# Richmond Electric Vehicle Charging Station
# 2022 Annual Report to the Select Board

March 6, 2023

Reporting period: 2022 calendar year

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# Background

Richmond, Vermont, installed an electric vehicle (EV) charging station in November, 2020, at the Town Center parking lot. The Town received a grant of $21,897 from the State Electric Vehicle Supply Equipment Grant program, which covered about 90% of the total project cost.

Per the grant agreement, the Town must provide usage data to the Department of Public Service, annually for five years. The first Usage Data report was provided to the State on February 28.

The charging station is a ChargePoint CT4020-HD-GW, a level-2 (220V) charger with 2 charging heads. The station is web-enabled to handle payments and track activity. Drivers can locate the charging station on various widely-used mobile apps and web sites. ChargePoint usage reports provided the data for this Annual Report.

# Usage Data

This report covers the 2022 calendar year, the second year of operation.

Key metrics:

| Metric | 2022 | Change from 2021 |
|---|---|---|
| Charging Sessions | 621 | ↑ 67% |
| Average Session Length | 1.8 hours | ↓ 20% |
| Days when both chargers were occupied for some part of the day (users would have to wait to charge up) | 90 days (25% of days) | ↑ from 30 days |
| Days when the chargers were not used | 72 days (20% of days) | ↓ from 171 days |
| Electric Energy Charged | 4,349 kWh | ↑ 14% |
| Gasoline Saved | 539 gallons | ↑ 14% |
| Fuel cost savings to users (gas cost minus electricity cost) | $1,364 | ↑ 207% |
| Equivalent gasoline saved (adjusted for CO2-equivalent of electric energy used) | 429 gallons | ↑ 14% |
| CO2e savings | 3,645 kg (8,036 lb) | ↑ 14% |

Key observations:

- The number of charging sessions month-to-month has trended upward in 2021 and the first half of 2022, but may have plateaued.
- Fuel cost savings to users were considerably higher in 2022 than in 2021, due to high gas prices in 2022.
- There were 90 days when both chargers were in use at some point, but it's difficult to estimate how many times users actually had to wait for a charger, or decided to leave without charging. The frequency probably doesn't warrant consideration of adding additional chargers at this time. However, that would be a concern if the Police Department or other nearby offices were to start using the charger on a regular basis.

The following tables provide usage data for the second year of operation.

## 2022 Monthly Usage and Savings Data

| | Sessions | | kWh Charged | | | Gasoline Saved | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Source:** | ChargePt | ChargePt | ChargePt | ChargePt | Calc | Calc [1] | Calc [2] | [3] | Calc |
| **Month** | **Charging Sessions** | **Unique Drivers** | **kWh Charged** | **kWh Charge Rate** | **kWh Total Cost** | **Estimated Driving Miles** | **Equivalent Gallons of Gas** | **Gasoline $/gal** | **Equivalent Gas Cost** |
| Jan | 49 | 24 | 358.3 | $0.19 | $68 | 1,111 | 44 | $3.36 | $149 |
| Feb | 40 | 24 | 215.0 | $0.19 | $41 | 667 | 27 | $3.55 | $95 |
| Mar | 54 | 30 | 251.1 | $0.19 | $48 | 778 | 31 | $4.26 | $133 |
| Apr | 36 | 20 | 269.4 | $0.19 | $51 | 835 | 33 | $4.05 | $135 |
| May | 49 | 33 | 305.2 | $0.19 | $58 | 946 | 38 | $4.35 | $165 |
| June | 63 | 39 | 437.0 | $0.19 | $83 | 1,355 | 54 | $5.05 | $274 |
| July | 70 | 49 | 492.6 | $0.19 | $94 | 1,527 | 61 | $4.65 | $284 |
| Aug | 50 | 29 | 340.4 | $0.19 | $65 | 1,055 | 42 | $4.16 | $176 |
| Sep | 53 | 34 | 348.3 | $0.19 | $66 | 1,080 | 43 | $3.86 | $167 |
| Oct | 65 | 44 | 548.1 | $0.19 | $104 | 1,699 | 68 | $3.76 | $256 |
| Nov | 40 | 24 | 329.1 | $0.19 | $63 | 1,020 | 41 | $3.95 | $161 |
| Dec | 52 | 29 | 454.6 | $0.19 | $86 | 1,409 | 56 | $3.50 | $197 |
| **TOTAL** | **621** | | **4,349** | | **$826** | **13,482** | **539** | | **$2,191** |

