Portland General Electric Company
121 SW Salmon Street • 1WTC0306 • Portland, OR 97204
portlandgeneral.com

May 19, 2022

Via Electronic Filing

Public Utility Commission of Oregon
Attention: Filing Center
P.O. Box 1088
Salem, OR 97308-1088

Re: UM 1938 Evaluation of PGE's Transportation Electrification Pilot

Dear Filing Center,

In accordance with PGE's Transportation Electrification (TE) Plan approved by Commission Order No. 18-054 in Docket No. UM 1811 and the TE Pilots Deferral in Docket No. UM 1938, enclosed is the 2021 evaluation of Portland General Electric Company's (PGE's) TE pilots: Electric Mass Transit (TriMet), Electric Avenue (EA), and Outreach & Education. This evaluation addresses the required learnings agreed to by parties in Docket No. UM 1811 and approved in Order 18-124 as well as the reporting requirements stated in OAR 860-087-0040. The UM 1938 Pilot Deferral also includes cost detail regarding the evaluation.

The Evaluation

PGE contracted with a third-party evaluator, Opinion Dynamics or ODC, to track progress towards pilot goals; document implementation successes, challenges, and key learnings; and offer recommendations for continuing implementation. ODC's 2021 evaluation report is enclosed.

This is the third of multiple evaluation reports that will be produced, and the report appendix lists evaluation activities planned in 2022 through 2023 (some activities have been revised in response to the COVID-19 pandemic).

Some of the key findings from ODC's 2021 evaluation include:

Outreach & Education:

- Customer familiarity with electric vehicles (EVs) has increased since 2018. Additionally, significantly more customers reported intending to purchase an EV or plug-in hybrid electric vehicle (PHEV) for their next vehicle in recent years—increasing from 17% in 2019 to 32% in 2021. However, only one-quarter (24%) of customers have had first-hand experience driving an EV. Customers who are not currently considering purchasing an EV are significantly less likely to report having first-hand experience with driving an EV.
- Environmental protection and fuel savings are the primary motivations for purchasing an EV among residential customers, but affordability of EVs and vehicle range continue to be

primary barriers to purchasing an EV for customers. Customer concerns over affordability go beyond the purchase price of an EV and include EV charging costs and the costs of installing home charging.

- Multifamily building owners and managers are interested in installing on-site charging and there is an expectation that tenant demand for EV charging will increase over time; however, they perceive low demand for EV charging today and lack information about the charger installation process. About one-quarter (23%) of residential customers who are not considering purchasing an EV for their next vehicle report living in multifamily properties and could be more likely to consider an EV if charging was available to them.

Electric Avenue:

- Charger uptime has improved since 2020; however, the EA network continued to see some hardware and software issues in 2021. PGE has worked with the charging equipment and software vendors to implement a performance improvement plan to increase the reliability of chargers.
- About two-fifths (38%) of EV owners report being aware of and having charged their EV at PGE's EA sites. Among customers who indicated they were not considering an EV for their next vehicle, about half (45%) mentioned that additional charging infrastructure may encourage them to purchase or lease an EV in the future, suggesting a continued need for community charging infrastructure.
- There is limited awareness of PGE's EA sites among multifamily owners, managers, and tenants.

Electric Mass Transit:

- The buses running on Line 62 have continued to experience intermittent availability throughout 2021 due to vehicle issues and COVID-19 related service reductions. Currently, PGE staff rely on the vendor or subcontractors to complete the repair work, which has led program staff to look for ways to train internal staff to perform maintenance and repairs on faulty chargers in order to provide TriMet with a more seamless experience and faster repair turnaround times. Despite these challenges, TriMet remains committed to fleet electrification and plans to expand its electric bus fleet, integrating learnings from this pilot along the way.

Following are ODC's recommendations to PGE, and PGE's response:

Pilot Area	**ODC Recommendation**	**Actions**
Outreach and Education	Consider ways to increase customer familiarity with EVs. Past Pilot efforts to increase familiarity with EVs have included ride-and-drive events and partnerships with transportation network companies (TNCs) to increase adoption of EVs among TNC drivers, which have been successful to date. When safe to do so, consider sponsoring additional ride-and-drives to increase	PGE with the lead sponsor for the EV showcase "Electric Avenue" at the 2022 Portland International Auto Show (no relation to PGE's Electric Avenue network). The Electric Avenue was expanded this year and allowed us to have two dedicated sections. In each area we had dedicated staff to engage

	customer familiarly with EVs. Additionally, continue to partner with TNCs to further familiarize drivers and customers with EVs.	attendees on rebates and incentives, charging infrastructure, and the general benefits of driving electric. PGE is also sponsoring two Ride and Drive events in 2022: Electric Car Guest Drive (May 27 & 28), and National Drive Electric Week (week of September 23). For both of these events, we will conduct outreach to include TNC drivers with the intention of letting them explore EVs.
	Consider ways to alleviate customer concern with the price of EVs. Continue to target marketing to residential customers highlighting the lower cost of electric fuel compared to gasoline and diesel and the lower maintenance costs associated with EVs. Additionally, consider providing customers with a Total Cost of Ownership (TCO) tool on the PGE website, which customers can use learn about the costs of owning EVs as compared to gasoline-fueled vehicles. The TCO tool should include information on electric fuel costs, maintenance costs, and available tax incentives. Information about tax incentives is especially crucial for low- to moderate-income customers who may qualify for Oregon's recently increased Charge Ahead tax rebate.	PGE will launch a TCO tool on our website in Q2 2022, and will actively market the tool to residential customers. The tool will offer specific cost and greenhouse gas emissions savings based on the user's selected driving and charging habits, and will display information about available tax credits, state rebates, and PGE programs that can help further lower costs.
	Consider ways to connect customers with used EVs. As EVs are relatively new to the market, customers may not realize the availability of used EVs. Providing information about the availability of used EVs and designing messaging to alleviate used EV concerns (i.e., resale value and battery range) could help to increase EV adoption.	PGE maintains its partnership with Platt Automotive, the predominant local used EV dealership in our service territory. We partnered with Platt to highlight used EVs at the Fall 2021 Home and Garden show as part of our event participation.
	Consider expanding EV-related outreach and education efforts to residential customers, focusing on PGE's advisory role for installing home charging. This could	PGE plans to develop a trade ally network of qualified installers for residential and commercial EV chargers by the end of 2022.

	include developing a trade ally network of qualified installers that could help customers to assess panel capacity for installing new circuits and selecting and installing chargers.	
	Consider conducting a multifamily market characterization study to identify the prevalence of different parking configurations at multifamily properties (e.g., number of onsite spaces, assigned parking, etc.) to use in program design and customer targeting.	PGE intends to undertake this work as part of its development of a tailored multifamily charging solution in 2022.
	Target information to multifamily property owners and managers, specifically related to the costs of owning and maintaining EV charging equipment and how to fit chargers in existing parking configurations.	PGE intends to undertake this work as part of its development of a tailored multifamily charging solution in 2022.
	Consider an updated program offering tailored to multifamily properties for EV charging infrastructure.	PGE intends to undertake this work as part of its development of a tailored multifamily charging solution in 2022.
	Consider short-term ways to lessen upfront costs of EV charging for multifamily properties until tenant demand increases. Without the lower costs, building owners and managers may not see enough benefit to make the installation worthwhile yet.	PGE intends to undertake this work as part of its development of a tailored multifamily charging solution in 2022.
Electric Avenue	Continue to monitor performance metrics to ensure uptime and first pass charge rate meet agreed upon levels.	PGE closely monitors equipment performance via remote review of real-time equipment utilization and fault data and has increased on-site tests and inspections. PGE also plans to train and certify PGE staff to self-perform equipment repairs to further shorten periods of equipment down time.
	Expand EA sites and/or provide additional community charging infrastructure in PGE's service territory.	PGE is considering a program to work with municipal customers to install EV charging in communities.
	Consider increasing promotion of EA sites to increase customer awareness and help alleviate customer concerns about public charging infrastructure availability.	PGE will highlight EA sites in its TCO tool.
	Consider outreach to multifamily property owners and managers regarding the current	PGE will consider this as part of its municipal offer.

	EA sites to ensure that tenants are aware of nearby charging availability.	
TriMet	Continue to invest in training for internal staff or partner with local electricians to ensure chargers are repaired in a timely manner. Added internal technical expertise can also be leveraged to assist other customers with heavy-duty charging needs.	PGE has dedicated additional staff time to remote monitoring, testing, inspecting, and coordination and plans to train and certify PGE staff to self-perform equipment repairs.
	Explore workforce, education, and training (WE&T) programs to increase the number of qualified technicians available to install and repair heavy- and light-duty chargers. PGE could partner with local trade unions and technical programs to help tradespeople transition their skills in diesel infrastructure to EV bus repair and charging infrastructure.	PGE plans to train and certify PGE staff to self-perform equipment repairs. PGE staff are also evaluating long term workforce development needs in corporation with a variety of stakeholders.

If you have any questions or require further information, please contact Megan Stratman at 503-464-7488. Please direct all formal correspondence and requests to the following e-mail address pge.opuc.filings@pgn.com.

Sincerely,

/s/ Jaki Ferchland
Manager, Revenue Requirement

Enclosure

cc: UM 1811 and UM 1938 Service Lists and Eric Shierman, OPUC Staff

Opinion Dynamics

Portland

503 287 9136 tel
503-281-7375 fax

1500 NE Irving Street
Suite #370
Portland, OR 97232

Evaluation of Portland General Electric's Transportation Electrification Pilot Programs

2021 Annual Report

March 29, 2022

Opinion Dynamics

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1. Executive Summary

1.1 Pilot Summary and Evaluation Activities

Portland General Electric (PGE) launched a coordinated set of three pilot programs in late 2018 that encourages greater electrification of the transportation sector. While each pilot program has its specific activities and immediate targets, they work concurrently toward several overlapping near-term outcomes including increasing customer awareness and use of electric vehicles (EVs), buses, and charging stations to lower barriers to the adoption of EVs. The following summarizes each pilot's objectives and related evaluation activities conducted by Opinion Dynamics ("the team") in 2021.

Outreach, Education, and Technical Assistance (OE&TA) Pilot

- **Residential customers:** Since 2020, PGE's OE&TA activities targeting residential customers have been limited due to the COVID-19 pandemic. Prior to the pandemic, PGE provided outreach to potential EV purchasers and lessees by sponsoring ride-and-drive events, working with a transportation network company (TNC) to increase adoption of EVs among TNC drivers, and attending the Portland International Auto Show. Additional residential OE&TA activities included sponsoring nine interactive educational kiosks at auto dealerships and providing dealer training, as well as partnering with original equipment manufacturers (OEMs) to offer vehicle rebates to PGE customers.
  - **Evaluation approach:** Surveys with residential customers who are considering purchasing a vehicle in the next five years and EV owners

- **Nonresidential customers:** PGE provided technical assistance and education to business customers interested in (non-fleet) vehicle electrification or workplace charging. In 2021, PGE began offering consultations about fleet electrification through its Fleet Partner program.
  - **Evaluation approach:** Interviews with multifamily property owners and managers, surveys with recipients of technical assistance consultations, and PGE-sponsored education[1]

Electric Avenue (EA) Pilot

- PGE installed six EA charging stations consisting of 12 Level 2 (L2) and 22 Direct Current Fast Charging (DCFC) ports geographically dispersed throughout its service territory.
  - **Evaluation approach:** Interviews with pilot staff and partners, interviews with multifamily property owners and managers, and surveys with EV owners and residential customers who are considering purchasing a vehicle in the next five years

Electric Mass Transit 2.0 (TriMet) Pilot

- PGE installed, owns, and operates two bus depot charging stations and one en route charging station, while TriMet procured five electric buses with 200 kWh batteries.
  - **Evaluation approach:** Interviews with pilot staff and partners

[1] Results from surveys with recipients of technical assistance consultations and PGE-sponsored education will be included in the 2022 Annual Report.

1.2 Key Findings and Recommendations

The following section provides key evaluation findings and recommendations, by pilot. **Evaluation activities will continue through 2023 that will allow the team to monitor and expand on these findings (See Appendix A for a summary of future evaluation activities).**

1.2.1 Outreach, Education, and Technical Assistance (OE&TA) Pilot

- **Residential customer familiarity with EVs:** Customer familiarity with EVs is moderate to high and has increased since 2018. Additionally, significantly more customers reported intending to purchase an EV or plug-in hybrid electric vehicle (PHEV) for their next vehicle in recent years—increasing from 17% in 2019 to 32% in 2021. Customer familiarity with EVs, however, continues to lag behind that of diesel and gasoline vehicles. This is likely due in part to limited personal experience with an EV, as only one-quarter (24%) of customers have had first-hand experience driving an EV. Customers who are not currently considering purchasing an EV are significantly less likely to report having first-hand experience with driving an EV. Further, although customer understanding of EV fuel costs compared to gasoline vehicles has improved since the Baseline and Wave 1 surveys, customer understanding that EVs have lower maintenance costs has remained low.
  - **Recommendation:** Consider ways to increase customer familiarity with EVs. Past Pilot efforts to increase familiarity with EVs have included ride-and-drive events and partnerships with TNCs to increase adoption of EVs among TNC drivers, which have been successful to date. When safe to do so, consider sponsoring additional ride-and-drives to increase customer familiarly with EVs. Additionally, continue to partner with TNCs to further familiarize drivers and customers with EVs.
- **Motivations and barriers to purchasing EVs:** Environmental protection and fuel savings are the primary motivations for purchasing an EV among residential customers. Motivations for purchasing an EV differ between EV owners and non-EV owners, with EV owners being significantly more likely to report less vehicle maintenance, vehicle performance, and the convenience of charging at home as major reasons to purchase an EV compared to non-EV owners. Affordability of EVs and vehicle range continues to be primary barriers to purchasing an EV for customers. Tax incentives are key to helping decrease the purchase price of EVs; however, fewer than half (44%) of customers are aware of state and federal tax incentives—with awareness particularly low among customers who are not considering purchasing an EV. Further, used EVs can be an affordable alternative to purchasing a new vehicle, especially among lower income customers. About half (55%) of residential customers who report considering an EV indicated they would in interested in purchasing a used EV. Customer concerns over affordability go beyond the purchase price of an EV and include EV charging costs and the costs of installing home charging. Customers who are not currently considering purchasing an EV are significantly more likely to have these concerns.
  - **Recommendation #1:** Consider ways to alleviate customer concern with the price of EVs. Continue to target marketing to residential customers highlighting the lower cost of electric fuel compared to gasoline and diesel and the lower maintenance costs associated with EVs. Additionally, consider providing customers with a Total Cost of Ownership (TCO) tool on the PGE website, which customers can use learn about the costs of owning EVs as compared to gasoline-fueled vehicles. The TCO tool should include information on electric fuel costs, maintenance costs, and available

tax incentives. Information about tax incentives is especially crucial for low- to moderate-income customers who may qualify for Oregon's recently increased Charge Ahead tax rebate.[2]

- **Recommendation #2:** Consider ways to connect customers with used EVs. As EVs are relatively new to the market, customers may not realize the availability of used EVs. Providing information about the availability of used EVs and designing messaging to alleviate used EV concerns (i.e., resale value and battery range) could help to increase EV adoption.

- **Information about EVs:** While PGE is not a primary source of EV-related information, residential customers do look to PGE to ensure reliable and affordable charging, particularly at their home. Residential customers report receiving information about EVs from a variety of resources, primarily friends and colleagues. About one-fifth (22%) of customers reported being aware of at least one PGE EV-related resource or campaign. EV owners are significantly more likely to report being aware of PGE's EV resources or campaigns than non-EV owners (39% compared to 22%), specifically PGE's EV website. A large majority of customers express high agreement that PGE should ensure the existing electrical system can support EV charging and that PGE should help to make installing EV charging at home easier. Further, there is high, and increasing interest among customers in PGE offering discounted EV charging plans.

  - **Recommendation:** Consider expanding EV-related outreach and education efforts to residential customers, focusing on PGE's advisory role for installing home charging. This could include developing a trade ally network of qualified installers that could help customers to assess panel capacity for installing new circuits and selecting and installing chargers.

- **Charging opportunities at multifamily properties:** Multifamily building owners and managers are interested in installing on-site charging but lack information about the process. Owners and managers would need additional information, primarily around cost, placement of chargers, and tenant demand to overcome this barrier and install on-site charging. Additionally, there is interest in utility-owned infrastructure; however, building owners and managers would need to know the specifics of the ownership structure before pursuing that option.

  - **Recommendation #1:** Consider conducting a multifamily market characterization study to identify the prevalence of different parking configurations at multifamily properties (e.g., number of onsite spaces, assigned parking, etc.) to use in program design and customer targeting.

  - **Recommendation #2**: Target information to multifamily property owners and managers, specifically related to the costs of owning and maintaining EV charging equipment and how to fit chargers in existing parking configurations. Key decision makers, including property owners and managers need this information to inform their decision-making.

  - **Recommendation #3**: Consider an updated program offering tailored to multifamily properties for EV charging infrastructure. About half of property owners and managers reported being unsure what ownership structure would work best for them as they did not have enough information about the ownership costs to make an informed decision.[3] A program offering should provide details related to customer costs and commitments for different charging infrastructure ownership structures.

- **Demand for EV charging at multifamily properties**: Multifamily property owners and managers consider tenant needs when adding amenities to their property, which often compete with required property

[2] The Oregon Charge Ahead tax rebate increased from $2,500 to $5,000 on January 1, 2022, for households earning less than 400% of the federal poverty guidelines.

[3] Property owners and managers were asked if they had a preference utility-owned or property-owned charging infrastructure but were not provided details on the ownership structures.

maintenance. Property owners and managers currently perceive low demand for EV charging; however, there is an expectation that tenant demand for EV charging will increase over time. Further, about one-quarter (23%) of residential customers who are not considering purchasing an EV for their next vehicle report living in multifamily properties and could be more likely to consider an EV if charging was available to them.

- **Recommendation**: Consider short-term ways to lessen upfront costs of EV charging for multifamily properties until tenant demand increases. Without the lower costs, building owners and managers may not see enough benefit to make the installation worthwhile yet.

1.2.2 Electric Avenue (EA) Pilot

- **Charger uptime:** Charger uptime has improved since 2020; however, the EA network continued to see some hardware and software issues in 2021. PGE has worked with the charging equipment and software vendors to implement a performance improvement plan to increase the reliability of chargers. The improvement plan included replacing malfunctioning charger components and changes to performance tracking to focus both on charger uptime and first pass charge rates (i.e., how often a charge is successfully delivered to an EA user).
  - **Recommendation:** Continue to monitor performance metrics to ensure uptime and first pass charge rate meet agreed upon levels.
- **Customer awareness and use of EA sites:** There are moderate levels of customer awareness and use of PGE's EA sites, which could help increase customer consideration of EVs in the future. Residential customer awareness of PGE's EA sites has decreased since 2019; however, awareness levels are significantly higher than 2018: 25% of customers reported being aware of EA sites in 2021, down from 33% in 2019 but up from 13% in 2018. About two-fifths (38%) of EV owners report being aware of and having charged their EV at PGE's EA sites. Among customers who indicated they were not considering an EV for their next vehicle, about half (45%) mentioned that additional charging infrastructure may encourage them to purchase or lease an EV in the future, suggesting a continued need for community charging infrastructure.
  - **Recommendation #1:** Expand EA sites and/or provide additional community charging infrastructure in PGE's service territory.
  - **Recommendation #2:** Consider increasing promotion of EA sites to increase customer awareness and help alleviate customer concerns about public charging infrastructure availability.
- **Multifamily awareness of EA sites**: There is limited awareness of PGE's EA sites among multifamily owners, managers, and tenants. About one-third of interviewed owners and managers reported being aware of the EA site that was within a mile from their property. Additionally, few owners and managers reported that tenants are aware of or have inquired about the nearby EA sites.
  - **Recommendation**: PGE should consider outreach to multifamily property owners and managers regarding the current EA sites to ensure that tenants are aware of nearby charging availability. Although most building owners and managers reported having a general positive working relationship with PGE, most owners and managers have not been taking full advantage of PGE programs. Additional outreach should be provided to this population to encourage greater awareness of PGE opportunities and greater participation in PGE's programs.

1.2.3 Electric Mass Transit 2.0 (TriMet) Pilot

- **Bus availability:** The buses running on Line 62 have continued to experience intermittent availability throughout 2021 due to hardware issues and COVID-19 related service reductions. In 2021, four out of five buses were dispatched approximately 25% of the time, with the remaining bus being out of service for most of 2021 due to hardware issues. Bus maintenance and operator staff shortages were an ongoing challenge for Line 62 in 2021, in addition to low transit demand due to the COVID-19 pandemic. PGE staff mentioned that bus issues kept the fleet grounded far more than charger issues in 2021. Currently, PGE staff rely on the vendor or subcontractors to complete the repair work, which has led program staff has to look for ways to train internal staff to perform maintenance and repairs on faulty chargers in order to provide TriMet with a more seamless experience and faster repair turnaround times.
  - **Recommendation #1:** Continue to invest in training for internal staff or partner with local electricians to ensure chargers are repaired in a timely manner. Added internal technical expertise can also be leveraged to assist other customers with heavy-duty charging needs.
  - **Recommendation #2:** Explore workforce, education, and training (WE&T) programs to increase the number of qualified technicians available to install and repair heavy- and light-duty chargers. PGE could partner with local trade unions and technical programs to help tradespeople transition their skills in diesel infrastructure to EV bus repair and charging infrastructure.
- **Charger operations and maintenance:** The en route fast charger at the Sunset Transit Center experienced issues that caused disruptions to bus service in 2021; however, the charger has been functional for most of the year. Additionally, TriMet has seen reliable performance from the Merlo Garage chargers in 2021. TriMet and PGE report being satisfied with the timeliness of the charging equipment vendor in addressing issues and most issues with vendor communication documented in previous reports have been corrected in 2021. However, PGE is actively looking for ways to train internal staff to complete charger repairs to improve turnaround times. Further, the Pilot has implemented a preventative maintenance schedule to ensure charger reliability, which includes quarterly visual checks on the en route and depot chargers to ensure that they are working properly.

2. Introduction

2.1 Transportation Electrification Pilot Background

PGE launched a coordinated set of pilot programs in late 2018 that encourages greater electrification of the transportation sector. While each pilot program has specific activities and immediate targets (Table 1), they work together to bring about overlapping near-term outcomes: (1) PGE customers will see and use EVs, buses, and charging stations, helping to lower barriers to the adoption of EVs; (2) Multifamily and low-income customers will have better access to EV transportation; and (3) Businesses, municipalities, and governmental agencies will receive technical assistance and education that will improve their ability to support an EV-ready infrastructure and encourage adoption of EV fleets.

Table 1. Description of PGE's Pilot Activities and Outcomes

Outreach, Education, and Technical Assistance Pilot (OE&TA)
This pilot relies on the following strategies to increase the adoption of EVs in PGE's territory: ▪ EV technical assistance to commercial and industrial customers, municipalities, governmental agencies, non-profits, transit agencies and providers, low-income service providers, and community-based organizations (CBOs) that are considering fleet electrification, workplace charging, or procurement of EVs. ▪ EV ride-and-drive events (currently paused due to COVID-19). ▪ Educational kiosks and education of auto dealer staff on a proprietary EV charger labeling system and mobile application for EV drivers who reside in PGE territory. ▪ Partnerships with OEMs (BMW, Chevrolet, and Nissan) to offer combined PGE and OEM incentives for an EV to PGE customers (referred to as "bulk purchase partnerships"). ▪ Partnerships with TNCs to educate drivers about the benefits of driving EVs and increase EV utilization through discounted charging initiatives.
Electric Avenue Pilot
PGE installed six EA charging sites geographically dispersed throughout its service territory. The pilot will test pricing signals to encourage off-peak charging and charging when excess renewable energy is available. The pilot will also examine the impact of community charging on increasing adoption of EVs by PGE customers (including multifamily residents) and TNC drivers.
Electric Mass Transit 2.0 ("TriMet") Pilot
PGE owns two bus depot charging stations (150 kW each) and one en route charging station (450 kW), while TriMet procured five electric buses with 200 kWh batteries. The pilot will gather bus charging data from the stations to assess the energy and cost impacts of electrifying an entire bus route over time as well as operations impacts to TriMet.

2.1.1 Pilot Accomplishments

The following provides a summary of accomplishments during the first three years (2019–2021) of the TE Pilots.

Outreach, Education, and Technical Assistance Pilot

Since the beginning of the OE&TA Pilot in late 2018, PGE has conducted several outreach and education activities, including:

- **Installing EV educational kiosks:** A total of nine educational kiosks have been installed at partner dealerships: two BMW dealerships (2019 and 2021), a dealership for pre-owned EVs (2019), an Audi dealership (2021), a Chevrolet dealership (first installed in 2018 and moved to a different dealership

in 2021), a Ford dealership (2021), a Hyundai dealership (2021), a Volkswagen dealership (2021), and a Volvo dealership (2021).

- **Partnering to offer financial incentives for EVs and chargers to PGE customers:** Partnership incentives have included a $3,500 rebate on the Nissan Leaf (87 rebates issued in 2019[4]), a $500 rebate on the Chevrolet Bolt or a free L2 home charger at a Chevrolet dealership (12 Chevrolet Bolt rebates issued in 2019), and $5,000 in a raffle towards an EV for 2019 National Drive Electric Week.[5]
- **Sponsoring Ride-and-Drive events:** PGE sponsored Ride-and Drive events at the Portland International Auto Show (January 2019), a Chevrolet dealership (February 2019), EA grand openings (April, May, and October 2019), the Electric Car Guest Drive (June 2019), National Drive Electric Week (September 2019), and an event specifically for TNC drivers (November 2019). Note that no PGE-sponsored Ride-and-Drive events occurred in 2020 or 2021 due to COVID-19.
- **EA exhibit at 2020 International Auto Show:** PGE along with other stakeholders sponsored an EA exhibit at the 2020 International Auto Show in February 2020. The exhibit included three 2020 EVs, a vehicle display wall showcasing readily available EVs and PHEVs in Oregon, an information booth with staff available to answer questions from attendees, two EV educational kiosks similar to those placed in participating dealerships, and two charging stations. The exhibit generated approximately 230,000 impressions over the course of four days.
- **Business technical assistance:** PGE staff provided workplace charging and fleet electrification technical assistance to commercial, industrial, and non-profit organizations as well as local governments and transit authorities. In total, 155 individuals consulted with PGE staff for business technical assistance as part of the OE&TA Pilot since September 2018 (34 in 2018, 89 in 2019, 25 in 2020, and 7 in 2021), representing 85 local organizations (18 in 2018, 42 in 2019, 18 in 2020, and 7 in 2021).[6]
- **Comprehensive fleet electrification assessments:** In addition to the business technical assistance consultations, PGE and a fleet electrification solution provider produced five comprehensive fleet electrification assessments in 2020. The five assessments found that 4,597 light-duty fleet vehicles could be economically converted to EVs, resulting in a reduction of 17,642 metric tons of CO_2 annually, lifetime fuel savings of $49 million, and lifetime maintenance savings of $25 million. As of July 2021, fleet electrification assessments are being offered through PGE's Fleet Partner program.
- **Educational events webinars, classes, and conference sessions**: PGE sponsored two educational events co-sponsored by a builder training implementor for those interested in building EV-ready homes, two workplace charging webinars, two fleet electrification classes, an electrifying school transportation session at the 2018 Oregon Pupil Transportation Conference, and a workplace charging session at the 2019 Northwest Facilities Expo. In total, 92 individuals attended an educational event, webinar, or class since May 2018.
- **Social media activity:**
  - **2018–2019:** A total of 330 posts on Twitter, Facebook, and Instagram between 2018 and 2019 (97 in 2018 and 233 in 2019) resulting in 3,435 engagements (830 "likes," comments, and

[4] Due to changes to the dealership database, the team was unable to determine the number of Nissan Leaf rebates issued after 2019.
[5] Rebates for the Nissan Leaf were discontinued in 2021 due to supply chain issues. As of December 2020, there are no OEM rebates being offered to customers in partnership with PGE.
[6] Business technical assistance offered through the OE&TA Pilot was discontinued in July 2021. Business technical assistance is now being offered through PGE's Fleet Partner program. Note that one additional follow-up survey will be fielded with technical recipients in early 2022 with findings being presented in the 2022 Annual report.

shares in 2018 and 2,605 in 2019) and a reach of 2.2 million (394,000 in 2018 and 1.8 million in 2019).

