Q. Will Hydro's planning and operating criteria for supply to the Avalon Peninsula change post Muskrat Falls? Specifically, please provide a detailed analysis of the demand/supply situation for the Avalon Peninsula post Muskrat Falls showing demand, existing generation, new generation, sales/purchases, demand management including interruptible supply contracts, firm imports over the transmission feeding the Avalon Peninsula and reserve margins for the 10-year period following commissioning of Muskrat Falls and interconnecting transmission project. Please show results for base case and contingency scenarios.

A. The supply to the Avalon Peninsula will be enhanced by the completion of the Labrador-Island HVdc Link (LIL). The LIL will make 673 MW of capacity available to the Island at Soldier's Pond net of the Nova Scotia block corresponding to approximately 730 MW at Muskrat Falls. This 673 MW will replace the current capability of the Holyrood Thermal Generating Station (HTGS) of 465 MW. In addition, the completion of the third circuit from Bay d'Espoir to the Avalon Peninsula will strengthen the supply to the area from other areas of the grid. Furthermore, the addition of the LIL and the high inertia synchronous condensers at Soldiers Pond will eliminate the need for operation of the under frequency load shedding scheme for loss of on island generation.

Hydro's planning and operating criteria will not change with respect to supply to the Avalon Peninsula post Muskrat Falls. Hydro's existing transmission planning criteria with respect to equipment load levels and voltage levels under both normal and single contingency events will remain in effect.

Hydro plans generation additions for the Island Interconnected System as one system and not by region or geographic area. Table 1 provides a base case analysis of the demand/supply situation for the Island Interconnected System net customer generation for the period 2018 to 2027. The Hydro allocation for deliveries over the Labrador-Island Link is estimated to be 673 MW net of the Nova Scotia Block allocation.

Table 1
NLH Island Interconnected System
Base Case
Peak Demand – Supply Analysis - MW
2018 - 2027

Firm Generation	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
NLH Hydro	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3
NUGs	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0
HVdc	673.0	673.0	673.0	673.0	673.0	673.0	673.0	673.0	673.0	673.0
Subtotal	1686.3	1686.3	1686.3	1686.3	1686.3	1686.3	1686.3	1686.3	1686.3	1686.3
NLH Standby	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7
NP standby	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
Subtotal	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2
Total Gen	1962.5	1962.5	1962.5	1962.5	1962.5	1962.5	1962.5	1962.5	1962.5	1962.5
System Peak	1570	1559	1558	1568	1589	1616	1635	1656	1677	1695
Reserve	392.5	403.5	404.5	394.5	373.5	346.5	327.5	306.5	285.5	267.5

Notes:
Analysis is for NLH System
NUGs – non-utility generators
NLH Standby includes Hardwoods (50 MW), Stephenville (50 MW), New Holyrood Combustion turbine (120 MW), Hawke's Bay (5.0 MW)and St. Anthony (9.7 MW) diesel plants
NP Standby includes Greenhill, Wesleyville and Grand Bay Combustion turbines and portable diesels
System Peak taken from 2013 Provincial Load Forecast (PLF) dated June 19, 2013
Holyrood units (while available for 2018 to 2020 period) have not been included in the reserve analysis

Table 2 provides an analysis of the demand/supply situation for the Island Interconnected System net of customer generation for the period 2018 to 2027 under the loss of one pole on the Labrador-Island Link (i.e., monopolar outage). Hydro's allocation under continuous operation in monopolar mode is estimated to be 448 MW.

Table 2
NLH Island Interconnected System
Contingency Loss of One Pole of The Labrador-Island Link
Peak Demand – Supply Analysis - MW
2018 - 2027

Firm Generation	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
NLH Hydro	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3
NUGs	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0
HVdc	448.0	448.0	448.0	448.0	448.0	448.0	448.0	448.0	448.0	448.0
Subtotal	1461.3	1461.3	1461.3	1461.3	1461.3	1461.3	1461.3	1461.3	1461.3	1461.3
NLH Standby	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7
NP standby	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
Subtotal	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2
Total Gen	1737.5	1737.5	1737.5	1737.5	1737.5	1737.5	1737.5	1737.5	1737.5	1737.5
System Peak	1570	1559	1558	1568	1589	1616	1635	1656	1677	1695
Reserve	167.5	178.5	179.5	169.5	148.5	121.5	102.5	81.5	60.5	42.5

Notes:
Analysis is for NLH System
NLH allocation via HVdc at Soldiers Pond reduced to 448 MW in continuous monopolar operation.
NUGs – non-utility generators
NLH Standby includes Hardwoods (50 MW), Stephenville (50 MW), New Holyrood Combustion turbine (120 MW), Hawke's Bay (5.0 MW)and St. Anthony (9.7 MW) diesel plants
NP Standby includes Greenhill, Wesleyville and Grand Bay Combustion turbines and portable diesels
System Peak taken from 2013 PLF dated June 19, 2013
Holyrood units (while available for 2018 to 2020 period) have not been included in the reserve analysis

