Portland General Electric Company
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February 15, 2019

Public Utility Commission of Oregon
Attn: Filing Center
201 High Street, SE, Suite 100
P.O. Box 1088
Salem, OR 97308-1088

RE: **UM 1811 Transportation Electrification Compliance Filing**

Portland General Electric Company (PGE) submits this Compliance filing pursuant to OPUC Order No. 18-054 in Docket No. UM 1811.

In February 2018, Order 18-054 adopted in part and modified in part, a stipulation which included agreement to propose future pilot programs, namely a residential home charging program and a workplace and/or fleet charging programs within one year of the Commission approval of the stipulation (i.e. February 15, 2019). Pursuant to paragraphs 30-32 of the stipulation, PGE proposes the following pilot programs:

- **Residential Electric Vehicle (EV) Charging pilot program**: PGE proposes a Residential EV Charging pilot program to encourage customers to deploy connected Level 2 EV charging infrastructure at their homes. The pilot program, which targets single-family homes, offers to provide rebates for approximately 3,600 charging stations over a three-year period. Participants will receive a rebate, per charger, and EV dealers will receive a mid-stream rebate for referring a qualified and successful EV charger installation. Enrollment in time of use will be offered to customers receiving rebates, as PGE has a current time of use rate in its Schedule 7 for Residential Customers. Time of use participation will not be required as a condition of receiving the rebate. Further, the pilot program will test the effectiveness of providing grid services, specifically demand response-using home chargers, by offering customers an annual incentive for participating in grid service events. PGE estimates a 14-year net present value net cost for the Residential EV Charging pilot program to be $3.9 million.
- **Business EV Charging pilot program**: PGE proposes a Business EV Charging pilot program that aims to mitigate customer issues with cost, complexity, and effort that otherwise may preclude businesses from installing charging infrastructure. Through the pilot program, PGE will support nonresidential customers' deployment of chargers with approximately 600 charging ports at 90 customer sites over about three years. This pilot program targets two groups of customers, which is open to both cost-of-service and direct access customers:
    1. Business charging at workplaces, multifamily dwellings, multitenant buildings, destination centers (e.g. big-box retail), and fleets. PGE

proposes to install, own, and maintain both the distribution and the make ready infrastructure, as well as provide rebates for the customer-owned charging equipment; and

2. Public transit agencies electrifying their fleets. PGE proposes to install, own, operate, and maintain the distribution infrastructure, the make-ready infrastructure, and the EV charging equipment.

All chargers deployed under the Business EV Charging pilot program will be DR-enabled, allowing for integration into PGE's Energy Partner program. Further, in exchange for their participation, customers will sign over environmental credits (i.e. Clean Fuels Credits) to PGE which will be used to buy down pilot program costs. The stipulation included an allocation of approximately $1 million for a workplace and/or fleet charging program. PGE estimates a 14-year net present value net benefit for the Business EV Charging pilot of $1.5 million.

Included in this filing, as Exhibit A, is PGE's Electric Vehicle Charging Proposals for Residential and Nonresidential customers which provides more details on the pilot programs. Appendix A, of Exhibit A, provides additional terms and descriptions for EVs and Appendix B provides stakeholder letters of support regarding these pilot programs. In addition, the Stipulating Parties encouraged both PGE and Pacific Power to coordinate in the development of the cost effectiveness and attribution methodologies, which is provided in Appendix C.

Should you have any questions or comments regarding this filing, please contact Kalia Savage at (503) 464-7432.

Please direct your communications related to this filing to the following email address: pge.opuc.filings@pgn.com