- **2020:** Due to COVID-19, PGE did not engage in any social media activity related to the OE&TA Pilot in 2020.
- **2021:** Posts associated with PGE's Residential EV Charging Pilot on Facebook and Instagram resulted in 119,769 impressions and 1,596 clicks.[7] Additionally, a social media campaign associated with National Drive Electric Week on Facebook and Instagram resulted in approximately 2 million impressions and 98 clicks.[8]

Electric Avenue Pilot

PGE developed the EA Pilot Program under its initial Transportation Electrification Plan to help increase the growth of EV adoption and support the growing network of EV charging infrastructure. PGE's first EA site in Downtown Portland was opened to the public in 2015. EA Pilot activities in 2019 and 2020 included expanding the EA network to include six additional sites throughout PGE's service territory (Table 2). Users can charge their vehicles at EA sites for $3 per two-hour session using a L2 charger, $5 per two-hour session using a DCFC, or an unlimited charging plan for $25 per month.[9] PGE charges an additional 19 cents per kWh when customers charge their EVs at the EA sites between 3:00 p.m. and 8:00 p.m. to account for peak time and shape demand,

Table 2. EA Network Site Information

Location	Site Description	Opening Date	# L2 Chargers	# DCFCs
Downtown Portland[a]	Street parking in front of World Trade Center in Downtown Portland	2015	2	4
Milwaukie	Parking lot in Downtown Milwaukie	4/6/2019	2	4
Hillsboro	Shopping plaza	5/18/2019	2	4
East Portland	Shopping plaza	10/26/2019	2	4
Salem[b]	Street parking in front of Oregon State Capital building	1/16/2020	2	2
Beaverton	Public parking lot across from shopping plaza	2/3/2020	2	4
Wilsonville	Library and shopping plaza	4/6/2020	2	4

[a] Also known as the World Trade Center EA. Note that the Downtown Portland EA was the first EA site PGE opened and is not included in the EA pilot evaluation.

[b] Due to construction at the Oregon State Capital Building, the Salem site was offline for the majority of 2021.

Electric Mass Transit 2.0 (TriMet) Pilot

TriMet and PGE completed the installation and commissioning of two 150 kW Merlo Garage chargers and one 450 kW overhead fast charger at Sunset Transit center in early 2019. An electric bus manufacturer delivered the first of five electric buses in April 2019. By October 2019, all five buses on Line 62 had been delivered by the bus manufacturer and were in service. As of December 2021, four out of five buses on Line 62 were in

[7] Note that while the Residential Charging EV Pilot is not funded through the TE Pilots, it does have potential impact customer adoption of EVs, which is an overarching goal of the TE pilots.
[8] Note that National Drive Electric Week social media activity is through January 28, 2022.
[9] The two-hour charging time limit is dictated by the parking signage installed at the EA sites and not the tariff.

service. The one bus that is not in service was experiencing wiring and battery issues that the TriMet team was working to fix.

2.2 Evaluation Objectives and Activities

This report is the third annual report as part of a five-year evaluation and covers pilot activities that began in late 2019 and continued through December 2021. There are three primary objectives for the five-year evaluation:

- Understand how PGE can improve its program implementation during and after the pilots
- Quantify the impacts of the pilots on EV awareness, sales, use, and barriers
- Determine the load impacts of public and electric bus chargers

This annual report primarily addresses the first and second objectives. The team conducted three research activities in 2021, beginning in January 2021 and ending in December 2021. Appendix A provides a summary of planned evaluation activities through 2023.

2.2.1 PGE TE Pilot Staff and Pilot Partner Interviews

The team conducted interviews with PGE staff and pilot partners involved with the Electric Avenue and TriMet Pilots in November and December 2021. The purpose of the interviews was to document successes and challenges associated with the two pilots after the third year of program activities. During the third round of interviews, the team interviewed five program staff and four pilot partners (Table 3).

Table 3. Count of 2021 Pilot Staff and Pilot Partner Interviews Conducted

Pilot	Pilot Staff	Pilot Partners	Total
EA	2	3	5
TriMet	2	3	5
EA and TriMet	1	-	1
Total	**5**	**6**	**11**

2.2.2 Wave 2 General Population Residential and EV Owner Survey

In 2018, PGE conducted a baseline survey (Baseline) with the general population of residential customers who indicated they were considering purchasing a vehicle within five years to assess EV awareness and perceptions.

In 2019, the team adapted the 2018 Baseline survey to create a post-pilot launch survey. The first wave of the post-pilot launch survey ("Wave 1") was conducted in 2019 and the second wave ("Wave 2"), summarized below, was conducted in July 2021. A third wave of the post-pilot launch survey ("Wave 3") will be conducted in 2023.

For Wave 2, the team invited a random sample of 16,000 PGE residential customers with email addresses to take the Wave 2 survey. Additionally, the team invited an oversample of 9,740 residential customers who potentially owned or leased an EV or PHEV to take the Wave 2 survey and respond to questions about their EV. Customers who completed the survey were entered into a drawing to win one of 12 gift cards (two valued

at $500 each and 10 valued at $100 each). The team conducted the Wave 2 survey using the same methodology as used for the previous surveys.

The survey included questions about pilot awareness, consideration of purchase, and intention to purchase or lease an EV or PHEV as well as questions explicitly addressing the pilot activities, such as if customers are familiar with any pilot campaigns. The Wave 2 survey also included additional questions to understand EV owner characteristics and behavior.

Table 4 provides a disposition summary of completed surveys for the Baseline, Wave 1, and Wave 2 general population and EV owner surveys. Overall, 929 (54%) of Baseline, 1,026 (59%) of Wave 1, and 1,179 (53%) of Wave 2 general population survey respondents reported planning to purchase a vehicle in the next five years and completed the survey. Among the oversample of EV owners, 1,951 (85%) respondents reported owning an EV and were valid respondents for purposes of analysis. Section 5 provides a summary of findings from Wave 2 respondents and provides an overall comparison to Baseline and Wave 1 survey respondents. A detailed discussion of the survey sampling, screening criteria, and survey weighting approach can be found in Appendix B.

Table 4. Disposition Summary of Baseline, Wave 1, and Wave 2 Surveys

Disposition	Baseline (2018)		Wave 1 (2019)		Wave 2 (2021)					
					General Population		EV Owner Oversample		Total	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Total Completed Screening Questions	1,736	100%	1,752	100%	2,209	100%	2,284	100%	4,493	100%
Total Screened Out	807	47%	726	41%	1,030	47%	333	15%	1,363	30%
Valid Respondents	929	54%	1,026	59%	1,179	53%	1,951	85%	3,130	70%
Overall Response Rate	**8%**		**11%**		**15%**		**25%**		**20%**	

2.2.3 Multifamily Building Owner and Manager In-depth Interviews

The team conducted interviews with owners and managers of multifamily properties located near PGE's six newly installed EA sites between October 26 and December 9, 2021. The purpose of the interviews was to assess awareness and use of nearby EA sites and to determine interest installing on-site EV charging, barriers to installing on-site EV charging, and decision-making around capital improvements

Sampling Strategy

To carry out the interviews, the evaluation team, in collaboration with PGE, designed a sampling strategy that used geospatial information systems (GIS) to identify multifamily buildings near each EA site. The team received data from PGE that included multi-unit parcels within one mile and within a half mile of each EA site with associated electric meter information and account contact information. From that, the team flagged records listed with residential rates, a multifamily dwelling type, or that had a "Nature of Business" being described as an apartment, residential multifamily property management, residential rentals, condo association, or housing. The team then flagged properties that did not have any meters that met the above criteria as lower priority in favor of prioritizing properties for which there was more certainty of having residential tenants.

Next, the team reshaped the file such that there was one record per property while keeping all contact information associated with each property. The contact information was prioritized in order according to the

meter information described above. This process resulted in a sample of 492 properties that had either a phone number or an email address associated with the account. Table 5 shows the distribution of properties by proximity to the nearest EA site.

Table 5. Multifamily Property Sample by Location to EA Site

Electric Ave	Stratum		Total
	Within Half a Mile	Within one Mile	
Beaverton	38	84	122
Salem	44	64	108
East Portland	27	50	77
Wilsonville	36	40	76
Milwaukie	35	37	72
Hillsboro	12	25	37
Total	**192**	**300**	**492**

After creating the sample of properties, the team determined that about half (47%) of the properties in the sample contained duplicate contact information. For duplicate contacts, the team combined associated property information to reference during the interviews.

Outreach and Response Rate

The team sent out initial invitation emails and at least one reminder to every email address in the sample of properties. Due to limited response from email outreach and undeliverable emails (3% of the sample), the team attempted to reach all contacts who were unresponsive via phone, if a phone number was available. The team also attempted to contact respondents who did not have a valid email address at least twice via phone, effectively attempting a census. To increase response, the team offered each respondent a $50 gift card to complete the interview.

Table 6 provides a summary of completed interviews by location to each EA site. In total, the team completed 12 interviews resulting in a 3% response rate. This response rate is calculated based on the number of properties that were sampled and does not take into account the occurrence of duplicate contacts.

Table 6. Multifamily Building Owner Completed Interviews by Location to EA Site

Electric Ave	Stratum		Total
	Within Half a Mile	Within one Mile	
Beaverton	4	1	5
Salem	2	0	2
East Portland	1	1	1
Wilsonville	0	0	0
Milwaukie	1	1	2
Hillsboro	1	0	1
Total	**9**	**3**	**12**

3. OPUC Learnings

PGE provides the Oregon Public Utilities Commission (OPUC) with learnings associated with each pilot as part of the effort to monitor the progress of the pilots.[10] Table 7 through Table 9 provide findings associated with the OPUC learnings by pilot. Note that the key findings are derived from the 2019, 2020, and 2021 evaluation activities and details for some findings are presented in the 2019 and 2020 evaluation reports. Also note that data collection activities related to some OPUC learnings are in progress or have not yet been initiated, as noted in the tables.

3.1 Outreach, Education, and Technical Assistance Pilot

Table 7. Outreach, Education, and Technical Assistance Pilot OPUC Learnings Key Findings

OPUC Learning	Key Findings
1.The impact of outreach efforts (e.g., ride-and-drive events, education) and marketing (e.g., ads), if available, on:	▪ Ride-and-drive events at dealerships have been of mixed success and could be improved with additional promotional support from PGE for future ride-and-drive events. ▪ The partnership between PGE's ride-and-drive implementer and PGE can be leveraged further to increase attendance at non-dealership ride-and-drive events in the future. ▪ The 2020 Portland International Auto Show was an effective venue in educating people who are interested in EVs, and more cost-effective than ride-and-drives.
1a. PGE customer awareness of EVs in the service area as measured through PGE customer surveys, focus groups, one-on-one interviews, program data, etc.;	▪ Two-fifths of customers report being familiar with EVs (80%) or PHEVs (80%). The familiarly with EVs has increased since the Wave 1 and Baseline surveys, while familiarity with PHEVs has remained consistent.
1b. The consideration of an EV for new car shoppers; and	▪ Dealers say that EV educational kiosks help to explain EVs to new-car shoppers and alleviate their concerns regarding range and where and how to charge. ▪ Few (15%) EV owners report being shown an EV educational kiosk while visiting a PGE partner dealer. ▪ Customer consideration of EVs and PHEVs for their next vehicle has increased. More customers who are likely to purchase a vehicle during the next five years would "definitely" or "probably" consider purchasing an EV (52%, up from 39% of Wave 1 and 38% of Baseline) or PHEV (42%, up from 33% of Wave 1) compared to the previous waves.
1c. Overall sales and leases of EVs in the service area as measured through the evaluation of recent EV purchasers/lessees.	Results pending second impact analysis in 2022.
2. The impact of technical assistance programs and marketing on the installation of workplace EV chargers.	First and second wave survey results suggest technical assistance from PGE was influential in the decision to install workplace charging (60% of respondents indicated PGE's technical assistance was highly influential).
2a. Number of recipients of technical assistance that result in charger installations.	About half of technical assistance survey respondents (53%) who provide on-site parking have installed chargers or outlets for charging since receiving assistance.

[10] Report on Finalized Learnings for PGE's Transportation Electrification Programs (2018): *https://apps.puc.state.or.us/orders/2018ords/18-124.pdf*

OPUC Learning	Key Findings
3. The change to participation rates in TOU rate schedules by EV owners.	Results pending second impact analysis in 2022.
4. The change in EV charging load characteristics, influenced by education efforts.	Results pending second impact analysis in 2022.
5. The major challenges business customers face when planning for and siting EV charging infrastructure.	Business customers noted a variety of challenges including the installation taking more time to complete than expected, permitting taking longer than expected, and stations not working as intended.
5a. Evaluate the efficacy of outreach effort including challenges; and	Anecdotally, customers have positive feedback about their consultations. PGE could improve their ability to evaluate the efficacy of their outreach; however, by systematically tracking data on the customers' experience, including whether they have purchased EVs or installed charging equipment as a result of the consultation.
5b. Adjustments to outreach efforts to increase effectiveness and response to barriers.	Most customers reached out to PGE about their consultation needs. A PGE contact indicated that outreach efforts could be improved by tracking data about customers' needs and knowledge of EVs to improve future outreach efforts.
6. Gather data on customer awareness of EVs and their exposure to PGE's EV marketing campaigns.	▪ The 2020 Portland International Auto Show, which was well-attended, has engaged customers and is likely more effective in educating people who are interested in EVs compared to ride-and-drives. ▪ Similar to Wave 1, about one-fifth (22%) of likely vehicle purchasers in Wave 2 reported seeing at least one PGE EV resource, campaign, or discount.
7. Develop and implement a plan to gather sample information from a variety of populations in PGE's service territory, including those listed below:	Evaluation meets this requirement
7a. General sample of PGE customers;	Evaluation meets this requirement
7b. Recent EV purchasers;	Evaluation meets this requirement
7c. Recent technical assistance customers;	Evaluation meets this requirement
7d. Recent non-EV purchasers;	Evaluation meets this requirement
7e. Trade allies (e.g., dealers, manufacturers); and	Evaluation meets this requirement
7f. Key stakeholders (e.g., ride-and-drive implementer, transportation authorities, program staff).	Evaluation meets this requirement

3.2 EA Pilot

Table 8. EA Pilot OPUC Learnings Key Findings

OPUC Learning	Key Findings
1. Effect of EV charging on PGE's system to determine how EVs can be used to create a system benefit	Results pending second impact analysis in 2022.

OPUC Learning	Key Findings
2. The impact of the presence of visible, reliable, and accessible charging infrastructure on:	
2a. Customers' willingness to purchase an EV; and	More customers in the Wave 2 survey report their next vehicle will be an EV compared to the Baseline and Wave 1 surveys (19%, up from 14% of Wave 1 and 7% of Baseline). Additionally, customers are now about equally likely to report they intend to purchase an EV (19%) or PHEV (15%) as a gasoline-fueled vehicle in the next five years (34% compared to 36%, respectively).
2b. Customers' willingness to take longer trips in an EV.	Even with improved charging infrastructure, customer expectations for vehicle battery range have increased over time. Over half (57%) of customers who mentioned "minor" or "major" concerns with vehicle range report that EVs would need a battery range of over 250 miles to alleviate range concerns, compared to just under a half (47%) of customers in Wave 1.
3. To the extent possible, learning who the predominant users of the charging infrastructure are:	Results pending EA intercept surveys in 2022.
3a. Whether there are distinct use cases with predictable load profiles;	▪ In 2020, TNC and EA Monthly Subscribers showed similar charging profiles with highest peak occurring at 8:00 p.m. and the secondary peak in the early afternoon. ▪ TNC EA Subscribers had the greatest shift in load to off peak hours, with a sharp increase at 8:00 p.m. ▪ The impact of the peak period surcharge was observed in the charging profiles from TNC subscribers and EA monthly subscribers while the peak pricing impact was not observed in the charging profile of non-subscribers. In addition, TNC EA subscribers consumed the most energy on a per customer basis.
3b. Whether the chargers are regularly utilized by non-PGE customers; and	Customer response TBD via intercept surveys in 2022.
3c. If possible, use by and effects of TNCs.	▪ One TNC company offered its drivers a discounted subscription pricing plan for EA charging. In 2020, PGE reported that the Downtown Portland and East Portland EA sites were popular with TNC drivers, suggesting that drivers are utilizing the pricing plan and the EA network. EA impact analysis confirmed the East Portland EA was most popular with TNC drivers; however, user group data was unavailable for the Downtown Portland EA. These sites are likely popular due to their central location and relative proximity to the airport. ▪ TNC drivers aggregately consumed an average of 1,879 kWh per month, which was approximately 19% of total EA charging between March 2019 and October 2020.
4. Utilization and/or demand for quick chargers versus L2 chargers, including the time of day and pricing information.	▪ Partner interview data revealed that customer demand for L2 chargers still exists among EA users though charging and utilization data suggests that customers prefer DCFC chargers. In 2020, DCFCs served 96% of energy delivered by EA chargers. In addition, the DCFC utilization rate was 6.5%, nearly twice that of L2 chargers. ▪ The daily usage patterns of L2 and DCFC chargers exhibit differences: the daily average DCFC load profile exhibits two peaks with a dip between 3:00 p.m. and 8:00 p.m., during peak

OPUC Learning	Key Findings
	pricing, while the L2 average charging profile only peaks once around noon. The impact of peak pricing is not observable in the L2 average charging profile.
5. To the extent possible, learning who is not using the charging infrastructure and why?	▪ Multifamily building owners, managers, and tenants have limited awareness of EAs and do not currently have large demand for charging capabilities. ▪ Lack of awareness is a major barrier to using the charging infrastructure. Customer awareness of PGE's EAs, while still higher than the Baseline survey, significantly decreased in Wave 2. About one-quarter (25%) of respondents reported they have seen at least one EA (down from 33% in Wave 1), and about two-fifths (38%) of EV owners have reported using at least one Electric Avenue location to charge their vehicle. ▪ Additional results pending EA intercept surveys in 2022.
6. Network load profiles and the impacts on PGE's distribution system, including coincident and noncoincident peak loads of DC fast chargers and power qualify in the vicinity of the chargers.	▪ In 2020, charging load at six EA sites had minimal impact on PGE's distribution system.[a] None of the feeders at the EA sites were at risk of overloading even when all chargers are used at the same time. ▪ EA charging load is not observed to be highly coincident with PGE's system peak. For all EA sites combined, the non-coincident peak (NCP) ranged from 153–239 kW month by month after all charging stations were online, which is about 13%–20% of the total charging capability. As for the coincident peak, on average, 48 kW of charging happens during the top 3% of PGE load hours, which is approximately 4% of the total charging capability.
6a. Gathering of information to assist with analysis of impacts to PGE' s system, including how many users are charging off-peak and how that affects the system.	In 2020, 52% of charging occurred during off-peak period, 31% occurred during mid-peak period, and 17% occurred during peak periods.[b]
7. A comparison of customer use of charging infrastructure under time-variant rates versus free charging.	The $0.19/kWh peak charge from 3:00 p.m. to 8:00 p.m. on weekdays has an observable impact on the charging load shape and has helped shift the charging away from the system peak period. In 2020, an estimated 14.2 MWh of peak period charging for the Beaverton, East Portland, Hillsboro, Milwaukie, Salem, and Wilsonville EAs was shifted to off-peak hours during the study period or approximately 39.1 kWh/day.
7a. Gathering of information to assist with analysis of whether price signals change charging behavior and why or why not.	Both PGE and the evaluation team have observed on-peak and off-peak charging patterns among customers at a couple of EA sites. This preliminarily demonstrates that the price signals have been successful at changing charging behavior at some sites. COVID-19 also had an impact on daily charging patterns among customers and utilization rates; post COVID-19 may be different.
8. Impact of, and customer interest in, unlimited monthly charging versus other pricing options (e.g., single use, who uses, behavior).	▪ Although still minor in scope, the unlimited monthly charging pricing plan may have an adverse effect on popular EA sites, where congestion occurs because drivers have no incentive to unplug and move on once charging is complete. If the problem persists, an alternative pricing structure may be warranted. ▪ PGE staff reported potentially adjusting the EA subscription model as EV customers become more accustomed to per minute or per kWh charging. Some customers have complained that the

OPUC Learning	Key Findings
	current pricing structure is restrictive and expensive, especially for those who are not consistent EA users or are only charging for a short time. ▪ EA monthly subscribers and TNC subscribers show observable responses to peak pricing, which is not observed in the charging profile of non-subscribers. ▪ PGE reportedly wants to continue to gauge customer awareness of and interest in different pricing options (such as charging per minute or per kWh) as a future research effort.
9. The additional PGE infrastructure, if any, needed to support and ensure highly reliable public charging infrastructure (and applicable costs).	▪ EA charger downtime continued to be an issue in 2021; however, increased communication between vendors and PGE has improved service across sites. PGE developed a new service level agreement (SLA) with their charger vendor which includes a performance improvement plan to ensure a reliable charging network.

[a] Six EA sites include Beaverton, East Portland, Hillsboro, Milwaukie, Salem, and Wilsonville EAs.

[b] Off-peak, mid-peak, and on-peak periods are defined based on PGE's residential TOU tariffs: https://portlandgeneral.com/energy-choices/energy-choices-home/time-of-use-pricing-home.

3.3 Electric Mass Transit 2.0 (TriMet) Pilot

Table 9. Electric Mass Transit 2.0 (TriMet) Pilot OPUC Learnings Key Findings

OPUC Learning	Key Findings
1. Pilot design elements, including an exploration of:	
1a. Program Implementation (Pricing and Suppliers)	▪ An electric bus manufacturer supplied five buses to TriMet for $930,000 each (including warranties and upfitting). ▪ A transit-charging vendor supplied the charging systems for a total cost of $789,000 for equipment. ▪ TriMet estimated the total make-ready cost (installation, engineering, design, and permits) for both charging systems was $787,670.
1b. PGE physical infrastructure and cost (line extension, line drop, and distribution equipment requirements)	▪ At Merlo Garage, transformer pads and primary power connections were designed to ensure larger transformers and additional secondary runs could be accommodated in the future. ▪ The Sunset Transit Center has capacity for a second 450 kW charger.
1c. Customer service and technical assistance needs	▪ TriMet trained its drivers on bus operation and charging and trained its dispatchers so their advice to operators matched their bus. ▪ PGE and TriMet determined the scope of operations and maintenance (O&M) to include routine maintenance, emergency repair, having spare parts on site, and monitoring services. ▪ PGE monitors charger operation and informs TriMet and, if needed, the charging vendor of any problems. ▪ PGE is advising TriMet on the build-out of its Powell Garage. ▪ PGE reports it needs greater communication and more timely responses when contacting the charging vendor with questions related to the dashboard.

OPUC Learning	Key Findings
	▪ Driver shortages due to COVID-19 has hindered bus service.
2. Actual impacts of bus charging load on system infrastructure:	No feeder or substation upgrades were required for the Merlo Garage/Sunset Transit Center chargers.
2a. Additional infrastructure and cost, if any, needed to support and ensure reliable bus charging infrastructure	
3. Actual impacts of bus charging load on the distribution system loading:	▪ Neither the Sunset Transit Center nor the Merlo Garage feeders are at risk of overloading despite the use of high-powered chargers. ▪ In 2020, loading in the summer on the feeders serving Merlo Garage and Sunset Transit Center was 58% and 41%, respectively, of its rating below the threshold that would trigger a capacity study by PGE.
3a. Total load and non-coincident peak load compared to feeder loading.	▪ In 2020, the non-coincident peak load at the Sunset Transit Center ranged from 300 kW to 425 kW. The non-coincident peak load at Merlo Garage was typically around 150 kW. ▪ The charging capacity (450 kW) of the Sunset Transit Center represents about 2.5% of the feeder's capacity, and the charging capacity (300 kW) at Merlo Garage represents about 1.7% of the feeder's capacity, showing that bus charging contributes very little to feeder loading.
3b. Coincident peak demand, summer, and winter of combined depot chargers.	▪ In 2020, the total bulk system coincident peak demand at the Sunset Transit Center and Merlo Garage ranged between 14 and 161 kW during summer. The coincident peak demands were 107 kW and 77 kW during winter morning and evening peak periods, respectively. ▪ Coincident peak load on the distribution system was generally low. The Merlo Garage charging load averaged less than 3 kW, or 1% of the chargers' capacity, in the top 3% of feeder load hours in the summer 2019, winter 2019–2020, and summer 2020 seasons. Sunset Transit Center's average load during summer 2019 peak hours was 44 kW, or 10% of the en route charger's capacity. During other seasons, the average load during peak hours was significantly lower on Sunset Transit Center's feeder as 28 kW and 6 kW during winter 2019–2020 and summer 2020, respectively.
4. Actual impacts to the bus fleet and fleet facility, of which TriMet will provide some information.	▪ In 2021, all buses had performance issues affecting reliability and availability. One bus in particular experienced battery and wiring issues, which caused it to be out of service for over two months. This bus continues to be out of service at the time of this report. All five buses were in operation for less than 10% of the year. ▪ COVID-19 has heavily impacted ridership and bus driver availability. Due to these impacts, TriMet staff expected at least a 10% decrease in service. ▪ TriMet staff reported that replacement of bus components and repairs are more common with electric compared to diesel buses. TriMet staff are still trying to understand the cadence at which components need to be replaced based on severity of use and age.

