PGE Clean Fuels Program

2022 Annual Report

April 2023

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[1] Cover image courtesy of Clackamas Service Center, a 2020 DCF award recipient.

Introduction

Portland General Electric Company (PGE or the Company) is pleased to submit its 2022 Clean Fuels Program (CFP) report to the Oregon Department of Environmental Quality (DEQ) as required by OAR 340-253-0640(11). This report covers PGE's programs and expenditures for the 2022 calendar year for its programs funded through the sale of Clean Fuels Program credits generated through residential electric vehicle (EV) charging in PGE's service area.

PGE plans CFP-funded programs through an iterative approach with stakeholders in consultation with DEQ and the Oregon Public Utility Commission (OPUC) staff. This iterative approach is facilitated by OPUC staff as part of Order No. 18-376 in Docket No. UM 1826. This order establishes six program design principles that investor-owned utilities must follow when planning CFP-funded programs as shown in figure 1.[2]

Figure 1. OPUC Clean Fuels Program Design Principles

Starting in 2020, PGE proposed a portfolio approach to residential clean fuels funded programs. PGE consulted with stakeholders to consider what types of programs to support through that approach. Based on that input, market research, and CFP participation, PGE then developed a portfolio method to plan for the CFP going forward. These programs are organized in the following categories:

Infrastructure & grants to accelerate deployment of vehicles and charging across Oregon;

Education & outreach to increase awareness of transportation electrification (TE), dispel existing misconceptions, and help create an ecosystem of support roles (EV/Charger maintenance job training, re-training, etc.) that promote a dependable customer experience; and

Emerging technology to test new concepts that have an EV nexus and the ability to scale to larger utility programs.

Additionally, administrative costs are tracked and expected to remain below ten percent of total annual expenditures. While funding amounts vary from year to year based on residential CFP revenue, PGE plans for the approximate budget breakdown and percentages below for the Clean Fuels portfolio submissions:

[2] Note that on August 26, 2022 the OPUC adopted Order No. 22-314, which amended Order No. 18-376 to eliminate CFP Design Principle #4 and revise the process for stakeholder review and input into PGE's CFP-funded activities. This did not affect the previously adopted budget for 2022 but will be reflected in PGE's CFP programs going forward.

Table 1-CFP Program Percentage Targets

Category	% Portfolio per Year
Grants & Infrastructure	70% - 80%
Education & Outreach	5% - 15%
Emerging Technology	5% - 15%
Administrative Costs	5% - 10%

PGE's 2022 Clean Fuels Program Plan was presented to stakeholders and the OPUC in December 2021 as follows:

Table 2-2022 Clean Fuels Program Plan

Program Category	Total Cost	Portfolio %
Grants and Infrastructure	**$5,250,000**	**79%**
Education and Outreach	**$725,000**	**8%**
Emerging Technology	**$336,000**	**5%**
Administrative Costs	**$200,000**	**8%**
PORTFOLIO TOTAL	**$ 6,511,000**	**-**

Total Revenue from the Sale of Base and Incremental Credits

PGE's 2022 programs were funded through the sale of credits in 2021 generated from residential EV charging in 2020. At that time only base residential credits were available. DEQ's 2021 CFP rulemaking introduced the concept of base and incremental credits. Base credits are generated through use of a fuel with carbon intensity (CI) lower than that of gasoline or diesel. Incremental credits are generated when a registered entity claims a lower carbon intensity of electricity by retiring Renewable Energy Certificates (RECs) alongside claiming CFP credits for EV charging. Therefore, PGE did not claim or sell incremental credits in 2021 or budget for use of funds from these credits in 2022 programs.

PGE did purchase RECs in 2022 to claim incremental credits for 2021 that will fund 2023 program years. DEQ assigned 46,752 incremental credits to PGE for 2021 (there is a two-year delay between CFP credit generation and programmatic year, 2021 CFP credits are funding 2023 Program year) resulting in approximately $5,394,400 in incremental revenue.

PGE began 2022 with 28,281 credits in its account. On March 6,2022 DEQ deposited 30,053 base residential credits and on May 1, 2022, DEQ deposited 46,752 residential incremental credits into PGE's account in the CFP system. On October 19, 2022, QEQ deposited 38,218 residential base credits for the EV count for the first six months of 2022. PGE ended the year with 22,306 credits in the account. Between January 1, 2022, and December 31, 2022 PGE executed 16 separate sales of CFP credits at an average price of $115.38 per credit, with proceeds of residential credits totaling $11,758,817.08. The 2022 residential credit revenue from 2021 residential EVs will fund 2023 CFP Programs.

2022 Residential Clean Fuels Program Expenditures

Following the portfolio approach PGE's 2022 CFP expenditures break down as follows:

Table 3- 2022 Clean Fuels Program Expenditures

Program Category	Amount Spent by close of 2022	Percentage of Overall Expenditure
Grants and Infrastructure	$ 5,009,449	77%
Education and Outreach	$612,352	9%
Emerging Technology	$349,239	5%
Administrative costs	$563,087	9%
Total	**$6,534,126**	**100%**

Program Descriptions

Since 2021 PGE has administered its CFP-funded programs using a portfolio approach. CFP funded programs are organized in the following three categories:

I. **Grants and Infrastructure**

II. **Education and Outreach**

III. **Emerging Technology**

INFRASTRUCTURE AND GRANTS

Drive Change Fund

The Drive Change Fund (DCF) is a competitive grant available to non-residential customers for transportation electrification projects that prioritize underserved communities, advance transportation electrification, and benefit residential customers. Table 4 describes the DCF program details on eligibility, grant scopes which can be considered, and other elements of the program.

Table 4- Drive Change Fund Program

Applicant Eligibility	• Applicants may be nonprofit, for-profit or government entities, with a preference for nonprofit and government; • Applicants need not be PGE customers; however, projects must provide a community benefit in areas PGE serves.
Grant Scope	• Projects must advance TE and provide a benefit to residential customers, with priority given to projects that address the needs of underserved communities; • Applicants should demonstrate efforts to obtain all other available funding sources, incentives, federal grants, and tax credits; • Any charging stations that are funded must be part of the PGE qualified product list;

	• Where appropriate, PGE claims Clean Fuels credits to continue to fund the DCF.
Other Assistance	• Financial assistance is offered to compensate qualifying nonprofit applicants for staff time required to prepare an application; • Where possible, PGE may direct applicants to other complementary funding streams and synchronize application processes.
Process	• A third-party evaluator evaluates the applications, with an internal PGE selection committee making final funding decisions.

Since 2019, PGE has awarded over $8.92 million in DCF grant funding to 54 projects. PGE ran the fourth cycle of DCF in 2022, awarding $2.28 million to 15 community transportation electrification projects. Table 5 provides a breakdown of the projects awarded and Appendix A details project summaries.

Image 2-2021 DCF awardee Sustainable Northwest operating their first electric tractor after its delivery in summer 2022

Table 5- 2022 Drive Change Awardees

Organization Name	Org Type	Project Type	# of Vehicles	# of Ports	Total Awarded
Working Theory Farm	Nonprofit	EV	1	0	$40,125.00
APANO Communities United Fund	Nonprofit	Chargers	0	12	$168,376.00
Chemeketa Community College	Community College	Chargers, EV, Education	2	2	$183,458.00
Volunteers of America Oregon	Nonprofit	Chargers, EV	6	6	$251,384.00
Tualatin Hills Parks & Rec	Government	EV	2	0	$126,378.00
Raphael House	Nonprofit	Chargers, EV	2	2	$88,910.00
NW Pilot Project	Nonprofit	EV	1	0	$76,957.00
Immigrant and Refugee Community Organization	Nonprofit	Chargers, EV	3	3	$482,770.00
Outgrowing Hunger	Nonprofit	EV	1	0	$43,664.00
City of Tigard	Government	EV, Education	0[3]	0	$105,800.00
Ecumenical Ministries of Oregon	Nonprofit	Chargers, EV	3	3	$431,425.00
Hacienda CDC	Nonprofit	EV	1	0	$66,000.00
Central City Concern	Nonprofit	Chargers	0	11	$84,478.00
Linfield University	Nonprofit	Chargers	0	4	$57,845.56
Community Cycling Center	Nonprofit	EV	1	0	$65,000.00
TOTAL			**23**	**43**	**$2,272,570.56**

PGE continues to seek feedback from stakeholders, applicants, recipients, and transportation electrification organizations to expand upon the OPUC's program design principles, with the goal of creating an equitable application, evaluation process, and funding deployment structure. PGE updates and refines the DCF annually with an aim of improving the process for applicants, particularly for smaller community organizations. Table 6 presents some examples of the ways PGE took this feedback into consideration in management and continuous improvement of the DCF in 2022.

[3] The City of Tigard projects funds 6 electric cargo bikes

Table 6. Incorporation of Feedback and Program Enhancements in the Drive Change Fund

Staffing

- Hired a grants coordinator to work with awardees to provide greater support and improve project completion timeline

Timeline

- Reduced the evalution period of the grant cycle to improve response timeline
- Initial award check cut in the year of award to improve reporting and budget tranparency

Tracking

- Selected and started migration to a grants management platform, Cybergrants, to streamline the process for applicants, awardees, and admin
- Improved charging/port tracking

Program Improvements

- Successful RFP for a new third-party grant evaluator (work starting with 2023 cycle)
- Toolkits/social media guides for DCF & electric school bus (ESB) awardees - increased storytelling & awareness of TE
- Ensured alignment across applicant materials and award agreement terms
- Creation of contingency process to be more responsive to increased supply chain costs

Electric School Bus Fund

The Electric School Bus Fund is a competitive grant available to public school districts located in PGE's service area to help fund the incremental costs of purchasing electric school buses, with a focus on school districts that serve underserved communities. Since 2020, PGE has awarded over $4.9 million in grant funding to purchase 19 electric school buses. In 2022, PGE allocated approximately $1,500,000 to help school districts and school bus fleet operators acquire electric buses and charging infrastructure. PGE awarded grants to five districts to fund a total of six buses. These buses are in addition to the thirteen buses now operating or on-order from the 2020 and 2021 grant awards.