| | Climate Impact | | | | Charging Port Occupation | | | Revenue |
|---|---|---|---|---|---|---|---|---|
| **Source:** | Calc [4] | Calc [5] | ChrgPt [6] | ChargePt | ChargePt | ChargePt | ChargePt | ChrgPt [7] |
| **Month** | **Equivalent Gallons Saved** | **CO2 Saved per Equiv. Gal. (kg)** | **GHG Savings (kg)** | **GHG Savings (kg/kWh)** | **Days with Max 2 Ports Occupied** | **Days with Max 1 Port Occupied** | **Days with 0 Ports Occupied** | **Gross Revenue** |
| Jan | 35.3 | 300 | 254 | 0.71 | 10 | 16 | 5 | $83.28 |
| Feb | 21.2 | 180 | 153 | 0.71 | 8 | 15 | 5 | $41.35 |
| Mar | 24.8 | 210 | 178 | 0.71 | 5 | 20 | 6 | $48.92 |
| Apr | 26.6 | 226 | 191 | 0.71 | 4 | 14 | 12 | $57.92 |
| May | 30.1 | 256 | 217 | 0.71 | 8 | 18 | 5 | $60.36 |
| June | 43.1 | 366 | 310 | 0.71 | 11 | 14 | 5 | $94.85 |
| July | 48.6 | 413 | 350 | 0.71 | 10 | 16 | 5 | $100.33 |
| Aug | 33.6 | 285 | 242 | 0.71 | 7 | 20 | 4 | $67.49 |
| Sep | 34.3 | 292 | 247 | 0.71 | 6 | 20 | 4 | $71.60 |
| Oct | 54.0 | 459 | 389 | 0.71 | 11 | 14 | 6 | $120.19 |
| Nov | 32.4 | 276 | 234 | 0.71 | 6 | 15 | 9 | $62.99 |
| Dec | 44.8 | 381 | 323 | 0.71 | 4 | 21 | 6 | $110.88 |
| **TOTAL** | **428.8** | **3,645** | **3,088** | | **90** | **203** | **72** | **$920.16** |

Usage Data Notes:

[1] Assumes 3.1 mi/kWh for EVs

[2] Assumes 25 mi/gal for gas-only vehicles

[3] GasBuddy.com, https://www.gasbuddy.com/charts

[4] Assumes 122 MPGe for EVs in Vermont based on life-cycle analysis of EV impacts for New England power sources: https://blog.ucsusa.org/dave-reichmuth/plug-in-or-gas-up-why-driving-on-electricity-is-better-than-gasoline/

[5] Assumes 8.50 kg CO2/gallon of gasoline - presumably ignores the ethanol portion of the gasoline. US EIA, accessed 18-Dec-2021: https://www.eia.gov/environment/emissions/co2_vol_mass.php

[6] GHG savings per ChargePoint report - assumptions provided in the Admin FAQ: https://na.chargepoint.com/admin_faq

[7] Gross Revenue includes users' electric and dwelling fees, from which ChargePoint takes a 10% fee

An Excel spreadsheet of usage and savings data is available at https://tinyurl.com/yadpxx8z.

The 2021 spreadsheet is available at https://tinyurl.com/2p8ssax5.

# Usage Charges and Revenue

The usage charge (the cost to users) was $0.19/kWh. The Town pays $0.16864/kWh for the electricity and ChargePoint charges a 10% fee, thus the cost to the Town is $0.1855/kWh. This was rounded to $0.19/kWh.

For the 2022 calendar year:

| | |
|---|---|
| Gross Revenue | $920.16 |
| ChargePoint Fees | $91.62 |
| Net Revenue | $828.54 |

The dwelling fee was set at $1/hour after four hours, to discourage occupying a space for more than 4 hours.

Dwelling fees collected are estimated at $94, based on gross revenues less the electric usage costs.

# Climate Impacts

EVs have much lower greenhouse gas (GHG) emissions than gas vehicles. Gas engines are very inefficient (much of the energy is lost as heat), while electric power in Vermont is relatively clean since most of it is generated from hydroelectric, nuclear, and other low-GHG sources.

ChargePoint reported GHG savings of 3,088 kg (6,808 lb). A custom calculation found somewhat higher CO2-equivalent savings of 3,645 kg (8,036 lb), which equates to the impact of about 429 equivalent gallons of gasoline saved (i.e., net of the GHG impacts of the electricity used).

