

1 Q. **Reference: Supply Cost Deferrals 2015, 2016 and 2017 Application Evidence, Page**
2 **2, lines 18-22.**

3
4 *“This adjustment in operations ensures that generation is already online and*
5 *synchronized to the grid in the event of a system contingency, thereby mitigating*
6 *the impact on customers. While this approach minimizes both the magnitude of the*
7 *disruption as well as the number of customers impacted, this greater customer*
8 *reliability focus carries with it greater costs associated with the increased use of gas*
9 *turbines.”*

10
11 Were there any occasions when failure of a gas turbine or thermal unit that had
12 been placed online and synchronized to the grid solely to meet spinning reserve
13 requirements caused a customer outage? If so, please provide details.

14
15
16 A. Hydro operates all of its generation resources, conventional (primary) and standby,
17 to meet overall customer load requirements, satisfy any regional transmission
18 constraints and maintain operating reserves to position the system to withstand the
19 single worst contingency event. This includes (1) any single transmission
20 contingency without violating any operating limit and impacting customer service¹
21 and (2) the loss of the largest generating unit contingency without violating the
22 reserve criterion. Hydro dispatches its generation in order of least cost to satisfy the
23 customer load and reliability requirements.

¹ Not applicable for radially supplied systems.

1 Under isolated operation, when there is a sudden loss of any large generating unit,
2 normally loaded at 50 MW or greater, some customer's load must be interrupted to
3 bring generation output equal to customer demand. This automatic action of power
4 system protection, referred to as under frequency load shedding (UFLS), is
5 necessary to ensure the integrity and reliability of system equipment. By
6 maintaining spinning reserves of at least equal to the largest generating unit, the
7 system is positioned to ensure that customer outage time is minimized following
8 UFLS events.

9
10 In its response to NP-NLH-024² of the October 2016 Application - *Recovery of the*
11 *2015 and 2016 Balances*, Hydro provided a summary of each UFLS event from 2007
12 to 2016, most of which resulted from a failure of a generating unit or the
13 connecting transmission line into a generating station. Table 1 provides a similar
14 summary for 2017 UFLS events resulting from generating unit or connecting
15 transmission line issues. Events resulting from the failure of a gas turbine or thermal
16 unit are included in NP-NLH-304, Attachment 1 as well as Table 1. As the Holyrood
17 units are operated to satisfy a number of requirements (to meet customer loads, to
18 support Avalon transmission, to maintain operating reserves, hydraulic reservoir
19 support, etc.) and frequently several of these requirements at the same time, it is
20 difficult to determine when it is *online and synchronized to the grid solely to meet*
21 *spinning reserve requirements*. There are two UFLS events - December 20, 2016 and
22 February 13, 2017 - that resulted from failures of the Holyrood Gas Turbine. The
23 reasons for operation of this unit are outlined in Schedule 1, Appendix L of Hydro's

² Attached as NP-NLH-304, Attachment 1.

- 1 Application. On both occasions the unit was indicated to be on for *support of*
2 *spinning reserves*³ prior to the UFLS event.

Table 1

Date	Event	Cause	Load Shed (MW)	Island Reserve (MW) ¹
Jan 30, 2017 14:06	Hinds Lake Unit	TL243 trip	37	395
Feb 13, 2017 9:21	Holyrood GT	Fire suppression system	37	234
May 01, 2017 8:55	Holyrood Unit 2	Loss of pressurized air to the boiler flame scanner	86	328
Jun 03, 2017 15:57	Holyrood Unit 2	Issues with the Mark V turbine governor system	29	341
Jul 03, 2017 17:40	Bay d'Espoir Unit 7	Excitation system brush failure	128	268
Jul 22, 2017 11:25	Cat Arm Units 1 and 2	TL247 trip	40	230
Sep 16, 2017 9:33	Bay d'Espoir Units 1 and 3	Synchronizing error	122	233
Sep 18, 2017 9:51	Holyrood Unit 1	Undervoltage event on the Unit 1 4160V unit board	29	375
Oct 05, 2017 1:48	Holyrood Unit 2	Damaged conductors in the east forced draft (FD) fan breaker	40	313

Note 1: This value is the Island spinning reserve – which includes the reserve on the unit that tripped.

³ Operation in this area includes for Spinning and Avalon Reserves which are generally load driven and/or due to deratings of generating equipment.

1 Q. For the years 2007-2016, please provide a table showing (i) each under frequency
2 load shedding event, (ii) the cause of each under frequency load shedding event,
3 (iii) the amount of load shed, (iii) whether the Holyrood GT was operating at the
4 time, (iv) and the amount of Island and Avalon generation reserves at the time of
5 the under frequency load shedding event.