Table 7- 2022 Electric School Bus Fund Awardees

School District	Project County	# of Buses	Amount awarded for electric school bus[4]
Beaverton School District	Washington	1	$272,509
Gresham-Barlow School District	Multnomah	1	$ 273,750
Tigard-Tualatin School District	Washington	2	$466,024
Portland Public Schools	Multnomah	1	$162,335
Salem-Keizer Public School District	Marion/ Polk	1	$280,842
Total	**-**	**6**	**$1,455,460**

As of March 2023, all school districts awarded electric school bus funds in 2022 have placed their orders for the electric school bus(es). The delivery lead time for electric school buses ranges from 12-18 months, so most will not be in service until late 2023 or early 2024. All school districts except for Tigard-Tualatin School District have been awarded grants in a previous round. For the 2022 award year, Tigard-Tualatin and Gresham-Barlow received an additional $50,000 for charging infrastructure. Two 2022 recipients (Tigard-Tualatin and Beaverton School Districts) are participating in PGE's Fleet Partner program[5] to support infrastructure planning needs and did not receive additional funding for infrastructure from the 2022 ESB fund.

[4] Final total award amount varies based on actual infrastructure costs.
[5] More information on PGE's Fleet partner program is available here: https://portlandgeneral.com/energy-choices/electric-vehicles-charging/business-charging-fleets/fleet-charging

Image 3- Portland Public School District Student Journalists pose with one of the district's electric school buses

Matching External Funds

In 2022, PGE reserved up to $400,000 to provide matching funds to public agencies, community-based organizations, nonprofits, educational institutions, and other partnerships applying to external funding opportunities. PGE identified the need for reserving matching external funds through receipt of community feedback and from the increased federal funding opportunities for electric transportation.

No successful grant matching bids were received in the first year of grant matching (2022), likely because the program was only launched three months prior to the DCF award process. The funding was put towards the 2022 DCF total. Now that program management policies are in place and ready, PGE expects an increase in matching opportunities in 2023.

PGE uses the following criteria to evaluate eligibility for grant matching opportunities, based on the principles for use of CFP funds established by Commission Order 18-376 in UM 1826:

1. Will the proposed grant project support electrifying Oregon's transportation sector?
2. Will the proposed grant project benefit residential customers?
3. Will the proposed grant project benefit traditionally underserved communities?
4. Is the proposed grant project eligible for external funding?

In deployment of matching funds PGE uses the following program parameters:

- If a proposed project awarded matching funds by PGE does not receive the external funds on which the project depends, the CFP funds will revert to the overall DCF funding pool.
- If any matching funds remain uncommitted when annual DCF awards decisions are made, that uncommitted matching fund amount will revert to the overall DCF funding pool.

Public Charging Infrastructure

The project of upgrading outdated public charging infrastructure continued as part of the Infrastructure and Grant portfolio in 2022. To date, this project focused on updating legacy charging equipment that had been previously installed and operated by other entities dating back to 2012 often referred to as the Oregon Electric Byway (OEB). Upgrading and updating these sites has proven to be a greater challenge than originally anticipated.

After a year of engagement with site hosts, signed site host agreements were not progressing by mid-2022 which was impacting the ability to upgrade and update the sites. PGE evaluated what locations were most likely to result in improved EV driver experience and updated infrastructure. PGE provided a deadline to site hosts and offered the option for site hosts to either sign new agreements and easements with PGE to update the sites or take over ownership of the existing make-ready without further PGE engagement. Due to the potential for poor driver experience, PGE did not want to leave unreliable or non-functional equipment in place. Table 8 notes the status of the Oregon Electric Byway locations updated, and those transferred or decommissioned.

Table 8- Status of updates for Oregon Electric Byways

Site Status	Electric Byway Site	Location	Charging Capacity	Details
Sites Updated	Roth's Fresh Markets 2	918 N 1st St Silverton, OR 97381	4 Ports: Two 150 kW DCFC; One dual port 12 kW L2 charger	Charging station came online 10/2022
	IBEW 48 Union Hall	15937 NE Airport Way Portland, OR 97230	1 Port: One 150 kW DCFC	Location under construction
	Lincoln Center (Shorenstein)	10200 SW Greenburg Rd. Tigard, OR 97223	4 Ports: Two 150 kW DCFC; One dual port 12 kW L2 charger	Location under construction
Sites Transferred or Decommissioned	Courtyard Marriott (PacTrust)	15686 SW Sequoia Pkwy Tigard, OR 97224	3 Ports: One 50 kW DCFC, One dual port 7.2 kW L2 charger	Customer declined upgrade and took ownership of equipment

Site Status	Electric Byway Site	Location	Charging Capacity	Details
	Burgerville	3504 SE 92nd Ave Portland, OR 97266	3 Ports: One single port 50 kW DCFC, Two 7.2 kW L2 charger	Chargers were removed in 2022 due to repeated vandalism at site; remaining assets transferred to customer; less than 0.5 miles from Eastport Electric Avenue
	Shari's Café and Pies 1	4998 River Rd Keizer, OR 97303	3 Ports: One dual port 50 kW DCFC, One 7.2 kW L2 charger	Customer declined upgrade and non-performing chargers were removed
	Shari's Café and Pies 2	16280 SW Langer Dr Sherwood, OR 97140	3 Ports: One dual port 50 kW DCFC, One 7.2 kW L2 charger	Customer declined upgrade and non-performing chargers were removed
	Roth's Fresh Markets 1	3045 Commercial St SE Salem, OR 97302	3 Ports: One dual port 50 kW DCFC, One 7.2 kW L2 charger	Property owner declined upgrade and non-performing chargers were removed
	Wilsonville Town Center	8269 SW Wilsonville Rd Wilsonville, OR 97070	4 Ports: One dual port 50 kW DCFC, Two 7.2 kW L2 charger	PGE did not upgrade due to less than 0.1 mile proximity to Wilsonville Electric Avenue; Non-performing chargers were removed
	Clackamas Town Center	12000 SE 82nd Ave Happy Valley, OR 97086	5 Ports: One dual port 50 kW DCFC, three single port 7.2 kW L2 chargers	Customer declined upgrade since other chargers were installed nearby

As work at the sites that can be upgraded nears completion and some unspent funds remain allocated to this purpose, PGE will propose to use the remaining infrastructure budget to update other legacy chargers that are not fully functioning and providing a poor charging experience for drivers that rely on public charging. PGE will seek feedback in 2023 from stakeholders on this use of funds to replace other not fully functioning legacy public charging PGE owns that were funded through budget-limited pilot projects.

OUTREACH AND EDUCATION

Oregoin' Electric

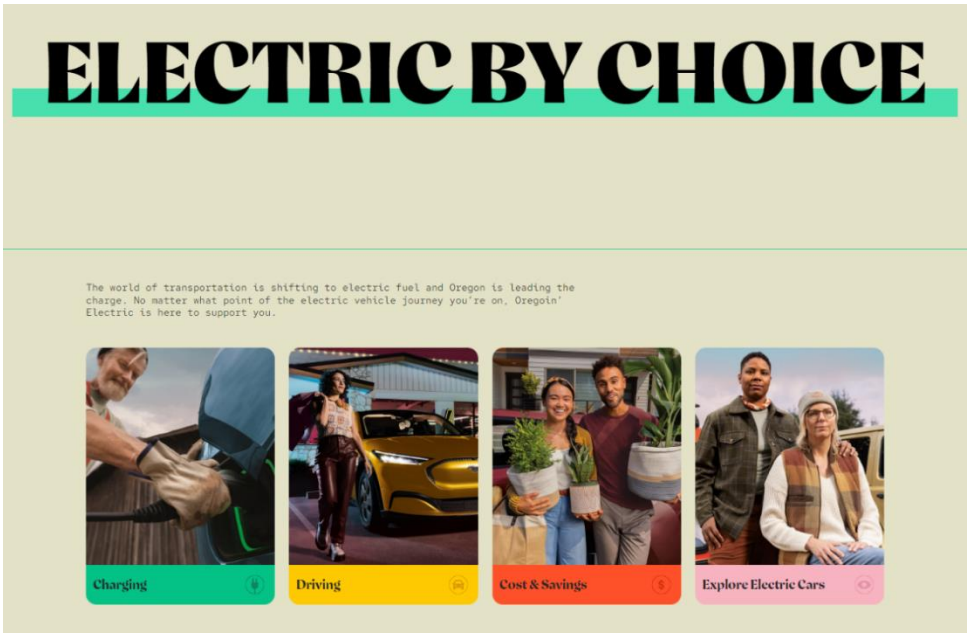
In 2022, PGE continued the Oregoin' Electric campaign in coordination with Pacific Power, the Oregon Department of Transportation, Oregon Department of Energy, and DEQ. This year the campaign continued to target populations in Oregon that are underserved by electric transportation. The campaign featured real individuals, real

vehicles, and real quotes illustrating why Oregonians chose EVs. PGE's team coordinated with an external marketing partner to produce new imagery and campaign content.

In coordination with State partners and stakeholders, PGE completely redesigned the Oregoin' Electric campaign website[6] in 2022 with an emphasis on updated content, a more user-friendly user interface, and updated images. PGE once again worked with For Good & Co. to produce the new website and content. Reaching underserved communities has been a key aim of the campaign so the entire website is available in both Spanish and English. This new website is more reflective of the broad variety of content available to customers, with the most meaningful content found in sections on Charging, Driving, Costs & Savings, Explore EVs, and News & Events.

