

- 1 **Q. (Reference PUB-NP-007) The NPV analyses in Table 1 and Table 2 of**
 2 **Attachment A imply that the cumulative NPVs of the two alternatives for street**
 3 **lighting replacement become equal sometime in 2041.**
- 4 **a) Please confirm that from 2041 to 2055, the avoided electricity costs used**
 5 **in those analyses are based on the 2040 value of marginal costs from**
 6 **the Marginal Cost Study Update-2021 escalated by the Conference**
 7 **Board of Canada forecast of the GDP deflator.**
- 8 **b) What evidence does NP possess to support the conjecture that marginal**
 9 **cost after 2041 to 2055 will increase at the same rate as the GDP deflator**
 10 **forecast?**
- 11 **c) For the years 2023 to 2040 inclusive, please provide a table containing**
 12 **the annual values of CBOC's GDP deflator forecasts and the estimated**
 13 **marginal cost of energy and of transmission/capacity from the Marginal**
 14 **Cost Study Update-2021. Also include in that table, the annual**
 15 **percentage change in the forecast GDP deflator and each of the two**
 16 **marginal costs. Based on those figures please provide the correlation**
 17 **coefficient between the annual percentage changes in the forecast GDP**
 18 **deflator and the annual percentage changes in each marginal cost.**
- 19 **d) Did NP consider the potential impact that the end of the Churchill Falls**
 20 **contract in 2041 could have on marginal costs and therefore on avoided**
 21 **electricity costs in that year and to 2055? Did NP consider any other**
 22 **alternative way to develop forecasts of avoided cost beyond 2040 other**
 23 **than using the percentage increases in the forecasts of the GDP deflator?**
- 24 **e) In PU-36 (1998-1999) the GDP deflator was authorized for forecasting.**
 25 **Please provide any further studies that were undertaken in reference to**
 26 **this GDP deflator.**
- 27
- 28 **A. a) It is confirmed.**
- 29
- 30 **b) Newfoundland Power completed its net present value ("NPV") analysis for the**
 31 **LED Street Lighting Replacement Plan (the "Plan") based on nominal dollar cash**
 32 **flows. The analysis requires cost projections to include the effects of inflation**
 33 **over time. In the absence of long-term marginal cost projections, the Gross**
 34 **Domestic Product ("GDP") deflator, a general inflationary index, was used for the**
 35 **escalation of marginal costs beyond 2040.**
- 36
- 37 To address the marginal cost uncertainty beyond 2040, Newfoundland Power
 38 completed a sensitivity analysis on the marginal cost estimate beyond 2041.
 39 This sensitivity analysis assumes the marginal costs beyond 2041 are zero.

1 Table 1 provides a summary of the sensitivity analysis.

Table 1 NPV Result (2023-2055) (\$000s)							
	Capital Expenditures	Retirement	Taxes and Net Salvage	Maintenance Costs	Avoided Electricity Costs	Total Cost	NPV
Alternative 1 End of Life HPS Fixture	\$26,027	\$8,458	\$6,932	\$29,265	-\$6,733	\$63,950	\$29,973
Alternative 2 Replacement Program	\$26,430	\$7,720	\$6,864	\$17,875	-\$20,459	\$38,430	\$26,652
Difference	\$403	-\$738	-\$68	-\$11,390	-\$13,726	-\$25,520	-\$3,321

2 The sensitivity analysis confirmed that continued implementation of the Plan,
3 shown as Alternative 2, is the least cost option for customers even if the
4 marginal cost of electricity is zero beyond 2041. Continued Plan implementation
5 will reduce overall costs to customers by approximately \$25.5 million, or
6 approximately \$3.3 million on an NPV basis.

7
8 See Attachment A to this response for the detailed results of the sensitivity
9 analysis.¹

10
11 c) See Attachment B for the requested analysis.

12
13 d) The expiration of the current Churchill Falls contract in 2041 is approximately
14 19 years away. The outcome of future Churchill Falls contract negotiations and
15 the impact on marginal costs on the Island Interconnected System will not be
16 known for some time.

