q. **System Reliability**

Provide, in tabular form, Hydro's System Average Interruption Frequency Index (SAIFI) and its System Average Interruption Duration Index (SAIDI) indices (including and excluding major events) for the transmission system and the distribution systems, by region, for each year 2009, 2010, 2111, 2012, and 2013. In the response include the criteria used to determine a "*major event*", how Hydro's reliability indices compare with Canadian Electricity Association (CEA) average indices and explain if Hydro has reliability goals and any programs for attaining those goals.

A. Please refer to PUB-NLH-339 Attachment 1 for the Transmission System Average Interruption Frequency Index (T-SAIFI) and System Average Interruption Duration Index (T-SAIDI) indices (including and excluding major events). These tables also compare Hydro to the CEA Canadian average. The Transmission system uses the Canadian Electricity Association (CEA) guidelines for reporting Significant Power Interruptions to determine a "major event". The guidelines are attached as PUB-NLH-339 Attachment 2.

Please refer to PUB-NLH-339 Attachment 3 for the Distribution System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) indices (including and excluding significant events). These tables also compare Hydro to the CEA Canadian average. Hydro does not identify major events in its Distribution Outage Reporting System (DORS). In order to extract significant events, Hydro has applied a filter to define "significant events" reported to the PUB following the "Power Outage Advisories Guidelines".[1] The Canadian Electricity

[1] Outages of less than 60 minutes to isolated diesel plants were not defined as a significant event nor were planned outages.

Association (CEA) does collect Most Prominent Event (MPE) data, but Hydro does not identify or report any MPE data. This has been an optional requirement of the CEA and is a user defined reporting system. Utilities who report MPE data indicate the criteria used to establish the MPE. This could be the IEEE 2.5 Beta method or any other utility defined criteria.

Hydro's reliability goals have been to reach and maintain the top quartile for Transmission system and seek a continuous improvement of five percent over the previous five year average performance for Distribution systems. The programs that are in place to attain these goals were outlined in an RFI response in Hydro's 2013 General Rate Application and is attached as PUB-NLH-339 Attachment 4.

For both the transmission and distribution system, Hydro's performance is generally above the CEA national average. However, the CEA transmission members across Canada include utilities in major cities with underground systems or grids where there are multiple transmission circuits serving delivery points. Hydro's grid contains a number of single radial transmission lines supplying multiple delivery points and distribution systems with no local or backup generation for the distribution systems. This results in more delivery points being interrupted for a single transmission line disturbance than a system with multiple transmission supplies. This difference can also be noted by the transmission reliability performance for Newfoundland Power and Industrial Customers which are supplied mostly by multiple transmission lines and as a result their performance is generally better than Hydro Rural customers.

Additionally, planned transmission and station outages in Hydro rural supplied areas often result in a customer interruption for the duration of the work.

Newfoundland Power and Industrial Customers are supplied by multiple sources and work does not so frequently require a customer interruption.

T-SAIFI (Forced Only) - Including Major Event Data

Year	CEA**	Hydro	TRO Northern	TRO Labrador	TRO Central*	Central (rural)	Industrial	Nfld Power
2009	0.71	0.38	1.25	3.00	0.09	0.08	0.00	0.12
2010	0.64	1.38	4.08	5.00	0.54	0.75	0.00	0.54
2011	0.69	3.49	14.08	4.00	0.49	0.86	0.20	0.38
2012	0.79	1.32	2.50	5.00	0.81	1.73	0.20	0.54
2013	0.83	2.59	7.83	5.00	1.05	0.91	0.71	1.19

Note: *TRO Central is the equivalent total of Central (Rural), Industrial and Nfld Power.

** The CEA data is not available with Major Event Data excluded.

T-SAIDI (Forced Only) Including Major Event Data

Year	CEA**	Hydro	TRO Northern	TRO Labrador	TRO Central*	Central (rural)	Industrial	Nfld Power
2009	78.16	13.53	58.17	15.00	1.56	0.08	0.00	2.73
2010	55.08	41.27	9.58	186.00	46.74	117.08	0.00	23.27
2011	80.80	220.59	868.17	161.50	41.25	132.90	6.20	6.85
2012	56.29	45.54	108.25	95.50	25.24	53.27	14.20	15.50
2013	96.19	276.53	638.17	278.00	177.84	164.45	279.14	156.23

Note: *TRO Central is the equivalent total of Central (Rural), Industrial and Nfld Power.