6

7

8 A. Table 1 outlines each under frequency load shedding event from 2007 to 2016. The
9 Holyrood Gas Turbine (GT) was on-line for three events.¹ These events were March
10 11, 2015, December 8, 2016 and December 20, 2016 (a trip of Holyrood GT resulted
11 in the under frequency for the latter event). The Avalon generation reserves were
12 not specifically tracked in real time prior to January 2016.²

Table 1 Under Frequency Load Shedding Events from 2007 to 2016

Date	Event	Cause	Load Shed (MW)	Island Reserve ³ (MW)	Avalon Reserve (MW)
Feb 10, 2007 13:46	TL247 Tripped/Cat Arm Units 1&2	Unknown trip of TL247	120	372	N/A
Mar 23, 2007 09:53	Upper Salmon Unit	Station Service Fault	66	220	N/A
Jun 19, 2007 13:28	Holyrood Unit 1	Station Service Supply - Switching Issue	50.5	200	N/A
Oct 12, 2007 12:28	Holyrood Unit 3	Boiler trip due to high drum level	41.8	251	N/A
Nov 26, 2007 12:08	Holyrood Unit 1	Boiler trip due to high drum level	131	200	N/A
Dec 28, 2007 14:21	Holyrood Unit 1	Lube oil pump failure	100	228	N/A

¹ The Holyrood GT was officially released for service on February 27, 2015.

² Refer to NP-NLH-030 for additional details on the Avalon generation reserve

³ This value is the Island spinning reserve – which includes the reserve on the unit that tripped.

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Date	Event	Cause	Load Shed (MW)	Island Reserve ³ (MW)	Avalon Reserve (MW)
Jan 01, 2008 00:28	Holyrood Unit 3	Phase wire fell on unit transformer	60	395	N/A
Feb 14, 2008 16:26	Holyrood Unit 3	Water in control cabinet of station service transformer UST3	127	128	N/A
Feb 20, 2008 03:57	Bay d'Espoir Unit 3	Stator Ground Fault	71	301	N/A
Jul 03, 2008 12:31	TL247 Tripped/Cat Arm Units 1&2	Lightning strike to TL247	29.5	187	N/A
Jul 29, 2008 18:09	Hinds Lake Unit	High Bearing Temperature	29	205	N/A
Jul 29, 2008 22:26	TL247 Tripped/Cat Arm Units 1&2	Lightning strike to TL247 - Plant isolated from the grid	145	145	N/A
Mar 05, 2009 17:14	Holyrood Unit 1	Boiler trip due to high drum level	69	232	N/A
Jul 29, 2009 10:26	Planned outage on TL248	Overload on Deer Lake Power System after TL248 was opened with one of DLP's lines also on a planned outage/Switching Error	48	152	N/A
Aug 24, 2009 03:21	TL202 Tripped	Slow clearing fault on TL202	27	177	N/A
Aug 24, 2009 03:33	TL202 Tripped	Slow clearing fault on TL202	30	180	N/A
Nov 06, 2009 19:41	Holyrood Unit 2	Boiler trip due to high drum level	84	287	N/A
Dec 02, 2009 00:33	Deer Lake Power Lines 1 & 2 Trip	Overload and trip for Deer Lake TS transformer T1	38	390	N/A
Dec 06, 2009 16:27	Holyrood Unit 3	Boiler trip due to high drum level	19	357	N/A
Jul 13, 2010 12:30	TL233 Tripped	Slow clearing fault on TL233	8	79	N/A
Jul 18, 2010 19:18	Hinds Lake Unit	Lightning strike to TL243 - Plant isolated	10	224	N/A

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Date	Event	Cause	Load Shed (MW)	Island Reserve ³ (MW)	Avalon Reserve (MW)
		from the grid			
Jul 18, 2010 22:54	NP Line 363L	Lightning Strike	8	156	N/A
Nov 14, 2010 22:33	Bay d'Espoir Unit 3	Plant operator inadvertently opened unit breaker for unit 3 while shutting down unit 5 - switching error	18	326	N/A
Dec 22, 2010 21:19	Upper Salmon Unit	Low governor air pressure	34.5	381	N/A
Dec 30, 2010 12:57	Holyrood Unit 3	Cooling water flow issue	38.5	409	N/A
Jan 14, 2011 14:33	Holyrood Unit 3	Trip during testing of west fuel oil pump - control system error	20	398	N/A
May 12, 2011 17:13	Holyrood Unit 1	Boiler trip due to low drum level	18.5	147	N/A
Oct 27, 2011 00:04	Upper Salmon Unit	Unit transformer lockout due to water in the auxiliary contacts of the oil temperature trip relay	12	277	N/A
Jan 14, 2012 13:15	Holyrood Units 1 & 2	Fault on 66 kV line supplying station service	129	381	N/A
May 22, 2012 13:12	Cat Arm Unit 1	Fire protection deluge system operated on unit transformer T1	12	160	N/A
Oct 17, 2012 19:11	Holyrood Unit 1	Boiler trip due to high drum level	43	184	N/A
Nov 21, 2012 14:38	Holyrood Unit 2	Low drum level due to operator error	51	278	N/A
Nov 25, 2012 11:24	Holyrood Unit 2	Equipment failure and operator error during an isolation procedure	16	188	N/A
Jan 16, 2013 23:35	Holyrood Unit 3	False trip due to a faulty vacuum trip alarm	87	322	N/A

