

1 Q. **System Reliability**

2 Provide tables indicating the causes of customer interruptions by year, including  
3 total numbers of Customer Interruptions (CIs) and numbers of Customer Minutes of  
4 Interruptions (CMIs), without and with major events, each year, the number of CIs  
5 for each cause each year, and the percentage each cause contributed to the total  
6 CIs for each year from 2009 through 2013. For the "*equipment malfunction*" cause,  
7 provide a table for each year indicating the equipment type which failed including,  
8 but not limited to, substation transformers, relays, cutouts, poles, insulators, wires,  
9 underground cables, aerial cables, splices, etc. State what is assumed to be causes  
10 under "*other*". Are trees generally the cause of wind and weather caused outages?  
11  
12

13 A. Please refer to PUB-NLH-338 Attachment 1 for a table of the causes of customer  
14 interruptions from 2009 to 2013 (including and excluding significant events).  
15

16 Hydro does not identify major events in its Distribution Outage Reporting System  
17 (DORS). In order to extract significant events, Hydro has applied a filter to define  
18 "significant events" reported to the PUB following the "Power Outage Advisories  
19 Guidelines"<sup>1</sup>. The Canadian Electricity Association (CEA) does collect Most  
20 Prominent Event (MPE) data, but Hydro does not identify or report any MPE data.  
21 This has been an optional requirement of the CEA and is a user-defined reporting  
22 system. Utilities who report MPE data indicate the criteria used to establish the  
23 MPE. This could be the IEEE 2.5 Beta method or any other utility defined criteria.

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<sup>1</sup> Outages of less than 60 minutes to isolated diesel plants were not defined as a "significant event" nor were planned outages.

1 With respect to PUB-NLH-338 Attachment 1, Loss of Supply can be the result of a  
2 transmission supply outage, an under frequency load shedding trip, or the loss of  
3 generation for an isolated system with no transmission supply.

4

5 Equipment malfunction is not a cause that is presently recorded by Hydro. Hydro  
6 does record outages under a Defective Equipment cause code that includes  
7 equipment failures such as deterioration due to age, inadequate maintenance, or  
8 imminent failures detected by maintenance. Please refer to PUB-NLH-338  
9 Attachment 2 for a table of Defective Equipment failures broken down by  
10 component type for 2009 to 2013.

11

12 The “Unknown/Other” cause is used when there is a customer interruption to  
13 which there is no apparent cause or reason which could be attributed to the outage  
14 (Unknown). Hydro also uses this cause code when there is a customer interruption  
15 to which the cause or reason cannot be attributed to the other cause codes (Other).

16

17 An outage caused by a tree or contact by a tree branch is identified as “tree  
18 contact”. The wind and weather caused outages would be the result of events other  
19 than tree contact with the line.

**Including Significant Events**

<b>2009</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions (CI)</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	382	0.2%	118,620
	Adverse Weather	4,705	2.8%	928,657
	Defective Equipment	16,840	10.0%	2,129,629
	Environment-Corrosion	625	0.4%	56,544
	Environment-Salt Spray	1,801	1.1%	191,050
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	2,321	1.4%	188,829
	Foreign Interference-Vehicle	1,030	0.6%	370,142
	Human Error	1,611	1.0%	87,110
	Loss of Supply	92,762	55.1%	11,440,655
	Lightning	154	0.1%	38,341
	Scheduled Outage-Planned	35,025	20.8%	6,405,311
	Tree Contacts	1,541	0.9%	365,914
	Unknown / Other	9,601	5.7%	954,518
	<b>Total</b>	<b>168,398</b>	<b>100%</b>	<b>23,275,320</b>

**Including Significant Events**

<b>2010</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions (CI)</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	1,638	1.2%	714,686
	Adverse Weather	4,427	3.2%	987,394
	Defective Equipment	13,699	10.0%	1,598,452
	Environment-Corrosion	402	0.3%	83,137
	Environment-Salt Spray	4,563	3.3%	592,370
	Foreign Interference	754	0.6%	306,878
	Foreign Interference-Object	6,139	4.5%	428,753
	Foreign Interference-Vehicle	218	0.2%	79,232
	Human Error	2,182	1.6%	417,377
	Loss of Supply	45,071	33.0%	3,972,668
	Lightning	10,003	7.3%	300,767
	Scheduled Outage-Planned	31,455	23.0%	3,582,638
	Tree Contacts	994	0.7%	199,340
	Unknown / Other	14,937	10.9%	1,241,012
	<b>Total</b>	<b>136,482</b>	<b>100.0%</b>	<b>14,504,704</b>