17
18 In preparation for the eventual expiration of the current Churchill Falls contract,
19 the Government of Newfoundland and Labrador has established an expert panel
20 to provide strategic advice aimed at maximizing the value of Churchill Falls assets
21 and other potential generation sites on the Churchill River. Whether the advice
22 of the panel will address marginal costs on the Island Interconnected System

¹ The sensitivity analysis was applied to the updated economic analysis provided in the response to Request for Information PUB-NP-007 (1st Revision).

beyond 2041 is uncertain.²

If electricity from Churchill Falls was eventually made available to the Island Interconnected System upon the expiry of the current Churchill Falls contract, additional transmission infrastructure would be required.³ Recent experience with the construction of the Labrador Island Link (“LIL”) transmission line from the Muskrat Falls Project to the Avalon Peninsula has shown that such transmission infrastructure is expensive. For example, the cost to construct the LIL, not including financing costs, is estimated to be \$3.7 billion.⁴

Newfoundland and Labrador Hydro’s (“Hydro”) marginal capacity costs on the Island Interconnected System reflect the cost of capacity additions on the island.⁵ The Churchill Falls hydroelectric generating facility is located in Labrador.⁶ As a result, the appropriateness of using Churchill Falls capacity as a reliable source of supply for the Island Interconnected System in the future is questionable.

As discussed in part b), a sensitivity analysis considered the alternative of marginal costs being reduced to zero beyond 2041. The sensitivity analysis confirmed that continued implementation of the Plan would be least cost for customers under such a scenario.

Overall, continuation of the Plan would provide customers with lower street and area lighting rates, fewer street lighting outages and better lighting quality. It would also provide system benefits by lowering system capacity requirements on the Island Interconnected System and increasing the amount of energy available for Hydro to export. A decision to stop implementation of the Plan in 2023 would be detrimental to customers and inconsistent with Canadian utility practice.⁷

- e) The use of the GDP Deflator as an appropriate inflation index to forecast non-labour expenses was supported by all parties represented in Newfoundland Power’s *1996 General Rate Application*. Newfoundland Power has not completed any further studies on this matter since use of the GDP Deflator was ordered by the Board in Order No. P.U. 36 (1998-1999).

² See Government of Newfoundland and Labrador News Release: *Expert Panel on Churchill Falls 2041 Announced; Premier Furey and Minister Parsons Available to the Media*, May 11, 2022. Based on the referenced correspondence, advice from the Panel is expected in 2022. If and when such advice will be made public and whether such advice will provide clarity on marginal energy costs beyond 2041 is uncertain.

³ See *Commission of Inquiry Respecting the Muskrat Falls Project, Muskrat Falls: A Misguided Project, Volume 4*, page 3, which states: “The transmission facilities required to wheel the enormous amount of electricity produced at Churchill Falls on a route through Newfoundland will be expensive and building them will carry the risk of cost overruns. The subsea portion of the route will be subject to significantly higher transmission losses than the overland transmission facilities in Quebec.”

⁴ See Nalcor Energy, *Muskrat Falls Project Cost and Schedule Update*, September 28, 2020, page 10.

⁵ See Hydro’s *Reliability and Resource Adequacy Study – 2019 Update, Volume III: Long Term Resource Plan*, page 37.

⁶ The Churchill Falls hydroelectric generating facility is located approximately 1,350 kilometres from Newfoundland Power’s load centre on the Avalon Peninsula.

⁷ See Newfoundland Power’s *2021 Capital Budget Application, Volume I, LED Street Lighting Replacement Plan, Appendix A – Survey of Canadian Utility Practice*.

ATTACHMENT A:

LED Street Lighting Replacement Plan – Sensitivity Analysis (Zero Value Marginal Costs Beyond 2041)

Table 1
Net Present Value Analysis
Sensitivity Analysis (Zero Value Marginal Costs Beyond 2041)
Alternative 1: HPS End of Service Life