OPUC Learning	Key Findings
	▪ Buses were occasionally grounded due to issues connecting to the en route charger: a bolt in the mechanical component fell out causing connection issues. The en route charger has since been rebuilt by the charging equipment vendor and is working properly.
4a. How does the integration of chargers impact the internal logistics of route planning? (Benefits and costs to operations).	TriMet is currently piloting several long-range buses that only require depot charging to limit the use of en route charging because of unreliability.
4b. How does their optimal schedule for charging align with system load?	The charging load did not contribute significantly to PGE's system peak during the 2020 study period; however, the team observed high variation of average peak demand during the system peak hours due to the variation of buses arrival time at Sunset Transit Center. Given that, high-power charging at the Sunset Transit Center could occur by chance during PGE's peak hours in the future.
4c. How flexible is their charging need such that it could better align with system loading?	2019 and 2020 findings indicate charging flexibility for the transit sector is based on bus type and route length. There is little flexibility to shift buses charging to off-peak times given the short-range buses and route configuration.
4d. TriMet staff feedback on operations and charging compared to existing fleet resources	Operators enjoyed the buses because of their performance and quietness.
4e. Total combined costs from PGE and TriMet, including charging infrastructure installation, operation, and maintenance costs	See 1a above for charging and infrastructure costs.
5. PGE's initial deployment with TriMet will include TOU rates with demand charges (through Schedule 85-P). PGE intends to study the system impacts on peak days, evaluate the bus charging use case, and assess the customer's needs.	Results pending second impact analysis in 2022.

4. Staff and Partner In-Depth Interview Findings

4.1 Electric Avenue Pilot

The section presents key findings from in-depth interviews conducted with EA Pilot staff (n=3) and Pilot partners (n=2). This section summarizes PGE staff and partner feedback on:

- The operation and maintenance (O&M) of the EA sites
- Coordination between program staff, partners, and manufacturers
- Customer feedback of EA sites
- Ongoing charger downtime and maintenance issues, lessons learned, and challenges encountered throughout the process

We build upon previous conversations with program staff and partners in 2019 and 2020 to understand how the EA pilot has functioned throughout 2021.

4.1.1 Operation & Maintenance

Charger Maintenance

Additional staff has been added to PGE's EA O&M team to aid in weekly inspection and maintenance of chargers. Program staff reported they have added one wireman helper to test, inspect, and clean sites on a weekly basis to ensure that the EA network provides consistent service to customers. The addition of this team member is part of PGE's performance improvement plan outlined below.

Charger Uptime

While charger uptime has improved since 2020, the EA network continued to see frequent hardware and software issues in 2021. Program staff and the software vendor agreed that uptime was trending in the right direction although there were still some improvements to be made. Chargers were frequently down due to hardware and software issues and the length of time that chargers are down varied from a couple of hours to a few weeks depending on the issue. The software vendor noted that more recently, shipping delays and part shortages had impacted uptime as well. Program staff noted some chargers were delivered with existing hardware or software issues that were either fixed or sent back to the charging equipment vendor to be replaced. The most common issues with chargers across EA sites in 2021 include:

- **Charging plug issues.** With an increased volume of customer use, the charging plug connector tabs have been breaking frequently across sites.
- **Network connectivity issues.** Chargers have shown issues with network connectivity and signal strength affecting customers' ability to successfully complete a charge at the unit. The software vendor noted that some stations are in areas that can experience intermittent network strength affecting charger connectivity and uptime. Program staff also reported that network issues have been an issue for some chargers, and they are currently trying to see what they can do to work around the issue. The Milwaukie EA site has been experiencing more network connectivity issues compared to other sites. Program staff also noted that changes with carrier's contracts with certain manufacturers have affected their network connectivity.

- **Credit card reader issues.** Program staff and the software vendor mentioned that credit card readers have compatibility issues with the charging unit software. Program staff noted their most reliable charger has only been able to utilize a credit card reader about 70% of the time. Program staff mentioned that manufacturers did not recommend installing a credit card reader onto their chargers due to these compatibility issues. Program staff also reported the credit card readers are not necessary for customers to charge their vehicles since customers can access the chargers through an app.
- **Customer interface issues.** Program staff and the software vendor both reported issues with customers accidentally pressing the emergency stop button on the charger. The software vendor reported that this occurs approximately one to two times a week and requires the charger emergency code to be cleared and reset.
- **Vandalism.** While vandalism was not as much of an issue as those mentioned above, program staff did note that they have had some issues with people breaking the screens on the chargers.

Customer Feedback on Pricing Structures

Customer feedback on pricing structures may lead to pricing updates in future program years. PGE staff reported customer confusion regarding paying for a monthly subscription through the software vendor app while also needing to keep funds in their app wallet to cover additional fees, such as peak hour surcharges. Additionally, customers have complained that the current pricing structure is restrictive and expensive—especially for those who are not consistent EA users or are only charging for a short time. To alleviate customer confusion and attract new customers who may not be interested in subscribing to the EA network, program staff reported they are considering providing customers with a per kWh pricing option. Changes to the pricing plan may occur in future program years.

Coordination Between Hardware and Software Vendors

While some issues with vendor partnerships and maintenance processes have continued from 2020, the relationship between hardware and software vendors and PGE has improved in 2021. PGE staff noted that vendors have agreed to a performance improvement plan to increase the reliability of chargers across sites. The following are vendor coordination issues staff experienced in 2021 and details about the performance improvement plan for vendors.

- **Vendor communication and responsiveness.** While PGE staff noted occasional delays in the charging equipment and software vendors' response time, the vendors have made strides to improve communication with PGE. As a part of the performance improvement plan outlined in more depth below, PGE and the hardware and software vendors have committed to weekly meetings to improve communication and responsiveness to issues.
- **Process of dispatching technicians.** PGE staff reported they have streamlined reporting issues at charging sites by implementing an internal new asset management and work order system. The software vendor has access to this app, which allows them to communicate with the charger vendor about issues involving their equipment. The software vendor noted that response times from the charger vendor can range from a couple of days to a few weeks. The software vendor also noted that if PGE staff submit a ticket through the vendor's app and will cover the cost of the repair then they can dispatch someone within 24 to 48 hours after they receive the necessary part. Program staff noted that problem resolution between the software and hardware vendors has continued to affect downtime at chargers. However, weekly meetings are helping to improve communication about these issues and improve response times.

- **Charging equipment vendor staffing.** Similar to 2020 findings, PGE and software vendor staffs report that their main point of contact for the hardware vendor changes frequently, requiring staff to work with new hires to get them up-to-speed. This turnover impacts the efficiency of addressing operational issues: PGE staff experience longer wait times than they would prefer to get technicians out to an EA site.

While some issues documented in 2020 have persisted in to 2021, the charging equipment vendor and PGE agreed to a performance improvement plan to improve charger uptime and communication. The plan includes two key phases and updated service level agreements outlined below:

- **Charger rework campaign.** In the first phase, the charger vendor agreed to rework five of the six EA sites and replace all malfunctioning components. They also screened all chargers and ran them through various tests to ensure they were functioning correctly. This phase of the plan was completed in September 2021.
- **Performance tracking**. In the second phase, PGE and the hardware vendor evaluated the functionality of each unit and tracked each charger throughout October 2021. Within this time frame, four of the twenty chargers did not meet the agreed upon performance standards and are in the process of being replaced by the vendor. The agreed upon metrics for performance standards are as follows:
  - **Uptime.** Chargers must now show an uptime of 98%.
  - **First pass charge rate.** PGE staff reported that chargers were appearing online but not delivering any successful charging sessions. Therefore, they have added a second metric called first pass charge rate, which tracks the number of times that a customer tries to get a charging session from the station compared to the number of times in which a charge is successfully delivered. The charger vendor and PGE have agreed upon a first pass charge rate of 93%.

After evaluating each of the chargers, PGE staff proceeded to re-negotiate service level agreements with vendors and standardize them based on data collected during the performance improvement evaluation and previous years of experience implementing the program.

The updated service agreements will include the following:

- Ensures that spare parts are readily available to program staff to make repairs to chargers
- Requires a certain number of vendor staff in the service area be available to service stations in a timely manner
- Sets up charging performance targets for vendors
- Outlines consequences for not meeting agreed upon performance targets

4.1.2 Future Community Charging

The EA Pilot program may add infrastructure in more "charging deserts" and underrepresented communities. Program staff noted that they would like to extend the program into more underrepresented communities to fill service gaps in PGE's service territory. Staff feel that future conversations and decisions about the expansion of EAs should directly include these underserved communities.

4.2 Electric Mass Transit 2.0 (TriMet) Pilot

The section below presents key findings from in-depth interviews conducted with TriMet Pilot staff (n=3) and Pilot partners (n=2). The section summarizes stakeholder roles and documents the ongoing issues with operating the buses and chargers, charging practices, and future electrification plans. At the time of this report, four out of five buses are in service intermittently due to several issues including staffing shortages and bus malfunctions or breakdowns.

4.2.1 Electric Buses

All five electric buses for Line 62 have experienced intermittent availability throughout 2021. TriMet staff reported that throughout the year, four out of five buses were dispatched approximately 25% of the time. Dispatching has been affected by staffing shortages (drivers and maintenance), COVID-19 complications, and buses needing repairs. which has caused four out of the five buses to run on and off throughout 2021. The remaining bus has been out of commission periodically throughout the year and more recently for almost two months due to wiring and battery issues. As of January 2022, TriMet reported that the bus will require a full battery swap and they are unsure when it will be back online. TriMet staff reported the months with the most inconsistent service in 2021 were January, February, June, July, and October. Staff noted that they were able to maintain consistent service with four buses in August and September 2021.

Bus service has been experiencing interruptions due to the ongoing pandemic. TriMet staff reported that bus service has been interrupted due to surges in COVID-19, causing operators to call out from work. Electric bus operators must go through additional training to operate electric buses, which makes them difficult to replace. Due to COVID-19 shutdowns and bus driver shortages, TriMet staff expects bus service to decrease by 10% or more in the coming months.

From a fuel cost perspective, the cost of running the electric buses has been comparable if not less expensive than running diesel buses. As reported in 2020, the more the buses are running, and the more miles driven, the lower the kWh cost per mile. However, the incidence of breakdowns has been much more common than diesel buses, which affects bus service. PGE staff noted that with more time and understanding of the electric bus technology, reliability of service and cost-effectiveness has been improving and will continue to improve.

Bus battery range varies from 50 to 100 miles depending on the energy-intensity of the route seasonally. As reported in 2020, cold winter days can have a significant impact on battery range. TriMet Staff reported that buses typically use 1.8 kWh per mile for six to eight months out of the year; in the winter months energy usage will increase to 2.2 kWh to 2.3 kWh per mile due to heating the bus. Due to the additional energy required for heating, buses must use the en route charger at the Sunset Transit Center in order to complete the entire route.

4.2.2 Charging Infrastructure

The en route fast charger at the Sunset Transit Center experienced issues that caused major disruptions to bus service in late summer to early fall of 2021; however, for most of the year the charger has been functional. PGE staff reported that after experiencing some water intrusion issues, a manufacturer representative upgraded the entire system. After a few months in operation, however, the pantograph malfunctioned once again because a bolt in the charger was not properly secured. The manufacturer representative was brought out again to repair the charger and run a few tests to ensure it was operating properly. PGE staff also mentioned they replaced the charging rails for the pantograph based on the manufacturer's recommendation. They reported that future research will be needed to determine the frequency with which the charging rails will

need to be replaced. Program and TriMet staff indicated that they will be moving away from en route charging and utilize long range electric buses instead.

TriMet saw relatively reliable performance from the Merlo Garage chargers in 2021. PGE staff note the number of service calls for the depot chargers at Merlo Garage decreased in 2021. Program staff, TriMet staff, and the charger vendor have all reported that charging infrastructure has been relatively reliable; however, there have been issues with a handful of chargers. One charger continued to have hardware problems and needed specific components to be replaced. PGE staff reported that after troubleshooting those issues in summer and early fall, they have seen reliable performance. Program staff also noted some difficulty getting someone with the right training and certifications from the charger vendor's partners out to the depot to repair the chargers.

4.2.3 Charger Maintenance

TriMet and PGE reported that the charging equipment vendor resolved most charger issues in a timely manner in 2021 and most issues with vendor communication have been corrected, however some issues still remain. TriMet staff reported that the relationship between vendors and PGE has improved since 2020 and was relatively stable in 2021. The vendor has been more responsive and will typically resolve issues within two weeks; however, new vendor staff and vendor staff turnover continues to make it difficult to get knowledgeable repair staff out to maintain chargers.

The Pilot implemented a preventative maintenance schedule to ensure charger reliability and consistent bus service. PGE staff reported conducting quarterly visual checks on the pantograph and depot chargers to ensure they are working properly. TriMet staff also mentioned that PGE has been helpful in monitoring and maintaining charging infrastructure by committing to visual checks of the equipment.

The charger vendor will typically take about two weeks to dispatch repair staff to fix chargers. Therefore, PGE staff have been exploring ways to train internal staff to conduct charger maintenance and repairs. The charger vendor recognized that their response times in 2021 were not as fast as TriMet staff would like, and also mentioned that without a service level agreement with TriMet, they will not be able to respond faster than they currently are to requests for repairs. Since PGE staff are only able to remotely monitor chargers, they must rely on the vendor or subcontractors to do physical repair work. PGE staff report they have been exploring ways to train internal PGE electricians to maintain and repair chargers when needed. PGE staff report that they hope to improve the service they are providing to TriMet to ensure bus service is more reliable.

4.2.4 Future Plans

TriMet plans on expanding its electric bus fleet by adding long-range buses that do not require en route charging. TriMet and program staff both noted that TriMet was in the process of piloting five long-range buses outside of the PGE TriMet pilot. Although still in early conversations, PGE staff and TriMet have discussed transitioning to long-range buses for future route electrification to eliminate the need for en route charging. Additionally, PGE staff and TriMet have discussed possible updates to TriMet's rate plans with the addition of these long-range buses to ensure PGE was adequately recovering the costs while not overburdening customers. Long-range buses require more electricity to operate than short-range buses, which can result in higher operational costs compared to diesel buses if utilization is low and electricity demand charges are incurred. PGE staff and the TriMet noted that they are continuing to monitor the cost to operate both short- and long-range buses and trying to improve the efficiency level of the long-range buses so that they operate at a lower cost-per-mile than diesel buses.

TriMet is currently piloting several buses that have been converted from diesel to electric. In addition to replacing diesel buses at the end of their life with new electric buses, TriMet is also piloting mid-life conversions

from diesel to electric. TriMet staff mentioned that if this pilot is successful, its bus fleet will consist of both new electric buses and buses converted from diesel to electric.

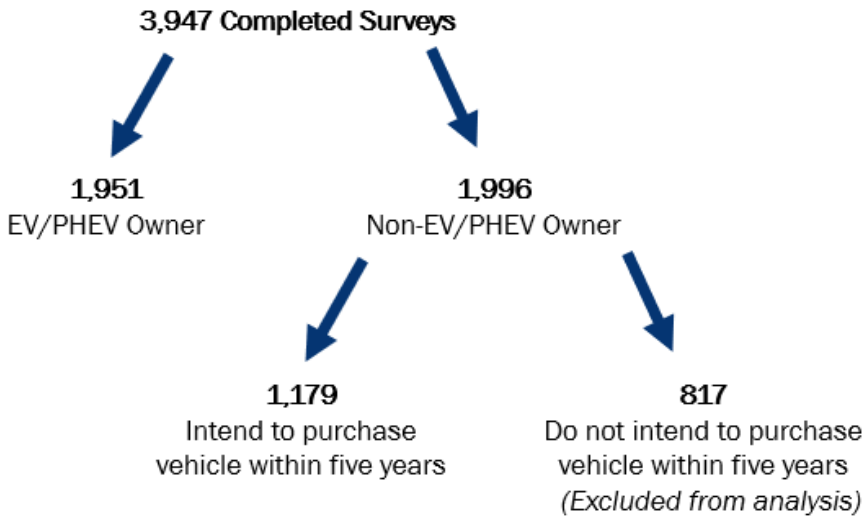
TriMet does not anticipate adding any other charging infrastructure for the next four to five years beyond a few chargers that will be installed at the Powell garage in June 2022. Program staff reported that TriMet installed six additional chargers at the Merlo Garage. TriMet noted that the current charging infrastructure plan is sufficient to handle the number of buses running through the TriMet UM1811 Pilot; therefore, they do not anticipate adding any more chargers in the short term. PGE will not own, operate, or maintain any of the new chargers installed at the Powell and Merlo garages.

5. General Population Residential Customer and EV Owner Survey Findings

This section presents key findings from Wave 2 of the general population survey fielded to PGE residential customers and potential EV owners in July 2021 and, where questions are comparable, makes comparisons to the Baseline survey fielded in 2018 and Wave 1 survey fielded in 2019. The survey included questions about pilot awareness, consideration of purchase, and intention to purchase or lease an EV as well as questions specifically addressing the pilot activities and EV owner characteristics.

In the Wave 2 survey, a total of 3,947 customers completed survey screening questions, of which 1,951 customers (49% of all respondents) reported owning or leasing an EV or PHEV. Among non-owners, 1,179 customers (59%) indicated they would likely purchase a vehicle within the next five years (Figure 1). The remaining 817 non-owners (21% of all respondents) reported they do not intend to purchase a vehicle within the next five years and were excluded from the analysis.

Figure 1. Survey Respondents' Intent to Purchase any Vehicle within Five Years



The survey results are presented by breaking out the respondents into four segments: three non-EV/PHEV owner segments—EV/PHEV non-considerers, EV/PHEV considerers, and EV/PHEV intenders (see Table 10 for definitions of each segment)—and the EV/PHEV owner segment. Note that when comparing results of the Baseline, Wave 1, and Wave 2 surveys, the team excluded EV owners to be consistent with previous years.[11] In the analysis of the Wave 2 survey, the team included current EV owners as a separate segment. The team conducted statistical testing to detect any significant differences between the four segments and survey waves.

The number of customers intending to purchase an EV or PHEV in the next five years increased significantly since the Wave 1 and Baseline surveys (32%, up from 24% and 17%, respectively), while fewer said they would

[11] In 2018, PGE conducted a baseline survey with a general population of residential customers who indicated they were considering purchasing a vehicle in the next five years to assess EV awareness and perceptions in the PGE territory. Opinion Dynamics adapted the 2018 Baseline survey to create a post-pilot launch survey. The first wave of the post-pilot launch survey ("Wave 1") was conducted in 2019. A third wave of the post-pilot launch survey ("Wave 3") will be conducted in 2023. Only the Wave 2 and Wave 3 surveys include/will include oversamples of EV owners.

not consider an EV (41%, down from 51% and 53%, respectively) (Table 10). The share of respondents who would consider an EV has remained consistent between the surveys.

Table 10. General Population Customer Survey Analysis Segments

Segment and Definition		Baseline (2018)		Wave 1 (2019)		Wave 2 (2021)	
		n	%	n	%	n	%
EV/PHEV Owners [a]	PGE residential customers who indicate they currently own an EV or PHEV	44	3%	78	4%	76	6%
All likely vehicle purchasers	PGE Residential customers who indicate that they expect to purchase or lease a new or used vehicle within the next five years	929	100%	1,026	100%	1,179	100%
EV/PHEV Non-Considerers	Likely Vehicle Purchasers who indicate they are not planning to consider an EV or PHEV for their next vehicle purchase	494	53%	526	51%	488	41%*
EV/PHEV Considerers	Likely Vehicle Purchasers who indicate they will consider an EV or PHEV for their next vehicle but selected another type of vehicle when asked which one type they are most likely to acquire the next time they purchase or lease a vehicle	276	30%	253	25%*	312	27%
EV/PHEV Intenders	Likely Vehicle Purchasers who selected EV or PHEV when asked: "Considering everything you currently know, which one type of vehicle listed below are you most likely to acquire the next time your household purchases or leases a vehicle?"	159	17%	247	24%*	379	32%*

[a] Only respondents from the general population survey sample are included in the calculation of EV/PHEV Owners in PGE's service territory in this table. Respondents from Wave 2 EV owner oversample are excluded.

* Indicates statistically significant difference between previous survey wave (z-test for proportions, $p < .05$).

5.1 Customer Familiarity and Consideration of EVs

5.1.1 Familiarity

Customers have moderate to high levels of familiarity with EVs and PHEVs. The familiarity with EVs increased significantly since the Wave 1 and Baseline surveys (80% of Wave 2 customers reported being "somewhat" or "very familiar" with EVs, up from 73% and 76%, respectively), while customer familiarity with PHEVs remained consistent over survey waves (Figure 2). Customers who own EVs or PHEVs reported greater familiarity with all vehicle fuel types compared to non-owners.

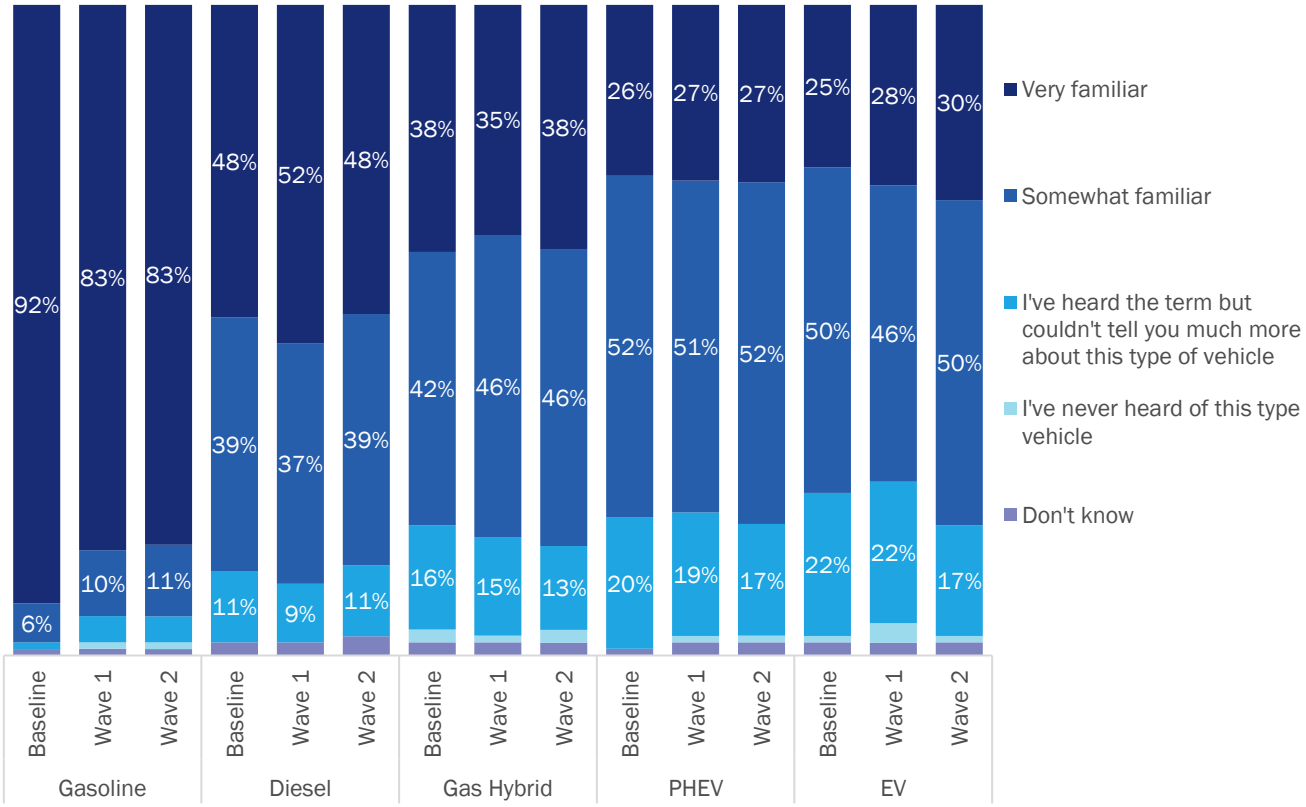
Figure 2. Respondent Familiarity with Vehicle Fuel Types, by Survey Wave and Segment (Multiple Responses Allowed)

Vehicle Fuel Type Familiarity (% Reporting Somewhat or Very Familiar)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
Gasoline	97% B C	93% A	94% A	93% D	95% D	95% D	99% A B C
Diesel	87%	89%	86%	86% D	86% D	86% D	92% A B C
Gas Hybrid	80%	82%	84%	75% B C D	87% A D	92% A D	97% A B C
EV	76% C	73% C	80% A B	68% B C D	83% A C D	94% A B D	100% A B C
PHEV	78%	78%	80%	69% B C D	85% A D	89% A D	96% A B C
Biodiesel	57%	62%	58%	52% C D	60% D	65% A	71% A B
Natural Gas	38%	39%	40%	37% D	40% D	45% D	53% A B C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Although customers are generally aware of EVs and PHEVs, high familiarly levels for EVs and PHEVs currently lags behind gasoline and diesel vehicles. As shown in Figure 3, consistent with Wave 1 and Baseline, respondents were significantly less likely to report being "very familiar" with EVs and PHEVs compared to gasoline and diesel vehicles. Additionally, about one-sixth of respondents indicated they had heard about EVs and PHEVs but did not know much about these vehicle types. These findings suggest that although customers are aware of EVs and PHEVs, they continue to lack first-hand experience with these vehicle types that would likely lead to increased familiarity.

Figure 3. Respondent Level of Familiarity with Vehicle Fuel Types, by Survey Wave (Baseline n=929; Wave 1 n=1026, Wave 2 n=1179)



5.1.2 Perception of Vehicle Environmental Friendliness, Fuel Costs, and Maintenance Costs

A majority of customers perceive EVs as the most environmentally friendly and having the lowest fuel costs compared to other vehicle types; however, fewer associate EVs with lower maintenance costs. Consistent with previous surveys, about three-quarters (67%) of customers reported that EVs are the most environmentally friendly, followed by PHEVs (Figure 4). Fewer non-considerers reported that EVs and PHEVs are most environmentally friendly compared to the other segments.

Figure 4. Respondents' Perception of Environmental Friendliness of Vehicle Fuel Types, by Survey Wave and Segment

Vehicle Fuel Type Environmental Friendliness (% Reporting 8-10)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
EV	68%	69%	67%	49% B C D	79% A D	83% A D	93% A B C
PHEV	43%	45% C	39% B	32% B	50% A D	41% D	31% B C
Gas Hybrid	29%	28%	25%	22% B D	31% A D	23% D	13% A B C
Natural Gas	23% C	22% C	18% A B	20% D	20% D	14%	11% A B
Biodiesel	17%	19% C	15% B	15% D	15% D	14% D	9% A B C
Diesel	3% C	4%	6% A	9% B C D	3% A	4% A D	2% A C
Gasoline	3%	3%	5%	8% B C D	2% A	3% A D	1% A C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Similarly, most customers also associate EVs with the lowest fuel costs, followed by PHEVs (Figure 5). More EV owners reported that EVs have the lowest fuel costs, while fewer EV owners reported that PHEVs and biodiesel have the lowest costs compared to the other customer segments.