For 2023, PGE will use the updated website to drive statewide outreach campaigns, with content including but not limited to, EV incentives and rebates included in the Inflation Reduction Act, Oregon's Clean Vehicle Rebate, Utility EV Rebates, and EV benefits. Funding for this work will continue through 2025 with a RFP for a marketing consultant, updates, maintenance, and media buys. To better evaluate the effectiveness of our outreach campaign, we have added analytics which will allow us to track unique visits, click through activity, content engagement, referrals, and common keywords, among others. We will analyze the web data to refine the web experience, and as the residential EV market expands and engagement increases, additional elements will be adapted to reflect evolving needs and further target underserved communities.

Image 4- 2022 Oregoin' Electric updated images and website



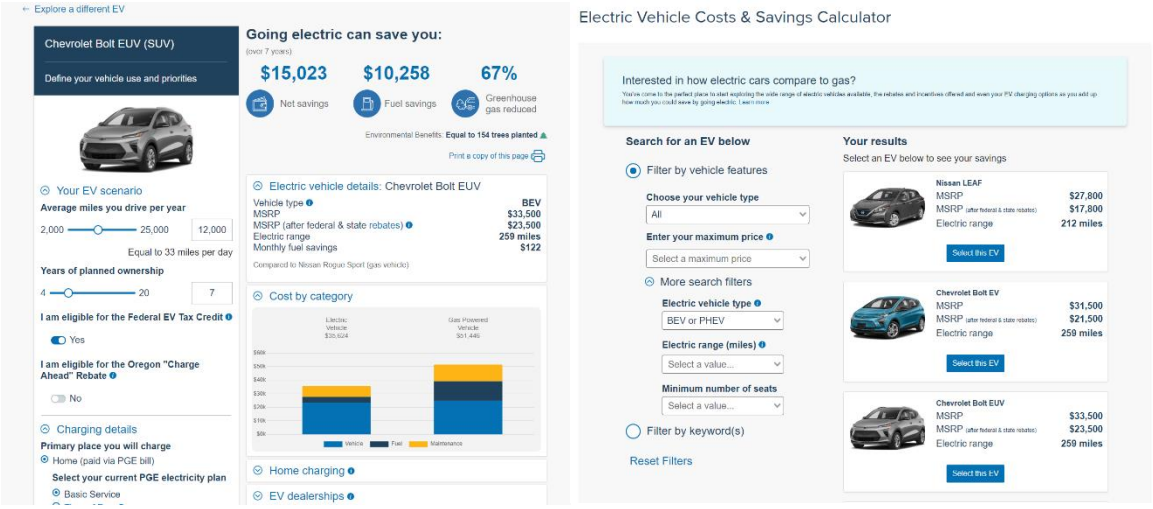
[6] https://oregoinelectric.com/

Electric Vehicle Costs & Savings Calculator

PGE published an EV Costs & Savings Calculator in June 2022 on the Company's website[7] which uses data from PGE's rates and available state and federal financial incentives to help inform a customer on what owning an EV could look like for their budget and charging accessibility. This interactive tool has a comprehensive, updated inventory of all currently available electric vehicles, and their respective available financial incentives. The search page allows users to filter for their vehicle needs, including vehicle type, minimum range, price, etc. After a user selects their vehicle, they see all the vehicle details on one page. Users can change settings based on their vehicle usage, including average miles driven, years of ownership, eligibility for financial incentives, and charging strategy. After toggling to their usage, users can see their estimated total net savings, fuel savings, and greenhouse gas emissions reduced.

The tool also includes details such as: electric vehicle specifications, cost by category, home charging options, EV dealerships, and a public charging map. In the 5+ months that the calculator was live in 2022, there were 17,700 new visitors. In surveys taken by site users, 65.8% of users rated the tool 5 out of 5 in ease of use and 66.2% would recommend the calculator to others[8]. Once people are aware of the savings, incentives, and benefits of electric transportation, they are significantly more likely to consider purchasing an EV[9]. In an ongoing survey of tool users, 52.6% are more likely to purchase an EV after using the calculator, and 43.8% of users were planning to purchase an EV.

Image 5- PGE EV Costs & Savings Calculator



Ride and Drive

In 2022 PGE hosted the company's first ride and drive event since 2019. Held at Portland Community College Sylvania campus August 12 and 13, the event was successful in increasing awareness of the wide variety of EVs currently available and

[7] https://portlandgeneral.com/energy-choices/electric-vehicles-charging/ready-to-buy-an-ev/electric-vehicle-costs-and-savings-calculator

[8] Data captured from survey results of 82 users that utilized the EV Costs & Savings Calculator from June-December 2022.

[9] Opinion Dynamics, Evaluation of PGE's Transportation Electrification Pilots, 2020

addressing barriers to EV adoption. In addition to driving, attendees were able to ask questions of EV owners and ask PGE subject matter experts about charging at home or on the go.

Highlights and learnings from the ride and drive included:

- The most popular cars to test drive were Ford Mustang Mach-E and Kia EV-6.
- 12 attendees already drove an EV.
- 100 of the 117 attendees asked said they are "very likely" to purchase an EV for their next car and 14 said they are "probably likely"[10].
- Respondents attended the event primarily to test drive EVs. Many attendees reported being at least somewhat knowledgeable about EVs, with some having experience driving EVs or already owning an EV of their own.
- Attendees reported high satisfaction with all aspects of the Ride-and-Drive, although some would have liked to see more vehicles available to test drive. Most indicated that the event increased their likelihood to buy or lease an EV[11].
- The primary concern of attendees for purchasing or leasing an EV is the vehicle cost.

[10] Electric Car Guest Drive After-Action Report, Electric Car Insider, 2022
[11] Opinion Dynamics PGE Transportation Electrification Pilot Program – 2022 Electric Car Guest Drive and EV Charger Exhibit Intercept Survey Results, 2022

Image 6- 2022 Ride and Drive at Portland Community College Sylvania

EMERGING TECHNOLOGY

Vehicle to Grid

PGE operated two separate vehicle-to-grid (V2G) projects in 2022, comprised of one passenger vehicle charger and one electric school bus charger.

The first V2G project was a +/- 6.2 kW Wallbox Quasar Level 2 charger designed to operate with a passenger vehicle (Nissan LEAF) through a CHAdeMO charging connector. PGE energized the charger in late 2021 and in 2022 successfully demonstrated V2G capabilities by drawing power from the connected EV's battery. PGE plans to continue testing this V2G charger and may test additional chargers at this site as they become commercially available.

PGE is conducting the second V2G demonstration project in partnership with First Student, a school bus transportation contractor. The project uses a +/- 60 kW Nuvve DCFC unit installed at the First Student bus yard. This unit charges a Bluebird Type-C bus with a 155 kWh battery. The charger was energized in March 2022 and V2G capabilities were demonstrated in June 2022 before the charger was relocated. In 2022 Q3 the original school district selected a new transportation contractor who declined to continue testing at the original site.

The V2G charger has been relocated to the Wilsonville-West Linn School District and will resume testing in 2023. At the new site, testing will focus on the best time interval to control and collect data, communication latency, and overall charging/discharge efficiency. PGE looks forward to moving beyond the early exploration phase of testing towards the potential for V2G to support community resiliency.

Pole charging

In 2022, PGE evolved the initial CFP-funded pole charging demonstration to a broader utility pilot. Funding for this emerging technology enabled critical learnings that will result in more equitable charging infrastructure available across the region. These learnings include:

- Following a new method of mounting chargers to poles to satisfy National Electric Code (NEC) and National Electric Safety Code (NESC) safety guidelines. The new mounting method puts chargers higher on the pole, with a QR code down below to activate a charging session. By mounting chargers higher up on the pole, PGE has been able to reduce safety concerns around climbing hazards and cable management that were brought up with the original demonstration chargers.
- Developing an engineering standard design for the new chargers influenced by the original pole mounted chargers.
- Efficiently deploying equitable charging accessibility. PGE's experience with pole-mounted chargers and their lower relative cost when compared to pedestal chargers informed PGE's planning for a larger scale program.

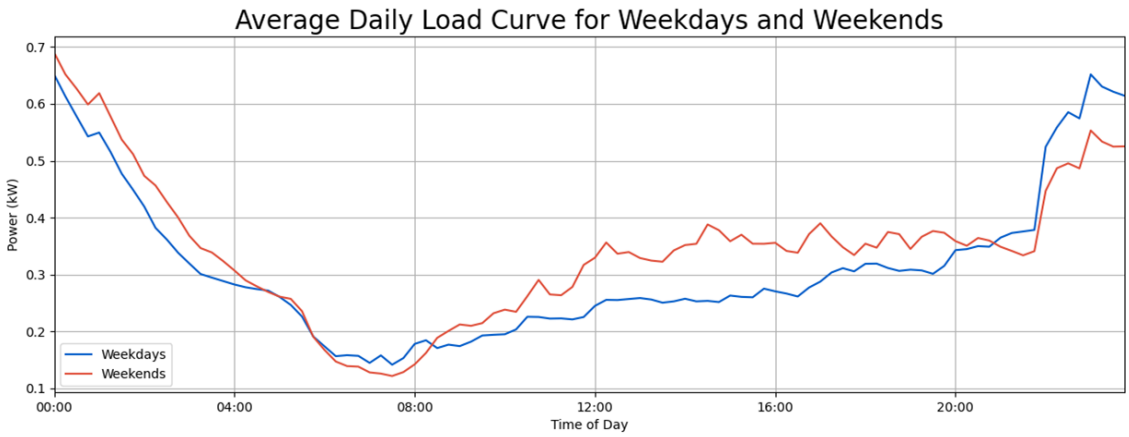
Beyond the initial chargers PGE plans to use learning from the pole-charging demonstration to implement a new utility pilot funded by the Monthly Meter Charge (MMC). This larger and broader municipal charging pilot offering will work in collaboration with municipalities and offer pole charging with other right of way chargers on a much larger scale, focusing on equitable access for underserved communities. PGE plans to install 60 utility pole mounted chargers using 2022 MMC funds and to install 100 utility pole mounted chargers with 2023 MMC funds.