# Charging Port Occupation Rates

For the first two years of operation:

| | 2022 | | 2021 | |
|---|---|---|---|---|
| **Charging Port Occupation** | **Days** | **% of Days** | **Days** | **% of Days** |
| Maximum of 2 Ports Occupied | 90 | 25% | 37 | 9% |
| Maximum of 1 Port Occupied | 203 | 56% | 188 | 47% |
| No Ports Occupied | 72 | 20% | 171 | 43% |

When both ports (charging heads) are occupied, a potential user could arrive to find they have to wait to charge up, or leave disappointed. That was fairly rare in 2021 but is occurring much more often in 2022.

It's difficult to estimate how many times potential users arrived to find both ports occupied. The frequency probably doesn't warrant consideration of adding additional chargers at this time. However, that would be a concern if the Police Department or other nearby offices were to start using the charger on a regular basis.

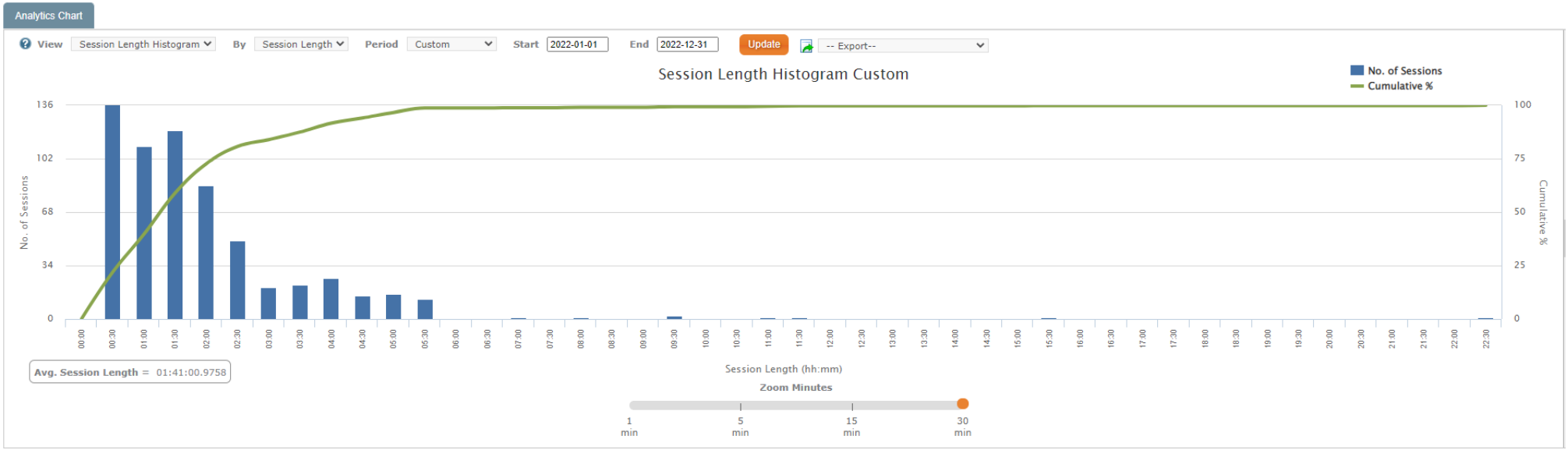
In the future, the Town can consider expanding the number of charging heads if demand continues to rise. There is conduit to the existing station that could support a 1-head station at a higher amperage (charging rate), or another 2-head charging station with the same capacity as the existing station.

# Session Time Histogram

A histogram of charging session times is provided on the following page.

About 13% of sessions were more than 4 hours in duration, a decrease from 24% of sessions in 2021. After 4 hours the dwelling fee kicks in ($1/hour of dwelling time).

# Session Time Histogram




Summary of session times:

| | 2022 | | 2021 | |
|---|---|---|---|---|
| **Length of Charging Session** | **# of Sessions** | **%** | **# of Sessions** | **%** |
| <2 hours | 366 | 59% | 168 | 45% |
| 2 to <4 hours | 177 | 29% | 115 | 31% |
| 4 to <9 hours | 72 | 12% | 81 | 22% |
| >= 9 hours | 6 | 1% | 7 | 2% |
| **Total** | **621** | | **371** | |

Estimated dwelling hours and dwelling fees:

| Year | Dwelling Hours | Dwelling Fees |
|---|---|---|
| 2022 | 89 | $94 |
| 2021 | 119 | $113 |

*Dwelling hours are estimated from the histogram, and dwelling fees as gross revenue less electric revenue. Rounding errors account for the difference at $1/dwelling hour.

*2021 dwelling hours and fees were mis-calculated in the 2021 annual report, but are corrected here.