** The CEA data is not available with Major Event Data excluded.

T-SAIFI (Forced Only) - Excluding Major Event Data

Year	CEA**	Hydro	TRO Northern	TRO Labrador	TRO Central*	Central (rural)	Industrial	Nfld Power
2009	0.71	0.36	1.17	3.00	0.09	0.08	0.00	0.12
2010	0.64	1.32	4.08	4.00	0.49	0.67	0.00	0.50
2011	0.69	1.85	6.58	3.50	0.44	0.68	0.02	0.38
2012	0.79	1.13	2.50	4.00	0.60	1.73	0.20	0.19
2013	0.83	1.38	2.33	3.00	1.05	0.36	0.00	0.19

Note: *TRO Central is the equivalent total of Central (Rural), Industrial and Nfld Power.

** The CEA data is not available with Major Event Data excluded.

T-SAIDI (Forced Only) Excluding Major Event Data

Year	CEA**	Hydro	TRO Northern	TRO Labrador	TRO Central*	Central (rural)	Industrial	Nfld Power
2009	78.16	10.29	42.50	15.00	1.60	0.08	0.00	2.73
2010	55.08	18.25	9.58	16.00	20.72	51.67	0.00	10.42
2011	80.80	75.01	308.25	48.00	10.73	21.28	6.20	6.85
2012	56.29	40.46	108.25	34.00	21.40	53.27	14.20	9.31
2013	96.19	151.91	73.83	50.00	177.84	54.45	0.00	30.69

Note: *TRO Central is the equivalent total of Central (Rural), Industrial and Nfld Power.

** The CEA data is not available with Major Event Data excluded.

T-SAIFI (Planned Only) - No Major Events Defined

Year	CEA	Hydro	TRO Northern	TRO Labrador	TRO Central*	Central (rural)	Industrial	Nfld Power
2009	0.12	0.52	1.42	0.00	0.29	0.58	0.00	0.23
2010	0.10	0.93	1.08	0.00	0.91	1.92	0.00	0.62
2011	0.11	1.02	2.58	0.00	0.63	1.63	0.20	0.27
2012	0.08	0.55	1.42	0.00	0.33	0.64	0.20	0.23
2013	0.07	0.86	1.92	2.50	0.50	1.55	0.00	0.19

Note: *TRO Central is the equivalent total of Central (rural), Industrial and Nfld Power.

T-SAIDI (Planned Only) - No Major Events Defined

Year	CEA	Hydro	TRO Northern	TRO Labrador	TRO Central*	Central (rural)	Industrial	Nfld Power
2009	14.20	86.76	197.25	0.00	59.22	155.83	0.00	30.58
2010	11.06	132.18	147.75	0.00	130.91	349.58	0.00	55.15
2011	34.71	211.29	536.17	0.00	129.88	359.91	183.20	16.12
2012	10.96	125.25	403.50	0.00	51.71	159.36	19.20	12.42
2013	19.68	191.91	318.83	1042.00	118.66	369.73	0.00	44.38

Note: *TRO Central is the equivalent total of Central (rural), Industrial and Nfld Power.

Significant Power Interruptions

A) **Bulk Electricity System (BES)** is composed of the Power Resources, the Transmission System which includes busses, switching equipment and circuits above 60 kV, all transformers connected to those busses or circuits and the low side busses associated with these transformers as well as the Auxiliary System Equipment. It does not include the Distribution System.

B) **System Minute** is the unsupplied energy in an event, in MW-Minutes, divided by the annual peak system load in MW. One System Minute is equivalent to an interruption of the total system load for one minute at a time of the annual system peak.

$$\text{SYSTEM MINUTES} = \frac{\text{UNSUPPLIED ENERGY (MW-MIN)}}{\text{SYSTEM PEAK LOAD (MW)}}$$

C) **Severity** is the degree of impact due to the power interruption, expressed in system minutes. The severity measure is intended to facilitate comparison between events and comparison with another.

Degree of Severity is a grouping of Severity according to the following:

Degree 1 - an unreliable condition which may have significant impact to one or more customers but is not considered serious. Typically the customer impact is less than a factor of 10 above that which is normally considered acceptable.

Degree 2 - an unreliable condition which is of serious impact to customers. Typically the customer impact is 10 to 100 times above that which is considered acceptable.

Degree 3 - Very serious impact to customers. Typically the customer impact is 100 times above that which is normally acceptable.

SEVERITY	BES Interruptions (SYSTEM MINUTES)	Local Interruptions (MW-minutes)
DEGREE 1	1 to 9	1,000 to 9,999
DEGREE 2	10 to 99	10,000 to 99,999
DEGREE 3	100 and above	100,000 and above

Degree of Severity of SPI

From Canadian Electricity Association Instruction Manual - 2014

D) **Significant Power Interruption (SPI)** is an event

(a) of severity of at least 1 system minute (BES disturbance) or 1000 MW-minutes (Local disturbance), and
(b) which originated on the BES.