Smart Charging

Launched in late 2020, this three-year smart charging pilot program used vehicle telematics tools to track EV driver habits in the PGE Smart Grid Test Bed areas to understand the impacts of EV charging behavior on overall grid load.[12] All participants received a $150 enrollment incentive, and a $25 seasonal participation bonus twice a year. The pilot was scoped for up to 500 EVs but due to geographical restriction of the Test Bed only 177 vehicles could participate. PGE collected driving and charging data (e.g., charging time, location, consumption and travel distances and times) through integration between the vehicle and telematics software.

[12] PGE's Smart Grid Test Bed is a first-of-its-kind-project that integrates smart grid technology at scale. The Test Bed spans three distinct neighborhoods within PGE's service area, in Hillsboro, Milwaukie and North Portland. Through the Test Bed, the company works with 20,000 customers to take advantage of special demand-response signals as well as incentives for using smart-home technologies, giving them greater control over their energy use and carbon footprint.

Figure 1 Average daily load curve for all EVs across incentive groups



This initial testbed pilot resulted in the following key learnings that influenced PGE's ongoing residential EV programing:

Driving and Charging

- Longer-range EVs (battery capacity greater than 50kWh) tend to drive longer distances and have a higher energy demand than short range EVs and plug-in hybrid vehicles
- EV Drivers typically start charging with a state of charge (SOC) of ~65% and end with an SOC of 90%. Longer range EV drivers end with a lower SOC of ~80%
- Most charging sessions took place using a Level 2 charger and there is some dependency on fast charging with approximately 2% of charges occurring at this charging level.
- Summer and winter charging demand was similar but weekend charging was more sporadic than weekday charging

Charging Incentives learnings

- The Test Bed groups exhibited different behavior from the control group and demonstrate willingness to charge off-peak, particularly where incentives were offered.
- Daytime off-peak times were not highly utilized by EV drivers.
- The small sample sizes of the groups may allow for individual vehicles to become overly influential when analyzing load curves.

Conclusion

PGE appreciates the opportunity to share its second annual Clean Fuels Program report with the Department of Environmental Quality and stakeholders. The portfolio program approach organized into Grants and Infrastructure, Education and Outreach, Emerging Technology provided continued structured program implementation in 2022. While 2022 presented challenges like long lead times for vehicles and difficulty upgrading infrastructure, there were also successes, with new rounds of the Drive Change Fund and Electric School Bus grants,a

ride and drive, and V2G research. The company looks forward to continuing its work on the CFP in collaboration with DEQ, stakeholders, and other utilities to support electric transportation in Oregon.

Appendix A

2022 Drive Change Fund Grant Recipients

Grant recipients as of November 2022

APANO Communities United Fund

APANO Communities United Fund is a statewide, grassroots organization uniting Asians and Pacific Islanders to achieve social justice. Their DCF project will install charging infrastructure in partnership with two local, Asian-American owned retail businesses along the 82nd Ave corridor. As an emerging civic corridor that cuts through several of the most diverse census tracts in the Portland Metro region, EV charging stations will help advance equity and climate goals.

Central City Concern

Central City Concern is a nonprofit organization serving adults and families in the Portland metro area, who are impacted by homelessness, poverty and addiction. Their DCF project will install charging infrastructure at two new multi-family affordable housing properties, Cedar Commons and Meridian Gardens. This will support the organization's efforts to electrify their fleet of vehicles and to remove barriers to access for the 15,000 clients served annually who may acquire electric vehicles.

Chemeketa Community College

Chemeketa Community College is a two-year comprehensive public community college located in the Willamette Valley. Their DCF project will include two electric tractors to be used in community college classes, trainings for high school aged students, outreach to community agriculture and lent out to individual farms and vineyards. Agricultural workers in the valley are subjected to the toxic effects of diesel-powered equipment. Affordable access and training with innovative electric technology increases the likelihood that farms and vineyards will adopt electrified agricultural equipment.

City of Tigard

City of Tigard is one of the fastest growing cities in Oregon with a strategic vision that will transform the city into "an equitable community that is walkable, healthy and accessible for everyone." Their DCF project is an e-bike library pilot that will place e-bikes and storage modules at affordable housing sites in socially vulnerable neighborhoods to provide free access to this emerging technology. This pilot project will illuminate challenges and opportunities to scale e-bike libraries citywide.

Community Cycling Center

Community Cycling Center's mission is to broaden access to cycling and its benefits. Their DCF funding will be used to purchase an electric sprinter van to support their community outreach programs and transport the 40 tons of steel and aluminum bicycle parts they rescue from waste every year. This will assist Community Cycling Center in reducing their carbon footprint and expanding the services they provide to the community.

Ecumenical Ministries of Oregon

Ecumenical Ministries of Oregon's mission is to bring together diverse communities of faith to learn, serve and advocate for justice. Their DCF project includes installing charging infrastructure and purchasing electric vehicles to expand their existing service in the Portland Metro region and beyond with a focus on HIV services, meal delivery and refugee programs.

Hacienda CDC

Hacienda CDC is a Latino Community Development Corporation and works to strengthen families by providing affordable housing, homeownership support, economic advancement and educational opportunities. Their DCF funds will be used to purchase an electric vehicle to support their Youth and Family Services Programs, distribute donations and provide transportation to staff. This project will expand impactful programs, support climate justice and increase access to TE technology.

Immigrant and Refugee Community Organization

IRCO promotes the integration of refugees, immigrants and the community at large into a self-sufficient, healthy and inclusive muti-ethnic society. Their DCF project will include charging infrastructure as well as the purchase of electric ADA vans and an e-transit cargo van. These electric vehicles will transport supplies and community members to services, events, after school programming and field trips. This project will help reduce IRCO's carbon footprint and protect public health by minimizing the air pollution released into environmental justice communities.

Linfield University

Linfield University is an independent nonprofit university, which includes a School of Nursing Portland campus. Their DCF funds will be used to install charging infrastructure for use by students, staff, faculty, visitors, and community members. Linfield University is interested in supporting sustainable transportation practices and this project is the first step in developing the strategy for future EV charging infrastructure projects.

NW Pilot Project

Northwest Pilot Project provides services to very low and extremely low-income, disabled, and disenfranchised senior households living in Multnomah County. Their DCF project will purchase an electric vehicle for their new Permanent Supporting Housing program, which provides one-on-one personalized support to those with the highest barriers to permanent housing. This project will help increase housing stability and quality of life, while eliminating tailpipe emissions.

Outgrowing Hunger

Outgrowing Hunger is a community-based membership organization with agriculture program and garden space in Gresham and East Portland. Their DCF funds will be used to purchase an electric vehicle to provide support to a network of 13 farms and gardens serving 400 Black, Asian, Latinx, and Slavic farmers and gardeners in east Multnomah and Clackamas counties. Outgrowing Hunger expects this will result in a reduction of CO2 emissions of approximately 11,700 pounds annually.

Tualatin Hills Park & Rec

Tualatin Hills Park and Recreation's mission is to provide high quality park and recreation facilities, programs, services and natural areas that meet the needs of the diverse communities it serves. Their DCF funds will support their Mobile Recreation program, which is a dynamic, responsive program that offers free activities for youth at parks, Title I schools, community centers and affordable housing complexes. With the Drive Change Fund, THPRD will have the capacity to serve even more youth.

Raphael House

Rachael House provides lifesaving and life-changing support to adults and children who experience domestic violence. Their DCF project will provide electric vehicles and charging infrastructure to transport families to and from their shelter, accompany survivors to appointments and to look for housing, meet survivors in the community, and distribute donations. Through this project, Raphael House will be better able to serve survivors while reducing their environmental footprint and raising awareness about electric mobility.

Volunteers of America Oregon

Volunteers of America Oregon provides outpatient behavioral health treatment and wrap-around support services to some of Multnomah County's most vulnerable residents who need mental health and/or substance use treatment. Their DCF funding will be used to install charging infrastructure and purchase electric vehicles for their peer mentors – people with lived experience – as they connect with treatment program participants in the community, including transporting participants to and from appointments, activities, etc. This program will help provide stable, sustainable and safe solution for delivery of community-based peer support and transportation of program participants.