Sincerely,

Karla Wenzel
Manager, Pricing & Tariffs

Enclosures
cc: Service List – UM 1811

UM 1811 Transportation Electrification Compliance Filing
Exhibit A

PGE's Electric Vehicle Charging Pilot Program Proposals

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Table of Contents

Tables, Figures, and Charts

Acronyms

AMI ..... Advanced Metering Infrastructure
AR ..... Administrative Rulemaking
AWEC .. Alliance of Western Energy Consumers
CFP ..... Clean Fuels Program
CUB ..... Oregon Citizens' Utility Board
DCQC.... Direct Current Quick Charge
DEQ..... Department of Environmental Quality
DER..... Distributed Energy Resource
DR ..... Demand Response
DRMS .. Demand Response Management System
EE ..... Energy Efficiency
EV..... Electric Vehicle
EVSE .... Electric Vehicle Service Equipment
EVSP .... Electric Vehicle Service Provider
IOU..... Investor-Owned Utility
IRP..... Integrated Resource Plan
L2 ..... Level 2 Electric Vehicle Charger
NPV ..... Net Present Value
O&M ... Operations and Maintenance Costs
OAR ..... Oregon Administrative Rule
OCPP ... Open Charge Point Protocol
ODEQ .. Oregon Department of Environmental Quality
ODOT .. Oregon Department of Transportation
OPUC... Public Utility Commission of Oregon (some quotations refer to PUC)
PAC..... PacifiCorp
PGE..... Portland General Electric Company
TE ..... Transportation Electrification
TEAM... Transportation Electrification Assessment Methodology
TOU ..... Time of Use

Key Terms and Concepts

Charger or Charging Station – Charging equipment used to charge an electric vehicle.

Coincident Peak – For the purposes of this report, defined as the peak demand expressed as a percent of nameplate capacity by site type during peak system demand (3 PM to 8 PM on weekdays).

Clean Fuels Credits – The Oregon Clean Fuels Program[1] requires a ten percent reduction in the average carbon intensity of Oregon's transportation fuels from 2015 levels by 2025. Clean Fuels Credits are generated when the carbon intensity of a specific fuel is lower than the clean fuel standard in a given year.

Customer Make Ready – Customer facility upgrades (located on the customer's side of the meter) including conduit, wiring and panel/switchgear up to the charging station to "ready" a customer's site for installation of charging equipment.

Demand Response (DR) – "Demand response is a non-persistent intentional change in net electricity usage by end-use customers from normal consumptive patterns in response to a request on behalf of, or by, a power and/or distribution/transmission system operator. This change is driven by an agreement, potentially financial, or tariff between two or more participating parties."[2]

Electric Vehicle Service Providers (EVSPs) – Companies that install, operate, and maintain electric vehicle charging stations.

Line Extension – Distribution facility upgrades (located on Portland General Electric Company's side of the meter) to obtain additional capacity or a change in service conditions, such as to serve new electric vehicle charging loads. Excludes modifications to transmission or subtransmission voltage facilities or substations.

Load Factor – The ratio of average load over a given period to the maximum peak load in that period.

Port – Physical plug that delivers a charge to an EV. There are commonly one or two ports per charger or charging station.

Site – A physical location housing one or more chargers.

See Appendix A for more information on electric vehicle charging terminology.

[1] Oregon Department of Environmental Quality. *Oregon Clean Fuels Program.* Retrieved from https://www.oregon.gov/deq/aq/programs/Pages/Clean-Fuels.aspx

[2] Northwest Power and Conservation Council. *Demand Response Advisory Committee.* Retrieved from https://www.nwcouncil.org/energy/energy-advisory-committees/demand-response-advisory-committee

Executive Summary

Portland General Electric Company (PGE) is pleased to file these transportation electrification (TE) pilot program proposals as directed by the Public Utility Commission of Oregon (OPUC or Commission) and the Oregon State Legislature.[3,4] The transportation sector is Oregon's largest and fastest growing contributor to state-wide greenhouse gas emissions.[5] Senate Bill 1547 notes "transportation electrification is necessary to reduce petroleum use, achieve optimum levels of energy efficiency and carbon reduction, meet federal and state air quality standards, meet this state's greenhouse gas emissions reduction goals" and "improve the public health and safety."[6] Further, Governor Kate Brown outlined a statewide goal to achieve "50,000 or more registered and operating electric vehicles by 2020."[7]

In February 2018, the OPUC adopted in part and modified in part, a stipulation which included agreement to future pilot proposals, namely PGE proposing a residential home charging and workplace and/or fleet charging pilot programs.[8] Pursuant to paragraphs 30-32 of the stipulation,[9] PGE proposes the following pilot programs:

Residential Electric Vehicle (EV) Charging pilot program: PGE proposes a Residential EV Charging pilot program to encourage customers to deploy connected Level 2 EV Charging (L2) infrastructure at their homes. The pilot program, which targets single family homes, aims to provide rebates for approximately 3,600 charging stations over a three-year period. Participants will receive a rebate ranging from $500-1,000 per charger,[10] and EV dealers will receive a $100 mid-stream rebate for referring a qualified successful EV charger installation. Further, the pilot program will test the effectiveness of providing grid services, specifically demand response (DR) using home chargers, by offering customers a $50 annual incentive for participating in grid services events. We estimate a 14-year net cost for the EV Charging Pilot to be $3.9M.[11]

Business EV Charging pilot program: PGE proposes a Business EV Charging pilot program that aims to mitigate the issues with cost, complexity, and effort that otherwise preclude businesses from installing charging infrastructure. Through the pilot program, PGE will support nonresidential customers' deployment of chargers with approximately 600 charging ports at 90 customer sites over about three years. This pilot program targets two groups of customers:

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[3] In the passing of Chapter 28, Oregon Laws 2016, the state legislature acknowledges that there is a role for electric companies to play in accelerating TE.

[4] 78th Oregon Legislative Assembly, 2016 Regular Session. Chapter 28, 2016 *Oregon Laws.* Retrieved from https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2016orlaw0028.pdf

[5] Oregon Department of Environmental Quality. *Statewide Greenhouse Gas Emissions.* Retrieved from https://www.oregon.gov/deq/aq/programs/Pages/GHG-Oregon-Emissions.aspx

[6] 78th Oregon Legislative Assembly, 2016 Regular Session.

[7] Office of the Governor, State of Oregon. (2017). *Oregon Executive Order 17-21*. Retrieved from https://www.oregon.gov/gov/Documents/executive_orders/eo_17-21.pdf

[8] OPUC. *Order No. 18-054. OPUC Docket No. UM 1811.* 2018 Feb 16. Retrieved from https://apps.puc.state.or.us/orders/2018ords/18-054.pdf

[9] Ibid.

[10] The amount of the participant's rebate is based on the participant's income-level.

[11] The net cost is the NPV of the costs less the NPV of the benefits over the lifetime of the pilot program.

1. Business charging at workplaces, multifamily dwellings, multitenant buildings, destination centers (e.g. big-box retail), and fleets. PGE proposes to install, own, and maintain both the distribution and the make ready infrastructure, as well as provide rebates for the customer-owned charging equipment ($575 for L2 charging ports and $2,300 for ports installed at income-qualified multifamily properties); and
2. Public transit agencies electrifying their fleets. PGE proposes to install, own, operate, and maintain the distribution infrastructure, the make-ready infrastructure, and the EV charging equipment.

All chargers deployed under the Business EV Charging pilot program will be DR-enabled, allowing for integration into PGE's Energy Partner program[12]. Further, in exchange for the benefits of their participation, customers will sign over environmental credits (i.e. Clean Fuels Credits)[13] to PGE which will be used to buy down pilot program costs. PGE estimates the pilot program NPV net benefit of $1.5M[14] with a cost-effectiveness result of 1.06.

Both EV Charging pilot programs will support Oregon's climate goals, accelerate TE, and encourage efficient grid integration by:

- **Reducing customer costs**: Decrease costs associated with deploying charging infrastructure at home and at businesses;
- **Enhancing customer experience**: Simplify and standardize the EV charger buying and installation process;
- **Enabling efficient grid integration**: Ensure that future charging stations deployed in PGE's service territory are connected and participating or have the ability to participate in smart charging programs;
- **Expanding access**: Increase deployments of public and workplace charging for customers to empower those who may not be able to charge at home and increase prospective customers' likelihood to consider buying an EV; and
- **Supporting greater EV adoption in moderate-income and low-income communities**: By offering larger incentives for qualifying individuals and facilities and by supporting transit agencies in electrifying their fleets.

As demonstrated in Table 1, PGE estimates that the proposed residential and nonresidential customer pilot programs will have a 14-year net present value (NPV) net cost of $2.4M (which includes $34.7M in benefits and $37.1M in costs).

[12] Energy Partner is PGE's Nonresidential DR program through PGE's Tariff Schedules 25 and 26.
[13] Oregon Department of Environmental Quality. *Oregon Clean Fuels Program.*
[14] Note that the $1.5M net benefit is reflected in cost effectiveness tables as a negative net cost of $1.5M. Detailed cost effectiveness analyses of the Residential and Business pilot programs can be found in sections 2.4 and 3.4, respectively.