Year	HPS	Capital				Avoided		Net Present Value (\$)	Cumulative Present Value (\$)
	Beginning of Year	Expenditures (\$)	Retirement (\$)	Taxes and Net Salvage (\$)	Maintenance Costs (\$)	Electricity Costs (\$)	Total Cost (\$)		
2023	40,044	674,810	161,472	168,093	1,297,378	(42,566)	2,259,186	2,259,186	2,259,186
2024	38,824	681,438	168,100	170,757	1,269,638	(90,425)	2,199,508	2,078,745	4,337,932
2025	37,604	685,984	172,646	172,585	1,241,026	(103,649)	2,168,592	1,936,999	6,274,930
2026	36,384	690,787	177,449	174,515	1,212,359	(126,681)	2,128,430	1,796,746	8,071,676
2027	35,164	695,727	182,390	176,501	1,182,412	(165,289)	2,071,741	1,652,869	9,724,545
2028	33,944	700,833	187,495	178,554	1,151,012	(207,860)	2,010,033	1,515,591	11,240,135
2029	32,724	706,088	192,750	180,667	1,118,486	(259,044)	1,938,947	1,381,721	12,621,857
2030	31,504	711,413	198,075	182,807	1,084,051	(308,137)	1,868,208	1,258,217	13,880,073
2031	30,284	716,866	203,528	184,999	1,047,729	(361,847)	1,791,275	1,140,166	15,020,240
2032	29,064	722,398	209,061	187,223	1,009,774	(426,634)	1,701,822	1,023,755	16,043,994
2033	27,844	728,026	214,688	189,486	1,136,603	(342,020)	1,926,782	1,095,444	17,139,438
2034	26,624	735,045	220,416	192,048	1,097,563	(376,256)	1,868,815	1,004,152	18,143,590
2035	25,404	742,164	226,243	194,650	1,056,951	(422,790)	1,797,217	912,661	19,056,252
2036	24,184	749,427	232,215	197,310	1,014,645	(458,190)	1,735,407	832,887	19,889,139
2037	22,964	756,777	238,274	200,005	970,043	(504,305)	1,660,795	753,315	20,642,453
2038	21,744	764,253	244,459	202,751	923,879	(561,276)	1,574,067	674,776	21,317,229
2039	20,524	771,845	250,727	205,537	875,657	(604,565)	1,499,200	607,395	21,924,624
2040	19,304	779,602	257,161	208,389	825,313	(661,306)	1,409,160	539,570	22,464,195
2041	18,084	787,471	263,706	211,287	773,241	(709,746)	1,325,959	479,837	22,944,031
2042	16,864	795,464	270,377	214,234	719,133	0	1,999,208	683,750	23,627,781
2043	15,644	803,582	277,171	217,231	859,808	0	2,157,793	697,469	24,325,250
2044	14,424	815,643	284,099	221,048	804,774	0	2,125,565	649,329	24,974,579
2045	13,204	827,825	291,148	224,914	747,602	0	2,091,488	603,840	25,578,419
2046	11,984	840,162	298,351	228,841	687,984	0	2,055,338	560,823	26,139,242
2047	10,764	852,657	305,713	232,832	626,567	0	2,017,768	520,342	26,659,584
2048	9,544	865,313	313,235	236,888	562,948	0	1,978,384	482,175	27,141,759
2049	8,324	878,133	320,923	241,010	496,703	0	1,936,769	446,116	27,587,874
2050	7,104	891,122	328,778	245,200	442,047	0	1,907,147	415,173	28,003,048
2051	5,884	904,282	336,804	249,458	449,301	0	1,939,846	399,106	28,402,154
2052	4,664	917,617	345,006	253,787	456,674	0	1,973,084	383,656	28,785,810
2053	3,444	931,130	353,386	258,188	696,253	0	2,238,956	411,451	29,197,261
2054	2,224	944,825	361,948	262,661	707,678	0	2,277,113	395,488	29,592,748
2055	1,004	958,707	370,696	267,210	719,292	0	2,315,904	380,141	29,972,889

Table 2
Net Present Value Analysis
Sensitivity Analysis (Zero Value Marginal Costs Beyond 2041)
Alternative 2: LED Replacement Program