Working Theory Farm

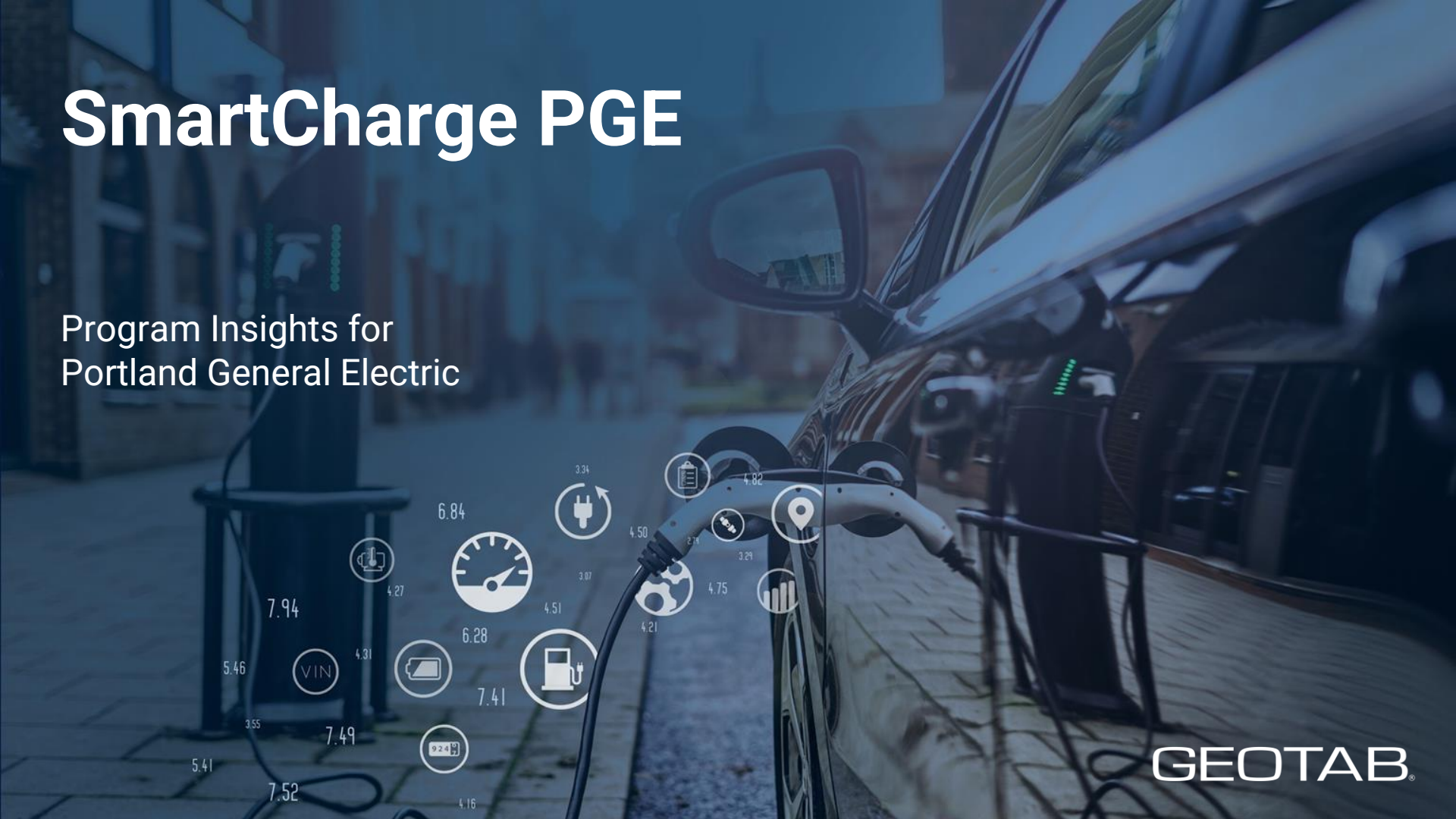
Working Theory Farm is a nonprofit educational farm in Hillsboro that works to empower youth through the shared work of farming to grow food for partner organizations who distribute this food to families in need. Their DCF project will include the acquisition of an electric tractor for the farm. This electric tractor will help reduce their carbon footprint and expand their educational program to demonstrate the latest environmental technologies addressing pollution and climate change.

Appendix B

See PDF Attachment B; Geotab Smart Charging Report

SmartCharge PGE

Program Insights for
Portland General Electric



GEOTAB

Introduction

SmartCharge PGE was a plug-and-play electric vehicle (EV) load profiling and management program designed to help Portland General Electric (PGE) stimulate EV load growth during desirable times for their electricity system, while reducing the cost of charging for their EV customers.

This 2.5 year program enabled the enrollment of up to 500 residential EV owners, focusing on EV owners in one of three test bed locations.

Program Objectives

This program aimed to achieve the following objectives:

- Identify and increase engagement with electric vehicle (EV) customers
- Collect and monitor baseline driving and charging data from EV owners
- To assess the effectiveness of charging incentives in test bed locations

Program Timeline

Recruitment

- Began on September 28, 2020, delayed from July 2020 due to COVID-19 pandemic
- Received 534 applications, the majority received in October 2020
- Total of 177 applications accepted

Data Collection

- 168 devices installed in vehicles
- Charging and trip data collected for 27 months
- Participants assigned to a control group or one of three test bed groups

Program End

- The program officially ended on December 31, 2022
- $54,621.26 of incentives distributed to participants

Group Structures

Group Name	Incentive Structure
Control	• $100 Getting Started Bonus • $10/month Participation Bonus
Proposed TOU	• $100 Getting Started Bonus • $10/month Participation Bonus • $0.061/kWh Off-Peak Charging Reward, 10pm-8am Mon-Fri, all day on weekends/holidays • -$0.024/kWh Mid-Peak Charging Reward, 8am-5pm Mon-Fri • -$0.123/kWh On-Peak Charging Reward, 5pm-10pm Mon-Fri
Flex TOU-2	• $100 Getting Started Bonus • $10/month Participation Bonus • $0.019/kWh Summer Off-Peak Charging (May 1 - Oct 31), 9pm-4pm Mon-Fri, all day on weekends/holidays • $0.019/kWh Winter Off-Peak Charging (November 1 - April 30), 9 pm - 8 am/12 pm - 4 pm Monday to Friday, all day on weekends and holidays • -$0.073/kWh Summer On-Peak Charging (May 1 - October 31), 4 pm - 9 pm Monday to Friday • -$0.073/kWh Winter On-Peak Charging (November 1 - April 30), 8 am - 12 pm/4 pm - 9 pm Monday to Friday
Renewable EV Rate	• $100 Getting Started Bonus • $10/month Participation Bonus • $0.02/kWh Off-Peak Charging 10pm-8am Mon-Fri, all day on weekends/holidays

State of Charge

- When charging most vehicles had a starting SOC ~ 65%
- When charging most vehicles had an ending SOC between 90 and 95%
- LR BEVs had a lower ending SOC on average, ~80%
- EV owners may not charge to 100% for two reasons: battery longevity and the reduction in charging rates

Group Name	Powertrain	Starting SOC %	Ending SOC %
Control	LR BEV	66.70	79.86
	SR BEV	64.62	90.77
	PHEV	51.24	96.22
Proposed TOU	LR BEV	71.59	79.67
	SR BEV	69.71	91.71
	PHEV	43.79	96.30
Flex TOU-2	LR BEV	65.80	82.67
	SR BEV	63.69	92.15
	PHEV	66.19	96.03
Renewable EV Rate	LR BEV	52.58	79.29
	SR BEV	63.44	93.50
	PHEV	63.60	94.10

Charge Sessions by Charger Level

- The majority of charge sessions occurred on a level 2 charger (64%)
- 72% of the total charge energy was derived from a level 2 charger
- DCFC charging was used only 2% of the time

Charger Level	Number of Charge Sessions	Total Charge Energy (kWh)	Number of Unique Vehicles
Level 1	32907	160762	144
Level 2	61830	560030	160
DCFC	1973	53593	88

Average Trip Distances

- On average LR BEVs drove the furthest, followed by PHEVs and SR BEVs
- Specifically LR BEVs in the Control group travelled the further distances

Group Name	Powertrain	Average Distance per Driving Day (miles)	Average Distance per Trip (miles)	Number of Unique Vehicles
Control	LRBEV	58.1	13.4	56
	SRBEV	38.1	9.1	36
	PHEV	41.5	11.1	6
Proposed TOU	LRBEV	53.9	11.9	8
	SRBEV	35.9	8.3	15
	PHEV	17.8	3.8	1
Flex TOU-2	LRBEV	52.1	12.3	9
	SRBEV	28.9	7.1	11
	PHEV	47.5	11.8	2
Renewable EV Rate	LRBEV	53.7	11.6	7
	SRBEV	37.4	9.0	17
	PHEV	49.7	9.4	1

Seasonal Average Trip Distances

- There was more travelling occurring in summer than winter
- Average trip distance was ~ 10 miles in all groups, although the Control group travelled more than other groups
- The Proposed TOU group had similar driving distances in both summer and winter
- The Flex TOU-2 group showed the biggest difference between summer and winter distances

Group Name	Season	Average Distance per Driving Day	Average Distance per Trip	Number of Unique Vehicles
Control	Summer	53.6	12.0	88
	Winter	46.6	11.5	95
Proposed TOU	Summer	42.1	9.3	24
	Winter	40.1	9.3	24
Flex TOU-2	Summer	45.1	10.5	21
	Winter	35.7	8.9	22
Renewable EV Rate	Summer	45.9	10.0	25
	Winter	38.9	9.5	25

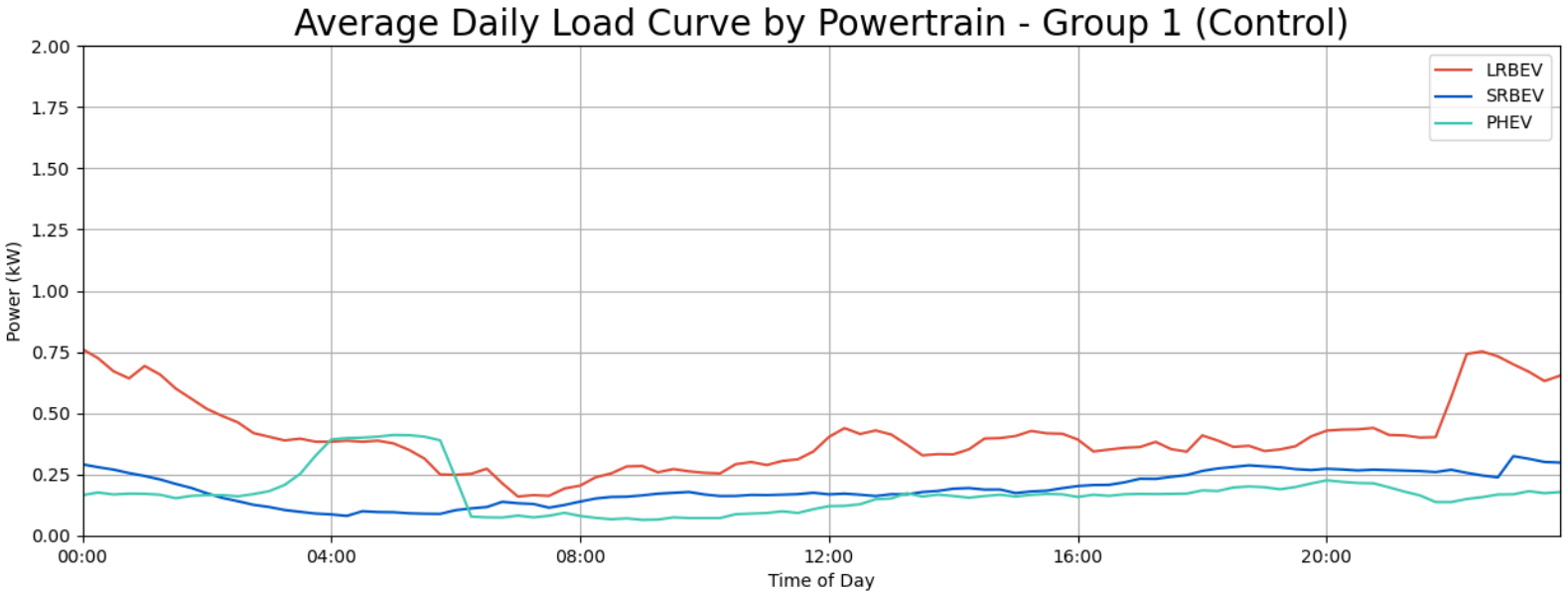
Summer: May 1st to October 31st
Winter: November 1st to April 30th