**Including Significant Events**

<b>2011</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions (CI)</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	661	0.3%	354,160
	Adverse Weather	14,490	6.8%	8,430,079
	Defective Equipment	14,318	6.7%	1,764,107
	Environment-Corrosion	2,334	1.1%	215,681
	Environment-Salt Spray	563	0.3%	310,945
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	5,070	2.4%	1,199,724
	Foreign Interference-Vehicle	5,602	2.6%	999,229
	Human Error	1,552	0.7%	358,245
	Loss of Supply	116,458	54.9%	14,938,536
	Lightning	1,539	0.7%	129,884
	Scheduled Outage-Planned	28,578	13.5%	3,248,801
	Tree Contacts	9,599	4.5%	4,232,238
	Unknown / Other	11,478	5.4%	1,400,190
	<b>Total</b>	<b>212,242</b>	<b>100.0%</b>	<b>37,581,818</b>

**Including Significant Events**

<b>2012</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions (CI)</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	1,905	1.1%	31,901
	Adverse Weather	6,791	4.1%	997,966
	Defective Equipment	19,147	11.5%	2,634,928
	Environment-Corrosion	312	0.2%	31,104
	Environment-Salt Spray	3,651	2.2%	446,027
	Foreign Interference	1	0.0%	55
	Foreign Interference-Object	4,074	2.4%	489,286
	Foreign Interference-Vehicle	918	0.6%	155,824
	Human Error	1,750	1.1%	181,732
	Loss of Supply	73,925	44.4%	4,577,495
	Lightning	848	0.5%	113,779
	Scheduled Outage-Planned	42,820	25.7%	7,539,741
	Tree Contacts	3,782	2.3%	979,984
	Unknown / Other	6,589	4.0%	464,973
	<b>Total</b>	<b>166,513</b>	<b>100.0%</b>	<b>18,644,795</b>

**Including Significant Events**

<b>2013</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions (CI)</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	1,608	0.7%	370,609
	Adverse Weather	10,703	4.9%	3,828,274
	Defective Equipment	55,688	25.5%	6,953,912
	Environment-Corrosion	1,627	0.7%	148,314
	Environment-Salt Spray	1,348	0.6%	186,511
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	3,787	1.7%	550,920
	Foreign Interference-Vehicle	4,193	1.9%	845,380
	Human Error	480	0.2%	53,580
	Loss of Supply	70,632	32.3%	10,663,695
	Lightning	6,684	3.1%	1,281,560
	Scheduled Outage-Planned	37,152	17.0%	12,081,429
	Tree Contacts	8,481	3.9%	4,542,819
	Unknown / Other	16,377	7.5%	2,154,211
	<b>Total</b>	<b>218,761</b>	<b>100.0%</b>	<b>43,661,230</b>

**Excluding Significant Events**

<b>2009</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions (CI)</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	382	0.3%	118,620
	Adverse Weather	4,224	3.6%	565,717
	Defective Equipment	13,225	11.2%	1,181,344
	Environment-Corrosion	349	0.3%	39,984
	Environment-Salt Spray	1,801	1.5%	191,050
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	2,321	2.0%	188,829
	Foreign Interference-Vehicle	1,030	0.9%	370,142
	Human Error	1,611	1.4%	87,110
	Loss of Supply	47,079	39.8%	3,202,171
	Lightning	154	0.1%	38,341
	Scheduled Outage-Planned	35,025	29.6%	6,405,311
	Tree Contacts	1,541	1.3%	365,914
	Unknown / Other	9,601	8.1%	954,518
	<b>Total</b>	<b>118,343</b>	<b>100.0%</b>	<b>13,709,051</b>

**Excluding Significant Events**

<b>2010</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	1,598	1.7%	678,686
	Adverse Weather	2,955	3.2%	404,645
	Defective Equipment	8,671	9.4%	861,220
	Environment-Corrosion	402	0.4%	83,137
	Environment-Salt Spray	15	0.0%	1,130
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	1,821	2.0%	132,368
	Foreign Interference-Vehicle	218	0.2%	79,232
	Human Error	1,781	1.9%	343,593
	Loss of Supply	37,016	40.1%	1,611,711
	Lightning	2,899	3.1%	268,799
	Scheduled Outage-Planned	29,464	31.9%	3,374,067
	Tree Contacts	994	1.1%	199,340
	Unknown / Other	4,502	4.9%	297,502
	<b>Total</b>	<b>92,336</b>	<b>100.0%</b>	<b>8,335,430</b>

**Excluding Significant Events**

<b>2011</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	95	0.1%	16,240
	Adverse Weather	6,635	7.1%	1,286,469
	Defective Equipment	13,026	14.0%	1,397,273
	Environment-Corrosion	2,334	2.5%	215,681
	Environment-Salt Spray	556	0.6%	210,145
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	2,658	2.9%	145,777
	Foreign Interference-Vehicle	296	0.3%	38,769
	Human Error	1,552	1.7%	358,245
	Loss of Supply	22,243	23.9%	604,133
	Lightning	1,539	1.7%	129,884
	Scheduled Outage-Planned	28,578	30.7%	3,248,801
	Tree Contacts	4,537	4.9%	657,920
	Unknown / Other	9,046	9.7%	1,283,624
	<b>Total</b>	<b>93,095</b>	<b>100.0%</b>	<b>9,592,960</b>