SPI can be categorized into a BES Disturbance or Local Interruption.

E) **BES Disturbance** is an event resulting in widespread interruption of customers, characterized by one or more of the following phenomena:

(1) loss of system stability
(2) cascading outages of transmission lines, and
(3) abnormal range of frequency or voltage, or both.

F) **Local Interruption** is an event resulting in interruption of a local nature but having major impact on customers owing to the duration or amount of load affected.

SAIFI (Forced) with major events included

Year	CEA	Hydro	TRO Central			TRO Labrador			TRO Northern		
	Region 2	Total	Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**2.00**	**3.58**	1.98	2.22	2.00	6.14	10.22	6.73	2.07	4.12	2.40
2010	**2.24**	**2.71**	2.01	2.05	2.01	2.73	8.24	3.52	1.94	6.69	2.71
2011	**2.68**	**4.92**	2.53	5.03	2.70	7.18	7.38	7.21	5.32	4.78	5.24
2012	**2.58**	**3.27**	1.54	1.98	1.57	3.81	6.38	4.18	3.66	7.84	4.33
2013	**2.75**	**4.77**	3.91	2.37	3.81	5.84	8.16	6.16	4.37	4.67	4.42

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIDI (Forced) with major events included

Year	CEA	Hydro	TRO Central			TRO Labrador			TRO Northern		
	Region 2	Total	Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**4.61**	**7.76**	3.15	1.10	3.00	19.68	8.70	18.09	3.38	3.26	3.36
2010	**6.33**	**4.99**	7.25	0.54	6.79	3.95	8.16	4.55	2.68	6.59	3.32
2011	**6.92**	**14.84**	16.21	1.92	15.24	10.26	10.50	10.29	22.00	3.06	18.93
2012	**5.05**	**4.96**	3.43	3.76	3.45	4.18	6.00	4.44	7.58	5.70	7.27
2013	**9.14**	**13.74**	21.18	1.81	20.02	12.22	6.79	11.46	9.56	4.89	8.81

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIFI (Planned) with major events included

Year	CEA Region 2	Hydro Total	TRO Central			TRO Labrador			TRO Northern		
			Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**0.31**	**0.95**	0.93	0.21	0.88	1.10	3.65	1.47	0.61	0.13	0.53
2010	**0.3**	**0.81**	0.45	0.20	0.43	1.12	3.66	1.49	0.45	1.25	0.58
2011	**0.3**	**0.77**	0.38	1.19	0.44	0.99	0.90	0.98	1.05	0.48	0.96
2012	**0.25**	**1.13**	0.51	0.71	0.52	1.63	3.21	1.85	1.15	0.82	1.10
2013	**0.19**	**1.00**	0.12	0.48	0.14	2.73	0.88	2.47	0.52	0.14	0.46

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIDI (Planned) with major events included

Year	CEA Region 2	Hydro Total	TRO Central			TRO Labrador			TRO Northern		
			Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**0.70**	**2.90**	2.88	0.45	2.71	5.31	4.05	5.13	1.03	0.71	0.98
2010	**0.67**	**1.44**	0.69	0.37	0.67	2.38	4.10	2.63	0.85	2.85	1.17
2011	**0.61**	**1.47**	0.65	1.92	0.73	1.08	0.42	0.99	3.21	0.79	2.82
2012	**0.56**	**3.35**	1.54	1.17	1.52	5.10	9.12	5.67	3.47	1.19	3.10
2013	**0.69**	**5.40**	0.19	0.74	0.22	16.08	1.44	14.04	2.57	1.17	2.35

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIFI (Forced) with major events excluded

Year	CEA	Hydro	TRO Central			TRO Labrador			TRO Northern		
	Region 2	Total	Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**2.00**	**2.20**	1.96	2.22	1.97	0.96	10.22	2.30	2.05	3.99	2.36
2010	**2.24**	**1.55**	1.11	1.97	1.17	0.04	7.20	1.07	1.83	5.66	2.45
2011	**2.68**	**1.69**	1.24	4.88	1.49	0.77	6.78	1.64	1.59	3.91	1.96
2012	**2.58**	**2.02**	0.85	1.98	0.92	1.39	5.78	2.01	2.72	6.39	3.31
2013	**2.75**	**3.03**	2.45	2.37	2.44	3.61	8.02	4.22	2.19	3.94	2.47

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIDI (Forced) with major events excluded