Year	HPS Beginning of Year	Capital Expenditures (\$)	Retirement (\$)	Taxes and Net Salvage (\$)	Maintenance Costs (\$)	Avoided Electricity Costs (\$)	Total Cost (\$)	Net Present Value (\$)	Cumulative Present Value (\$)
2023	40,044	5,453,000	1,325,000	1,362,378	0	(349,469)	7,790,908	7,790,908	7,790,908
2024	30,033	5,507,387	1,379,387	1,384,242	0	(742,388)	7,528,627	7,115,273	14,906,181
2025	20,022	5,544,690	1,416,690	1,399,237	0	(850,956)	7,509,661	6,707,672	21,613,853
2026	10,011	5,584,101	1,456,101	1,415,081	0	(1,040,046)	7,415,236	6,259,682	27,873,535
2027	0	57,563	57,563	23,140	0	(1,085,615)	(947,348)	(755,810)	27,117,725
2028	0	58,611	58,611	23,562	0	(1,137,684)	(996,901)	(751,676)	26,366,049
2029	0	59,685	59,685	23,993	0	(1,215,281)	(1,071,917)	(763,863)	25,602,186
2030	0	60,761	60,761	24,426	0	(1,264,899)	(1,118,951)	(753,601)	24,848,585
2031	0	61,855	61,855	24,866	0	(1,320,334)	(1,171,757)	(745,836)	24,102,748
2032	0	62,954	62,954	25,308	0	(1,401,062)	(1,249,846)	(751,862)	23,350,886
2033	0	64,061	64,061	25,752	1,353,656	(1,021,082)	486,449	276,563	23,627,449
2034	0	75,774	65,177	28,331	1,377,249	(1,029,683)	516,848	277,713	23,905,162
2035	0	87,497	66,303	30,914	1,401,040	(1,068,028)	517,726	262,911	24,168,073
2036	0	99,241	67,451	33,505	1,425,295	(1,074,778)	550,714	264,308	24,432,382
2037	0	110,990	68,604	36,098	0	(1,104,086)	(888,394)	(402,964)	24,029,418
2038	0	112,159	69,773	36,568	0	(1,152,013)	(933,513)	(400,181)	23,629,237
2039	0	113,592	70,945	37,092	0	(1,167,872)	(946,244)	(383,367)	23,245,869
2040	0	115,052	72,143	37,626	0	(1,206,511)	(981,690)	(375,891)	22,869,978
2041	0	116,522	73,353	38,165	0	(1,226,735)	(998,696)	(361,407)	22,508,571
2042	0	118,006	74,576	38,709	0	0	231,291	79,104	22,587,675
2043	0	119,243	75,813	39,206	1,601,991	0	1,836,253	593,537	23,181,212
2044	0	151,761	77,066	45,994	1,628,462	0	1,903,283	581,425	23,762,637
2045	0	184,290	78,331	52,787	1,655,185	0	1,970,593	568,936	24,331,573
2046	0	216,841	79,616	59,588	1,682,347	0	2,038,392	556,199	24,887,772
2047	0	249,412	80,923	66,397	0	0	396,732	102,309	24,990,081
2048	0	250,740	82,250	66,931	0	0	399,922	97,470	25,087,551
2049	0	252,090	83,600	67,474	0	0	403,164	92,865	25,180,416
2050	0	253,462	84,972	68,025	0	0	406,459	88,483	25,268,899
2051	0	254,856	86,366	68,586	0	0	409,809	84,314	25,353,213
2052	0	256,274	87,784	69,156	0	0	413,213	80,347	25,433,561
2053	0	257,714	89,224	69,735	1,885,378	0	2,302,051	423,046	25,856,606
2054	0	259,178	90,689	70,323	1,916,318	0	2,336,508	405,803	26,262,410
2055	0	260,666	92,177	70,921	1,947,765	0	2,371,529	389,271	26,651,681