**Excluding Significant Events**

<b>2012</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	1,905	1.6%	31,901
	Adverse Weather	4,278	3.6%	391,655
	Defective Equipment	11,564	9.6%	1,125,854
	Environment-Corrosion	312	0.3%	31,104
	Environment-Salt Spray	1,702	1.4%	61,687
	Foreign Interference	1	0.0%	55
	Foreign Interference-Object	2,701	2.3%	175,096
	Foreign Interference-Vehicle	918	0.8%	155,824
	Human Error	1,750	1.5%	181,732
	Loss of Supply	43,537	36.3%	2,216,832
	Lightning	391	0.3%	38,374
	Scheduled Outage-Planned	42,820	35.7%	7,539,741
	Tree Contacts	2,140	1.8%	218,820
	Unknown / Other	5,866	4.9%	378,213
	<b>Total</b>	<b>119,885</b>	<b>100.0%</b>	<b>12,546,888</b>

**Excluding Significant Events**

<b>2013</b>	<b>Interruption Cause</b>	<b>Number of Customer Interruptions</b>	<b>Percent Contribution to CI</b>	<b>Customer Minutes of Interruptions</b>
	Adverse Environment	698	0.5%	70,309
	Adverse Weather	7,799	5.1%	1,645,874
	Defective Equipment	40,637	26.7%	2,117,608
	Environment-Corrosion	1,627	1.1%	148,314
	Environment-Salt Spray	799	0.5%	181,021
	Foreign Interference	0	0.0%	0
	Foreign Interference-Object	3,368	2.2%	249,240
	Foreign Interference-Vehicle	2,538	1.7%	87,355
	Human Error	7	0.0%	1,550
	Loss of Supply	36,325	23.8%	2,397,148
	Lightning	785	0.5%	114,605
	Scheduled Outage-Planned	37,152	24.4%	12,081,429
	Tree Contacts	5,349	3.5%	1,495,006
	Unknown / Other	15,389	10.1%	1,795,896
	<b>Total</b>	<b>152,474</b>	<b>100.0%</b>	<b>22,385,371</b>



## Defective Equipment Failure Causes

Component	Number of Failures					Total
	2009	2010	2011	2012	2013	
Customer Equipment-Breaker	9	4	3	10	3	29
Customer Equipment-Fuse	0	0	0	0	1	1
Customer Equipment-Meter	0	1	2	1	1	5
Customer Equipment-Meter Socket	4	11	9	9	11	44
Customer Equipment-Other	6	5	4	5	1	21
Customer Equipment-Street Light	0	0	0	1	0	1
Not Applicable	11	8	8	1	59	87
Overhead-By-Pass	1	0	0	0	0	1
Overhead-Anchor & Rod	0	1	0	0	0	1
Overhead-Connector	19	24	11	19	22	95
Overhead-Crossarm	0	0	0	1	0	1
Overhead-Disconnect Switch	52	0	51	19	23	145
Overhead-Fuse	0	39	1	0	0	40
Overhead-Insulator	18	26	25	41	32	142
Overhead-Insulink	3	3	0	0	0	6
Overhead-Jumper	1	6	3	4	1	15
Overhead-Lightning Arrestor	2	0	3	1	5	11
Overhead-Other	5	4	6	6	23	44
Overhead-Pin	1	2	2	1	3	9
Overhead-Pole	0	2	0	1	1	4
Overhead-Primary Conductor	2	3	3	3	2	13
Overhead-Recloser	7	0	7	0	3	17
Overhead-Secondary Conductor	4	2	1	4	1	12
Overhead-Sectionalizer	3	0	2	1	1	7
Overhead-Service Clamp	0	2	1	1	2	6
Overhead-Service Drop	8	12	17	6	14	57
Overhead-Splice	3	1	6	2	0	12
Overhead-Transformer	33	29	32	22	25	141
Overhead-Transformer Fuse	29	22	34	23	12	120
Substation-Lightning Arrestor	0	0	0	0	1	1
Substation-Power Transformer	0	6	0	0	0	6
Substation-Other	1	2	3	9	2	17
Substation-Overload	3	0	0	0	0	3
Substation-Recloser	0	1	1	0	13	15
Substation-Regulator	4	0	1	8	0	13
Substation-Terminator	0	0	0	0	2	2
<b>Total</b>	<b>229</b>	<b>216</b>	<b>236</b>	<b>199</b>	<b>264</b>	<b>1144</b>