Figure 5. Respondents' Perception of Fuel Costs of Vehicle Fuel Types, by Survey Wave and Segment

Vehicle Type with Lowest Fuel Costs	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
EV	58%	54%	59%	46%	65% A	71% A	91% A B C
PHEV	15%	15%	14%	15% D	15% D	12% D	3% A B C
Gas Hybrid	5%	6%	6%	9% C D	4% D	2% A	1% A B
Natural gas	7%	6%	5%	7% D	4%	3%	2% A
Gasoline	2%	3%	4%	6% C D	4% D	1% A	1% A B
Biodiesel	3%	4%	3%	3% D	2% D	3% D	1% A B C
Diesel	2%	3%	3%	4% D	1%	2%	1% A
Don't know	7%	8%	6%	8%	5%	3%	1%

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Consistent with the Baseline and Wave 1 surveys, about one-third (34%) of the respondents indicated EVs have the lowest maintenance costs, while one-fifth (21%) of respondents reported gasoline vehicles have the lowest maintenance costs (Figure 6). EV owners were significantly more likely to report that EVs have the lowest costs compared to the other segments, especially compared to non-considerers, suggesting an

opportunity for PGE to increase EV adoption by increasing customer understanding of the lower maintenance costs associated with EVs.

Figure 6. Respondents' Perception of Maintenance Costs of Vehicle Fuel Types, by Survey Wave and Segment

Vehicle Type with Lowest Maintenance Costs	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
EV	29% C	32%	34% A	21% B C D	33% A D	53% A D	93% A B C
Gasoline	25%	21%	21%	29% B C D	17% A D	13% A D	2% A B C
Diesel	6%	8%	7%	9% C D	7% D	4% D	1% A B C
PHEV	5%	6%	5%	4% B D	8% A D	5% D	1% A B C
Gas Hybrid	2%	4%	4%	2% D	5% D	4% D	0% A B C
Natural gas	3%	3%	3%	4% D	3% D	2% D	0% A B C
Biodiesel	1%	1%	2%	2% D	0%	2% D	0% A C
Don't know	28%	26%	24%	29%	26%	17%	3%

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

5.1.3 Consideration of EVs and Used Vehicles

Customer consideration of EVs and PHEVs for their next vehicle increased. When asked what fuel type they would consider for their next vehicle, more customers who are likely to purchase a vehicle during the next five years reported they would "definitely" or "probably" consider purchasing an EV (52%, up from 39% of Wave 1 and 38% of Baseline) or PHEV (42% up from 33% of Wave 1) compared to the previous waves (Figure 7). Among EV owners who indicated they would likely purchase a vehicle in the next five years, nearly all (94%) reported that they will consider an EV.

Figure 7. Respondent Fuel Type Consideration for Next Vehicle, by Survey Wave and Segment (Multiple Responses Allowed)

Vehicle Fuel Type Consideration (% Reporting will Definitely or Probably Consider)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1383) (D)
Gasoline	79% C	74% C	66% A B	82% B C D	74% A C D	37% A B D	18% A B C
EV	38% C	39% C	52% A B	†	84% C D	95% B	94% B
Gas Hybrid	42%	37% C	43% B	20% B C D	70% A C D	52% A B D	20% A B C
PHEV	39% B	33% A C	42% B	†	75% D	70% D	35% B C
Diesel	15% C	13% C	9% A B	11% C D	11% C D	4% B	4% B
Biodiesel	8%	9%	7%	4% B D	12% A D	7% D	2% A B C
Natural Gas	6%	7%	7%	4% B D	14% A C D	6% B D	2% A B C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons. The proportion of considerers who are considering EVs or PHEVs is less than 100%; however, the sum of customers in the considerers segment who are considering EVs and PHEVs is greater than 100%, as customers could be considering both EVs and PHEVs.

† Significant testing was not performed on these fuel types because responses were used in defining the EV/PHEV non-considerers segment.

When deciding about their next vehicle, about half (55%) of customers who are at least considering purchasing an EV would consider a used or pre-owed EV or PHEV. About half of considerers (59%) and intenders (51%) reported they would "definitely" or "probably" consider a used or pre-owned EV or PHEV. Customers reported they would consider a used or pre-owned EV/PHEV primarily because the vehicle would be more affordable (86%), or they prefer to purchase used vehicles (36%). Among customers who indicated they would not consider a used or pre-owned EV/PHEV, a large majority (90%) reported having concerns with resale value, followed by not being able to get incentives for a used EV or PHEV (76%), having concerns about vehicle range (68%), not normally purchasing used vehicles (54%), and having concerns about battery life (48%; multiple responses allowed).

5.1.4 Intent to Acquire

We asked survey respondents who would consider purchasing a fuel type for their next vehicle, which one they would be most likely acquire.

Significantly more customers in the Wave 2 survey report that their next vehicle will be an EV compared to the Baseline and Wave 1 surveys (19%, up from 14% of Wave 1 and 7% of Baseline) (Figure 8). Additionally, customers are now about equally likely to report they intend to purchase an EV (19%) or PHEV (15%) as a gasoline-fueled vehicle (34% compared to 36%, respectively). EV/PHEV intenders are slightly more likely to report that they will purchase an EV compared to a PHEV (58% vs. 42%) as their next vehicle.

Figure 8. Vehicle Fuel Type Respondents are Most Likely to Acquire for their Next Vehicle Purchase or Lease, by Survey Wave and Segment

Vehicle Type Respondents are Most Likely to Acquire for Next Purchase/Lease	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=921) (A)	Wave 1 (n=1016) (B)	Wave 2 (n=1157) (C)	EV/PHEV Non-Considerers (n=466) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1377) (D)
Gasoline	56% B C	46% A C	36% A B	65% B D	37% A D	0%	3% A B
EV	7% B C	14% A C	19% A B	1% C D	†	58% A D	76% A C
PHEV	11%	10% C	15% B	2% C D	†	42% A D	12% A C
Hybrid (non-plug-in)	15%	14%	14%	14% B D	33% A D	0%	3% A B
Diesel	3%	3%	3%	5% D	3% D	0%	1% A B
Biodiesel	0%	1%	1%	0%	1%	0%	0%
Natural gas	0%	0%	1%	0%	2% D	0%	0% B
Don't know	7% B C	12% A	12% A	12% B D	24% A D	0%	5% A B

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons. A small percentage (3%) of respondents in the EV/PHEV non-considerers segment indicated they would most likely purchase an EV or PHEV for their next vehicle even though they indicated they were not considering an EV or PHEV for their next vehicle.

† Significant testing was not performed on these fuel types because responses were used in defining the EV/PHEV Non-Considerers segment.

5.2 Sources of Information about EV Acquisition, Ownership, and Charging

Customers report receiving information about EVs from a variety of sources, with PGE being an important source of information. Respondents reported primarily receiving information about EVs from friends and colleagues (50%), consistent with the Wave 1 and Baseline surveys (Figure 9). Similar to Wave 1, one-quarter (25%) of respondents reported receiving information about EVs from PGE. Only 13% of EV owners reported receiving information from PGE about EVs, and about one-third (32%) indicated that the information at least moderately influenced their decision to purchase or lease an EV.[12] About two-thirds (68%) of EV owners who received information about EVs from PGE reported that they would have made the exact same purchase if they had not received any information from PGE.

[12] Respondents who rated the level of influence as 6–7 on a 10-point scale, where 0 was "not at all influential" and 10 was "extremely influential," were categorized as "moderately influenced" and those who rated the level of influence as 8–10 were categorized as "greatly influenced."

Figure 9. Sources of Information Respondents Recalled Reading, Hearing, or Seeing Information about EVs, by Survey Wave and Segment (Multiple Responses Allowed)

Sources from which Respondents Recall Reading, Hearing, or Seeing Information about EVs	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Friends and colleagues	48%	48%	50%	40% B C D	55% A	60% A	53% A
General internet search	30%	30%	34%	23% B C D	36% A	48% A B	58% A B C
Social media	26%	26%	30%	27%	31%	34% D	25%
Automobile manufacturers	31%	29%	28%	21% B C D	31% A	36% A	36% A
PGE	32% B C	23% A	25% A	23% D	29% D	24% D	13% A B C
Automobile reviews and consumer advice information	28%	25%	24%	17%	24%	35% A B	41% A B
Automobile dealerships	22%	20%	21%	19%	25% D	21%	17%
Environmental organizations	20% B	15% A	17%	10%	19% A	24% A D	18% A
Automobile websites	16%	16%	16%	13% D	16% D	20% A D	29% A B C
Automobile magazines	19%	15%	16%	16%	13%	19%	18%
U.S. Environmental Protection Agency (EPA)	9% B	6% A	7%	5%	7%	10% A D	6%
U.S. Department of Energy (DOE)	8%	5%	6%	6%	7%	5%	6%
Reddit	4%	5%	4%	3% D	5% D	5% D	12% A B C
Forth	2%	2%	2%	2% D	1% D	2% D	7% A B C
Electrical contractors	1%	1%	1%	1%	2%	2%	1%
Some other source	1% B C	5% A	5% A	4%	4%	5%	5%
None	8%	10%	8%	12% C D	8% C D	2% A B	2% A B
Don't know	10%	8%	10%	15% B C D	7% A	7% A	6% A

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

When asked which source of information respondents find most useful, PGE was ranked fifth (8%) among all sources of information, with friends and colleagues (25%), general internet searching (21%), automobile reviews (13%), and automobile manufacturers (8%) rounding the top five most useful information sources.

Similar to Wave 1, about one-fifth (22%) of Wave 2 respondents reported seeing at least one PGE EV resource, campaign, or discount (Figure 10). EV owners were about twice as likely to report seeing at least one PGE EV resource than non-EV owners (39% compared to 22%, respectively). Customers were most familiar with emails

and social media posts from PGE on EV services or charging, followed by PGE's EAs.[13] EV owners were significantly more likely to report visiting PGE's website for EV information than non EV-owners.

Figure 10. PGE EV Resources, Campaigns, or Discounts Seen by Respondents, by Survey Wave and Segment (Multiple Responses Allowed)

PGE EV Resources, Campaigns, or Discounts Respondents Have Seen	All Likely Vehicle Purchasers		Wave 2 - All Likely Vehicle Purchasers/Owners			
	Wave 1 (n=1025) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Emails from PGE on EV services or charging	6%	5%	3% D	7%	7%	11% A
Social media	2% C	5% B	6% D	4%	5%	3% A
PGE and Chevy's $500 discount for EVs or a free Level 2 charger	1% C	4% B	1% B C D	6% A	5% A D	9% A C
PGE's Electric Avenue in downtown Portland	4%	4%	2% B C D	5% A	5% A	10% A
PGE website information on EVs	4%	4%	4% D	3% D	5% D	11% A B C
PGE's Electric Avenue in Hillsboro	2%	2%	1%	2%	2%	2%
PGE's Electric Avenue in Milwaukie	2%	2%	1%	2%	2%	3%
PGE's Electric Avenue at Eastport Plaza	1% C	2% B	1%	2%	2%	2%
PGE's and Nissan's combined $3,500 Nissan Leaf discount	2%	1%	1% D	2% D	1% D	8% A B C
PGE's sponsored ride-and-drive events	2%	1%	2%	2%	0%	2%
Interactive Chargeway kiosks/displays at dealership	1%	1%	1%	1%	0%	1%
PGE's Drive Change Fund	1%	1%	0%	1%	1%	0%
PGE's Electric Avenue at Portland International Autoshow	1%	1%	1% D	1%	2%	3% A
PGE's Electric Avenue opening events	1%	1%	0% D	0%	2%	3% A
Electric Car Insider's Electric Car Guest Drive in Milwaukie	1%	0%	0%	0%	0%	1%
National Drive Electric Week advertising	1%	0%	0% D	1%	0% D	3% A C
Chargeway App	0%	0%	0% D	0% D	0%	4% A B
Didn't see any of these	63%	61%	66% C D	60% D	56% A	50% A B
Don't know	17%	17%	17% D	18% D	17% D	11% A B C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons. Question only asked of Wave 1 and Wave 2 survey respondents.

[13] Note that reported customer awareness of Electric Avenues was considerably lower in this question compared to when asked directly about what Electric Avenue locations they had seen (1%–4% vs 25%) (see Figure 27 below). Since this question was essentially an unaided request, asking about a variety of resources, campaigns, or discounts (17 in total), it is possible that customers overlooked the Electric Avenue options.

5.3 Customer Motivations and Barriers to Purchasing or Leasing an EV or PHEV

This section outlines customer motivations to purchase an EV or PHEV, barriers to adoption, and the likely changes needed to address customer concerns and increase likelihood to purchase an EV.

5.3.1 Motivations

Environmental impact and limiting gasoline usage are primary reasons motivating customers to purchase or lease an EV. In an open-ended response, over half (53%) of respondents mentioned environmental impact and about one-quarter (23%) of respondents mentioned limiting gas use as reasons for purchasing or leasing an EV (Figure 11). Respondents were statistically more likely to report limiting gas use as a reason to purchase or lease an EV in Wave 2 compared to the previous waves (23%, up from 8% of Wave 1 and 5% of Baseline), whereas fewer respondents reported fuel or operating costs (15%, down from 28% of Wave 1 and 33% of Baseline). Respondents in the non-considerer segment were more likely to indicate (unspecified) costs as a reason for purchasing or leasing an EV than intenders and owners. Also, EV owners more commonly reported maintenance costs and liking EVs as reason for purchasing EVs than the other segments.

Figure 11. Unprompted Reasons Mentioned for Purchasing or Leasing an EV or PHEV, by Survey Wave and Segment (Multiple Responses Allowed) [a]

Main Reason for Purchasing or Leasing an EV/PHEV (Unprompted)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=933) (C)	EV/PHEV Non-Considerers (n=344) (A)	EV/PHEV Considerers (n=248) (B)	EV/PHEV Intenders (n=341) (C)	EV/PHEV Owners (n=1918) (D)
Environmental impact	42% C	40% C	53% A B	34% B C D	63% A	65% A	63% A
No/less gas used	5% B C	8% A C	23% A B	26%	21%	21%	22%
Fuel/operating cost	33% B C	26% A C	15% A B	23% B C D	10% A D	11% A	16% A B
Cost (unspecified)	11%	9% C	13% B	19% C D	11%	7% A D	13% A C
Like electric cars	12% B C	6% A C	12% A B	10% D	14% D	12%	32% A B C
Maintenance costs	8% C	8% C	9% A B	10% D	4% C D	11% B D	28% A B C
Efficiency/fuel economy	7%	5%	7%	5%	7%	8% D	4% C
Have solar at home, so free charging	0%	0%	5%	5% D	4% D	7%	10% A B
Improved range	4%	2%	2%	2%	2%	3%	4%
Short/office commutes	2%	2%	2%	2%	1%	2%	3%
Don't know	2%	27%	25%	36%	23%	11%	2%

Notes: Those who indicated they were intending to purchase an EV or PHEV were asked "What are the main reasons you would consider an EV PHEV for your next vehicle purchase or lease?" All other respondents were asked "If in the future you were to consider purchasing or leasing an EV /PHEV, what would you expect to be the main benefits of having an electric vehicle?"

Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

[a] The number of respondents for Wave 2 is lower as respondents who did not give a valid response were excluded from the results. The team added "Don't know" as a response option beginning in the Wave 1 survey, hence the responses for Wave 1 and Wave 2 are significantly higher compared to the Baseline.

Similarly, when provided with a list of potential reasons for considering or purchasing or leasing an EV or PHEV, nearly all (86%) respondents indicated environmental protection was a "major" reason, which increased between the Baseline and Wave 2 surveys (86%, up from 78%) (Figure 12). EV owners were significantly more likely to report less vehicle maintenance (64% vs. 53%), vehicle performance (64% vs. 53%), and convenience of charging at home (70% vs. 46%) as major reasons for purchasing an EV compared to non-EV owners. EV owners were significantly less likely to report the availability of charging in PGE's territory (Portland and Salem metropolitan areas) as a major reason to purchase an EV compared to non-EV owners (17% vs. 35%), potentially because they have greater access to home charging (70% indicated that charging at home is a major reason why they purchased an EV).

Figure 12. Prompted Reasons for Purchasing or Leasing an EV/PHEV, by Survey Wave and Segment (Multiple Responses Allowed)

Reason for Purchasing or Leasing an EV/PHEV (% Reporting a Major Reason)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners		
	Baseline (n=435) (A)	Wave 1 (n=500) (B)	Wave 2 (n=691) (C)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
Protecting the environment	78% C	82%	86% A	82%	89%	85%
Lower fuel cost	82% B C	70% A	64% A	65%	64%	64%
Vehicle safety	68%	64%	64%	66%	63%	60%
Less vehicle maintenance	63% C	58%	53% A	51% D	55% D	64% B C
Vehicle's performance and handling	61% C	55%	53% A	55% D	52% D	64% B C
The convenience of charging vehicle at home	68% B C	49% A	46% A	36% D	54% D	70% B C
Availability of public charging stations in the Portland/Salem metro areas	56% B C	31% A	35% A	32% D	37% D	17% B C
Availability of public charging stations outside of the Portland/Salem metro areas	55% B C	30% A	33% A	34%	32%	30%
Tax incentives and rebates	41% B C	32% A C	25% A B	27%	24% D	32% C
The convenience of charging vehicle at work	26% B C	17% A C	17% A B	16% D	18% D	10% B C
Prirority parking at some locations	10%	9%	8%	10% D	7% D	3% B C
How I look driving and owning this vehicle	5%	6%	4%	5%	3% D	8% C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons. EV/PHEV Non-Considerers were not asked this question. Those who indicated they were intending to purchase an EV or PHEV were asked, "For each of the factors below, please indicate whether that factor is a major reason, a minor reason, or not a reason you are considering an all-electric vehicle / plug-in hybrid electric vehicle for your next purchase / lease." EV owners were asked "For each of the factors below, please indicate whether that factor was a major reason, a minor reason, or not a reason you decided to purchase or lease an all-electric vehicle / plug-in hybrid electric vehicle."

5.3.2 Barriers and Changes Needed to Increase EV Adoption

Affordability of EVs continues to be the primary barrier to purchasing or leasing an EV or PHEV, followed by availability of charging stations and infrastructure. In an open-ended response, over one-third (36%) of respondents mentioned that cost or affordability were barriers to purchasing or leasing an EV or PHEV, similar to previous surveys (Figure 13). There was a notable decrease, however, in the number of mentions related to availability of more EV models compared to the Baseline and Wave 1 surveys (4%, down from 9% of Wave 1 and 18% of Baseline). Interestingly, customers in the considerer and intender segments were significantly more likely to report cost or affordability as barriers compared to non-considerers and owners (42% and 48% vs. 25% and 24%, respectively), likely because customers in these segments have spent more time researching these vehicle types and understand the costs compared to conventional vehicles, while EV owners could likely afford these costs as they generally have higher incomes (see Section 5.6). Further, customers in the non-considerer segment are significantly more likely report that availability of charging stations and EV infrastructure are barriers to purchasing compared to other customer segments.

Figure 13. Unprompted Barriers Mentioned to Purchasing or Leasing an EV or PHEV, by Survey Wave and Segment (Multiple Responses Allowed)

Main Barrier to Purchasing or Leasing an EV/PHEV (Unprompted)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=956) (C)	EV/PHEV Non-Considerers (n=409) (A)	EV/PHEV Considerers (n=238) (B)	EV/PHEV Intenders (n=309) (C)	EV/PHEV Owners (n=1798) (D)
Cost/affordability	31% C	32%	36% A	25% B C	42% A D	48% A D	24% B C
Charging stations/infrastructure	22% B	13% A C	24% B	33% B C D	16% A	17% A	21% A
Range/battery life	25% B C	18% A	17% A	16% D	17% D	18% D	25% A B C
Cost of repairs/maintenance	8% C	6%	5% A	6% D	6% D	3% D	1% A B C
Convenience/ease of use	7% C	7% C	4% A B	5%	4%	3%	3%
Availability of more EV models	18% B C	9% A C	4% A B	4%	3%	5%	2%
Lack of familiarity	5% B	2% A	3%	3% D	5% C D	1% D	0%
Cost of electricity/cost to use	5% C	4% C	2% A	4% D	3%	0%	1% A
Negative environmental impacts	6% C	5% C	2% A B	2% D	1%	2% D	0% A C
Power/able to pull and tow	4% C	4% C	1% A B	1%	1%	0%	1%
Don't know	0%	19%	27%	25%	33%	26%	36%

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons. The team added "Don't know" as a response option beginning in the Wave 1 survey, hence the responses for Wave 1 and Wave 2 are significantly higher compared to the Baseline.

Similarly, when provided with a list of potential concerns to purchasing or leasing an EV or PHEV, a large majority of customers reported that the vehicle range was a major concern, followed closely by purchase price of the vehicle (Figure 14). However, customer concern about vehicle purchase price decreased significantly between Wave 1 and Wave 2 (77%, down from 84% of Wave 1). Customers in the non-considerer segment are significantly more concerned about the time it takes to charge an EV, availability of public charging, cost of installing charging at home, and cost of charging an EV compared to all other customer segments. EV owners

exhibited significantly less concern about vehicle purchase price compared to non-owners (57% vs. 76%), in addition to being less concerned about maintenance costs (33% vs. 56%). Even though there are considerably more EV models with over 200 miles in battery range on the market now compared to the Wave 1 survey, range continues to be a primary barrier to purchasing an EV/PHEV for customers (80% reported number of miles on a single charge is a "major" concern).

Figure 14. Prompted Barriers Mentioned to Purchasing or Leasing an EV/PHEV, by Survey Wave and Segment (Multiple Responses Allowed)

Barriers to Purchasing or Leasing an EV/PHEV (% Reporting a Major Concern)	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
Number of miles vehicle will go on a single charge	87% B C	79% A	80% A	80% D	81% D	78%	72% A B
Purchase price of vehicle	79%	84% C	76% B	75% D	80% D	75% D	57% A B C
Vehicle reliability	N/A[a]	77%	75%	72%	78%	77% D	71% C
Vehicle safety	69%	66%	65%	62%	67%	66%	61%
Ability to charge at home	66%	65%	63%	67%	61%	60%	67%
Amount of time required to charge battery	66%	62%	63%	68% B C D	59% A D	58% A D	46% A B C
Availability of public charging stations outside of the Portland/Salem metro areas	69% B C	59% A	60% A	70% B C D	55% A	53% A	49% A
Maintenance costs	65% C	61%	56% A	64% C D	61% C D	42% A B D	33% A B C
Vehicle's performance and handling	64% BC	58%	55%	56%	57%	50%	52%
Availability of public charging stations in the Portland/Salem metro areas	62% B C	48% A	50% A	60% B C D	44% A D	42% A	25% A B
Cost of installing home charging station	N/A[b]	N/A[b]	45%	58% B C D	46% A C D	26% A B D	6% A B C
Cost of charging the vehicle	54% B C	45% A	40% A	51% B C D	39% A D	29% A	20% A B
EV body types	45%	42%	40%	45% D	37%	37%	35% A
Concerns about electric power outages at home	N/A[b]	N/A[b]	34%	48% B C D	27% A D	22% A D	10% A B C
Ability to charge at work	38% C	33%	28% A	11% B C D	19% A D	14% A D	7% A B C
EV appearance	20% B	26% A	23%	29% B C D	21% A	17% A	23% A B
Learning how to charge an electric vehicle	N/A[b]	N/A[b]	10%	15% C D	9% D	4% A	1% A B

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (*z*-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

[a] Item not displayed to Baseline survey respondents.

[b] Item not displayed to Baseline or Wave 1 survey respondents.

Among customers who indicated they were not considering an EV or PHEV for their next vehicle, about half (45%) suggested that additional charging infrastructure may encourage them to purchase or lease an EV or PHEV in the future, while about two-fifths (42%) could not convey what changes to vehicle specifications or

charging infrastructure might convince them to purchase or lease (Figure 15). Additional charging infrastructure has consistently been the most suggested change over the three survey waves.

Figure 15. Unprompted Reported Changes Necessary to Consider EV or PHEV for Next Vehicle among Non-Considerers, by Survey Year (Multiple Responses Allowed) [a]

Changes Necessary to Consider EV or PHEV for Next Purchase/Lease (Unprompted)	EV/PHEV Non-Considerers		
	Baseline (n=494) (A)	Wave 1 (n=526) (B)	Wave 2 (n=350) (C)
Additional charging infrastructure	32% B C	25% A C	45% A B
Cost/affordability (unspecified)	23% B	16% A C	25% B
Range/battery life	24% C	21% C	11% A B
Style/model of car	24% B C	16% A C	9% A B
Time it takes to charge	8%	6%	7%
Size of vehicle	7%	6%	4%
Adress environmental impacts of batteries	5% C	4% C	1% A B
Grid reliability	0%	0%	1%
Cost of vehicle	8%	7%	0%
Nothing	3%	30%	28%
Don't know	8%	5%	14%

Note: Letters indicate statistically significant differences between survey waves (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

[a] Only asked of respondents in the EV/PHEV Non-Considerer segment. The team added "Nothing" as a response option beginning in the Wave 1 survey, hence the responses for Wave 1 and Wave 2 are significantly higher compared to the Baseline.

Customer expectations with vehicle battery range have increased over time. Over half (57%) of customers who cited "number of miles vehicle will go on a single charge" as a "minor" or "major" concern with purchasing an EV/PHEV reported that EVs would need a battery range of over 250 miles to alleviate range concerns, compared to just under a half (47%) of customers in Wave 1 (Figure 16). Customers who own an EV/PHEV were considerably more likely to report needing a vehicle with a battery range of over 250 miles compared to non-owners (75% vs. 57%, respectively).

Figure 16. Number of Miles EV Needs to Go on Single Charge to Reduce Range Concerns, by Survey Wave and Segment

Miles Needed on a Single Charge to Reduce Vehicle Range Concerns	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=903) (A)	Wave 1 (n=966) (B)	Wave 2 (n=1116) (C)	EV/PHEV Non-Considerers (n=454) (A)	EV/PHEV Considerers (n=296) (B)	EV/PHEV Intenders (n=365) (C)	EV/PHEV Owners (n=1848) (D)
100 miles or less	8%	11%	10%	6% A B C	12% A D	12% A D	2% A B C
101 to 200 miles	22%	23% C	19% B	15% D	22% D	21% D	7% A B C
201 to 250 miles	15% C	15% C	10% B	9% D	10%	10%	15% A
251 to 300 miles	22%	19%	20%	18% D	20% D	22% D	30% A B C
More than 300 miles	29% C	28% C	37% A B	43% B C	33% A D	33% A D	45% B C
Not sure	5%	4%	5%	8% B C D	2% A	2% A	2% A

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons. Question displayed only to those who reported "number of miles vehicle will go on a single charge" was a "minor" or "major" concern.