Table 1 Estimated TE Pilot Program Financial Summaries (14-year NPV)

NPV of Pilot Program Costs	Residential Charging Pilot Program $M	Business Charging Pilot Program $M	Total $M
Pilot Program Benefits[A]	$9.4	$25.3	$34.7
Pilot Program Costs[B]	$13.3	$23.8	$37.1
Net Cost	**$3.9**	**-$1.5**	**$2.4**

A. Pilot program benefits include: increased revenues from new electricity sales, market participation revenues (e.g. Clean Fuels), and avoided capacity costs (estimated for residential DR)

B. Pilot program costs include: incremental supply costs (capacity and energy), administrative costs, incentives, and capital costs

Subsequent to this filing, PGE will file an operational tariff for these pilot programs and their respective incentive structures. This operational tariff will reflect the feedback from stakeholders on these pilot program proposals. PGE is filing a cost recovery tariff in addition to this compliance filing, which is designed to recover costs associated with TE pilot programs,[15] and an application for the deferral of costs and revenues associated with the EV Charging pilot programs.

Pilot programs like these are likely to help accelerate Oregon's transition to a clean energy future. These proposed pilot programs wholly support the state's goals to decarbonize the transportation sector while ensuring that we are building a grid that can maximize value from these new distributed energy resources (DERs). As our customers' trusted energy partner, PGE brings a balance of technical knowledge and customer acumen to deliver programs to accelerate TE and create value to the grid. We believe that these two pilot programs will make charging more affordable, simplify the experience around installing charging infrastructure, increase the number of charging points in PGE's service territory, and create a pathway to capture and quantify new flexible energy resources. We look forward to working quickly and collaboratively with the Commission and stakeholders to launch these pilot programs in 2019 so we may support our communities' clean energy goals.

[15] For more information, see PGE Advice No. 19-05 (NEW PGE's Schedule 150 – Transportation Electrification Cost Recovery Mechanism).

Section 1 Background

1.1 Chapter 28, Oregon Laws 2016

In 2016, the Oregon State Legislature enacted Chapter 28, Oregon Laws 2016[16] with the intent of eliminating coal from the electricity supply, increasing renewable energy production, and promoting alternative technologies that reduce carbon and/or aid in efficiently integrating renewables onto the grid. The legislation includes a section that directs Investor-Owned Utilities (IOUs) to file applications with the Commission for programs to accelerate TE and states that "transportation electrification is necessary to reduce petroleum use, achieve optimum levels of energy efficiency and carbon reduction, meet federal and state air quality standards, meet this state's greenhouse gas emissions reduction goals" and "improve the public health and safety."[17] Such programs "may include prudent investments in or customer rebates for EV charging and related infrastructure."[18] These programs are to be consistent with the Oregon Legislative Assembly's findings related to TE, including that widespread TE requires that electric companies "increase access to the use of electricity as a transportation fuel" (especially in "low and moderate income communities"); that "the purchase and use of electric vehicles should assist in managing the electrical grid" and that this creates the potential for attaining a "net benefit for the customers of the electric company".[19]

When considering programs and determining cost recovery, the Commission shall consider if investments are:

- In the utility's service territory;
- Prudent;
- Reasonably expected to be used and useful;
- Reasonably expected to support the grid;
- Reasonably expected to improve grid efficiency and operational flexibility (including renewable integration); and
- Expected to stimulate innovation, competition, and customer choice.[20]

1.2 Commission Rulemaking

Following the passage of Chapter 28, Oregon Laws 2016, the OPUC opened an investigative docket, Administrative Rule (AR) 599,[21] to bring interested stakeholders together to provide input on how a TE Program should be

[16] 78th Oregon Legislative Assembly, 2016 Regular Session.
[17] Ibid, Sec. 20.1
[18] Ibid, Sec. 20.3
[19] Ibid, Sec. 20.2
[20] Ibid, Sec. 20.4
[21] OPUC (2016). *Senate Bill 1547 Transportation Electrification Program Application*. Retrieved from http://apps.puc.state.or.us/edockets/docket.asp?DocketID=20129

structured in Oregon. The rulemaking process included multiple rounds of written comments, as well as technical conferences which included all three IOUs – PGE, PacifiCorp (PAC) dba Pacific Power, and Idaho Power.