Understanding Load Curves

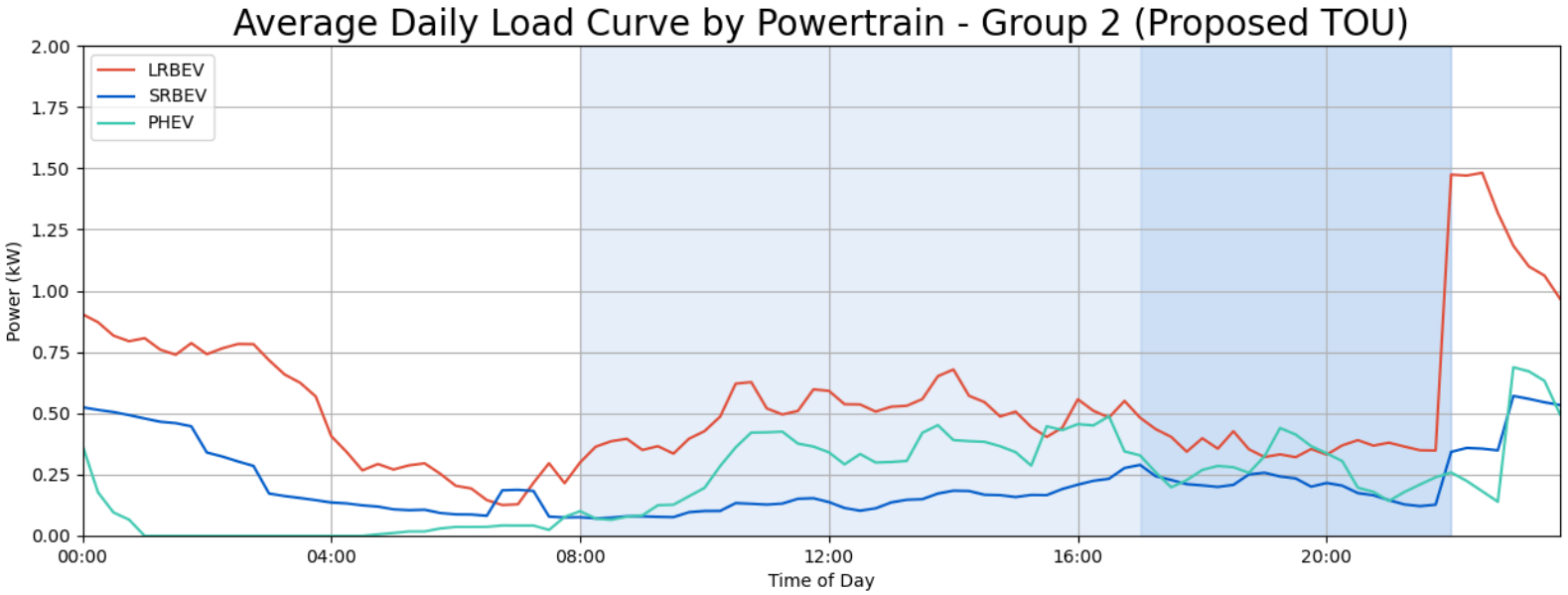
Load curves are graphical representations of power demand (kW) over time that can be used to compare the complexity of charging behaviour, a wide variety of vehicle makes and models and varying battery sizes together.

- Averages charging over the program duration, including when no charging was occuring
- Uses a random subset of vehicles for comparative purposes for the incentive group load curves:
    - Control - 6 PHEV, 36 SR BEV, 36 LR BEV
    - Proposed TOU - 1 PHEV, 8 SR BEV, 8 LR BEV
    - Flex TOU-2 - 2 PHEV, 9 SR BEV, 9 SR BEV
    - Renewal EV Rate - 1 PHEV, 7 SR BEV, 7 LR BEV

Group Load Curve Comparison - Control Group

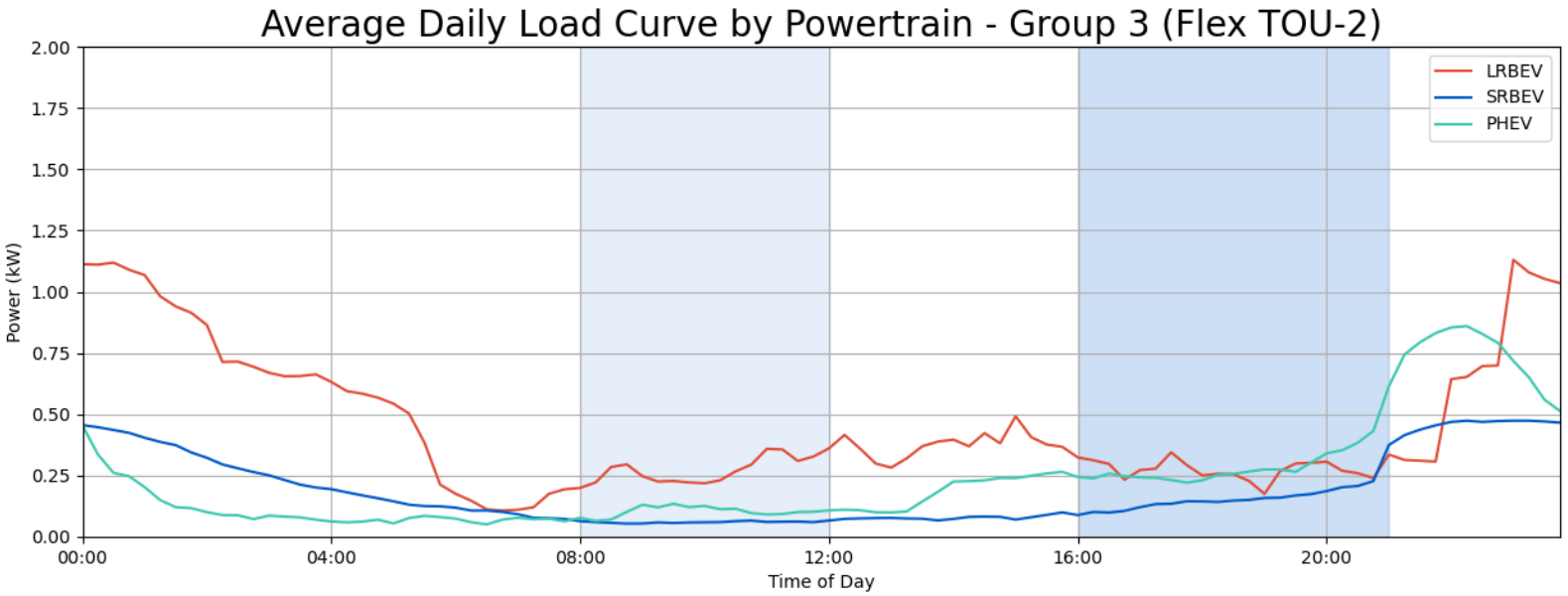


Group Load Curve Comparison - Proposed TOU



Off-Peak: 10 pm - 8 am Mon-Fri, all day weekends/holidays
Mid-Peak: 8 am - 5 pm Mon-Fri
On-Peak: 5 pm - 10 pm Mon-Fri

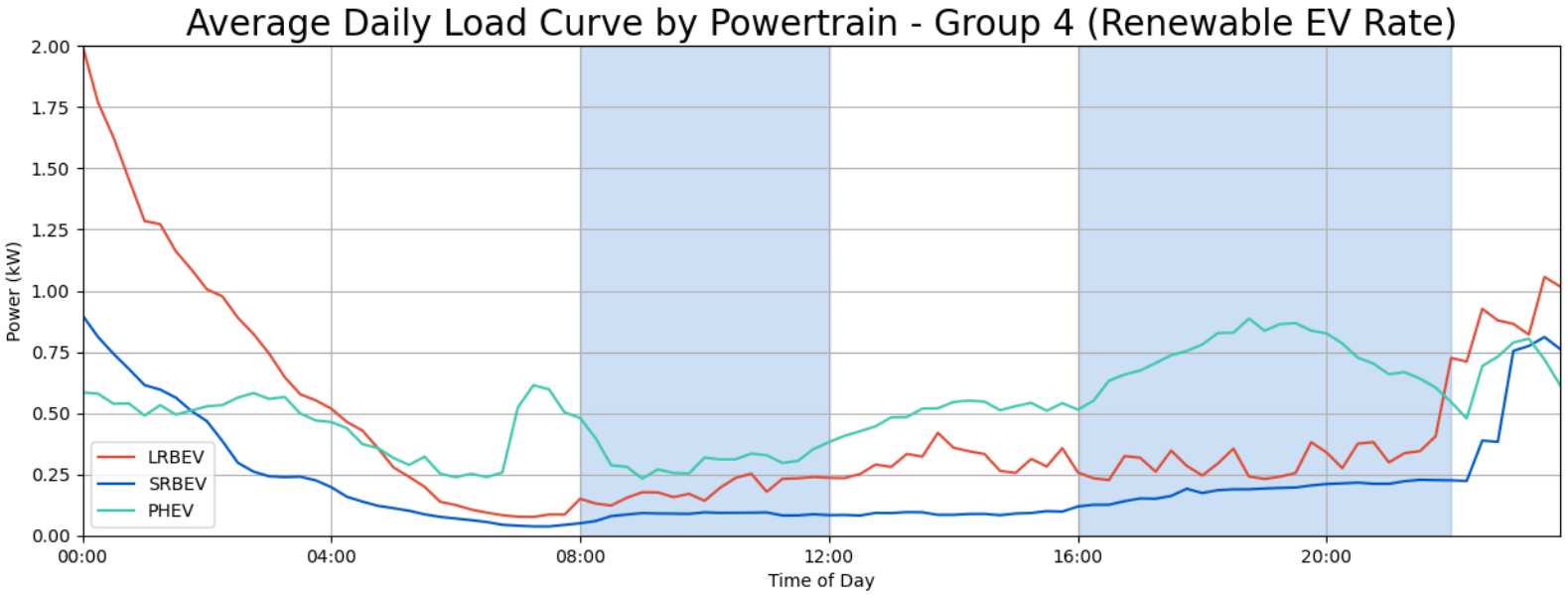
Group Load Curve Comparison - Flex TOU-2