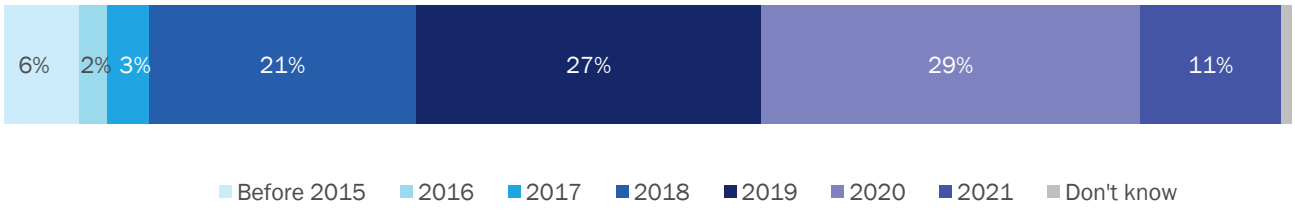
5.4 EV Owner Characteristics and Behavior

This section provides a profile of the EV owners who responded to the survey, including their vehicle and usage type, and charging behavior. It also examines EV-related knowledge and awareness of the general population compared to EV owners.

5.4.1 Vehicle Type, Year Purchased, and Primary Use

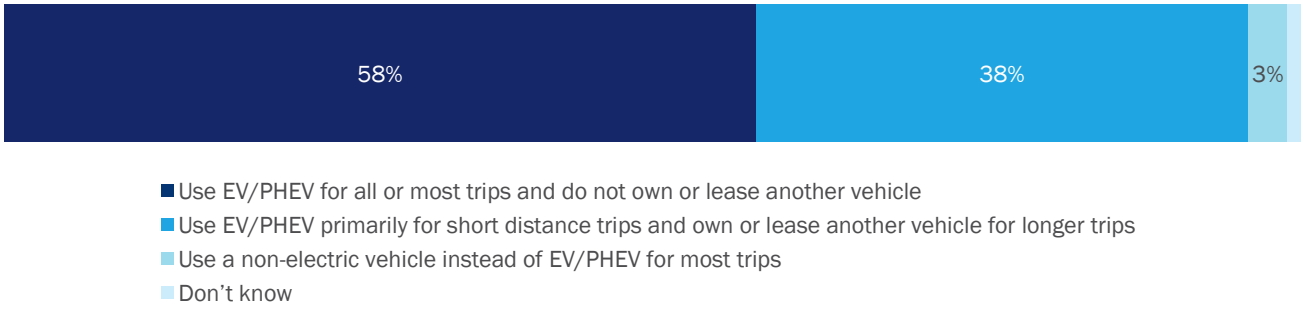
Of customers who reported owning an EV or PHEV, a large majority (96%) reported owning an EV and about one in ten (9%) report owning an PHEV (4% of customers reported owning both an EV and a PHEV). Nearly one-fifth of the customers (18%) reported owning more than one EV or PHEV, with a few (5%) owning three EVs or PHEVs. More than half (55%) of the reported vehicles were manufactured by Tesla. Chevrolet (13%), Nissan (13%), Hyundai (4%), and Volkswagen (3%) round out the top five of the most reported manufacturers. As shown in Figure 17, the majority (88%) of EVs or PHEVs were purchased after 2017.

Figure 17. EV or PHEV Purchase Year (n=2,386)



More than half of EV owners reported using their EVs or PHEVs for all or most of their trips, and that they did not own another vehicle (see Figure 18).

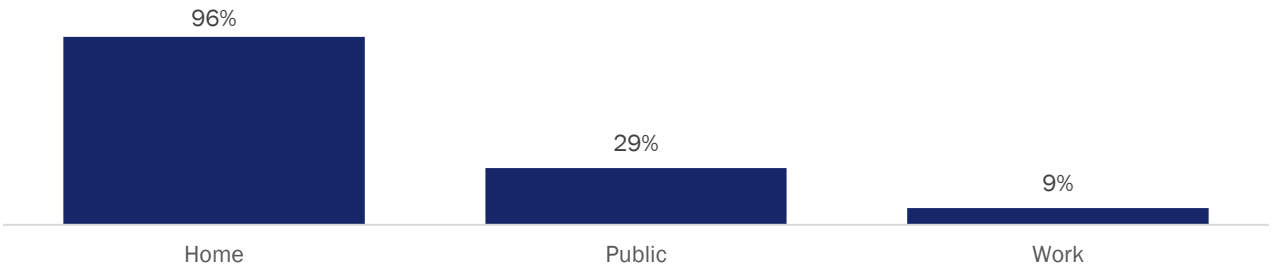
Figure 18. Typical Use of EV/PHEVs by EV Owners



5.4.2 EV Charging

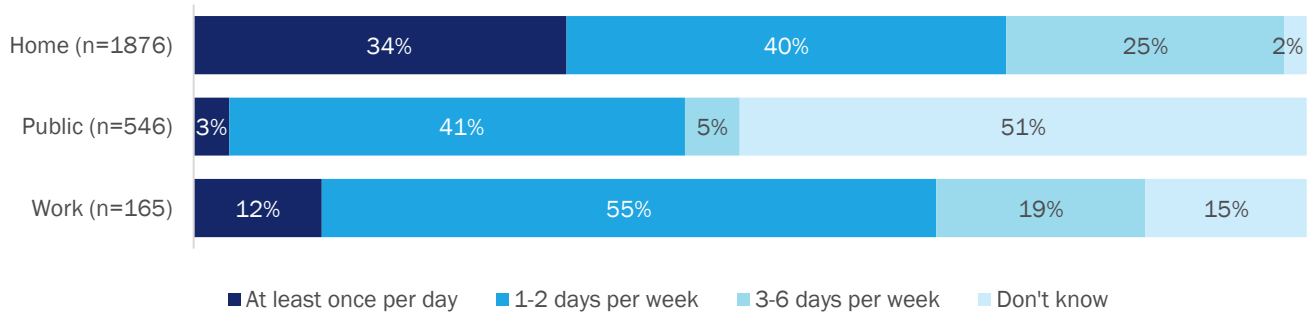
EV owners most commonly charge their EV at home. Nearly all (96%) EV owners reported typically charging at home; about one-third (29%) reported using public chargers (Figure 19). Among EV owners who charge at home, about three-quarters (73%) reported using a Level 2 charger, while about one-third (30%) reported using Level 1 charger (multiple responses allowed). Additionally, about one-third (30%) reported programming their EV/PHEV to start and stop charging at specific times and fewer than one-fifth (14%) indicated they were signed up for a PGE's Time of Use pricing.

Figure 19. Location EV Owners Typically Charge Their Vehicle (n=1,951; Multiple Responses Allowed)



Among EV owners who indicated they charge at home, about two-thirds reported charging less than once per day; about two-fifths (40%) reported charging only once or twice during the week (Figure 20). Note that about half (51%) of EV owners who indicated they use public charging reported not being sure how often they used public charging, suggesting infrequent use.

Figure 20. Frequency of Charging, by Charging Location (n=1,948)



Note: This question was asked only of respondents who reported that they charge their EV or PHEV at the said location in the above question.

Similarly, home charging is most important to customers, and its availability may factor into decisions to purchase or lease an EV or PHEV. Overall, about three-quarters (70%) of respondents indicated that having charging available at home was most important to them (Figure 21). Charging along major highways was the most important location for charging outside of the home, while few respondents (4%) reported that workplace charging was most important to them.

Figure 21. Most Important Location to Have Charging Available, by Survey Wave and Segment

Most Important Location to Have Charging Available	All Likely Vehicle Purchasers		Wave 2 - All Likely Vehicle Purchasers/Owners			
	Wave 1 (n=1025) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=495) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
At home	73%	70%	65% C D	72%	75% A	73% A
Along major highways to support inter-city travel	N/A[a]	13%	15% B C D	12% A D	11% A D	19% A B C
At public locations (e.g., grocery stores, coffee shops, malls)	14% B	8% B	7% D	8% D	7%	4% A B
At work	7% C	4% B	4%	5%	2%	3%

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.
[a] Item not displayed to Wave 1 survey respondents.

EV owners are more likely to have a personal garage to park their vehicles compared to other segments. More than two-thirds (69%) of EV owners reported parking their vehicle in their garage, while about half (52%) of the non-considerers and about two-fifths (44%) of considerers reported parking their vehicles in their driveway (Figure 22). Also, significantly more non-considerers (13%), considerers (12%), and intenders (9%) reported parking their vehicles in a shared garage compared to owners (2%), as they more often reported living in multifamily buildings (see Section 5.6 Key Demographic Comparisons). Among those customers parking on the street, significantly more non-considerers (37%) reported being unable to find a parking space close to their home compared to owners (5%).

Figure 22. Typical Parking Location at Home, by Survey Wave and Segment

Typical Parking Location at Home	All Likely Vehicle Purchasers		Wave 2 - All Likely Vehicle Purchasers/Owners			
	Wave 1 (n=990) (B)	Wave 2 (n=1145) (C)	EV/PHEV Non-Considerers (n=479) (A)	EV/PHEV Considerers (n=301) (B)	EV/PHEV Intenders (n=365) (C)	EV/PHEV Owners (n=1951) (D)
My driveway	46%	46%	52% C D	44% D	40% D	27% A B C
My garage	36%	35%	28% D	36% D	44% A D	69% A B C
In a shared parking garage	10%	11%	13% B C D	12% A D	9% A D	2% A B C
On the street	7%	7%	6% D	8% D	7% D	2% A B C
Don't know	1%	1%	1% D	0%	0%	0% A

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

When we asked respondents if they had access to an electrical service outlet where they park their vehicle, about one-third (36%) reported having one; owners were most likely to report having one (94% vs. 47% of intenders, 34% of considerers, and 29% of non-considerers).

Similarly, few customers (14%) reported having charging available at their workplace, which is consistent with previous survey waves. Again, EV owners are more likely to report having workplace charging compared to the other segments (29%, compared to 19% of intenders, 15% of considerers, and 9% of non-considerers). Workplace charging does not appear to be a critical factor in customers' decisions to purchase an EV in the aggregate; most respondents reported that having workplace charging would have either no effect on their decision (40%) or make them somewhat more likely to purchase or lease an EV/PHEV (36% reporting). Notably, the availability of workplace charging is statistically more important to respondents living in multifamily properties compared to those in single-family detached houses (27% indicated that having workplace charging would make them much more likely to purchase an EV, compared to 18% of respondents living in single-family detached homes).

5.4.3 EV Knowledge and Experience

Understanding of EV Fuel Costs

Customers' understanding of the fuel costs associated with EVs/PHEVs relative to gasoline vehicles has improved since the Wave 1 and Baseline surveys (58%, up from 20% of Wave 1 and 21% of Baseline) (Figure 23). Still, non-EV owners lag behind EV owners in their understanding of fuel costs. When asked whether respondents were aware that a typical EV or PHEV driver would spend approximately $1 for electricity instead of $3.10 for gasoline to drive the same distance, EV owners were significantly more likely to report being aware compared to all other segments, suggesting an opportunity for PGE to increase customer understanding of the lower fuel costs associated with EVs/PHEVs.

Figure 23. Awareness that EV Fuel Costs are Typically Less than Gasoline Vehicles, by Survey Wave and Segment

Awareness of Electricity Versus Fuel Cost	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=947) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=373) (C)	EV/PHEV Owners (n=1951) (D)
Yes	21%	20%	58% A B	49%	57%	70% A B	96% A B C
No	79% C	80% C	42%	51% C D	43% C D	30% D	4%

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Impact of EV Knowledge on Likelihood to Purchase EVs

After learning about the low fuel costs associated with EVs (as shown above), more than half of customers reported they would be much or somewhat more likely to consider EVs in the future, which is consistent with the previous waves (Figure 24). Non-considerers were significantly less likely to report a change in their likelihood to purchase an EV compared to the other segments.

Figure 24. Impact on Likelihood to Purchase EVs After Learning about Lower Fuel Costs, by Survey Wave and Segment

Impact of Knowledge of EV Fuel Costs on Future EV Purchase	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=947) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=373) (C)	EV/PHEV Owners (n=1951) (D)
Much or Somewhat more likely to purchase an EV	58%	54%	56%	37% B C D	67% A	71% A	72% A

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Similarly, after being informed that there are about 160 publicly accessible DCFCs in Oregon that can charge most EVs to 80% in 30 minutes to one hour, about half (51%) of the customers indicated being "much" or "somewhat" more likely to consider an EV in the future (Figure 25). Again, non-considerers were significantly less likely to report a change in their likelihood to purchase an EV compared to the other segments.

Figure 25. Impact on Likelihood to Purchase EVs After Learning about Fast Charging Time, by Survey Wave and Segment

Impact of Knowledge of DCFCs on Future EV Purchase	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=947) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=373) (C)	EV/PHEV Owners (n=1951) (D)
Much or Somewhat more likely to purchase an EV	38%	41%	51% A B	31% B C D	60% A C D	70% A B	69% A B

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Driving Experience

More customers report having personal experience driving EVs, which is influential in purchasing decisions. About one-quarter (24%) of respondents mentioned they had experience with driving an EV, up from about one-fifth (18%) in Wave 1 (Figure 26). Among EV owners who test drove an EV before leasing or purchasing (95% of owners), nearly three-quarters (72%) reported they were at least moderately influenced by the test

drive when deciding to lease or purchase their EV.[14] Without the test drive, one-third (32%) of these EV owners would have postponed purchasing an EV or purchased a different vehicle, while about two-fifths (44%) would have made the exact same purchase, highlighting the importance of ride-and-drives in customer purchasing decisions.

Figure 26. Respondent Experience with Driving an EV, By Survey Wave and Segment (Multiple Responses Allowed)

Respondent Experience Driving EV	All Likely Vehicle Purchasers		Wave 2 - All Likely Vehicle Purchasers/Owners			
	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Yes, a friend's, family member's, or colleague's	14% C	19% B	13% C	17% C D	28% A B D	11% B C
Yes, at a dealership	3%	3%	2% C D	2% D	6% A D	13% A B C
Yes, at some other ride-and-drive event	2%	1%	0%	1%	1%	2%
Yes, my own EV or PHEV	1%	1%	1% D	1% D	2% D	89% A B C
No experience	80% C	74% B	81% C D	77% C D	63% A B D	4% A B C
Don't know	2%	2%	2% D	2%	1%	1% A

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

TNC and On-Demand Delivery Drivers

About 2% of the survey respondents indicated that they were either a TNC driver (32 respondents), an on-demand delivery driver (38 respondents), or both TNC and on-demand delivery (12 respondents). Of the 82 TNC and on-demand delivery drivers, about one-third (31% or 26 respondents) reported owning an EV.[15] TNC and on-demand delivery drivers who reported owning an EV most commonly reported charging their vehicles at home (88%) and/or public charging stations (54%). Of those drivers who charge their vehicles at PGE's EAs (7 of 26), three reported having an unlimited monthly charging subscription, two indicated paying by the hour, while another two were unsure of their typical payment method at the Electric Avenues.

[14] Respondents who rated the level of influence as 6–7 on a 10-point scale, where 0 was "not at all influential" and 10 was "extremely influential," were categorized as "moderately influenced" and those who rated the level of influence as 8–10 were categorized as "greatly influenced."

[15] Note the survey included an oversample of EV owners, which is why there is a large proportion of EV owners among TNC and on-demand delivery drivers. Excluding respondents from the EV owner oversample reveals an EV ownership rate of about 2% for TNC and on-demand delivery drivers. This is slightly lower than the EV ownership rate among the general population of residential customers (6%) in PGE's service territory.

5.5 EV Services, Infrastructure, and Incentives

5.5.1 EV Services and Infrastructure Supported by PGE

Electric Avenues and Other Public Charging

Customer awareness of PGE's Electric Avenues, while still higher than the Baseline survey, significantly decreased in Wave 2. About one-quarter (25%) of respondents reported they have seen at least one Electric Avenue (down from 33% in Wave 1) (Figure 27). Customers who are considering or intending to purchase an EV/PHEV are more likely to have seen an Electric Avenue than non-considerers (32% and 31% vs. 17%). Further, about two-fifths (38%) of EV owners report being aware of at least one Electric Avenue location. Among EV owners who reported seeing an Electric Avenue, about two-fifths (38%) reported using at least one Electric Avenue location to charge their vehicle. EV owners most commonly reported using the Downtown Portland (65%) and the Hillsboro (18%) Electric Avenues for charging their EVs.

Figure 27. Electric Avenue Locations Seen by Respondents, by Survey Wave and Segment (Multiple Responses Allowed)

Seen PGE Electric Avenues	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=488) (A)	EV/PHEV Considerers (n=312) (B)	EV/PHEV Intenders (n=379) (C)	EV/PHEV Owners (n=1951) (D)
Has seen Electric Avenue	13% B C	33% A C	25% A B	17% B C D	32% A	31% A D	38% A C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Partner Dealers

Few (12%) EV owners reported visiting a PGE partner dealer when purchasing their EV/PHEV. Partner Nissan and Chevrolet dealers were the most common partner dealers visited (Table 11). A majority (55%) of EV owners reported visiting a Tesla store when they purchased their EV/PHEV. EV owners who visited a partner dealer rated a partner used EV dealer as the most informative (an average rating of 9 on a 0–10 scale), likely because this dealer primarily sells used EVs and PHEVs. About half (53%) of EV owners who visited a partner dealer reported they were at least moderately influenced by the visit to lease or purchase an EV.[16]

Few (15%) EV owners reported being shown the educational kiosk while visiting a PGE partner dealer. Customers who visited partner Audi and Nissan dealers were most likely to report being shown the kiosk. Customers who were shown the educational kiosk reported finding the kiosk moderately helpful in understanding EV charger availability and EV charging times (providing an average rating of 7 on a 0 to 10 scale, where 0 was "not at all helpful" and 10 was "extremely helpful").

[16] Respondents who rated the level of influence as 6–7 on a 10-point scale, where 0 was "not at all influential" and 10 was "extremely influential," were categorized as "moderately influenced" and those who rated the level of influence as 8–10 were categorized as "greatly influenced."

Table 11. Proportion of EV Owners Who Visited Partner Dealers, Rated Level of Informativeness of Dealer, and Proportion of EV Owners Shown the Educational Kiosk

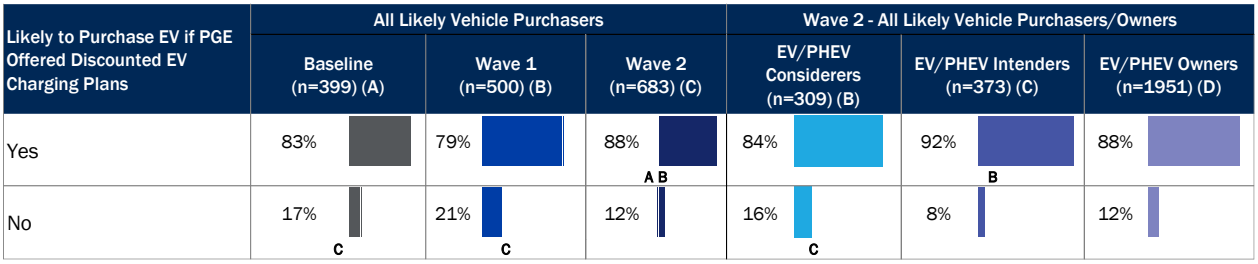
Dealer	Visited (n=1,951)		Average Informative Score[a]	Shown the Educational Kiosk
	Count	Percent		
Partner Nissan dealer	103	5%	7	19%
Partner Chevrolet dealer	81	4%	6	5%
Partner used EV dealer	21	1%	9	10%
Partner Audi dealer	19	1%	7	21%
Partner BMW dealer	16	1%	6	13%
Partner Hyundai dealer	14	1%	5	14%

[a] EV Owners were asked to rate each dealer on how informative they were when they purchased or leased their EV or PHEV using a scale from 0 to 10, with 0 meaning "not at all informative" and 10 meaning "very informative".

Potential Rebates and Services

There is high, and increasing, interest in PGE offering discounted EV charging plans among customers. A large majority (88%) of respondents reported that PGE offering discounted EV charging plans would increase their likelihood to purchase an EV (Figure 28). Wave 2 respondents were significantly more likely to consider purchasing an EV if PGE offered discounted pricing plans compared to the previous waves.

Figure 28. Increased Likelihood to Purchase EV if PGE Offers Discounted Charging Plans, by Survey Wave and Segment



Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

Customers are supportive of PGE's efforts to ensure convenient EV charging is available in the community. When asked about different roles that PGE could play to support EVs, respondents were most in agreement that they support PGE investing to ensure that the existing electrical system supports convenient charging, and that PGE should help to make installing a home EV charging station easier (Figure 29). Respondents were in less agreement about whether PGE should install and maintain multifamily EV charging stations or electrify its fleet. Overall, customers in the non-considerer segment were less likely to report agreeing with the statements about PGE's role in supporting EVs compared to the other segments.

Figure 29. Respondent Agreement with Statements About PGE's Role in Supporting EVs, by Survey Wave and Segment (Multiple Responses Allowed)

Respondent Agreement with Statements about PGE's Role in Supporting EVs	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=929) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
I support PGE working and investing now to ensure that the existing electric system is able to support convenient recharging of electric cars and trucks	81%	80%	84%	71% B C D	90% A	96% A	96% A
PGE should make installing a home electric vehicle charging station easier	N/A[a]	N/A[a]	83%	72% B C D	88% A	93% A	90% A
PGE should make owning an EV more convenient and feasible by installing and maintaining public charging stations	75%	77%	79%	64% B C D	88% A	92% A	89% A
PGE should take an active role in educating people about EVs	75%	74%	77%	62% B C D	86% A	90% A	89% A
PGE is a credible source of information about EVs	73%	74%	75%	65% B C D	82% A	83% A	77% A
PGE should convert its own vehicle fleet to electric power as soon as possible	67%	67%	72%	54% B C D	82% A	90% A	87% A
PGE should make owning an electric vehicle more convenient and feasible by installing and maintaining multifamily charging stations	N/A[a]	N/A[a]	69%	55% B C D	77% A	80% A	79% A

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). The statements "PGE should make installing a home electric vehicle charging station easier" and "PGE should make owning an electric vehicle more convenient and feasible by installing and maintaining multifamily charging stations" were added for Wave 2 and were not asked of Wave 1 and Baseline respondents. Respondents who rated the level of agreement as 6–10 on a 10-point scale, where 0 was "completely disagree" and 10 was "completely agree," were categorized as agreeing with the above statements.

[a] Item not displayed to Baseline or Wave 1 survey respondents.

5.5.2 Other EV Incentives

Less than half of the customers reported being aware of any state or federal tax incentives to help offset the up-front costs of EVs (Figure 30). Non-considerers and considerers are significantly less likely to report being aware of tax incentives compared to intenders (35% and 42%, compared to 58%). Awareness of incentives is much higher among owners compared to the other segments (94%, compared to 44% of non-owners). However, few (14%) EV owners reported receiving any financial assistance from the government, car manufacturers, or car dealers when leasing or purchasing their EVs. Of those that did, over two-fifths (44%) would have postponed the EV purchase or purchased a different vehicle if the financial assistance was unavailable, while another two-fifths (39%) would have made exactly the same decision.

Figure 30. Awareness of State or Federal Tax Incentives, by Survey Wave and Segment

	All Likely Vehicle Purchasers			Wave 2 - All Likely Vehicle Purchasers/Owners			
	Baseline (n=947) (A)	Wave 1 (n=1026) (B)	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=373) (C)	EV/PHEV Owners (n=1951) (D)
Aware of state or federal tax incentives	47%	43%	44%	35% C D	42% C D	58% A B D	94% A B C

Note: Letters indicate statistically significant differences between survey waves and likely vehicle purchaser segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

EV owners were also asked what factors (such as information from PGE, federal or state tax credits, rebates, or manufacturer or dealership discounts) were influential on their decision to purchase or lease an EV. Most EV owners reported that the federal (69%) and state tax credits (61%) they received when purchasing their EV had a great influence on their decision, followed by rebates (24%).

5.6 Key Demographic Comparisons

This section provides a profile of the customers who responded to the survey, including education, housing tenure, housing type, income, and gender. Overall, demographic analysis shows that EV owners are statistically more likely to report owning their home and living in single-family detached housing with a driveway compared to non-EV owners. Further, EV owners are statistically more likely to report higher levels of educational attainment, have higher household incomes, and identify as male compared to non-EV owners.

Homeownership rates are significantly higher among EV owners. Nearly all (94%) EV owners reported owning a home compared to about two-thirds (67%) of non-EV owners (Figure 31). Customers in the non-consider and consider segments are significantly more likely to report renting their home compared to those in the intender segment and EV owners (34% and 29%, compared to 22% and 4%, respectively).

Figure 31. Respondent Housing Tenure, by Survey Wave and Segment

Respondents Who Own or Rent		Wave 2 - All Likely Vehicle Purchasers/Owners			
	Wave 2 (n=1179) (C)	EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Own	67%	62%	66%	75% A B	94% A B C
Rent	29%	34% C D	29% C D	22% D	4%
Other	1%	1%	2%	1%	1%
Don't know	1%	1%	1%	1%	0%
Prefer not to say	2%	2%	2%	1%	1%

Note: Letters indicate statistically significant differences between segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

EV owners are more likely to report living in single-family housing. Over two-fifths (86%) of EV owners reported living in single-family housing with a driveway compared to about two-thirds (63%) of non-EV owners (Figure 32).

Figure 32. Respondent Housing Type, by Survey Wave and Segment

Respondent Home Type	Wave 2 (n=1179)	Wave 2 - All Likely Vehicle Purchasers/Owners			
		EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Single-family detached house with a driveway	63%	62% D	59% D	68% D	86% A B C
Apartment or condominium with 5 units or more	22%	23% D	25% D	19% D	3% A B C
Single-family attached home (such as a townhouse)	5%	4%	6%	5%	4%
Duplex, triplex, or four-plex	4%	4% D	4% D	4% D	1% A B C
Single-family detached house with no driveway	2%	2%	2%	2%	2%
Manufactured or mobile home	1%	2% D	1%	1%	0% A
Other	0%	1%	0%	0%	0%
Prefer not to answer	2%	2%	2%	2%	1%

Notes: This question was not asked of Baseline survey respondents.
Letters indicate statistically significant differences between segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

EV owners report higher levels of education than non-EV owners. About half (46%) of EV owners reported having a graduate or professional degree compared about one-quarter (26%) of non-EV owners (Figure 33).

Figure 33. Respondent Education Level, by Survey Wave and Segment

Respondent Educational Level	Wave 2 (n=1179)	Wave 2 - All Likely Vehicle Purchasers/Owners			
		EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Some high school	1%	1%	2% D	1%	0%
Graduated high school	6%	8% C D	6% D	4%	2%
Trade or technical school	4%	5% D	4% D	3%	1%
Some college	21%	27% C D	21% D	14% D	9%
Graduated college	38%	35%	42%	39%	39%
Graduate/professional school	26%	19%	22%	37% A B	46% A B C
Prefer not to say	3%	4%	3%	2%	2%

Note: Letters indicate statistically significant differences between segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

EV owners have higher incomes than non-EV owners. Over half (59%) of EV owners reported annual household incomes over $100,000 compared about one-quarter (25%) of non-EV owners (Figure 34).

