Q. **With reference to Technical Workshop presentation slide 8 (pdf page 8 of 37)**

Please provide all backup data to derive the table from slide 8 of the Technical Workshop presentation, including

(a) Number of vehicles, by type, by year

(b) All marginal costs unit values, by year, and consumption by vehicle type, by year.

(c) All utility revenue numbers, including unit costs and volume, by year.

(d) Any other inputs required, e.g., program and incentive costs (by unit, and total).

(e) Any other data required to derive the noted lines.

In preparing the above, please provide a detailed description of the impact of load management systems, and the amount of peak that is required to be displaced by these systems to derive the noted capacity benefits.

A. Please refer to TC-IC-NLH-008, Attachment 1 for the data used to create the table from slide 8 of the Technical Workshop presentation.

The table from slide 8 of the Technical Workshop presentation includes a peak demand increase of 42 MW, which is associated with electric vehicle ("EV") charging in 2034, coupled with load management. With load management, 85% of peak demand impacts associated with unmanaged EV charging are estimated to be shifted to off-peak hours.[1]

[1] "Application for Approvals Required to Execute Programming Identified in the Electrification, Conservation and Demand Management Plan 2021–2025," Newfoundland and Labrador Hydro, rev. July 8, 2021 (originally filed June 16, 2021), sch. 3, sch. C, p. 150 of 325.

**Units by Vehicle Category**[1]

| Vehicle Type | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential BEV[2] | 33 | 213 | 649 | 1,498 | 2,832 | 6,674 | 11,947 | 18,426 | 25,704 | 33,774 | 42,523 | 51,824 | 61,413 | 71,411 |
| Residential PHEV[3] | 44 | 195 | 481 | 895 | 1,521 | 2,815 | 4,433 | 6,339 | 8,432 | 10,704 | 13,126 | 15,553 | 17,969 | 22,051 |
| Commercial BEV | 4 | 24 | 66 | 160 | 329 | 752 | 1,423 | 2,352 | 3,488 | 4,904 | 6,429 | 8,111 | 9,928 | 11,763 |
| Commercial PHEV | 10 | 61 | 164 | 387 | 755 | 1,487 | 2,623 | 4,174 | 6,075 | 8,400 | 11,128 | 14,185 | 17,626 | 21,218 |
| MDV[4] | 2 | 4 | 8 | 13 | 93 | 209 | 370 | 583 | 855 | 1,193 | 1,602 | 2,077 | 2,652 | 3,301 |
| HDV[5] | 0 | 0 | 0 | 0 | 3 | 9 | 19 | 33 | 52 | 81 | 119 | 167 | 225 | 292 |
| Bus | 0 | 1 | 2 | 4 | 13 | 24 | 38 | 56 | 78 | 104 | 134 | 168 | 207 | 249 |
| **Total** | **93** | **498** | **1,370** | **2,957** | **5,546** | **11,970** | **20,853** | **31,963** | **44,684** | **59,160** | **75,061** | **92,085** | **110,020** | **130,285** |

[1] The table uses vehicle unit numbers from Newfoundland Power Inc., which were used in the net present value analysis.

[2] Battery Electric Vehicle ("BEV").

[3] Plug-In Hybrid Electric Vehicle ("PHEV").

[4] Medium-Duty Vehicle ("MDV").

[5] Heavy-Duty Vehicle ("HDV").

**Marginal System Costs**

| Year | Winter On-Peak Energy ($/MWh) | Winter Off-Peak Energy ($/MWh) | Non-Winter Energy ($/MWh) | Capacity ($/kW) |
|---|---|---|---|---|
| 2021 | 78.35 | 63.81 | 27.24 | 326.26 |
| 2022 | 78.62 | 64.21 | 28.60 | 333.46 |
| 2023 | 69.62 | 56.27 | 25.59 | 340.90 |
| 2024 | 68.46 | 56.27 | 26.80 | 349.56 |
| 2025 | 67.00 | 56.00 | 28.76 | 357.53 |
| 2026 | 74.12 | 63.36 | 29.42 | 364.18 |
| 2027 | 76.59 | 66.02 | 30.40 | 371.67 |
| 2028 | 79.35 | 69.28 | 33.74 | 380.44 |
| 2029 | 83.28 | 71.82 | 39.41 | 390.08 |
| 2030 | 84.95 | 73.26 | 40.20 | 397.87 |
| 2031 | 86.65 | 74.72 | 41.01 | 405.82 |
| 2032 | 88.38 | 76.22 | 41.83 | 413.94 |
| 2033 | 90.15 | 77.74 | 42.66 | 422.21 |
| 2034 | 91.95 | 79.30 | 43.52 | 430.64 |