Summer Off-Peak: 9 pm - 4 pm Mon-Fri, all day weekends/holidays
Winter Off-Peak: 9 pm - 8 am & 12 pm - 4 pm Mon-Fri, all day weekends/holidays
Summer On-Peak: 4 pm - 9 pm Mon-Fri
Winter On-Peak: 8 am - 12 pm & 4 pm - 9 pm Mon-Fri

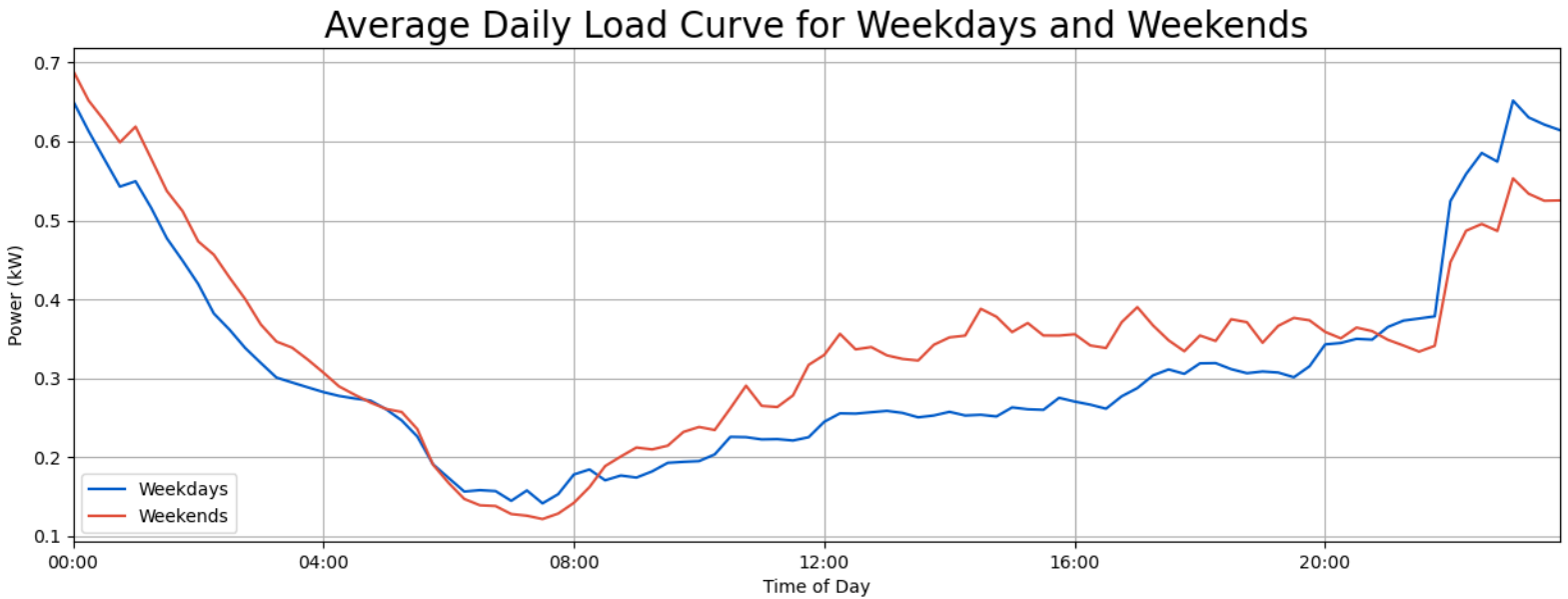
Summer: May 1st to October 31st
Winter: November 1st to April 30th

Group Load Curve Comparison - Renewal EV Rate

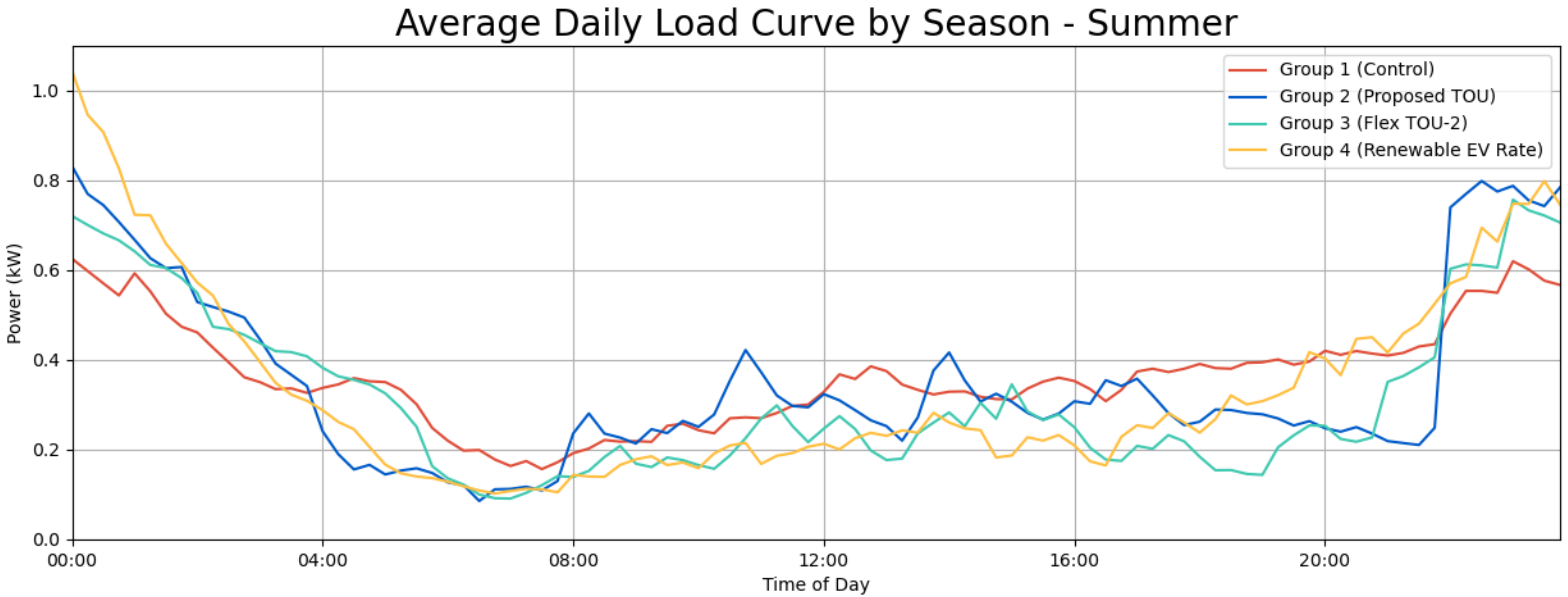


Off-Peak: 10 pm - 8 am & 12 pm - 4 pm Mon-Fri, all day weekends/holidays

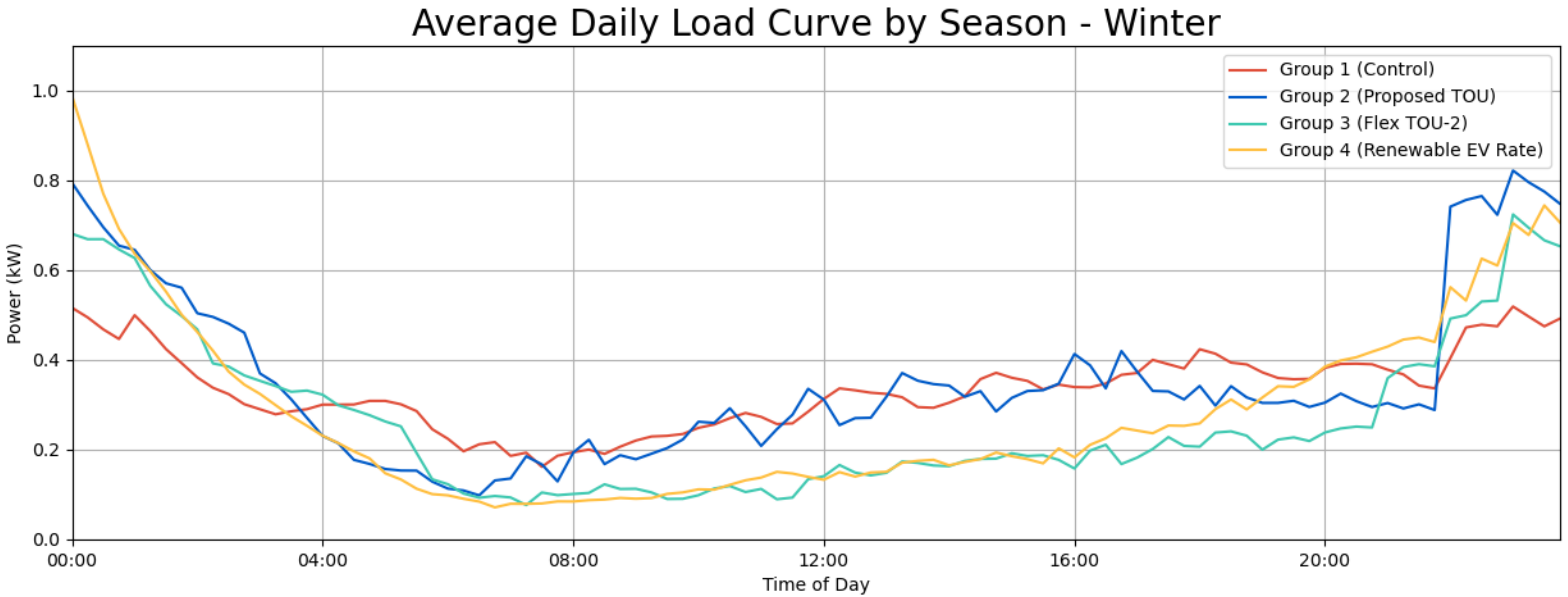
Weekday and Weekend Load Curve Comparison