Table 3 provides an analysis of the demand/supply situation for the Island Interconnected System net of customer generation for the period 2018 to 2027 for the low probability contingency of the loss of the Labrador-Island Link bipole. For loss of the entire Labrador-Island Link, Hydro will import up to 300 MW of power from the Maritime Provinces over the Maritime Link to the island. The calculations indicate that based upon firm generation values there will be insufficient generation reserves for loss of the bipole over peak beginning in 2023. The response to PUB-NLH-217 identifies options that would be considered to extend the generation shortfall beyond 2023.

Table 3
NLH Island Interconnected System
Contingency Loss of The Labrador-Island Link
Peak Demand – Supply Analysis - MW
2018 - 2027

Firm Generation	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
NLH Hydro	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3	927.3
NUGs	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0
HVdc	0	0	0	0	0	0	0	0	0	0
Subtotal	1013.3	1013.3	1013.3	1013.3	1013.3	1013.3	1013.3	1013.3	1013.3	1013.3
NLH Standby	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7	234.7
NP standby	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
Subtotal	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2
Total Island Gen	1289.6	1289.6	1289.6	1289.6	1289.6	1289.6	1289.6	1289.6	1289.6	1289.6
Import ML	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
Total Gen	1589.6	1589.6	1589.6	1589.6	1589.6	1589.6	1589.6	1589.6	1589.6	1589.6
System Peak	1570	1559	1558	1568	1589	1616	1635	1656	1677	1695
Reserve	19.6	30.6	31.6	21.6	0.6	-26.4	-45.4	-66.4	-87.4	-105.4
Max cont hydro capacity	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1
Min interruptible	0	0	0	0	0	0	15.3	36.3	57.3	75.3

Notes:
Analysis is for NLH System
NUGs – non-utility generators
NLH Standby includes Hardwoods (50 MW), Stephenville (50 MW), New Holyrood Combustion turbine (120 MW), Hawke's Bay (5.0 MW)and St. Anthony (9.7 MW) diesel plants
NP Standby includes Greenhill, Wesleyville and Grand Bay Combustion turbines and portable diesels
System Peak taken from 2013 PLF dated June 19, 2013
Holyrood units (while available for 2018 to 2020 period) have not been included in the reserve analysis

With respect to the supply to the Avalon Peninsula, generation contingencies will have little impact on the ability to supply the region with all 230 kV transmission lines in operation. The addition of a new 230 kV transmission line between Bay d'Espoir and Western Avalon to ensure stable operation of the LIL under system contingencies will alleviate the existing transmission system constraints along the Bay d'Espoir east 230 kV corridor. When considering the supply to the Avalon Peninsula it is important to consider the load supplied at the isthmus via the Sunnyside and Come By Chance Terminal Stations.

During winter peak load conditions, the three 230 kV transmission lines between Bay d'Espoir and the Avalon Peninsula (i.e., TL202, TL206 and the new Bay d'Espoir to Western Avalon line) will have a combined thermal load limit of 1198 MVA.

Table 4 provides the transfers and generation capacities for the 230 kV transmission system east of Bay d'Espoir in the base case scenario (i.e., no outages). The table indicates by reference to the required flow from Bay d'Espoir (BDE) that there is sufficient transfer capacity and generation to supply the Bay d'Espoir-East load throughout this period.

Table 4
NLH Island Interconnected System
Bay d'Espoir East Base Case
Peak Demand – Supply Analysis - MW
2018 - 2027

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Avalon Peninsula	924.5	931.8	938.5	949.7	964.9	974.0	985.3	996.7	1004.9	1016.2
CBC	31.0	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Sunnyside	110.2	111.3	112.2	113.7	115.8	117.0	118.5	120.1	121.2	122.7
Total load East of BDE	1034.7	1043.1	1050.7	1063.4	1080.7	1091.0	1103.9	1116.8	1126.1	1138.9
Avalon Gen										
HVdc	830.0	830.0	830.0	830.0	830.0	830.0	830.0	830.0	830.0	830.0
Paradise River	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Required flow from BDE	196.7	205.1	212.7	225.4	242.7	253.0	265.9	278.8	288.1	300.9
Avalon Standby Gen										
Hardwoods	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Holyrood CT	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
NP CTs	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Total standby	200	200	200	200	200	200	200	200	200	200

Notes:
Analysis is for NLH System
NLH Standby includes Hardwoods (50 MW), Stephenville (50 MW), New Holyrood Combustion turbine (120 MW), Hawke's Bay (5.0 MW)and St. Anthony (9.7 MW) diesel plants
NP Standby includes Greenhill, Wesleyville and Grand Bay Combustion turbines and portable diesels
System Peak taken from 2013 PLF dated June 19, 2013
Holyrood units (while available for 2018 to 2020 period) have not been included in the reserve analysis

Table 5 provides the demand/supply analysis for the system east of Bay d'Espoir assuming that the Labrador-Island Link is operating in continuous monopolar mode.