The OPUC adopted Oregon Administrative Rule (OAR) 860-087-0000 et seq. (Transportation Electrification Programs) on November 26, 2016.[22] The scope of these rules related to applications submitted prior to December 31, 2016.

On December 18, 2018, the OPUC opened Docket No. AR 609 to add OAR 860-087-0020. As of this filing, the rulemaking process for TE plans are still ongoing.

1.3 Regulatory History (OPUC Docket No. UM 1811)[23]

PGE filed proposals with the OPUC to run several TE pilot programs in March 2017.[24] On February 16, 2018, Commission Order No. 18-054 adopted in part and modified in part, a stipulation which included agreement to future pilot proposals:

- A residential home charging pilot program, which includes rebates for customers installing a connected L2 home charger and going on a time of use (TOU) rate, within one year of Commission approval of this plan.[25]
- A workplace charging and/or fleet charging pilot program to be proposed within one-year of the date of the order. The approximate total cost of the proposal will be $1M. The pilot program shall be open to both cost-of-service and direct access customers. The proposed $1M results from a removal of $1M from the PGE's proposed Education and Outreach budget in its application. PGE will also separately consider developing programs to increase access to electricity as a transportation fuel at multifamily dwellings.[26]

Further the Commission opined on how SB 1547 was being interpreted:

- We confirm . . . that SB 1547 does not prohibit utility ownership of EV service equipment;
- We conclude that the language in Section 20(4) of SB 1547 sets out six factors we must *consider* in evaluating a program to accelerate TE, and does not . . . establish six *criteria* that must be met for each program (emphasis in original); and
- We are to take in account these factors during our review, but that we retain discretion in our decision-making whether to approve a program.[27]

[22] OPUC (2016). *Order No. 16-477 Rulemaking to Prescribe Application Requirements for Transportation Electrification Programs*. Retrieved from http://apps.puc.state.or.us/orders/2016ords/16-447.pdf

[23] OPUC (2016-). *UM 1811: PGE Transportation Electrification Program Applications.* Retrieved from https://apps.puc.state.or.us/edockets/docket.asp?DocketID=20573

[24] PGE (2017). *UM 1811 Direct Testimony and Supplemental Application for Transportation Electrification Programs.* Retrieved from https://edocs.puc.state.or.us/efdocs/HTB/um1811htb164014.pdf

[25] OPUC (2018). *Order No. 18-054*. Retrieved from https://apps.puc.state.or.us/orders/2018ords/18-054.pdf.

[26] Ibid.

[27] Ibid, p. 8-9.

1.4 Executive Order 17-21

On November 6, 2017, Governor Kate Brown signed Executive Order No. 17-21 declaring that "Oregon is committed to meeting the international Paris Agreement targets to reduce greenhouse gas emissions by 26 to 28 percent below 2005 levels by 2025," and that "greater transition of internal combustion engines to zero emission vehicles, like electric cars, buses, and trucks, play a key role in helping Oregon achieve its climate change goals, improving the health of Oregon communities, and encouraging clean energy job development."[28] In that order, the Governor outlined a statewide goal to achieve "50,000 or more registered and operating electric vehicles by 2020." [29] Further, the order highlights several key considerations for utility programs:

- "The PUC, with input from interested stakeholders, is directed to implement the transportation electrification program, established in SB 1547 (2015), to support electric vehicle charging in the investor-owned utilities' transportation electrification plans such that the transportation electrification program is designed to achieve the state goal…" and "[w]henever possible, the PUC is directed to encourage programs that support greater electric vehicle adoption in moderate- and low-income communities."[30]

- "ODOT, working with ODOE, PUC, and DEQ, is directed to develop tools, information, and best practices to assist transit agencies when making decisions about zero emission vehicle bus technology adoption in transit fleets for their transit districts." [31]

1.5 Stakeholder Engagement

In preparing this filing, PGE provided external stakeholders an opportunity to contribute and provide feedback on our proposed ideas. PGE's workshops focused on pilot program valuation, attribution, and new pilot program design concepts; and included participation from customers, regulators, automakers, peer electric companies, equipment manufacturers, government bodies, and non-governmental organizations.