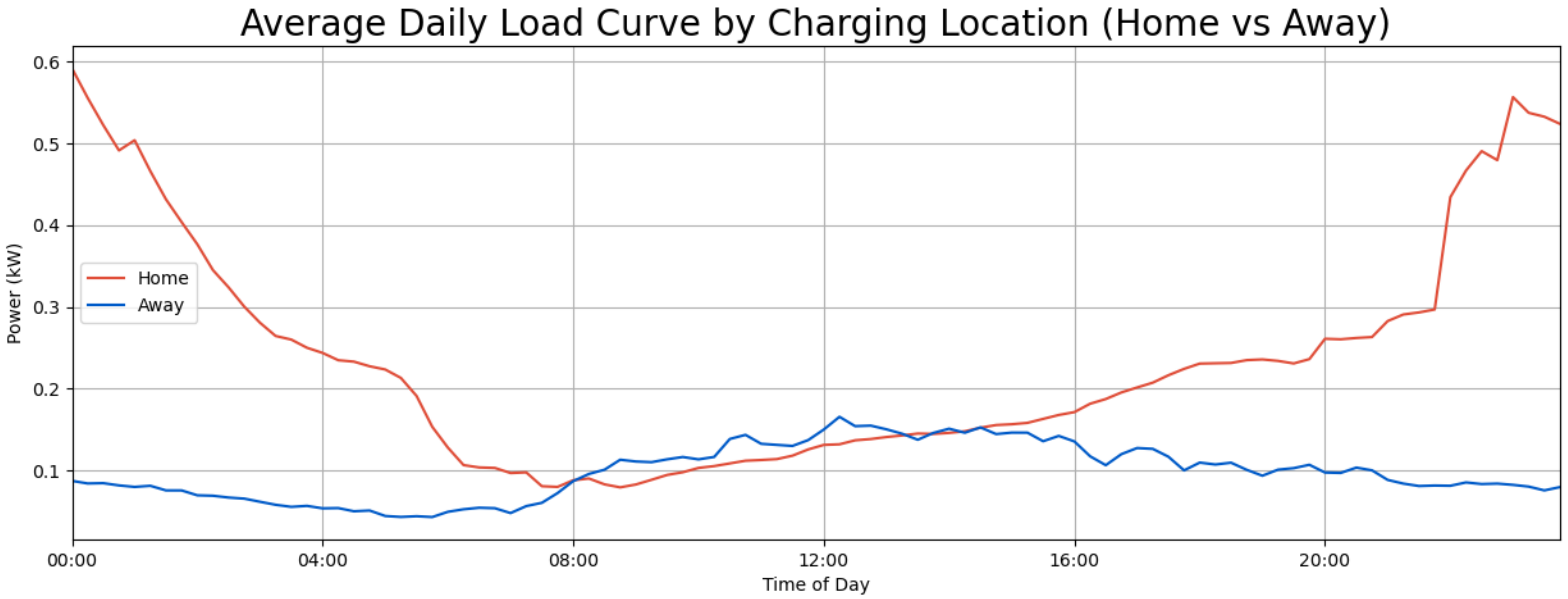
Seasonal Load Curve Comparison - Summer



Seasonal Load Curve Comparison - Winter



Charging Location Load Curve Comparison



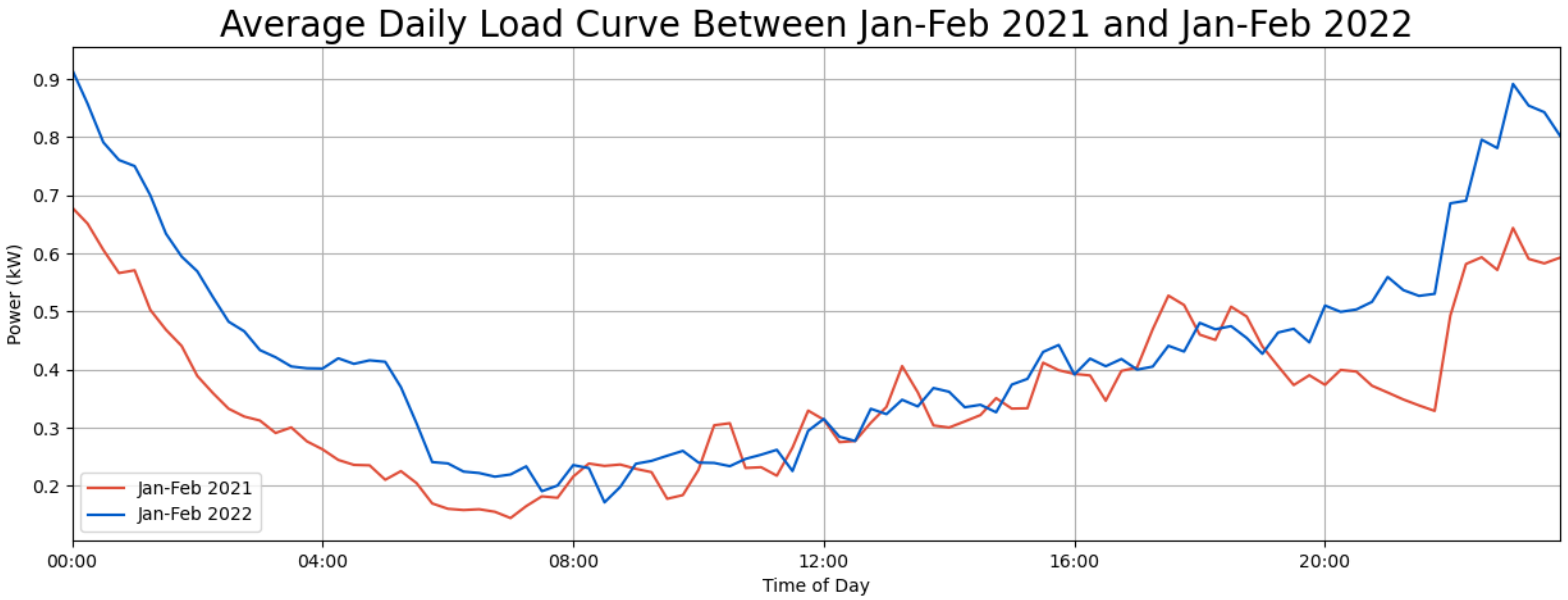
COVID-19 Impacts on Driving and Charging

The impacts of the COVID-19 pandemic were analyzed by comparing data from January and February in the year 2021 to data collected in the year 2022:

- Approximately 19% more miles travelled were recorded in 2022 after travel restrictions from the pandemic had loosened.
- Approximately 16% more energy was charged in 2022 over 2021 for the same period.

Duration	Total Distance (miles)	Total Charge Energy (kWh)	Number of Unique Vehicles
Jan - Feb 2021	133108	53805	146
Jan - Feb 2022	158867	62533	133

Load Curve Comparison - COVID-19 Impacts



Conclusions

Driving and Charging

- LR BEVs tend to drive longer distances and have a higher energy demand than SR BEVs and PHEVs
- EV Drivers are aware of charging impacts on their battery and typically start charging with a SOC of ~65% and end with an SOC of 90%. LR BEV drivers end with a lower SOC of ~80%
- Most EV Drivers charge using a Level 2 charger and their is some dependency on DCFC with approximately 2% of charges occurring at this charging level.
- Summer and winter charging demand was similar but weekend charging was more sporadic than weekday charging

Charging Incentives

- The test bed groups exhibited somewhat different behaviour from the control group and seemed to demonstrate some willingness to charge off-peak, particularly where incentives were offered.
- When off-peak times were available for daytime charging these did not seem to be overly utilized
- The small sample sizes of these groups may allow for individual vehicles become overly influential when analyzing load curves

Appendix - Definitions

Direct Current Fast Charge (DCFC) - There is no standard charge for DCFCs, but they range in power from 50 kW-140+ kW and can deliver a charge of approximately 80% in 30 minutes.

Driving Day - a day, midnight to midnight, in which the vehicle was driven. This is used to calculate averages only for days that the individual vehicle drove some distance.

Level 1 Charger - a Level 1 (L1) charger is included with most EVs. It plugs into a traditional 110V-120V household outlet and is capable of a charge power of 1.5 kW

Level 2 Charger - a Level 2 (L2) charger can be found in areas for public parking and also be installed at a residential location for personal use. They provide power at 220V-240V

Long Range Battery Electric Vehicle (LR BEV) - a fully electric vehicle with a battery capacity of greater than 50 kWh

Plug-in Hybrid Electric Vehicle (PHEV) - leverages both a battery to power an electric motor and another fuel to power an internal combustion engine

Short Range Battery Electric Vehicle (SR BEV) - a fully electric vehicle with a battery capacity of 50 kWh or less

State of Charge (SOC) - the level of charge of an electric battery relative to its capacity.

Time of Use (TOU) - electricity rate per kilowatt hour charged to customers on a sliding scale rate, based on the time used.

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