Figure 34. Respondent Household Income, by Survey Wave and Segment

Respondent Income	Wave 2 (n=1179)	Wave 2 - All Likely Vehicle Purchasers/Owners			
		EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Less than $50K	18%	21% C D	18% D	14% D	4%
$50K to less than $75K	22%	22% D	23% D	20% D	6%
$75K to less than $100K	15%	13%	15% D	17% D	10%
Over $100K	25%	20%	26%	30% A	59% A B C
Prefer not to answer	20%	23%	18%	19%	23%

Note: Letters indicate statistically significant differences between segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

EV owners tend to identify as male (Figure 35). About two-thirds (64%) of EV owners identified as male compared to about two-fifths (42%) of non-EV owners.

Figure 35. Respondent Gender, by Survey Wave and Segment

Respondent Gender	Wave 2 (n=1179)	Wave 2 - All Likely Vehicle Purchasers/Owners			
		EV/PHEV Non-Considerers (n=496) (A)	EV/PHEV Considerers (n=309) (B)	EV/PHEV Intenders (n=374) (C)	EV/PHEV Owners (n=1951) (D)
Male	42%	34%	41%	53% A B	64% A B C
Female	52%	57% C D	55% C D	42% D	29%
Other	1%	1%	1%	0%	0%
Prefer not to answer	6%	8%	4%	5%	6%

Note: Letters indicate statistically significant differences between segments (z-test for proportions, $p < .05$). EV owners are excluded from overall survey wave comparisons.

6. Multifamily Building Owner and Manager In-Depth Interview Findings

The following section provides key findings from the Multifamily Building Owner and Manager In-depth Interviews. The team conducted 12 interviews with owners and managers of multifamily properties located within one mile of PGE's six EA sites between October 26 and December 9, 2021. The purpose of the interviews was to assess awareness and use of nearby EA sites and to determine interest in installing on-site EV charging, barriers to installing on-site EV charging, and decision-making around capital improvements.

Respondents described themselves as an owner and/or a property manager of at least one multifamily property (six respondents were managers, five were owners, and one was an owner and manager of the property). These respondents owned or managed an average of 12 buildings or about 200 units. The average building age was 46 years with a standard deviation of 24 years. All respondents reported leasing units at market rate; however, two respondents noted that a portion of the units at their property were occupied by residents using Section 8 housing vouchers. Lastly, none of the owners or managers worked with age-restricted properties.

6.1 Relationship with PGE

Building owners and managers generally describe having a positive working relationship with PGE. Of the 12 interviewed owners and managers, about two-fifths (5 of 12) noted having a positive relationship with PGE, expressing sentiments that PGE is easy to work with and they have been happy with service from PGE. None of the owners and managers reported having a negative relationship with PGE though one-quarter (3 of 12) noted that the relationship was nonexistent, and they did not have direct interactions with PGE outside of paying bills. The remaining owners and managers (4 of 12) noted the relationship was minimal, but pleasant; these interactions often surrounded discussing power outages or the possibilities of moving service and participating in a program.

Building owners and managers have not been taking full advantage of PGE programs and support. One-third (4 of 12) of the owners and managers mentioned participating in PGE's energy-efficient programs for their multifamily property, including receiving equipment such as smart meters, insulation, lighting, and showerheads. Only two of the 12 owners and managers recalled participating in PGE's Connected Water Heaters program. None of the 12 respondents, however, had worked with PGE to find specific rate plans.

6.2 Awareness of and Demand for EV Charging

There is minimal awareness of nearby EA sites among building owners, managers, and tenants. Prior to the interview, one-third (4 of 12) of owners and managers reported being aware of the EA site that was within a mile from their property, and none mentioned attending any opening ceremonies.[17] Additionally, two of the owners and managers reported that tenants were aware of the EA sites, having either received inquiries from tenants or overheard tenants talking about the sites.

Demand for on-site EV charging is currently low but building owners and managers expect demand for charging will increase in the future. None of the properties represented by interviewed owners and managers had on-site EV charging; however, two owners and managers reported a few of their tenants may own an EV. The remaining owners and managers indicated they were not aware of any tenants owning EVs (6 of 12), that

[17] Note that only the Eastport Plaza, Hillsboro, and Milwaukie EAs had opening ceremonies.

some tenants own hybrid vehicles (3 of 12), or that they were not sure (1 of 12). Despite the low ownership of EVs among tenants, however, one-third (4 of 12) of the owners and managers mentioned that inquiries about charging at the property were increasing. Two-thirds (8 of 12) of the owners and managers mentioned they would like to see the development of additional EA sites or other nearby on-street charging, noting "that is where the market is going" and "[having EV charging nearby] would benefit future tenants."

Building owners and managers are interested in installing on-site charging but have limited understanding of the process. Three-quarters (9 of 12) of owners and managers noted they might be interested in installing on-site EV charging at their properties but would need additional information, primarily around cost, placement, and tenant demand (Table 12). Of the three owners and managers that did not express interest in installing on-site charging at their properties, all cited a lack of tenant demand for on-site charging.

Table 12. Knowledge Barriers to Installing EV Charging at Multifamily Buildings (n=12) (Multiple Mentions Allowed)

Item	Count
Cost of owning and maintaining chargers	9
Placement of chargers / space requirements	5
If there would be any limitations on who could or could not use the chargers depending on any program-related requirements (i.e., tenants only)	2
Current demand for EV charging among potential tenants	2
How much tenants would pay to charge their vehicle	1

Building owners and managers prefer a utility-owned option when considering installing on-site EV charging. Half (6 of 12) of owners and managers reported they would prefer to have utility-owned charging, where they would pay a small upfront fee and the utility would manage the installation, maintenance, and operations of the charging stations. The other half (6 of 12) were not sure if they would prefer a utility-owned option for chargers or a property-owned option; one mentioned they would need additional information regarding the pros and cons of the ownership structures.

6.3 Existing Conditions and Configurations and Process for Upgrading Common Areas

The configuration of electric metering varies across multifamily property buildings. Half (6 of 12) of owners and managers reported electrical meters were dispersed throughout their buildings while one-third (4 of 12) of building owners and managers indicated their buildings have a centralized metering room. The remaining two owners and managers have differing configurations across the various properties they own. Of the ten owners and managers with consistent metering arrangements throughout their properties, nine reported each unit had a dedicated meter to track its energy usage and is used for utility billing, and one reported there was a master meter where multiple tenants' energy use is measured with a single meter. Lastly, of the nine owners and managers with separate unit meters, six reported having a separate meter for common areas while the last three reported not having common areas.

The building owners and managements are the primary decision makers for making upgrades around the building. Most (11 of 12) interviewed owners and managers reported they were the primary decision makers for property upgrades. The remaining owner stated the corporate office oversees all upgrade decisions. Almost half (5 of 12) of the owners and managers noted tenant demands factor heavily into upgrade decisions; however, some sentiments expressed by the owners and managers suggested they consider an interplay of costs, basic needs, and regulatory standards.

Parking configurations vary across multifamily properties. All owners and managers described having parking available on the properties, though the spaces per rental unit varied. Ten owners and managers described having one to two dedicated spots per rental unit, and most (8 of 10) reported also having extra guest spaces or extra spaces to rent for an additional fee. Of the remaining owners and managers, one reported having just enough parking for the tenants at a one space per unit ratio, though not explicitly reserved for the tenets, in addition to two mandatory ADA spaces and one reported that parking configurations vary greatly across their properties.

Owners and managers have questions related to existing parking configuration and installation of on-site charging. About two-fifths (5 of 12) of owners and managers indicated they were unsure about how chargers would fit into their existing parking configuration and had questions such as:

- Could chargers be placed in ADA parking stalls instead of general parking stalls?
- How many parking stalls would generally have to be given up for chargers?
- Where would chargers need to be placed?
- What connections are needed for chargers?
- Would the chargers fit inside parking garages?

Appendix A. Future Evaluation Activities

The evaluation of the pilots will continue through 2023. The following is a summary of planned evaluation activities for 2022 and 2023.

- Planned 2022 Evaluation Activities
  - Round 3 of ride-and-drive intercept surveys
  - Wave 3 of the follow-up technical assistance surveys
  - Round 1, 2, and 3 of the Electric Avenue intercept surveys
  - Round 2 of focus groups with TNC drivers
  - Second charging impact analyses (EAs and TriMet), and analysis of equity impacts
- Planned 2023 Evaluation Activities
  - Wave 3 of the general population survey
  - Wave 2 of the EV owner/lessee survey

Appendix B. General Population Residential Customer Survey Detailed Methodology

This section describes the general population residential customer survey methodology. The team followed the methodology used for Baseline and Wave 1 surveys to ensure comparability of results.

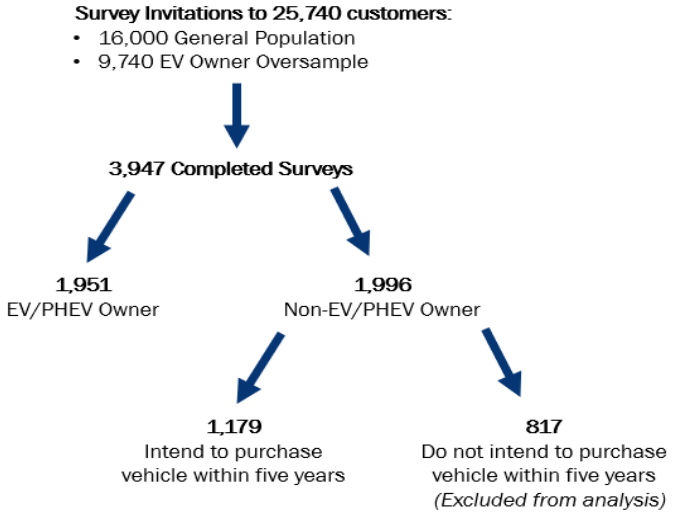
Survey Sampling Fielding

PGE provided the team with a random sample of 16,000 residential customers and 9,740 EV owners with an email address on record. The team assumed a 5% response rate based on the response rate from the previous surveys. The team invited all 16,000 residential customers and 9,740 EV owners to take the survey via email invitation on June 30, 2021. To mitigate response bias, the team used neutral language in the invitation and to did not specifically mention the survey topic, EVs. The invitation informed respondents that upon completion of the survey they would be entered into a drawing for one of 12 gift cards (two valued at $500 and ten valued at $100). The team sent two reminder emails to non-responders and closed the survey on July 19, 2021. A total of 2,209 residential customers and 2,284 EV owners completed the Wave 2 survey with a 15% and 25% response rate, respectively, for a total of 4,493 completes.

The survey included a series of screening questions at the beginning of the survey. Respondents who reported being under the age of 18, those that may have a conflict of interest (employed in an industry environmental, marketing, media, utility, or automotive industry), those not involved in the decision-making for purchasing a vehicle, and those who were not planning to purchase a vehicle in the next five years were asked to supply demographic information and exit from the survey. The team reviewed survey responses and removed any surveys with a survey duration significantly below the average survey duration time or had responses that suggested the respondent was not engaged with the survey. The team also removed respondents who were a part of the EV owner sample and reported that they did not own an EV in the survey. This process resulted in a final completed count of 3,947 completed surveys.

Of the 3,947 respondents, 1,951 customers (49% of all respondents) reported owning or leasing an EV or PHEV. Among non-owners, 1,179 customers (59%) indicated they would likely purchase a vehicle within the next five years (Figure 36). The remaining 817 non-owners (21% of all respondents) reported that they do not intend to purchase a vehicle within the next five years, so they were excluded from the analysis.

Figure 36. Survey Respondents' Intent to Purchase any Vehicle within Five Years



Weighting

Survey results of likely vehicle purchasers are weighted to correct for sampling and non-response bias present in the survey data. Specifically, the team used "raked weights" to adjust the sample to reflect known population proportions of age, income, county, and PGE residential segment. Population estimates of age and income are based on Acxiom data, and county and segment are based on PGE records. Sample estimates of age and income are based on survey responses, county and segment were appended from PGE records to each respondent.

Prior to calculating the raked weights, the team imputed age and income for any interested EV buyers that refused to provide their age or income in the survey. Since age and income were highly correlated ($r=.075$; $p<.05$), the team used age to inform income imputations: the team randomly assigned income values to respondents who declined to answer the income question relative to the income distribution of those in their age group that provided their income.

A similar imputation process was used for those that refused to provide their age and income (100% of those that declined to provide their age also declined to provide their income). Since the team was unable to use age to inform income imputation for these respondents, the team simply used the overall sample distributions of income and age (without applying any of the aforementioned age-based income imputations during this step) to establish the proportional random assignment imputation algorithms for cases missing both age and income.

These imputations resulted in the requisite survey data to execute the raked weighting procedure for all respondents, without altering the sample's distribution of age and income. The team then calculated and assigned raked weights to all surveyed likely vehicle purchasers; resulting raked weight values were not allowed to exceed 3.0. All likely vehicle purchaser results presented in this report are weighted.

Appendix C. General Population Residential Customer and EV Owner Survey Instrument

PGE TE Pilot Evaluation: Post TE Pilot Launch Wave 2 General Population and Wave 1 Electric Vehicle Owner Survey

Instrument Information

In 2019, Opinion Dynamics fielded the first of three waves (Wave 1) of the General Population residential customer survey. The survey was an adjusted version of the Baseline Electric Vehicle (EV) survey that was fielded in 2018 by Market Strategies International.

The below survey (Wave 2) is a revised version of the Wave 1 survey that Opinion Dynamics will field in June 2021 to a sample of general population residential customers and to a supplemental sample of EV or Plug-in Hybrid EV (PHEV) owners in PGE's territory. The EV Owner survey is embedded within the General Population Survey and will be fielded simultaneously to the supplemental sample of EV owners. The goal is to collect 400 additional completes with the general population and 68 completes with those who own or lease an EV or PHEV.

Note that the Wave 1 General Population survey did not specifically target customers who owned or leased an EV or PHEV, but we identified 78 customers who owned or leased an EV or PHEV through questions in the survey.

Opinion Dynamics will field Wave 3 of the General Population residential customer survey and Wave 2 of the EV Owner survey in 2023.

Font Color Key

Text in bold and blue is a flag for questions from the Baseline Electric Vehicle survey.

Text in bold and green is a flag for questions from the Baseline Electric Vehicle survey that we adjusted.

Text in bold and red is a flag for questions from the Baseline Electric Vehicle survey that we deleted.

Text in black and highlighted in yellow is a flag for new questions added in 2019 or 2021.

"BL" acronym below means baseline.

Screening

[ASK ALL]
S1. [BL – S1] Are you age 18 or older with a valid driver's license?

[SINGLE RESPONSE]

1. Yes
2. No [SKIP TO END OF SURVEY]

[ASK ALL]
S2. [BL – S2] Do you, or do any members of your household work in any of the following industries?

[MULTIPLE RESPONSE 1 THROUGH 6 ONLY]

1. Environmental Protection
2. Market research/Advertising/Public Relations
3. Media
4. Electric or Gas Utility
5. Energy
6. Automotive
7. No, none of these [EXCLUSIVE]
9798. Don't know [EXCLUSIVE]
9899. Prefer not to answer [EXCLUSIVE]

[IF S2 <> 7, THANK AND TERMINATE: "*No further responses are needed at this time. Thank you very much!*"]

[ASK IF S2 = 7]

S3. [BL – S3] How involved would you be in a decision to purchase or lease a new or used vehicle for your household?

[SINGLE RESPONSE]

1. I am the primary decision maker
2. I share the decision with someone else in my household
3. I'm not involved in the decision to purchase or lease a new vehicle [SKIP TO Q82 (DEMOGRAPHICS SECTION)]
98. Don't know [SKIP TO Q82 (DEMOGRAPHICS SECTION)]

[ASK ALL]

S1. [BL – S4 – ADJUSTED] How many vehicles does your household currently own or lease?

For the purposes of this survey "vehicle" refers to cars, crossovers-SUVs, trucks, and vans. This would not include motorcycles, bikes, scooters, etc.

[SINGLE RESPONSE]

8. 0
9. 1
10. 2
11. 3
12. 4
13. 5
14. 6
15. 7
16. 8
17. 9
18. 10 or more vehicles (Please specify): [OPEN-ENDED RESPONSE]
98. Don't know

[IF S4 >0 AND ≠ 98 (HAS AT LEAST ONE VEHICLE)]

S4. [BL-S4a] Does your household own or lease an electric vehicle or plug-in electric hybrid (electric + gas, can plug in to charge battery)?

[SINGLE RESPONSE]

2. Yes
3. No

[IF S5 = 2 (NO)]
S5a. [NEW – 2019] Did you or others in your household own or lease an electric or plug-in electric hybrid vehicle in the past?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF S5A = 1 (YES)]
S5b. [NEW – 2019] What happened to the electric or plug-in electric hybrid?

[SINGLE RESPONSE]

1. Sold to private party
2. Traded in / sold to dealership
3. Crashed / totaled
4. Given away
5. Stolen
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF S5B = 1 OR 4 (SOLD TO PRIVATE PARTY OR GIVEN AWAY)]
S5c. [NEW – 2019] Was the vehicle [IF S5b = 1 "sold" IF S5b = 4 "given away"] to someone living in Oregon?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[ASK ALL]
S5. [BL – S5] How soon do you expect to purchase or lease a new or used vehicle for your household?

For the purposes of this survey "vehicle" refers to cars, crossovers-SUVs, trucks, and vans. This would not include motorcycles, bikes, scooters, etc.

[SINGLE RESPONSE]

1. During the next 12 months
2. Between 1 year to 2 years from now
3. Between 2 years to 3 years from now
4. Between 3 years to 5 years from now
5. Between 5 years to 10 years from now
6. More than 10 years from now
7. Never – I do not plan on purchasing or leasing a new or used vehicle
98. Don't know

Familiarity with EVs and Awareness of EV Benefits

[ASK ALL]

Q1. [BL - FAM] In addition to vehicles using traditional gasoline internal combustion engines, some automobile manufacturers offer vehicles with powertrains that use other fuel types including diesel, biodiesel, natural gas and electricity. Please indicate how familiar you are with each vehicle type below.

(For each vehicle type below, select the response that best describes your level of familiarity.)

[SINGLE RESPONSE]

I've never heard of this type vehicle	I've heard the term but couldn't tell you much more about this type of vehicle	Somewhat familiar	Very familiar	Don't know
1	2	3	4	98

1. Gasoline (internal combustion engine)
2. Diesel
3. Biodiesel
4. Natural gas (compressed natural gas / CNG)
5. Hybrid (electric+gas, cannot plug in to charge battery)
6. Plug-in hybrid (electric+gas, can plug in to charge battery)
7. All electric

[ASK ALL]

Q2. [BL – ENV 1-7] Now, please indicate how ENVIRONMENTALLY FRIENDLY you think each type of vehicle type below is.

(Select the rating scale point that best describes how you feel. Your best guess is fine.)

[SINGLE RESPONSE]

Not at all environmentally friendly										Very environmentally friendly
0	1	2	3	4	5	6	7	8	9	10

11 No Opinion
98. Not sure=

[RANDOMIZE]

1. Gasoline (internal combustion engine)
2. Diesel
3. Biodiesel
4. Natural gas (compressed natural gas / CNG)
5. Hybrid (electric+gas, cannot plug in to charge battery)
6. Plug-in hybrid (electric+gas, can plug in to charge battery)
7. All electric

[ASK ALL]

Q3. [BL – LOWFUEL] Which one of these vehicle types would you expect to have the lowest fuel costs?

[SINGLE RESPONSE] [RANDOMIZE]

1. Gasoline

2. Diesel
3. Biodiesel
4. Natural gas
5. Hybrid (non-plug-in)
6. Plug-in hybrid
7. Electric
8. Something else
98. Don't know

[ASK ALL]

Q4. [BL – LOWMAINT] Which one of these vehicle types would you expect to have the lowest maintenance costs?

[SINGLE RESPONSE] [RANDOMIZE]

1. Gasoline
2. Diesel
3. Biodiesel
4. Natural gas
5. Hybrid (non-plug-in)
6. Plug-in hybrid
7. Electric
8. Something else
98. Don't know

EV Purchase Details

[ASK IF EV/PHEV DRIVER (S5=1)]

Q5. [BL – FTYPE and Year_ACQ - ADJUSTED] For each electric vehicle your household currently owns or leases, please indicate whether the vehicle is plug-in electric hybrid or 100% Electric, the year the vehicle was purchased or leased, and the make & model of the car. If your household has more than one electric vehicle, please provide this information for all your electric vehicles up to four.

[DISPLAY FOUR ROWS. EACH ROW SHOULD HAVE A DROP-DOWN FOR FUEL TYPE AND YEAR ACQUIRED.]

(Please select the vehicle type and year purchased from the dropdown lists below and also tell us make and model of the car.)

	Vehicle Fuel [DROP-DOWN LIST]	Year Purchased / Leased [DROP-DOWN LIST]	Make (e.g., Nissan) & Model (e.g., Leaf) [OPEN-END]
VEHICLE #1			
VEHICLE #2			
VEHICLE #3			
VEHICLE #4			

Vehicle Fuel drop-down list	Year drop-down list

1. Plug-in hybrid	1. Before 2010
2. Electric	2. 2010-2015
3. Don't Know	3. 2016
	4. 2017
	5. 2018
	6. 2019
	8. 2020
	9. 2021
	7. Don't Know

[ASK IF ANY VEHICLE IN Q5 WAS BOUGHT OR LEASED IN 2018 (IF ANY VEHICLE #1-4 = 5]
Q6. [NEW - 2019] When in 2018 did you purchase or lease your electric or plug-in hybrid vehicle(s)?

[SINGLE RESPONSE]

1. Before July 2018
2. July – August 2018
3. September – October 2018
4. November – December 2018
98. Don't know

[ASK IF EV/PHEV DRIVER (S5=1)]
Q7. [NEW - 2019] Which of the following best describes how you use your electric or plug-in hybrid vehicle(s)?

(If more than one, please select the option below for the electric or plug-in hybrid electric vehicle that you or others in your household drive the most.)

[SINGLE RESPONSE]

1. I use my electric or plug-in hybrid for all or most of my auto trips and do not own or lease another vehicle
2. I use my electric or plug-in hybrid primarily for short distance trips (30 miles or less) and own or lease another vehicle for longer trips
3. I own or lease a non-electric vehicle and drive that vehicle instead of my electric or plug-in hybrid for most of my trips
4. Something else, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK IF EV/PHEV DRIVER (S5=1)]
Q8. [BL – EV_LOC] Did you purchase or lease your electric or plug-in hybrid vehicle in Oregon or in another state?

(If your household has more than one, please indicate where your most recently acquired electric or plug-in hybrid electric vehicle was purchased.)

[SINGLE RESPONSE]

1. Purchased in Oregon

2. Leased in Oregon
3. Purchased in another state
4. Leased in another state
98. Don't know

Importance of Factors Considered During Vehicle Purchase / Lease Decision Process

[ASK IF LIKELY TO PURCHASE/LEASE IN NEXT 5 YEARS (S5=1-4)]
Q9. [BL – FT1] Thinking about the next vehicle your household might purchase or lease, how likely are you to consider a vehicle powered by…?

(For each fuel type below, select the response that best describes your opinion.)

[MATRIX QUESTION: SCALE]

[RANDOMIZE]	1 Will definitely not consider	2 Will probably not consider	3 Might or might not consider	4 Will probably consider	5 Will definitely consider	98 Don't know
Q9_1. Gasoline						
Q9_2. Diesel						
Q9_3. Biodiesel						
Q9_4. Natural gas						
Q9_5. Hybrid (non-plug-in)						
Q9_6. Plug-in hybrid						
Q9_7. Electric						

[ASK IF CONSIDERING (Q9_1 - Q9_7=3-5)]
Q10. [BL – FT2] Considering everything you currently know, which one type of vehicle listed below are you most likely to acquire the next time your household purchases or leases a vehicle?

[SINGLE RESPONSE]

1. [Show if Q9_1=3-5:] Gasoline
2. [Show if Q9_2=3-5:] Diesel
3. [Show if Q9_3=3-5:] Biodiesel
4. [Show if Q9_4=3-5:] Natural gas
5. [Show if Q9_5=3-5:] Hybrid (non-plug-in)
6. [Show if Q9_6=3-5:] Plug-in hybrid
7. [Show if Q9_7=3-5:] Electric
98. Don't know

[ASK IF LIKELY TO PURCHASE/LEASE IN NEXT 5 YEARS (S5=1-4)]
Q11. [BL – BT1] Based on everything you currently know, which one vehicle body type listed below are you most likely to consider the next time your household purchases/leases a vehicle?

[SINGLE RESPONSE]

1. Sedan
2. Coupe
3. Hatchback
4. Crossover or sports utility vehicle (CUV/SUV)
5. Truck
6. Minivan
7. Convertible
8. Wagon
9. Motorcycle
1. Another type of vehicle [OPEN-ENDED RESPONSE]
98. Don't know

[THESE ARE COMPUTED VARIABLES NOT SEEN BY RESPONDENTS]
EVINT. EV / PHEV intenders / non-intenders.

Set if (Q9_6=4-5 OR Q9_7=4-5) AND (S5 ≠ 1): EVINT = 1 (EV / PHEV intenders)

Else set: EVINT = 0 (EV / PHEV non-intenders)

SEG. Owner / Intender / Considerer / Non-Considerer / Unlikely Vehicle Purchaser

Set if (S5 = 1): SEG = 1 (Owner)
Set if (EVINT = 1 AND (Q10 = 6 OR Q10 = 7)): SEG = 2 (Intender)
Set if (EVINT = 1 AND (Q10 ≠ 6 OR Q10 ≠ 7)): SEG = 3 (Considerer)
Set if (EVINT = 0 AND S6 = 1 - 4): SEG = 4 (Non-Considerer)
Set if (EVINT = 0 AND S6 = 5 – 98): SEG = 5 (Unlikely Vehicle Purchaser)

Awareness/Consideration of EV and PHEV Makes/Models

[show if EV or PHEV intender (Q9_6 or Q9_7=4 or 5)]
[BL – SHOW PRIOR TO Q12] Several automobile companies have introduced electric cars and trucks over the past several years.

- Some of these are all-electric vehicles (EVs), which only run on electricity from a battery.
- Other vehicles using electric motors are plug-in hybrid electric vehicles (PHEVs), which run on electricity for 10-20 miles then switch to gasoline or diesel for ranges up to 400 miles.

[ASK IF ALL-ELECTRIC VEHICLE INTENDER (Q9_7 =4-5)]
Q12. [BL – ECON] Considering your next vehicle purchase, please list the make and model of the all-electric vehicles you are most strongly considering for your household.