In addition to this open workshop, PGE also held a number of smaller, topic-driven meetings and phone calls with a variety of stakeholders. For example, PGE held a roundtable discussion on pilot program design concepts methodologies and approaches, with representatives from the OPUC Staff, the Oregon Citizen's Utility Board (CUB), and Alliance of Western Energy Consumers (AWEC) in December and January. PGE also met multiple times with PAC and OPUC staff to discuss cost effectiveness and attribution. Through stakeholder meetings, we heard from stakeholders: propose larger pilot programs but not exceed the terms of the stipulation; plan on calculating attribution but do not include that in cost-effectiveness calculations; look for solutions that increase equitable access to TE.

Evidence of this robust stakeholder engagement process can be found in Appendix B, which incorporates letters of support from the cities of Beaverton, Gresham, Hillsboro, Milwaukie, Portland, Salem, and Wilsonville; Multnomah County; TriMet; Greenlots®; the Alliance for Transportation Electrification; Forth; and EVBox.

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[28] Office of the Governor, State of Oregon. (2017). *Oregon Executive Order 17-21*. Retrieved from https://www.oregon.gov/gov/Documents/executive_orders/eo_17-21.pdf

[29] Ibid.

[30] Office of the Governor, State of Oregon. (2017). *Oregon Executive Order 17-21.* Retrieved from https://www.oregon.gov/gov/Documents/executive_orders/eo_17-21.pdf

[31] Ibid.

Section 2 Residential Charging

2.1 Summary

PGE proposes to launch a Residential EV Charging pilot program to encourage customers to deploy connected L2 infrastructure at their homes (see Appendix A for a detailed description of L2 and other charger types). The pilot program targets single-family homes and aims to provide rebates for approximately 3,600 charging stations over approximately a three-year period. The Residential EV Charging pilot program aims to:

- Encourage EV adoption by reducing the cost and complexity of installing qualified connected charging stations; and
- Explore and establish mechanisms to realize the value of the delivery of grid services (DR, daily load shifting, and load following) from connected chargers.

Table 2 below describes the incentives that the pilot program will offer to facilitate the above aims.

Table 2 Proposed Incentives (Residential EV Charging)

Incentive Type	Amount	Frequency	Description
Standard Installation Incentive	$500	One-time	For the installation of a qualified connected L2 EV charging station at a single family residential home.
Income-Eligible Installation Incentive	$1,000	One-time	For qualifying income-eligible households, towards the installation of a qualified connected L2 EV charging station at a single family residential home.
Grid Services Incentive	$50	Annual	For customers that are participating in grid services (initially DR, later daily load shifting, and later load following) via the connected charging stations and/or connected vehicle.
Re-Connection and Grid Services Enrollment Incentive	$25-50	Promotional One-time	To encourage enrolled customers whose chargers have lost Wi-Fi connectivity[32] to reconnect their charger. Available at PGE's discretion. For customers with an existing charger who have not received an installation incentive and are enrolling into grid services.

Table 3 below describes the pilot program's participation goals.

Table 3 Projected Pilot Program Participation (~3-year period, Residential EV Charging)

Incentive	Projected Participation
Standard EV charger installation incentives	3,250 incentivized installations
Income-eligible EV charger installation incentives	360 incentivized installations
Grid Services	2,800 participating EV chargers

[32] If Wi-Fi connectivity drops below necessary thresholds, PGE will offer this incentive as needed to ensure the operationalization and evaluation of grid services.

2.2 Market Information

2.2.1 EV Buyer Needs and Wants

Through customer interviews, PGE found that EV buyers exhibit several key needs and wants. Many customers don't know how to navigate the transition from gas-fueled vehicles to EVs. While customers want green affordable transportation[33], they struggle to quantify the benefit of EVs when considering the purchase of a vehicle.

Customers want charging that is fast, easy, and convenient enough to compete with traditional fuel. The pilot program is designed to address the fact that most homes do not have an available 220 volt / 30-40 amp circuit installed in their garage or driveway to accommodate a L2 charger.

EV chargers represent an incremental cost[34] for EV buyers to move from fossil fuels to electric. Financing of charger and installation costs are often not addressed by EV manufacturers or dealers during the EV sales process. As a result, customers face many home charging options and often choose the lowest cost option, which is often not connected and has no opportunity for grid integration.

Many customers simply lack the information they need to figure out that EVs are affordable, reliable, and can make financial sense for them. Finally, early EV adopters and potential EV buyers indicate that they desire to be perceived as smart and knowledgeable within their community (e.g. friends, family, co-workers) when transitioning from gas-powered vehicles to EVs.