**Economic Evaluation
Major Inputs and Assumptions**

- Capital Expenditures:** Capital expenditures include all equipment and installation costs. This includes capital expenditures associated with a 1% annual failure rate of LED fixtures.
- Retirement Costs:** Labour costs associated with fixture replacement are charged 50% to retirement and 50% to capital in accordance with the Company's Capitalization Policy.
- Taxes and Net Salvage:** Income tax and net salvage costs are associated with financing and the eventual retirement of street light assets. Net Salvage costs are as detailed in the Company's 2019 Depreciation Study.
- Maintenance Costs:** Maintenance costs for each alternative were estimated on a per-fixture basis, as described in Section 1.3 of the Plan – Appendix B.
- Avoided Electricity Costs:** Avoided electricity cost for 2023-2040 are based the marginal cost projections provided by Hydro in the summary report *Marginal Cost Study Update – 2021* dated March 7, 2022. Beyond 2041, marginal cost projections are assumed to be zero.
- Discount Rate:** A discount rate of 5.81% is used based upon a 3.608% cost of debt, an 8.50% cost of equity, and the Company's existing capital structure of 55% debt and 45% equity.
- Net Present Value:** The calculated net present value of each alternative is shown in 2023 dollars for the period 2023 to 2055, the year in which all HPS street lights would have reached the end of their service life and have been removed from service.
- Escalation Factors:** Operating costs are escalated based on the Conference Board of Canada GDP Deflator, long term forecast dated January 22, 2022.
- Cumulative NPV:** The cumulative net present value for the particular year is the sum of the present value for the year and the preceding years in 2023 dollars.
- Supporting Documents:** Newfoundland and Labrador Hydro's *Marginal Cost Study Update - 2021 Summary Report*, March 7, 2022, Appendix A, filed in the response to Request for Information TC-IC-NLH-001, Attachment 1, *Electrification, Conservation and Demand Management Plan: 2021-2025*.



ATTACHMENT B:

Marginal Costs and GDP Deflator

NLH Marginal Costs Estimates¹
Delivered from Bulk Transmission System

Year	Energy Supply Costs			Generation and Transmission Capacity Costs			Annual %	GDP Deflator ⁴ Index to 2007 Index to 2023
	On-Peak ³ \$/MWh	Winter ² Off-Peak \$/MWh	Non-Winter All hours \$/MWh	On-Peak \$/MWh	Winter Off-Peak \$/MWh	Non-Winter All hours \$/MWh		
2023	62.65	49.37	16.69	167.76	64.70	2.76	338.53	1.2125
2024	60.96	49.30	15.75	184.20	71.13	3.05	371.96	1.2324
2025	55.59	46.74	15.29	126.94	48.61	2.01	255.14	1.2534
2026	51.62	43.91	15.28	113.04	43.11	1.75	226.71	1.2757
2027	50.99	43.13	15.58	120.97	46.20	1.89	242.79	1.2986
2028	49.83	43.06	16.06	129.51	49.53	2.04	260.14	1.3223
2029	52.06	44.84	18.04	138.73	53.12	2.20	278.85	1.3465
2030	51.55	45.13	17.02	148.34	56.87	2.36	298.35	1.3708
2031	47.05	40.47	16.33	162.32	62.33	2.61	326.75	1.3955
2032	45.05	39.51	15.80	177.76	68.36	2.88	358.14	1.4202
2033	45.60	39.01	14.64	113.60	43.12	1.71	227.22	1.4452
2034	40.51	36.38	13.30	119.30	45.32	1.81	238.75	1.4704
2035	41.40	35.70	13.77	125.31	47.65	1.91	250.91	1.4958
2036	35.58	32.16	12.21	131.65	50.11	2.02	263.74	1.5217
2037	36.25	31.30	10.99	138.35	52.70	2.13	277.28	1.5477
2038	36.38	33.77	11.51	144.34	55.02	2.23	289.40	1.5741
2039	34.41	30.62	10.34	150.61	57.45	2.33	302.07	1.6005
2040	33.27	32.07	9.81	157.17	59.99	2.44	315.34	1.6276
Correlation Coefficient ⁵	(0.97)	(0.96)	(0.85)	(0.06)	(0.08)	(0.16)	(0.07)	1.00

Notes:

- Based on Hydro's Marginal Cost Update - 2021, dated March 7, 2022.
- Winter Season defined as December through March.
- On-peak Hours 7:00 a.m. to 10:00 p.m., Monday to Friday Excluding Holidays.
- Conference Board of Canada Provincial Forecast: Winter Outlook (Medium Term) Jan-22 (Average Aggregation) Implicit Price Deflator: G.D.P. at Market Price (Index, 2007 = 1.00)
- Correlation Coefficient between 2023-2040 marginal cost estimates and GDP deflator.