Generation

Q. Reference: "2025 Capital Budget Application," Newfoundland Power Inc., June 28, 2024, Supporting Materials, Generation: 4.1, app. A, p. 3.

The CBHC Development can provide 14.5 MW of capacity during the winter. The cost of replacement capacity is dependent on the extent to which this capacity is available to meet peak load conditions.

a) Please provide the output in MW of the Cape Broyle hydroelectric generating plant and the Horse Chops hydroelectric generating plant during the hour of system peak for each year from 2014 to 2023. Please provide the results of the lifecycle cost analysis and the corresponding net economic benefit using the ten-year historical average of this data.

b) Please provide a listing of mid-winter rainfall events from 2014 to 2023 that have provided Newfoundland Power with the ability to recharge Mount Carmel Pond, increasing the available capacity assistance by an additional 3.49 GWh during the winter period.

A. a) Table 1 calculates the average plant output from both the Cape Broyle and Horse Chops plants during the annual system peak.

Table 1:
Plant Output During Annual System Peak[1]

Year	Cape Broyle Output (MW)	Horse Chops Output (MW)
2016	5.37	1.97[2]
2017	5.42	7.98
2018	5.47	0.04[3]
2019	5.27	7.45
2020	5.25	7.39
2021	5.30	5.87
2022	6.45	7.59
2023	6.35	7.84
Average	5.61	5.77

[1] Data from 2014 and 2015 was excluded from the analysis as Newfoundland Power installed its new data process information management system in 2016.
[2] In 2016, 45 minutes prior to system peak the Horse Chops plant output was 6.01 MW.
[3] In 2018, 8 hours prior to system peak the Horse Chops plant output was 6.92 MW and 8 hours after system peak was 6.26 MW.

Table 2 provides the results of the economic analysis using the average plant outputs during the annual system peak as calculated in Table 1.

Table 2:
CBHC Development Lifecycle Cost Analysis Results – Average System Peak Output

	50 Year Levelized Value	Net Benefit
Lifecycle Cost of the Development	2.65 ¢/kWh	
Cost of Replacement Production (Run-of-River)[4]	9.77 ¢/kWh	7.12 ¢/kWh
Cost of Replacement Production (Fully Dispatchable)	8.65 ¢/kWh	6.00 ¢/kWh

b) Newfoundland Power does not currently have meteorological measurement stations in the Cape Broyle – Horse Chops watershed area, nor does it have water level monitoring equipment at Mount Carmel Pond. In light of not having specific watershed meteorological data, Table 3 provides winter rainfall accumulations measured at the St. John's International Airport.[5]

Table 3:
Winter Rainfall Accumulations (mm)

Year	January	February	March	December	Total
2014	123.0	22.8	45.8	110.4	302.0
2015	100.6	66.9	56.2	29.3	253.0
2016	51.6	56.5	61.3	117.0	286.4
2017	74.5	41.2	76.8	148.2	340.7
2018	52.2	51.0	65.2	40.8	209.2
2019	116.0	40.2	63.0	71.4	290.6
2020	26.8	38.3	86.8	103.4	255.3
2021	65.6	32.2	45.6	100.9	244.3
2022	218.0	127.9	56.0	116.5	518.4
2023	136.7	47.2	19.6	29.4	232.9
Average	96.5	52.4	57.6	86.7	293.3

[4] 'Cost of Replacement Production' – 'Lifecycle Cost of the Development' = 'Net Benefit'
[5] For marginal cost analysis, winter is defined as December through March annually.

The Cape Broyle and Horse Chops generation plants have a plant output of 5.30 MW and 7.52 MW, respectively, at best efficiency. Based on plant efficiency testing, the flow of water required to generate these outputs is 11.46 m^3/s at Cape Broyle and 10.05 m^3/s at Horse Chops. For this analysis, a flowrate of 10.05 m^3/s was chosen as the limiting output of the Mount Carmel reservoir and the Cape Broyle output was reduced to 4.65 MW to account for the lower flowrate. The total efficient output of the Cape Broyle – Horse Chops development is set at 12.17 MW for this analysis. Based on the requirement of 10.05 m^3/s to produce 12.17 MW, 1 MWh can be calculated as requiring 2,973 m^3 of water.[6]

The watershed area upstream of the Mount Carmel Dam is 155,700,000 m^2. Assuming a watershed loss of 25% during the winter season[7], the total volume of water flowing into Mount Carmel Pond for every 1 mm of rainfall during the winter results in 116,775 m^3 of water.[8] Each 1 mm rainfall event will result in 39.3 MWhs of generation potential.[9]

Using the above analysis, 3.49 GWhs of storage will require 88.8 mm of rain.[10] Since the average winter rain accumulation calculated in Table 3 is 293.3 mm annually, it is reasonable to assume a mid-winter recharge of 3.49 GWhs into the Mount Carmel Pond reservoir is likely.

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6 (10.05 m^3/s * 3,600) / 12.17 MW = 2,973 m^3 per MWh.

7 Watershed losses occur from infiltration, evaporation and interception, all of which are low in the winter season.

8 (155,700,000 m^2 * 0.001 m) * 0.75 = 116,775 m^3.

9 116,775 m^3 / 2,973 m^3 per MWh = 39.3 MWhs

10 3,490 MWh / 39.3 MWh/mm = 88.8 mm