**Annual Impact to Electrical System by Vehicle**

| Vehicle Type | kWh | kW |
|---|---|---|
| Residential BEV[1] | 4,500 | 0.225 |
| Residential PHEV[2] | 2,300 | 0.225 |
| Commercial BEV | 6,700 | 0.420 |
| Commercial PHEV | 3,350 | 0.420 |
| MDV[3] | 22,500 | 1.199 |
| HDV[4] | 162,500 | 8.995 |
| Bus | 81,000 | 2.998 |

[1] Battery Electric Vehicle ("BEV").

[2] Plug-In Hybrid Electric Vehicle ("PHEV").

[3] Medium-Duty Vehicle ("MDV").

[4] Heavy-Duty Vehicle ("HDV").

**Electricity Consumption by Vehicle Category (MWh)[1]**

| Vehicle Category | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential BEV[2] | 149 | 959 | 2,921 | 6,741 | 12,744 | 30,033 | 53,762 | 82,917 | 115,668 | 151,983 | 191,354 | 233,208 | 276,359 | 321,350 |
| Residential PHEV[3] | 101 | 449 | 1,106 | 2,059 | 3,498 | 6,475 | 10,196 | 14,580 | 19,394 | 24,619 | 30,190 | 35,772 | 41,329 | 50,717 |
| Commercial BEV | 27 | 161 | 442 | 1,072 | 2,204 | 5,038 | 9,534 | 15,758 | 23,370 | 32,857 | 43,074 | 54,344 | 66,518 | 78,812 |
| Commercial PHEV | 34 | 204 | 549 | 1,296 | 2,529 | 4,981 | 8,787 | 13,983 | 20,351 | 28,140 | 37,279 | 47,520 | 59,047 | 71,080 |
| MDV[4] | 45 | 90 | 180 | 293 | 2,093 | 4,703 | 8,325 | 13,118 | 19,238 | 26,843 | 36,045 | 46,733 | 59,670 | 74,273 |
| HDV[5] | 0 | 0 | 0 | 0 | 488 | 1,463 | 3,088 | 5,363 | 8,450 | 13,163 | 19,338 | 27,138 | 36,563 | 47,450 |
| Bus | 0 | 81 | 162 | 324 | 1,053 | 1,944 | 3,078 | 4,536 | 6,318 | 8,424 | 10,854 | 13,608 | 16,767 | 20,169 |
| **Total** | **355** | **1,943** | **5,360** | **11,784** | **24,609** | **54,636** | **96,769** | **150,254** | **212,788** | **286,028** | **368,133** | **458,321** | **556,251** | **663,851** |

[1] Numbers may not add due to rounding.

[2] Battery Electric Vehicle ("BEV").

[3] Plug-In Hybrid Electric Vehicle ("PHEV").

[4] Medium-Duty Vehicle ("MDV").

[5] Heavy-Duty Vehicle ("HDV").