(Enter the all-electric vehicles that you're considering in the boxes below—one make and model per box. Be as specific as possible.)

1. [OPEN-ENDED RESPONSE]
2. [OPEN-ENDED RESPONSE]
3. [OPEN-ENDED RESPONSE]
4. [OPEN-ENDED RESPONSE]
5. [OPEN-ENDED RESPONSE]
98. Not sure [EXCLUSIVE]

99. Prefer not to say [EXCLUSIVE]

[ASK IF PHEV INTENDER (Q9_6=4-5)]

Q13. [BL – PCON] Considering your next vehicle purchase, please list the make and model of the plug-in hybrid electric vehicles you are most strongly considering for your household.

(Enter the plug-in hybrid electric vehicles that you're considering in the boxes below—one make and model per box. Be as specific as possible.)

1. [OPEN-ENDED RESPONSE]
2. [OPEN-ENDED RESPONSE]
3. [OPEN-ENDED RESPONSE]
4. [OPEN-ENDED RESPONSE]
5. [OPEN-ENDED RESPONSE]
98. Not sure [EXCLUSIVE]
99. Prefer not to say [EXCLUSIVE]

Q14. **[BL – EV_CON – QUESTION REMOVED IN 2021]**

Q15. **[BL – PHEV_CON – QUESTION REMOVED IN 2021]**

[ASK IF EVINT = 1]

USED_1. **[NEW – 2021]** Thinking about the electric or plug-in hybrid vehicle you might purchase, how likely are you to consider a **used or pre-owned** vehicle?

[SINGLE RESPONSE]

1. Will definitely not consider
2. Will probably not consider
3. Might or might not consider
4. Will probably consider
5. Will definitely consider
97. I was not aware that used or pre-owned electric or plug-in hybrid vehicles were available
98. Don't know

[ASK IF USED_1 = 1, 2, OR 3]

USED_2. **[NEW – 2021]** What are the main reasons you **would not consider** purchasing a used or pre-owned electric or plug-in hybrid vehicle? *Select all that apply.*

[MULTIPLE RESPONSE – RANDOMIZE 1-4]

1. Have concerns about battery life
2. Have concerns about vehicle range (number of miles driven per charge)
3. Do not normally purchase used or pre-owned vehicles
4. Concerns with resale value
5. Would not be able to get incentives for the vehicle
6. Some other reason, please specify: [OPEN-ENDED RESPONSE]

98. Don't know [EXCLUSIVE]

[ASK IF USED_1 = 4 OR 5]
USED_3. [NEW – 2021] What are the main reasons you **would consider** purchasing a used or pre-owned electric or plug-in hybrid vehicle? *Select all that apply.*

[MULTIPLE RESPONSE – RANDOMIZE 1-3]

1. The vehicle would be more affordable
2. Prefer to purchase used or pre-owned vehicles
3. Some other reason, please specify: [OPEN-ENDED RESPONSE]

98. Don't know [EXCLUSIVE]

Motivations/Barriers for EV/PHEV Acquisition

Q16. [BL – MOTIV_P] Show if EV driver (S4=1): What are the main reasons you purchased or leased an all-electric vehicle / plug-in hybrid electric vehicle?

Show if intender (EVINT=1): What are the main reasons you would consider an all-electric vehicle / plug-in hybrid electric vehicle for your next vehicle purchase or lease?

Show if non-considerer (SEG = 4): If in the future you were to consider purchasing or leasing an all-electric vehicle / plug-in hybrid electric vehicle, what would you expect to be the main benefits of having an electric vehicle?

(Enter your response in the box below. Be as specific as possible.)

1. [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF EV/PHEV INTENDER (EVINT=1) OR EV DRIVER (S5=1)]
Q17. [BL – EVFAC] Show if intender (EVINT=1) but not an EV driver (S5=2): For each of the factors below, please indicate whether that factor is a major reason, a minor reason, or not a reason you are considering an all-electric vehicle / plug-in hybrid electric vehicle for your next purchase / lease.

Show if EV driver (S5=1): For each of the factors below, please indicate whether that factor was a major reason, a minor reason, or not a reason you decided to purchase or lease an all-electric vehicle / plug-in hybrid electric vehicle.

(For each factor below, select the response that best describes your opinion)

[MATRIX QUESTION: SCALE]

Factors	1 Not a reason	2 A minor reason	3 A major reason	98 Not sure
Q17_1. Lower fuel cost				
Q17_2. Less vehicle maintenance required				
Q17_3. Protecting the environment				
Q17_4. Priority parking at some locations				
Q17_5. Tax incentives and rebates				
Q17_6. The convenience of charging my vehicle at home				
Q17_7. The convenience of charging my vehicle at work				
Q17_8. Availability of public charging stations in the Portland/Salem metro areas				

Factors	1 Not a reason	2 A minor reason	3 A major reason	98 Not sure
Q17_9. Availability of public charging stations outside of the Portland/Salem metro areas				
Q17_10. How I look driving and owning this vehicle				
Q17_11. Vehicle's performance and handling				
Q17_12. Vehicle safety				

[ASK ALL]

Q18. [BL – BAR_P] What are the main factors that might hold you back from purchasing or leasing an electric vehicle?

(Enter your response in the box below. Be as specific as possible)

1. [OPEN-ENDED RESPONSE]
98. Don't know

[ASK ALL]

Q19. [BL – BAR] For each item, please indicate whether the issue described is a major concern, a minor concern, or not a concern to you at all when considering whether or not to purchase or lease an electric vehicle.

(For each factor below, select the response that best describes your level of concern)

[Matrix Question: Scale]

Issue	1 Not a concern at all	2 A minor concern	3 A major concern	98 Don't know
Q19_1. Number of miles vehicle will go on a single charge				
Q19_2. Purchase price of vehicle				
Q19_3. Maintenance costs				
Q19_4. Cost of charging the vehicle				
Q19_5. Electric vehicle body types and sizes available				
Q19_6. Electric vehicle appearance				
Q19_7. Ability to charge at work				
Q19_8. Ability to charge at home				
Q19_9. Availability of public charging stations in the Portland/Salem metro areas				
Q19_10. Availability of public charging stations outside of the Portland/Salem metro areas				
Q19_11. Amount of time required to charge battery				
Q19_12. Vehicle's performance and handling				
Q19_13. Vehicle safety				
Q19_14. Vehicle Reliability				

Issue	1 Not a concern at all	2 A minor concern	3 A major concern	98 Don't know
Q19_16. Concerns about electric power outages at my home				
Q19_17. Learning how to charge an electric vehicle				
Q19_18. Cost of installing home charging station				

[ASK IF NON-INTENDER (EVINT=0)]

Q20. [BL – BAR_14] What changes would need to occur in terms of vehicle features and specifications and/or electric vehicle charging infrastructure in order for you to consider an electric vehicle or plug-in hybrid electric vehicle for your next vehicle purchase / lease?

Enter your response in the box below. Be as specific as possible

1. [OPEN-ENDED RESPONSE]

   97. No Changes needed [EXCLUSIVE]

[ASK IF RANGE IS A CONCERN (Q19_1 = 2 or 3)]

Q21. [BL – BAR_15] How many miles would an electric vehicle need to be able to go on a single charge to reduce your concerns about vehicle range?

[SINGLE RESPONSE]

1. At least 50 miles
2. 51 to 100 miles
3. 101 to 150 miles
4. 151 to 200 miles
5. 201 to 250 miles
6. 251 to 300 miles
7. More than 300 miles
8. None of the above

98. Don't know

[ASK IF EV/PHEV INTENDER (EVINT=1)]

Q22. [NEW – 2019] Which of the following best describes how you would use an electric or plug-in hybrid vehicle were you to purchase or lease one?

[SINGLE RESPONSE]

1. I would use an electric or plug-in hybrid for all or most of my auto trips and would not use another vehicle
2. I would use an electric or plug-in hybrid primarily for short distance trips (30 miles or less) and use another vehicle for longer trips
3. I would use a non-electric vehicle instead of an electric or plug-in hybrid for most of my trips

96. Something else, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Knowledge of EV Charging Options and Logistics

[ASK IF S4 > 0 AND ≠ 98 (OWNS OR LEASES AT LEAST ONE VEHICLE)]
Q23. [NEW – 2019] When at home, where do you typically park the vehicle you primarily use?

[SINGLE RESPONSE]

1. My garage
2. My driveway
3. On the street
4. In a shared parking garage
96. Something else, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK IF Q23 = 3 (ON STREET PARKING)]
Q24. [NEW – 2019] Is there usually a parking space available close to your home?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[ASK IF S4 > 0 AND ≠ 98 (OWNS OR LEASES AT LEAST ONE VEHICLE) AND S5 = 2 (DOES NOT OWN OR LEASE EV OR PHEV)]
Q25. [NEW – 2019] How much of a concern is your current parking situation in your decision on whether to purchase an electric or plug-in hybrid vehicle in the future?

[SINGLE RESPONSE]

1. Not a concern at all
2. A minor concern
3. A major concern
98. Don't know

[ASK ALL]
Q26. [NEW – 2019] Which location would be most important to you to have charging available if you were to purchase an electric or plug-in hybrid vehicle?

[SINGLE RESPONSE]

1. At home
2. At work
3. At public locations (e.g., grocery stores, coffee shops, malls)
4. Along major highways to support inter-city travel
98. Don't know

[ROTATE Q27-Q28. SHOW ON SAME SCREEN]

[ASK ALL]
Q27. [BL – CHRG_1] Do you have an electric service outlet available where you park your car at home?

[SINGLE RESPONSE]

1. Yes
2. No

98. Don't know

[ASK ALL]
Q28. [BL – CHRG_2 – ADJUSTED] Do you have an electric vehicle charging station available at your workplace?

[SINGLE RESPONSE]

1. Yes
2. No
1. Not applicable
98. Don't know

[ASK IF PARK OUTSIDE OF HH FOR WORK (Q28 ≠ 97)]
Q29. [BL – CHRG_3] Would having electric vehicle charging stations at your workplace make you…?

[SINGLE RESPONSE]

1. Much more likely to purchase or lease an electric vehicle
2. Somewhat more likely to purchase or lease an electric vehicle, or
3. Have no effect on your decision to purchase or lease an electric vehicle
98. Don't know

[ASK IF SEG = 1 - 4]
Q30. [BL – CHRG_5 - ADJUSTED] The federal government and state of Oregon offer financial incentives including tax credits to help offset the up-front costs of electric vehicles. Prior to this survey, were you aware of these incentives?

[SINGLE RESPONSE]

1. Yes, federal only
2. Yes, Oregon only
3. Yes, aware of both federal and Oregon
4. No, not aware of either
98. Don't know

[ASK IF SEG = 1 - 4]
Q31. [BL – CHRG_6] Approximately how much would you expect tax credits and incentives to offset the cost of a plug-in electric vehicle?

(Enter your response as a dollar amount below. Your best guess is fine.)

[ACCEPT RESPONSES BETWEEN 0 & 50,000]

$ Amount: [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

[SHOW Q32 & Q33 ON SAME SCREEN]
[ASK IF SEG = 1 - 4]
Q32. [BL – CHRG_7 - ADJUSTED] On average, a typical electric vehicle / plug-in hybrid electric vehicle driver would spend approximately $1 for electricity instead of $3.10 for gasoline, to drive the same distance, based on current fuel costs for a typical gasoline-powered vehicle averaging 28 miles per gallon.

Prior to this survey were you aware fuel costs for electric and plug-in hybrid electric vehicles are typically less than a gasoline-power vehicle?

[SINGLE RESPONSE]

1. Yes
2. No

[ASK IF SEG = 1 - 4]

Q33. [BL – CHRG_8] Does knowing this information make you more or less likely to consider an electric vehicle / plug-in hybrid electric vehicle for a future vehicle purchase?

(Select the response that best describes how you feel.)

Much less likely	Somewhat less likely	Neither more or less likely	Somewhat more likely	Much more likely	Don't know
1	2	3	4	5	98

Q34. **[BL – CHRG_10 – QUESTION REMOVED IN 2021]**

Q35. **[BL – CHRG_11 – QUESTION REMOVED IN 2021]**

Q36. [BL – CHRG_12] About 160 DC Fast Chargers have been installed in public locations in Oregon, allowing drivers to charge on the go and extend their driving range. A DC Fast Charger will charge most electric vehicles to 80 percent in 30 minutes to 1 hour.

Does knowing this information make you more or less likely to consider an electric vehicle / plug-in hybrid electric vehicle for a future vehicle purchase?

(Select the response that best describes how you feel)

[SINGLE RESPONSE]

Much less likely	Somewhat less likely	Neither more or less likely	Somewhat more likely	Much more likely
1	2	3	4	5

98. Don't know

[ASK IF SEG = 1 - 4]

Q37. [BL – CHRG_13A] Have you noticed any public electric vehicle charging stations in public areas and parking lots around Oregon?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

Q38. **[BL – CHRG_13B – QUESTION REMOVED IN 2021]**

Q39. **[BL – CHRG_14 – QUESTION REMOVED IN 2021]**

[ASK IF NOTICED STATIONS (Q37=1)]

Q37A. [BL – CHRG_13B - ADJUSTED] select the locations you have noticed electric vehicle charging stations in Oregon from the list below. *Select all that apply*

[MULTIPLE RESPONSE; RANDOMIZE 1-10]

1. At my workplace
2. Grocery stores or pharmacies
3. Restaurants
4. Shopping centers or malls
5. Parking lots or garages
6. Parks or recreational areas
7. Educational facilities (e.g., K-12 schools, universities, community colleges)
8. Along major roads or highways (e.g., I-5, I-84, US 20, US 26, US 30, US 101)
9. Gas stations
10. Central business districts (e.g., Downtown Portland or Salem)Some other location(s), please specify: [OPEN-ENDED RESPONSE]
98. Don't remember [EXCLUSIVE]

[ASK IF SEG = 1 - 4]

Q37B. [BL – CHRG_14 - ADJUSTED] Which of the following would be the most convenient location(s) for you to charge an electric vehicle? *Select all that apply.*

[MULTIPLE RESPONSE; RANDOMIZE 1-10]

1. At my workplace
2. Grocery stores or pharmacies
3. Restaurants
4. Shopping centers or malls
5. Parking lots or garages
6. Parks or recreational areas
7. Educational facilities (e.g., K-12 schools, universities, community colleges)
8. Along major roads or highways (e.g., I-5, I-84, US 20, US 26, US 30, US 101)
9. Gas stations
10. Central business districts (e.g., Downtown Portland or Salem)
11. Some other location(s), please specify: [OPEN-ENDED RESPONSE]
98. Don't remember [EXCLUSIVE]

[ASK IF SEG = 1 - 4]

Q37C. [NEW – 2021] If you had access to public on-street charging (typically mounted to utility poles) in your neighborhood, how much **more** likely, if at all, would you be to consider an electric vehicle / plug-in hybrid electric vehicle for a future vehicle purchase?

[SINGLE RESPONSE]

0 – No more likely										10 – Much more likely
0	1	2	3	4	5	6	7	8	9	10

98. Not sure

[ASK IF SEG = 1 - 4]

Q40. [BL – CHRG_15 – ADJUSTED] Which of the following Portland General Electric (PGE) "Electric Avenue" electric vehicle charging stations have you seen?

[MULTIPLE RESPONSE]

1. Downtown Portland (SW Salmon between SW 1st and 2nd Ave)
2. Milwaukie (intersection of SE McLoughlin Blvd and SE Jackson St)

3. Hillsboro (2105-2643 SE Tualatin Valley Hwy)
4. Eastport Plaza (4140 SE 82nd Ave)
6. Wilsonville (SW Wilsonville Rd & Memorial Dr)
7. Salem (900 Court St NE)
8. Beaverton (SW Canyon Rd & Broadway St)
5. None of these [MAKE EXCLUSIVE RESPONSE AT END OF LIST]

Q41. **[BL – CHRG_18 – QUESTION REMOVED IN 2021]**

[ASK IF EV/PHEV OWNER/INTENDER (EVINT=1 OR S5 = 1)]
Q42. [BL – CHRG_19] Would PGE offering discounted electric vehicle charging plans make you more likely to consider purchasing an electric vehicle?

1. Yes
2. No

[ASK IF EV/PHEV OWNER/INTENDER (EVINT=1 OR S5 = 1)]
Q43. **[NEW – 2019]** Which of the following would be your preferred method for charging station payment?

[SINGLE RESPONSE – RANDOMIZE OPTIONS EXCEPT DON'T KNOW]

1. A charging station mobile app
2. Contactless payment (using key fob, smart card, or other devices with RFID)
3. Credit or debit card reader
4. Mobile payment (e.g., Apple Pay, Google Pay, Samsung Pay)
5. Charging my PGE account and appearing on PGE bill
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Current EV/PHEV Owner Details

[ASK IF EV/PHEV OWNER (S5 = 1)]
Q44. [OWN_1] How many years have you owned an electric vehicle / plug-in hybrid electric vehicle (including any previous electric vehicles you have owned)?

(Enter your response in the box below. Your best guess is fine.)

[Accept responses between 1 & 50]

98. Don't know

[ASK IF EV/PHEV DRIVER (S5=1)]
Q45. [BL – OWN_2] Where do you typically charge your electric vehicle / plug-in hybrid electric vehicle?

Select all that apply

[MULTIPLE RESPONSE]

1. Home
2. A charging station at your workplace
3. Public charging station(s)
4. Other place, please specify: [OPEN-ENDED RESPONSE]

5. None of the above [MAKE EXCLUSIVE RESPONSE]
99. Prefer not to say [MAKE EXCLUSIVE RESPONSE]

[ASK IF CHARGES AT HOME, WORK, PUBLIC, OR OTHER CHARGING LOCATIONS (Q45 = 1, 2, 3, or 4)]
Q45A. **[NEW – 2021]** How often do you typical charge your electric or plug-in hybrid electric vehicle during the week at…

[MATRIX QUESTION]

[DISPLAY ONLY LOCATIONS SELECTED IN Q45]	1 More than once per day	2 Once per day	3 1-2 days per week	4 3-4 days per week	5 5-6 days per week	98 Don't know
Home						
A charging station at your workplace						
Public charging stations						
Other charging stations						

[ASK IF EV/PHEV DRIVER (S5=1) AND CHARGES AT HOME (Q45=1)]

Q45B. **[NEW – 2021]** What is the primary reason you charge at home? *Select all that apply*

[MULTIPLE RESPONSE]

1. Lower cost than a public charging station
2. Convenience
3. Ability to charge overnight
4. Some other reason, please specify: [OPEN-ENDED RESPONSE]
5. None of the above [MAKE EXCLUSIVE RESPONSE]

[ASK IF EV/PHEV DRIVER (S5=1) AND CHARGES AT WORK (Q45=2)]

Q45C. **[NEW – 2021] Approximately how much do you pay per month for charging at your workplace?**

1. Specify amount ($) per month: [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]
99. Prefer not to say [EXCLUSIVE]

[ASK IF EV/PHEV DRIVER (S5=1)]
Q45D. **[BL – OWN_3 - ADJUSTED]** What do you look for in a public charging station? *Select all that apply.* *Select all that apply.*

[MULTIPLE RESPONSE]

1. Speed – quicker than charging at home
2. Proximity to where my home is
3. Proximity to where I work
4. Proximity to where I shop
5. Ease of use
6. Affordable charging rate
6. Charger availability at location
7. Other, please specify: [OPEN-ENDED RESPONSE]
9. None of the above [MAKE EXCLUSIVE RESPONSE]

Q1. **[BL – OWN_3 – QUESTION REMOVED IN 2021]**

[ASK IF EV/PHEV DRIVER (S5=1) AND USE PUBLIC CHARGING STATIONS (0=2-6)]
Q2. [BL – OWN_4] How do you go about locating a public charging station when needed?

Please select all that apply.

[MULTIPLE RESPONSE]

1. Charging stations identified on my electric vehicle's navigation system
2. Vehicle app on my mobile phone
3. Charging networks App such as Electrify America, Chargepoint, EVGO, etc.
4. Third Party App such as Chargeway or PlugShare
5. Internet search
6. Some other way, please specify: [OPEN-ENDED RESPONSE]
7. None of the above [MAKE EXCLUSIVE RESPONSE]
99. Prefer not to say [EXCLUSIVE]

[ASK IF EV/PHEV DRIVER (S5=1) AND USE PUBLIC CHARGING STATIONS (0=2-6)]
Q3. [BL – OWN_6] Would you say that locating an operational, not in use public electric vehicle charging station when needed is typically…?

[SINGLE RESPONSE]

FLIP CODE DISPLAY [ANCHOR 99]

1. Very difficult
2. Somewhat difficult
3. Somewhat easy
4. Very easy
99. Prefer not to say

[ASK IF EV/PHEV DRIVER (S5=1) AND HAVE SEEN ELECTRIC AVENUE (Q40 = 1, 2, 3, OR 4)]
Q4. [BL – OWN_7 – ADJUSTED] How often do you use the Electric Avenue location(s) to charge your electric vehicle / plug-in hybrid electric vehicle?

[MATRIX QUESTION]

[DISPLAY ONLY LOCATIONS SELECTED IN Q40]	1 I have not charged at this location	2 Rarely (a few times per year or less)	3 About once per month	4 2 to 3 times per month	5 About once per week	6 Several times per week	98 Don't know
Downtown Portland (SW Salmon between SW 1st and 2nd Ave)							
Milwaukie (intersection of SE McLoughlin Blvd and SE Jackson St)							
Hillsboro (2105-2643 SE Tualatin Valley Hwy)							
Eastport Plaza (4140 SE 82nd Ave)							
Wilsonville (SW Wilsonville Rd & Memorial Dr)							
Salem (900 Court St NE)							
Beaverton (SW Canyon Rd & Broadway St)							

[ASK IF EV/PHEV DRIVER (S5=1)]
Q5. [BL – OWN_8] How many miles do you typically drive per day in your electric vehicle / plug-in hybrid electric vehicle?

(Enter your response in the box below. Your best guess is fine.)

[ACCEPT RESPONSES BETWEEN 1 & 997]

1. [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF EV/PHEV DRIVER (S5=1)]
Q50A. **[NEW – 2021]** What is the full range (in miles) of your electric vehicle / plug-in hybrid electric vehicle?

[DISPLAY IF PHEV IN Q5:] Please only consider your vehicle's battery range, not range from the gasoline engine.

(Enter your response in the box below. Your best guess is fine.)

[ACCEPT RESPONSES BETWEEN 1 & 997]

1. [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF EV/PHEV DRIVER (S5=1)]

Q50B. **[NEW – 2021]** And what is the typical range (in miles) remaining on your electric vehicle / plug-in hybrid electric vehicle when you choose to charge?

[DISPLAY IF PHEV IN Q5:] Please only consider your vehicle's battery range, not range from the gasoline engine.

(Enter your response in the box below. Your best guess is fine.)

[ACCEPT RESPONSES BETWEEN 1 & 997]

1. [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF EV/PHEV DRIVER (S5=1)]
Q6. [BL – OWN_9] Which type of home electric vehicle charging system do you have?

Please select all that apply.

[MULTIPLE RESPONSE]

1. Level 1 (120v – standard electric outlet)
2. Level 2 (240v - large 3-prong outlet such as for an electric clothes dryer)
3.
4. Other type; please specify here: [OPEN-ENDED RESPONSE]
5. None of the above [MAKE EXCLUSIVE RESPONSE]

[ASK IF Q6 = 2]
Q51A. **[NEW – 2021]** What is the manufacturer of your Level 2 electric vehicle charging station?

[SINGLE RESPONSE; RANDOMIZE OPTIONS EXCEPT FOR DON'T KNOW]

1. Blink

2. Bosch
3. ChargePoint
4. ClipperCreek
5. Evo Charge
6. JuiceBox
7. Megear
8. Mustart
9. Siemens
10. Tesla
11. Other manufacturer, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK IF Q6 = 2]
Q51B. [NEW – 2021] Where is your Level 2 charging station located?

[SINGLE RESPONSE]

1. My garage
2. In a covered carport attached to the house
3. Outside of my house
4. Somewhere else, please specify:

98. Don't know

[ASK IF Q6 = 1, 2, OR 3]
Q51C. [NEW – 2021] What time do you typically **start charging** your electric or plug-in electric hybrid vehicle at home?

Dropdown List	Weekdays	Weekends
Vehicle is charging all day		
12:00am-12:59am		
1:00am-1:59am		
2:00am-2:59am		
3:00am-3:59am		
4:00am-4:59am		
5:00am-5:59am		
6:00pm-6:59am		
7:00pm-7:59am		
8:00pm-8:59am		
9:00pm-9:59am		
10:00pm-10:59am		
11:00pm-11:59am		
12:00pm-12:59pm		

1:00pm-1:59pm		
2:00pm-2:59pm		
3:00pm-3:59pm		
4:00pm-4:59pm		
5:00pm-5:59pm		
6:00pm-6:59pm		
7:00pm-7:59pm		
8:00pm-8:59pm		
9:00pm-9:59pm		
10:00pm-10:59pm		
11:00pm-11:59pm		
Don't know		

[ASK IF Q6 = 1, 2, OR 3]

Q51D. [NEW – 2021] And what time do you typically **stop charging** your electric or plug-in electric hybrid vehicle at home?

Dropdown List	Weekdays	Weekends
Vehicle is charging all day		
12:00am-12:59am		
1:00am-1:59am		
2:00am-2:59am		
3:00am-3:59am		
4:00am-4:59am		
5:00am-5:59am		
6:00pm-6:59am		
7:00pm-7:59am		
8:00pm-8:59am		
9:00pm-9:59am		
10:00pm-10:59am		
11:00pm-11:59am		
12:00pm-12:59pm		
1:00pm-1:59pm		
2:00pm-2:59pm		
3:00pm-3:59pm		
4:00pm-4:59pm		

5:00pm-5:59pm		
6:00pm-6:59pm		
7:00pm-7:59pm		
8:00pm-8:59pm		
9:00pm-9:59pm		
10:00pm-10:59pm		
11:00pm-11:59pm		
Don't know		

[ASK IF Q6 = 1, 2, OR 3]
Q51E. [NEW – 2021] Do you program your electric or plug-in electric hybrid vehicle charger to start and stop at specific times?

[SINGLE RESPONSE]

1. Yes
2. No

98. Not sure

[ASK IF Q6 = 1, 2, OR 3]
Q51F. [NEW – 2021] Is your household signed up for PGE's Time of Use pricing? With Time of Use pricing, you pay a different price for each unit of electricity depending on the time of day you use that electricity.

[SINGLE RESPONSE]

1. Yes
2. No

98. Not sure

[ASK IF (EV/PHEV OWNER (S5=1) AND Q6 ≠ 2 (DOES NOT HAVE L2 CHARGER AT HOME)) OR IF EV/PHEV INTENDER (EVINT=1)]
Q7. [NEW - 2019] Are you aware of a new PGE program where you would receive a rebate of up to $500 for a level two home charger, in return for allowing PGE to manage the times your electric or plug-in hybrid vehicle can charge, so that the electrical grid does not get overloaded during peak times, and your vehicle is fully charged when you need it?