Year	CEA	Hydro	TRO Central			TRO Labrador			TRO Northern		
	Region 2	Total	Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**4.61**	**3.35**	3.09	1.10	2.96	3.61	8.70	4.35	2.78	3.12	2.84
2010	**6.33**	**2.26**	3.20	0.53	3.01	0.52	5.97	1.31	2.06	3.57	2.31
2011	**6.92**	**2.21**	0.80	1.91	0.88	0.13	7.07	1.14	5.34	2.32	4.85
2012	**5.05**	**2.24**	1.38	3.76	1.53	1.71	3.11	1.91	3.45	3.12	3.39
2013	**9.14**	**4.60**	6.69	1.81	6.39	3.10	5.68	3.46	3.80	3.12	3.69

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIFI (Planned) with major events excluded

Year	CEA	Hydro	TRO Central			TRO Labrador			TRO Northern		
	Region 2	Total	Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**0.31**	**0.95**	0.93	0.21	0.88	1.10	3.65	1.47	0.61	0.13	0.53
2010	**0.3**	**0.75**	0.45	0.20	0.43	1.04	3.66	1.42	0.45	0.61	0.48
2011	**0.3**	**0.77**	0.38	1.19	0.44	0.99	0.90	0.98	1.05	0.48	0.96
2012	**0.25**	**1.13**	0.51	0.71	0.52	1.63	3.21	1.85	1.15	0.82	1.10
2013	**0.19**	**1.00**	0.12	0.48	0.14	2.72	0.88	2.47	0.52	0.14	0.46

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

SAIDI (Planned) with major events excluded

Year	CEA	Hydro	TRO Central			TRO Labrador			TRO Northern		
	Region 2	Total	Inter.	Isolated	Total	Inter.	Isolated	Total	Inter.	Isolated	Total
2009	**0.70**	**2.90**	2.88	0.45	2.71	5.31	4.05	5.13	1.03	0.71	0.98
2010	**0.67**	**1.35**	0.69	0.37	0.67	2.26	4.10	2.53	0.85	1.60	0.97
2011	**0.61**	**1.47**	0.65	1.92	0.73	1.08	0.42	0.99	3.21	0.79	2.82
2012	**0.56**	**3.35**	1.54	1.17	1.52	5.10	9.12	5.67	3.47	1.19	3.10
2013	**0.69**	**5.40**	0.19	0.74	0.22	16.08	1.44	14.04	2.57	1.17	2.35

CEA Region 2 has mostly Rural Utilities which is comparable to Hydro.

CA-NLH-018
2013 NLH General Rate Application

Q. (Regulated Activities Evidence page 2.12, Chart 2.3)
Is Hydro pursuing programs to improve reliability going forward, and if so, what is the benefit to cost ratio of each program? Please identify each of Hydro's reliability improvement programs going forward, its costs, and the estimated benefits in terms of improved reliability and the value customers place on reliability.

A. The capital program is the primary area of investment for reliability improvements. The focus of the Hydro's capital program is on sustaining and renewing existing aging assets and on bringing new assets into service to meet growing customer demand. The scope and cost of each project is justified on its contribution to safe, least cost, reliable power. Furthermore, the projects do stand on their own merits as demonstrated in their justification sections.

Reliability is inherently considered in the System Planning Criteria used to establish the need for investment for load growth. These criteria, which Hydro provides to the Board, are a part of what Hydro uses to establish what upgrades, replacements or additions are required. Some of these projects contribute to improvements in reliability where existing systems are operating near their design limits.

Hydro does not have a specific measure of the value customers place on reliability. As such, the benefit to cost ratios have not been attempted and are not available. Please refer to CA-NLH-052.

Listed in the following table are sustaining projects planned in 2014 for the distribution systems which have expected reliability improvements identified.

Project Name	Cost [$000]	Expected Reliability Improvement[1]
Replace Poles – GYR (Grey River), Line 1	487	1%
Upgrade Distribution System - SOK (South Brook), Lines 1, 2,3,5,6,and 7	976	3%
Upgrade L1 & L3 Distribution Feeder – ROD (Roddickton), Lines 1&3	1,260	3%
Upgrade Distribution System – SLE (St. Lewis), Line 1	908	7%
Upgrade Distribution System – CRV (Conne River), Line 1	494	9%
Upgrade Distribution System – BDE (Bay d'Espoir), Line 1	693	28%
Upgrade Distribution System – BCX (Barachoix), Line 1,4 and 5	584	15%

In addition to the capital program, Hydro is developing and advancing initiatives associated with asset management, as outlined in the response to CA-NLH-017, which are expected to have a positive impact on reliability.

[1] In terms of SAIFI