**System Demand Impact by Vehicle Category (kW)[1]**

| Vehicle Category | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential BEV[2] | 7 | 48 | 146 | 337 | 637 | 1,502 | 2,688 | 4,146 | 5,783 | 7,599 | 9,568 | 11,660 | 13,818 | 16,067 |
| Residential PHEV[3] | 10 | 44 | 108 | 201 | 342 | 633 | 997 | 1,426 | 1,897 | 2,408 | 2,953 | 3,499 | 4,043 | 4,961 |
| Commercial BEV | 2 | 10 | 28 | 67 | 138 | 316 | 598 | 988 | 1,465 | 2,060 | 2,700 | 3,407 | 4,170 | 4,940 |
| Commercial PHEV | 4 | 26 | 69 | 163 | 317 | 625 | 1,102 | 1,753 | 2,552 | 3,528 | 4,674 | 5,958 | 7,403 | 8,912 |
| MDV[4] | 2 | 5 | 10 | 16 | 112 | 251 | 444 | 699 | 1,025 | 1,430 | 1,921 | 2,490 | 3,180 | 3,958 |
| HDV[5] | 0 | 0 | 0 | 0 | 27 | 81 | 171 | 297 | 468 | 729 | 1,070 | 1,502 | 2,024 | 2,627 |
| Bus | 0 | 3 | 6 | 12 | 39 | 72 | 114 | 168 | 234 | 312 | 402 | 504 | 621 | 747 |
| **Total** | **26** | **135** | **366** | **796** | **1,612** | **3,479** | **6,113** | **9,477** | **13,424** | **18,066** | **23,288** | **29,020** | **35,258** | **42,212** |

[1] Numbers may not add due to rounding.

[2] Battery Electric Vehicle ("BEV").

[3] Plug-In Hybrid Electric Vehicle ("PHEV").

[4] Medium-Duty Vehicle ("MDV").

[5] Heavy-Duty Vehicle ("HDV").

**Program Costs - Electric Vehicles ($)**

| Year | Capital | Admin[1] | Incentives | Total |
|---|---|---|---|---|
| 2021 | 1,538,318 | 1,168,940 | 166,610 | **2,873,868** |
| 2022 | 1,529,602 | 2,192,002 | 821,710 | **4,543,314** |
| 2023 | 460,139 | 2,124,842 | 1,816,475 | **4,401,456** |
| 2024 | 460,417 | 2,478,146 | 2,015,592 | **4,954,155** |
| 2025 | 310,703 | 1,198,216 | 3,187,280 | **4,696,199** |
| 2026 | - | 1,074,265 | - | **1,074,265** |
| 2027 | - | 1,706,223 | - | **1,706,223** |
| 2028 | - | 2,363,998 | - | **2,363,998** |
| 2029 | - | 2,980,070 | - | **2,980,070** |
| 2030 | - | 3,651,420 | - | **3,651,420** |
| 2031 | - | 4,333,560 | - | **4,333,560** |
| 2032 | - | 5,060,808 | - | **5,060,808** |
| 2033 | - | 5,787,603 | - | **5,787,603** |
| 2034 | - | 6,613,038 | - | **6,613,038** |

[1] Admin costs beyond 2025 are for the delivery of EV load management programs.

## Utility Revenue from Electric Vehicle Adoption ($)[1,2]

| Year | Energy Revenue | Demand Revenue | Total Revenue |
|---|---|---|---|
| 2021 | 45,719 | 2,798 | **48,517** |
| 2022 | 266,429 | 16,954 | **283,383** |
| 2023 | 731,314 | 40,422 | **771,736** |
| 2024 | 1,593,607 | 82,269 | **1,675,876** |
| 2025 | 3,217,108 | 197,214 | **3,414,323** |
| 2026 | 7,017,525 | 381,826 | **7,399,351** |
| 2027 | 12,475,432 | 666,345 | **13,141,776** |
| 2028 | 19,545,478 | 1,058,261 | **20,603,739** |
| 2029 | 28,018,693 | 1,564,691 | **29,583,384** |
| 2030 | 38,147,266 | 2,225,537 | **40,372,803** |
| 2031 | 49,800,438 | 3,024,697 | **52,825,136** |
| 2032 | 63,054,682 | 3,995,341 | **67,050,023** |
| 2033 | 77,800,436 | 5,147,965 | **82,948,401** |
| 2034 | 94,562,450 | 6,438,816 | **101,001,266** |

[1] Electric vehicle adoption as a result of programs and initiatives proposed in the Electrification, Conservation and Demand Management Plan 2021–2025 developed in partnership by Newfoundland and Labrador Hydro and Newfoundland Power Inc.

[2] Numbers may not add due to rounding.