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Date	Event	Cause	Load Shed (MW)	Island Reserve ³ (MW)	Avalon Reserve (MW)
Jan 18, 2013 21:40	Bay d'Espoir Unit 4	Faulty current transformer on the unit	20.5	74	N/A
Mar 01, 2013 03:06	Bay d'Espoir Unit 1	Exciter processor malfunctioned	23	334	N/A
Mar 10, 2013 16:33	Holyrood Unit 3	Faulty fuel oil pump	20	228	N/A
Apr 16, 2013 11:35	Holyrood Unit 2	Low bearing oil pressure	55	320	N/A
Apr 17, 2013 07:00	Bay d'Espoir Units 3 & 5	Breaker failure protection malfunctioned	138	151	N/A
Nov 29, 2013 18:13	Holyrood Unit 1	Boiler trip due to high drum level	25	199	N/A
Jan 10, 2014 18:56	Holyrood Unit 2	Compressor failure caused loss of power to 600 V power center	115	220	N/A
Jan 12, 2014 17:36	Holyrood Unit 3	Main feed water isolator failed to open causing low drum level	22	422	N/A
Jan 15, 2014 09:09	TL201 Tripped	Slow clearing fault due to two phase wires on the ground due to broken insulators	15	354	N/A
Jan 27, 2014 16:50	Holyrood Unit 1	Circuit breaker was inadvertently tripped on the burner management system during maintenance	60	238	N/A
Jan 30, 2014 05:10	Bay d'Espoir Unit 6	Failure of excitation transformer	36	305	N/A
Feb 17, 2014 04:22	Bay d'Espoir Unit 6	Failure of spare excitation transformer	48	393	N/A
Mar 18, 2014 22:02	Bay d'Espoir Units 3 & 4	Bus lockout and breaker failure on shutdown on Unit 4	38	229	N/A
Jul 14, 2014 14:14	Holyrood Unit 3	Forced draft fan tripped during a load test	13	375	N/A

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Date	Event	Cause	Load Shed (MW)	Island Reserve ³ (MW)	Avalon Reserve (MW)
Jul 28, 2014 07:28	Holyrood Unit 3	Switching issues during planned maintenance on the plant's electrical distribution system	19.5	177	N/A
Jul 29, 2014 09:43	Holyrood Unit 3	Human error during switching on station service supply for a planned maintenance outage	40	175	N/A
Oct 13, 2014 15:38	Holyrood Unit 2	Unit breaker inadvertently tripped during commissioning on Unit 1 unit breakers	16	238	N/A
Nov 15, 2014 16:20	Holyrood Unit 2	Operator error selected wrong unit valves	15	269	N/A
Dec 19, 2014 08:49	Holyrood Unit 2	Loose connection of a motor lead cable	23	404	N/A
Dec 30, 2014 23:34	Holyrood Unit 3	Operator error during adjustments on steam pressure	112	261	N/A
Jan 22, 2015 11:56	Holyrood Unit 1	Inadvertent trip during commissioning activities on light oil pump west	41	525	N/A
Mar 11, 2015 10:52	Holyrood Unit 1	Inadvertent trip during maintenance on network storage device	86	286	N/A
May 10, 2015 07:14	Holyrood Unit 1	Inadvertent trip during upgrades to power distribution panel	18	360	N/A
Jul 10, 2015 17:33	TL234 Tripped/Upper Salmon Unit/Granite Canal Unit	Lightning strike on TL234 isolated Upper Salmon and Granite Canal units from the grid	24	329	N/A
Aug 05, 2015 10:23	TL206 Tripped/Bay d'Espoir Unit 7	Lightning strike close to Bay d'Espoir Terminal Station 2 resulting in the unit	109	174	N/A

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Date	Event	Cause	Load Shed (MW)	Island Reserve ³ (MW)	Avalon Reserve (MW)
		breaker on Unit 7 and TL206 tripping			
Oct 01, 2015 22:08	Holyrood Unit 3	Operator error during weekly backwash on unit	22	244	N/A
Nov 15, 2015 00:48	Holyrood Unit 1	Faulty positioning device on unit's governor system	12.4	466	N/A
Nov 27, 2015 10:03	Holyrood Unit 1	Governor Control system issue	96	227	N/A
Mar 26, 2016 11:01	TL247 Tripped/Cat Arm Units 1&2	TL247 tripped due to ice bridging	100	238.3	184
Aug 14, 2016 13:50	Holyrood Unit 3	Over temperature trip on Unit transformer	11	353	425
Aug 24, 2016 17:10	TL234 Tripped/Upper Salmon Unit/Granite Canal Unit	Lightning strike on TL234 isolated Upper Salmon and Granite Canal units from the grid	27	304	263
Dec 08, 2016 13:10	Holyrood Unit 3	Faulty trip relay on Unit service transformer	55	405	235
Dec 20, 2016 18:05	Holyrood GT	Faulty thermocouple reading	57	248	205
Dec 23, 2016 10:32	Holyrood Unit 1	Human error during procedure to change filters on the Hydraulic system,	56	320	275