The results indicate required flows from Bay d'Espoir and west generation well below the thermal limits of the 230 kV corridor between Bay d'Espoir and the Avalon Peninsula.

Table 5
NLH Island Interconnected System
Bay d'Espoir East Labrador-Island Link in Monopolar
Peak Demand – Supply Analysis - MW
2018 - 2027

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Avalon Peninsula	924.5	931.8	938.5	949.7	964.9	974.0	985.3	996.7	1004.9	1016.2
CBC	31.0	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Sunnyside	110.2	111.3	112.2	113.7	115.8	117.0	118.5	120.1	121.2	122.7
Total load East of BDE	1034.7	1043.1	1050.7	1063.4	1080.7	1091.0	1103.9	1116.8	1126.1	1138.9
Avalon Gen										
HVdc	552.0	552.0	552.0	552.0	552.0	552.0	552.0	552.0	552.0	552.0
Paradise River	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Subtotal	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0
Avalon Standby Gen										
Hardwoods	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Holyrood CT	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
NP CTs	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Total standby	200	200	200	200	200	200	200	200	200	200
Total Gen	760.0	760.0	760.0	760.0	760.0	760.0	760.0	760.0	760.0	760.0
Required flow from BDE	274.7	283.1	290.7	303.4	320.7	331.0	343.9	356.8	366.1	378.9

Notes:
Analysis is for NLH System
NLH Standby includes Hardwoods (50 MW), Stephenville (50 MW), New Holyrood Combustion turbine (120 MW), Hawke's Bay (5.0 MW)and St. Anthony (9.7 MW) diesel plants
NP Standby includes Greenhill, Wesleyville and Grand Bay Combustion turbines and portable diesels
System Peak taken from 2013 PLF dated June 19, 2013
Holyrood units (while available for 2018 to 2020 period) have not been included in the reserve analysis

For loss of a single 230 kV transmission line between Bay d'Espoir and Sunnyside (i.e., TL202 or TL206), the transfer limit to the Avalon Peninsula is approximately 629 MW. This transfer limit is based upon thermal overload of the remaining circuit (TL206 or TL202) with the new Bay d'Espoir to Western Avalon line in service. Table 6 provides the demand/supply analysis of the system east of Bay d'Espoir assuming an outage to one of the three 230 kV lines east of Bay d'Espoir.

Table 6
NLH Island Interconnected System
Bay d'Espoir East TL202 Out of Service
Peak Demand – Supply Analysis - MW
2018 - 2027

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Avalon Peninsula	924.5	931.8	938.5	949.7	964.9	974.0	985.3	996.7	1004.9	1016.2
CBC	31.0	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Sunnyside	110.2	111.3	112.2	113.7	115.8	117.0	118.5	120.1	121.2	122.7
Total load East of BDE	1034.7	1043.1	1050.7	1063.4	1080.7	1091.0	1103.9	1116.8	1126.1	1138.9
Avalon Gen										
HVdc	830.0	830.0	830.0	830.0	830.0	830.0	830.0	830.0	830.0	830.0
Paradise River	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Subtotal	838.0	838.0	838.0	838.0	838.0	838.0	838.0	838.0	838.0	838.0
Avalon Standby Gen										
Hardwoods	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Holyrood CT	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
NP CTs	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Total standby	200	200	200	200	200	200	200	200	200	200
Total Gen	1038.0	1038.0	1038.0	1038.0	1038.0	1038.0	1038.0	1038.0	1038.0	1038.0
Required flow from BDE	0	5.1	12.7	25.4	42.7	53.0	65.9	78.8	88.1	100.9

Notes:
Analysis is for NLH System
NLH Standby includes Hardwoods (50 MW), Stephenville (50 MW), New Holyrood Combustion turbine (120 MW), Hawke's Bay (5.0 MW)and St. Anthony (9.7 MW) diesel plants
NP Standby includes Greenhill, Wesleyville and Grand Bay Combustion turbines and portable diesels
System Peak taken from 2013 PLF dated June 19, 2013
Holyrood units (while available for 2018 to 2020 period) have not been included in the reserve analysis

The analysis indicates a maximum flow of 100.9 MW from Bay d'Espoir and west generation to the Avalon Peninsula for this contingency. Given a maximum transfer capacity of approximately 629 MW on the remaining two 230 kV transmission lines there is significant margin to maintain supply to the Avalon Peninsula under the single 230 kV line outage event.