[SINGLE RESPONSE]

1. Yes, I am aware of the program
2. No, I am not aware of the program

[ASK IF EV/PHEV DRIVER (S5=1)]
Q8. [NEW - 2019] What dealer(s) did you go to when you purchased or leased your electric or plug-in hybrid vehicle?

[MULTIPLE RESPONSE]

1. Beaverton Honda
2. Beaverton Hyundai
3. Carr Chevrolet
4. Carr Nissan

5. Courtesy Ford
6. Dick Hannah Honda
7. Dick Hannah Nissan
8. Dick Hannah Volkswagen
25. Dicks Hillsboro Hyundai
9. Gresham Toyota
10. Herzog-Meier Volkswagen
11. Kia of Portland
12. Kuni BMW
13. Landmark Ford
14. Platt Auto
26. Rivian
15. Ron Tonkin Chevrolet
16. Ron Tonkin Honda
17. Ron Tonkin Hyundai
18. Ron Tonkin Toyota
19. Toyota of Portland
27. Tesla
20. Wentworth's Wilsonville Chevrolet
28. Wilsonville Audi
21. Weston Kia
22. Wilsonville Nissan
23. Wilsonville Toyota
24. Other, please specify: [OPEN-ENDED RESPONSE]
97. NOT APPLICABLE – DID NOT INTERACT WITH DEALER [EXCLUSIVE]
98. Don't know [EXCLUSIVE]

[ASK IF ANY IN Q51 SELECTED INPUT ALL DEALERS SELECTED IN Q8]

Q9. [BL – OWN_11 – ADJUSTED] How informative was the dealer(s) when you purchased or leased your electric vehicle / plug-in hybrid electric vehicle?

(Select the rating scale point that best describes how you feel.)

(If your household has more than one electric or plug in hybrid vehicle, please answer for your most recently acquired electric or plug-in hybrid electric vehicle.) [SINGLE RESPONSE]

[DISPLAY ONLY DEALERS SELECTED IN Q8] Item	0 Not at all informative	1	2	3	4	5	6	7	8	9	10 Very informative	98 Don't know
[INPUT DEALER 1]												
[INPUT DEALER 2]												
[INPUT DEALER 3]												
[INPUT DEALER 4]												
[INPUT DEALER 5]												
[INPUT REMAINING DEALERS FROM Q53 IF MORE THAN 5 ARE SELECTED]												

[ASK IF Q8 = 3, 4, 25, 12, 14, OR 28 (CARR CHEVROLET, CARR NISSAN, DICKS HILLSBORO HYUNDAI, KUNI BMW, PLATT AUTO, OR WILSONVILLE AUDI SELECTED)]

Q10. [NEW – 2019] When you went to [RESPONSE(S) FROM Q8], were you shown the [educational kiosk]?

(This is an interactive display that shows a map of charging stations, charging times, and a trip planning tool.)

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[ASK Q10 = 1 (RECALL INFORMATION KIOSK)]

Q11. [NEW – 2019] How helpful was the [educational kiosk] in helping you understand EV charger availability and EV charging times?

[SINGLE RESPONSE]

1. 0 – Not at all helpful
2. 1
3. 2
4. 3
5. 4
6. 5
7. 6
8. 7
9. 8
10. 9
11. 10 – Extremely helpful
98. Don't know

[ASK IF EV/PHEV DRIVER (S5=1) AND Q8 ≠ NA AND PURCHASED EV IN 2020 OR 2021]

Q12. [BL – OWN_12 - ADJUSTED] Did the dealer you purchased or leased your electric vehicle / plug-in hybrid electric vehicle from mention PGE's Residential EV Charging Pilot Program, where you can get a rebate of up to $500 when you purchase, install and connect a PGE-approved Level 2 charger for your home?

[SINGLE RESPONSE]

1. Yes
2. No
98. Not sure

[ASK IF EV/PHEV DRIVER (S5=1)]

Q13. [BL – OWN_13] At what point did you contact PGE regarding your electric vehicle / plug-in hybrid electric vehicle purchase and home charging set-up?

Please select all that apply.

[MULTIPLE RESPONSE]

1. Before deciding to acquire an electric vehicle / plug-in hybrid electric vehicle

2. During the purchase/lease process
3. After acquiring the vehicle
4. I did not contact PGE [MAKE EXCLUSIVE RESPONSE]
98. Not sure [MAKE EXCLUSIVE RESPONSE]

[ASK IF EV/PHEV DRIVER (S5=1)]

Q14. [BL – OWN_14 – ADJUSTED] How likely is it that you would recommend an electric vehicle / plug-in hybrid electric vehicle to your friends or family?

[SINGLE RESPONSE]

0- Not likely at all										10 - Extremely likely
0	1	2	3	4	5	6	7	8	9	10

98. Not sure

Sources of Information about EV/PHEV Acquisition, Ownership and Charging

[ASK IF SEG = 1 - 4]

Q15. [BL – INFO_1] From which sources, if any, do you recall reading, hearing or seeing information about electric vehicles?

Please select all that apply.

[MULTIPLE RESPONSE] [RANDOMIZE]

1. Automobile dealerships
2. Automobile manufacturers
3. U.S. Department of Energy (DOE)
4. U.S. Environmental Protection Agency (EPA)
5. Portland General Electric (PGE)
6. Environmental organizations
7. Automobile reviews and information in consumer advice publications / websites such as Consumer Reports
8. Automobile magazines (e.g., Car and Driver)
9. Automobile websites (e.g., jalopnik.com)
10. Electrical contractors
11. Friends and colleagues
12. Social media (e.g., Facebook, LinkedIn, Twitter)
13. Reddit
14. Forth (electric vehicle website or showroom)
15. General internet search
18. My employer
19. A local community-based organization or non-profit (please specify): [OPEN ENDED RESPONSE]
16. Some other source: [OPEN ENDED RESPONSE]
17. None of the above / Do not recall information about electric vehicles [MAKE EXCLUSIVE RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF EV INTENDERS SELECTED MORE THAN ONE SOURCE IN Q15 (EVINT=1 AND Q15=1-16 (2-17 ITEMS SELECTED))]

Q16. [BL – INFO_2] Which of these sources did you find most useful when looking for information about electric vehicles?

Please select all that apply.

[MULTIPLE RESPONSE]

1. RESTORE ITEMS 1-16 selected in Q15.

   [Set as selected item in Q15 if only one response selected]

[ASK ALL]

Q17. [BL – EXP_8 – ADJUSTED] Which of the following PGE electric vehicle resources, campaigns, or discounts have you seen?

Please select all that apply.

[MULTIPLE RESPONSE – RANDOMIZE OPTIONS 1 – 21; GROUP OPTIONS 11-17]

1. Social media information from PGE on electric vehicles (on Instagram, Facebook, Twitter, or LinkedIn)
2. Emails from PGE on electric vehicle services or charging
3. PGE website information on electric vehicles
4. PGE's and Nissan's combined $3,500 discount for the Nissan Leaf
5. PGE's $500 discount for purchasing and installing a PGE-approved Level 2 home charger
6. Educational kiosks/displays at dealerships with vehicle charging information (PGE sponsors those)
7. Chargeway App
8. National Drive Electric Week advertising (in 2018 or 2019)
9. Electric Car Insider's Electric Car Guest Drive in Milwaukie (PGE sponsored)
10. PGE's sponsored ride-and-drive events
11. PGE's Electric Avenue in downtown Portland (public charging station)
12. PGE's Electric Avenue in Milwaukie (public charging station)
13. PGE's Electric Avenue in Hillsboro (public charging station)
14. PGE's Electric Avenue at Eastport Plaza (public charging station)
18. PGE's Electric Avenue in Wilsonville (public charging station)
19. PGE's Electric Avenue in Salem (public charging station)
20. PGE's Electric Avenue in Beaverton (public charging station)
15. PGE's Electric Avenue opening events
16. PGE's Electric Avenue at Portland International Auto Show
17. PGE's Drive Change Fund
21. Other ride-and-drive events (not sponsored by PGE)
97. DIDN'T SEE ANY OF THESE [MAKE EXCLUSIVE RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF SEG = 1 - 4]

Q18. [BL – DRV_3] Have you driven a plug-in 100% electric or a plug-in hybrid vehicle before today?

Please select all that apply.

[MULTIPLE RESPONSE]

1. Yes, a friend's, family member's, or colleague's
2. Yes, my own electric or plug-in hybrid vehicle
3. Yes, at a dealership
4. Yes, at Forth's electric vehicle showroom in downtown
5. Yes, at some other ride-and-drive event
6. No [MAKE EXCLUSIVE RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF Q18=5]
Q19. [NEW - 2019] Do you recall who sponsored the ride-and-drive event?

Please select all that apply.

[MULTIPLE RESPONSE]

1. Portland General Electric (PGE)
2. Forth
96. Someone else, please specify: [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

Perceptions of PGE

[DISPLAY SENTENCE BELOW ON SAME PAGE AS Q65]

[BL – SHOW PRIOR TO NEXT QUESTION] Now, we have some questions about Portland General Electric…

[ASK ALL]
Q20. [BL – Q4] Please rate how well each statement **reflects your opinion of PGE**…

(For each statement below, select the response that best describes how you feel)

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

98. Don't know

Randomize

Q20_1. PGE helps protect the environment

Q20_2. PGE supports the expansion of electric vehicle adoption in the region

Q20_3. PGE offers innovative energy solutions

Expectations of PGE Supporting EV / PHEV Adoption and Developing the EV Charging Infrastructure

[ASK ALL]
Q21. [BL – EXP_1 – EXP_6] Please indicate how much you agree or disagree with the following statements…?

(For each statement below, select the response that best describes how you feel)

Completely Disagree										Completely Agree	Don't Know
0	1	2	3	4	5	6	7	8	9	10	98

[RANDOMIZE ITEMS]

Q21_2. I support the idea that PGE should be working and investing now to ensure that the existing electric system is able to support convenient recharging of electric cars and trucks.

Q21_3. PGE should take an active role in educating people about electric vehicles.

Q21_4. I believe that PGE is a credible source of information about electric vehicles.

Q21_5. PGE should convert its own vehicle fleet to electric power as soon as possible.

Q21_6. PGE should make owning an electric vehicle more convenient and feasible by installing and maintaining **public charging stations**.

Q21_8. PGE should make installing a home electric vehicle charging station easier and more affordable.

Q21_9. PGE should make owning an electric vehicle more convenient and feasible by installing and maintaining charging **multifamily charging stations**.

[ASK ALL]

Q22. [BL – EXP_OE] Do you have any other suggestions for ways PGE could help support the expansion of electric vehicle use in our region?

(Enter your response in the box below. Be as specific as possible)

1. [OPEN-ENDED RESPONSE]

97. No other suggestions [EXCLUSIVE]

Attribution

[ASK EV/PHEV DRIVERS WHO BOUGHT THEIR EV(S) AFTER THE PGE'S TE PILOTS LAUNCHED AND WHO REPORTED RECEIVING OR SEEING RESOURCES, INFORMATION, OR DISCOUNTS FROM PGE]

[ASK EV/PHEV DRIVER (S4=1) **AND** IN Q6 THEY SAY THEY BOUGHT THEIR EV AFTER NOVEMBER 2018 **AND** (Q13=1, 2, 3 OR Q15=5 OR Q17=1 THROUGH 17)]

Q23. **[NEW - 2019]** You recalled receiving or seeing information on electric vehicles, charging, discounts, or other electric vehicle resources from PGE. Please indicate how influential that information was in your decision to purchase or lease your electric or plug in hybrid vehicle.

(If your household has more than one electric or plug in hybrid vehicle, please answer for the electric or plug-in hybrid electric vehicle purchased closest to December 2018.)

[INSERT 0-10 SCALE WHERE 0=Not at all influential AND 10=Extremely influential WITH DON'T KNOW OPTION (98); LABEL ONLY THE END POINTS]

[ASK EV/PHEV DRIVER (S4=1) **AND** (Q17=9,10,21 OR Q53 ≠ 97 NA OR Q18=1,3,4,5 (MOST LIKELY TEST DROVE A VEHICLE)]

Q24. **[NEW - 2019]** You recalled driving an electric or plug in hybrid vehicle at a dealership, ride-and-drive event, or at some other place. Please indicate how influential the electric or plug in hybrid vehicle test ride was in your decision to purchase or lease your electric or plug in hybrid vehicle.

(If your household has more than one electric or plug in hybrid vehicle, please answer for the electric or plug-in hybrid electric vehicle purchased closest to December 2018.)

[INSERT 0-10 SCALE WHERE 0=Not at all influential AND 10=Extremely influential WITH DON'T KNOW OPTION (98) AND NA OPTION (97); LABEL ONLY THE END POINTS]

[ASK EV/PHEV DRIVER (S4=1) **AND Q8** = 3, 4, 25, 12, 14, OR 28 (PGE PARTNER DEALERSHIPS CARR CHEVROLET, CARR NISSAN, DICKS HILLSBORO HYUNDAI, KUNI BMW, PLATT AUTO, OR WILSONVILLE AUDI SELECTED)]

Q25. **[NEW - 2019]** You recalled that you went to [RESPONSE(S) FROM Q8]. Please indicate how influential the dealership [IF MORE THAN ONE DEALERSHIP MENTIONED: "visits were"; IF ONLY ONE DEALERSHIP MENTIONED: "visit was"] in your decision to purchase or lease your electric or plug in hybrid vehicle.

(If your household has more than one electric or plug in hybrid vehicle, please answer for the electric or plug-in hybrid electric vehicle purchased closest to December 2018. [IF MORE THAN ONE DEALERSHIP MENTIONED: "Please think of all visits"*)*

[INSERT 0-10 SCALE WHERE 0=Not at all influential AND 10=Extremely influential; LABEL ONLY THE END POINTS]

[ASK EV/PHEV DRIVER (S4=1)]

Q26. **[NEW - 2019]** When you purchased or leased your electric or plug in hybrid vehicle(s), did you receive financial assistance from any of these sources? Please s*elect all that apply.*

1. Federal Tax Credit
3. State Tax Credit
4. Rebate(s)
5. Discount(s) from car manufacturer(s) (GM, Tesla, Nissan, others)
6. Discount(s) from car dealership(s)
96. Other, please specify: [OPEN-ENDED RESPONSE]
97. None of these [EXCLUSIVE]

[ASK IF Q26 = 4,5,6, OR 96]

Q71A. Did you receive this financial assistance from PGE or other sources?

	Source	
	PGE	non-PGE
Q26A_4. [DISPLAY IF Q71 = 4] Rebate(s)	❑	❑
Q26A_5. [DISPLAY IF Q71 = 5] Discount(s) from car manufacturer(s) (GM, Tesla, Nissan, others)	❑	❑
Q26A_6. [DISPLAY IF Q71 = 6] Discount(s) from car dealership(s)	❑	❑
Q26A_96. [DISPLAY IF Q71 = 96] [PIPE IN RESPONSE FROM Q71_96]	❑	❑

[ASK EV/PHEV DRIVER (S4=1)]

Q27. **[NEW - 2019]** The following is a list of items that you identified you received, for each one, please indicate how important the item was in the decision to purchase or lease.

[INSERT 0-10 SCALE FOR EACH ITEM WHERE 0=Not at all important AND 10=Extremely important WITH DON'T KNOW OPTION (98); LABEL ONLY THE END POINTS]

[DISPLAY ONLY OPTIONS THAT THEY SELECTED IN Q26]

1. Federal Tax credit you said you received
2. State Tax credit you said you received
3. Rebate(s) you said you received
4. Car manufacturer discount(s) you said you received
5. Dealership discount(s) you said you received
1. Anything else – if so, please specify: [OPEN-ENDED RESPONSE]

[ASK EV/PHEV DRIVER (S4=1)]

Q28. [NEW - 2019] Please *use #1, #2, and so forth to rank which factors had the greatest influence (#1), next-greatest influence (#2), and so forth on the decision to purchase or lease.*

DISPLAY ONLY THOSE ITEMS THEY RATED IN Q27 AS 1 OR ABOVE AND RANDOMIZE OPTIONS	*RANK*
1. [DISPLAY IF THEY ANSWER Q23] PGE's information or resources you received	
2. Tax credit you said you received	
3. Rebate(s) you said you received	
4. Car Manufacturer discount(s) you said you received	
5. Dealership discount(s) you said you received	
6. Other factor(s) you mentioned	

[ASK EV/PHEV DRIVER (S4=1) **AND** IN Q6 THEY SAY THEY BOUGHT THEIR EV AFTER NOVEMBER 2018 **AND** (Q13=1, 2, 3 OR Q15=5 OR Q17=1 THROUGH 17)]

Q29. [NEW - 2019] If you had not received information on electric vehicles, charging, discounts, or other electric vehicle resources from PGE, which of the following is most likely: You would have…

[SINGLE RESPONSE]

1. …postponed buying or leasing an electric or plug in hybrid vehicle for 2-3 years
2. …bought or leased a vehicle, but a different one
3. …done the exact same purchase or lease
1. …done something else. If so, what: [OPEN-ENDED RESPONSE]
98. Don't Know

[ASK EV/PHEV DRIVER (S4=1) **AND** (Q17=9 OR 10 OR 21 OR Q18=1,3,4,5 (MOST LIKELY TEST DROVE A VEHICLE)]

Q30. [NEW - 2019] If you had not driven an electric or plug in vehicle at a dealership, ride-and-drive event, or at some other place, which of the following is most likely: You would have…

[SINGLE RESPONSE]

1. …postponed buying or leasing an electric or plug in hybrid vehicle for 2-3 years
2. …bought or leased a vehicle, but a different one
3. …done the exact same purchase or lease
1. …done something else. If so, what: [OPEN-ENDED RESPONSE]
97. I/we did not test drive electric or plug in hybrid vehicle before buying ours

98. Don't Know

[ASK EV/PHEV DRIVER (S4=1) **AND** Q26, = 2,3,4,5,6 (RECEIVED A DISCOUNT/SUBSIDY)]
Q31. **[NEW - 2019]** If you had not received a discount (tax credit, rebate, and/or discount from car dealer or manufacturer), which of the following is most likely: You would have…

[SINGLE RESPONSE]

1. …postponed buying or leasing an electric or plug in hybrid vehicle for 2-3 years
2. …bought or leased a vehicle, but a different one
3. …done the exact same purchase or lease
1. …done something else. If so, what: [OPEN-ENDED RESPONSE]
98. Don't Know

Q32. **[NEW – 2019 – QUESTION REMOVED IN 2021]**

[ASK IF Q29= 2 OR Q30=2 OR Q31=2 OR Q32=2]
Q33. **[NEW - 2019]** You said you would have bought or leased a vehicle but a different one in the previous question(s) if you had not [INPUT "received info from PGE" if Q29= 2, "test driven an electric or plug in vehicle" if Q75=2, "received a discount" Q31=2, "OR received a loan" Q32=2]. Which type of vehicle listed below would you have most likely acquired?

[SINGLE RESPONSE]

1. Gasoline
2. Diesel
3. Biodiesel
4. Natural gas
5. Hybrid (non-plug-in)
6. Plug-in hybrid
7. Electric
98. Don't know

Interest in Other Transportation Electrification Services

[ASK ALL]
Q34. **[BL – RID_1 – ADJUSTED]** Are you a current rideshare (Uber, Lyft, etc.) or on-demand delivery service driver (i.e., Grub Hub, DoorDash, Uber Eats, Postmates, Instacart, etc.)? Please s*elect all that apply.*

[MULTIPLE RESPONSE]

1. Yes, current rideshare driver
2. Yes, current on-demand delivery service driver
3. No [EXCLUSIVE]
99. Prefer not to say [EXCLUSIVE]

[ASK IF CURRENT RIDESHARE OR ON-DEMAND DELIVERY SERICE DRIVER (Q34=1 OR Q34=2)]
Q35. **[BL – RID_2 – ADJUSTED]** Do you currently use an electric vehicle / plug-in hybrid electric vehicle for rideshare or on-demand delivery services?

[SINGLE RESPONSE]

1. Yes
2. No

98. Don't know

[ASK IF Q35 = YES]
Q80A. [NEW - 2021] Which of the following locations have you used in the past year to charge the vehicle you use for rideshare or on-demand delivery services? Please s*elect all that apply.*

[MULTIPLE RESPONSE]

1. A charger at your home
2. PGE's Electric Avenues
3. Charging at your workplace
4. Public charging (other than at PGE's Electric Avenues)
5. Other location, please specify: [OPEN-ENDED RESPONSE]
98. Don't know [EXCLUSIVE]

[ASK IF Q35 = PGE'S ELECTRIC AVENUES]
Q80B. [NEW - 2021] How do you typically pay for charging at PGE's Electric Avenues?

[SINGLE RESPONSE]

1. Pay by the hour
2. Have an unlimited monthly charging subscription that rideshare company pays for
3. Have an unlimited monthly charging subscription that I pay for
4. Other location, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK ALL]
TE_1. [NEW - 2021] On a scale of 1-10 where 0 is "Not at all interested" and 10 is "extremely interested," how interested are you in using the following forms of electrified transportation?

(Select the response that best describes how you feel.)[RANDOMIZE ITEMS]	0 – Not at all interested	1	2	3	4	5	6	7	8	9	10 – Extremely interested	98 - Don't Know
1. Riding an electric transit bus												
2. Using an electric scooter (e.g., Bird, Lime, Spin, etc.)												
3. Using a bike share electric bicycle (i.e., BikeTown Bike Share)												
4. Sharing an electric car though a car share or peer-to-peer service (e.g., ZipCar, Getaround, etc.)												
5. Using rideshare service that uses electric vehicles (i.e., Uber of Lyft)												

[ASK ALL]
TE_2. [NEW - 2021] Thinking about the next year, how often do you expect to use each of the following forms of alternative transportation?

[RANDOMIZE ITEMS]	1- Daily	2- 2-3 time per week	3- Once per week	4- A few times	5- A few times per year	97- Do not plan to use	98 - Don't Know

				per month			
1. Riding on transit buses							
2. Riding on light rail or streetcars							
3. Using electric scooter (e.g., Bird, Lime, Spin, etc.)							
4. Using bike share (i.e., BikeTown Bike Share)							
5. Using a car though a car share or peer-to-peer service (e.g., ZipCar, Getaround, etc.)							
6. Using rideshare services (i.e., Uber or Lyft)							

EJ_1. [NEW - 2021] Please indicate whether any of the following scenarios apply to your household. *Please select all that apply.*

[MULTIPLE RESPONSE – RANDOMIZE 1-6]

1. We live an area that has high exposure to pollution from transportation (e.g., our home is near a major freeway, truck route, etc.).
2. We have been unable to qualify to receive a car loan in the past five years.
3. We rely on public transit as our primary form of transportation.
4. The closest grocery store to our home is more than a ten-minute drive away.
5. We spend approximately 25% or more of our monthly budget on transportation-related expenses, (e.g., gas, car repairs, insurance, public transit fares, and rideshare (Uber or Lyft) fees). Please exclude vacation-related transportation expenses such as a rental car, flight etc.)
6. My household has experienced challenges accessing transportation for essential needs (e.g., to get to work, the grocery story, medical appointments, etc.)

97. None of the above scenario apply to my household. [EXCLUSIVE]

Q36. **[RID_5 – QUESTION REMOVED IN 2021]**

Demographics

[ASK ALL]
Q37. [BL – EDUC] What is the highest level of education you've attained to date?

[SINGLE RESPONSE]

1. Elementary school
2. Some high school
3. Graduated high school
4. Trade or technical school
5. Some college
6. Graduated college
7. Graduate/professional school

99. Prefer not to say

[ASK ALL]
Q38. [BL – OWNR] Do you own or rent your home?

[SINGLE RESPONSE]

1. Own
2. Rent
96. Other
98. Don't know
99. Prefer not to say

[ASK ALL]
Q39. [R&D Survey – Q16] What type of home do you live in?

[SINGLE RESPONSE]

1. Single-family detached house with a driveway
2. Single-family detached house with no driveway
3. Single-family attached home (such as a townhouse)
4. Duplex, triplex, or four-plex – with parking
7. Duplex, triplex, or four-plex – without parking
5. Apartment or condominium with 5 units or more – with parking
8. Apartment or condominium with 5 units or more – without parking
6. Manufactured or mobile home
96. Other, please specify: [OPEN-ENDED RESPONSE]
99. Prefer not to answer

[ASK ALL]
Q40. [BL – LIVH] How many people live in your home?

[Accept responses between 0 & 996]

1. [OPEN-ENDED RESPONSE]
997. Prefer not to say [EXCLUSIVE]

Q85A. [NEW – 2021] What is your zipcode?

2. [OPEN-ENDED RESPONSE]
99. Prefer not to say [EXCLUSIVE]

[ASK ALL]
Q41. [NEW - 2019] What is your age?

1. 18-24 years
2. 25-34
3. 35-44
4. 45-54
5. 55-64
6. 65-74
7. 75 years or older
99. Prefer not to say

[ASK ALL]
Q42. [BL – LATIN] Are you of Latino or Hispanic descent – for example Mexican, Puerto Rican, Cuban, or some other Hispanic background?

[SINGLE RESPONSE]

1. Yes, Latino/Hispanic
2. No, not Latino/Hispanic
99. Prefer not to say

[ASK ALL]
Q43. [BL – RACE] Is your racial or ethnic background white, black or African American, Asian, or something else?

[SINGLE RESPONSE]

1. White
2. Black or African American
3. Asian (Japanese, Korean, Pacific Islander, etc.)
4. American Indian/Native American
96. Other, please specify: [OPEN-ENDED RESPONSE]
97. Not applicable
98. Don't know
99. Refused

[ASK ALL]
Q44. [BL – EMPL] Please select the option that best describes your employment status.

[SINGLE RESPONSE]

1. Employed full time
2. Employed part time
3. Homemaker
4. Self-employed
5. Retired
6. Student
7. Unemployed
96. Something else: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK ALL]
Q45. [BL – INCOME] What was your household's total annual income before taxes in 2020? Please include the income of all people living in your home in this figure.

[SINGLE RESPONSE]

1. Less than $15,000
2. $15,000 TO $19,999
3. $20,000 to $29,999
4. $30,000 to $39,999
5. $40,000 to $49,999
6. $50,000 to $74,999
7. $75,000 to $99,999

8. $100,000 to $124,999
9. $125,000 or more
99. Prefer not to answer

[ASK ALL]
Q46. [BL – GENDER] Are you…

[SINGLE RESPONSE]

1. Male
2. Female

96. Other
99. Prefer not to say

Thank you for your participation in this survey! Those are all the questions we have for you.

For more information, please contact:

Zac Hathaway
Principal Consultant

503-943.2371 tel
zhathaway@opiniondynamics.com

1500 NE Irving Street
Suite #370
Portland, OR 97232