2.2.2 EV Buyer Characteristics & Target Market Size

Through customer interviews, PGE found that typical buyers of EVs fall into the annual household income category of greater than $60,000. Despite this, PGE found that all the buying groups desire to drive green, eliminate the use of fossil fuel to meet their transportation needs, and are generally supportive of and/or are existing participants in PGE green programs (e. g. renewable power, DR, paperless billing).

The market size of potential EV adopters (innovators through early majority) in PGE's service territory is estimated at 240,000 households. Roughly 30% of these prospective customers are not able to install a home charger because they live in non-owner-occupied housing or have a physical/legal barrier to installing an off-street charger. This leads to a potential target market size of 160,000 installed home chargers (participating households).

2.2.3 EV Sales Medium Term Outlook (through 2025)

The Residential EV Charging pilot program addresses the need for convenient and fast home charging for the 100,000 electric passenger vehicles that are expected to be registered in Oregon by the end of 2025. PGE recently conducted a DER Potential Study[35] through the Integrated Resource Plan (IRP) process, which suggests that

[33] Edmonds, Ellen. (2018, May 8). *1-in-5 U.S Drivers Want an Electric Vehicle*. AAA. Retrieved from https://newsroom.aaa.com/2018/05/1-in-5-us-drivers-want-electric-vehicle/

[34] Agenbroad, Josh (2014, April). *Pulling Back the Veil on EV Charging Station Costs*. Rocky Mountain Power Institute. Retrieved from https://rmi.org/pulling-back-veil-ev-charging-station-costs/

[35] Navigant (2019). *DER Potential Study.*

Battery Electric Vehicle[36] sales will reach a velocity of 10,600 new registrations per year in PGE service territory in 2025.

2.2.4 Eligible Target Market Size During Pilot Program Period

As shown in Table 4, research data suggests annual EV sales will accelerate from 1,900 cars per year to 5,500 cars per year during the timeframe that we propose for this pilot program. The cumulative number of EVs sold in the period from 2019-2022 are estimated at 15,000.

To forecast program participation, PGE estimates approximately 15,000 new EV sales in our service area by 2022.[37] Adjusting for 1) fleet sales, 2) non-qualifying new installations of EV chargers, and 3) customers that do not have the option to install an EV home charger (among other factors), PGE estimates that 6,300 qualifying EV home chargers will be installed during the approximately three-year term of the pilot program (see Table 4 for details).

PGE expects that some of these EV chargers, despite being the correct model, will not receive incentives for the installation of the equipment and/or participation in DR events due to lack of awareness for the pilot program and/or non-timely submission of incentive applications, among other factors.

Table 4 Estimated Annual EV Sales and Installations of Eligible EV Home Chargers in PGE's Service Territory

Sales by Year	2019	2020	2021	2022	Total	2025
Annual New EV Sales[38]	1,937	3,537	4,296	5,461	15,231	10,613
Annual Installations of Qualifying Charging Stations	700	1,350	1,800	2,500	6,300	NA

Adjusting for fleet sales, non-qualifying new installations of EV chargers, and customers that do not have the option to install an EV home charger (among other factors) PGE estimates 6,300 qualifying EV home chargers will be installed during the approximately three-year pilot program period.

PGE expects that some of these EV chargers, despite being the correct model, will not receive incentives for the installation of the equipment and/or participation in DR events due to lack of awareness for the pilot program and/or non-timely submission of incentive applications, among other factors.

[36] The estimate does not include registrations of plug-in hybrid electric vehicles (PHEVs) in PGE's service territory. PHEVs have lower battery capacities than BEVs. BEV owners are also less likely to install L2 home chargers.

[37] The forecast model uses high-level macroeconomic factors like gross domestic product and population as well as vehicle density and historic sales data to project overall light duty vehicle market growth. These forecasts are helpful for sizing program adoption but are not intended to suggest that there is not a need to accelerate TE. There is a need to accelerate TE as the forecasted levels of EV adoption are not on pace to meet the Governor's 50,000 EV goal by 2020, nor are they sufficient to meet the state's greenhouse gas reduction goals. PGE expects that programs like this one will add to the customers' value proposition when considering an EV and, in turn, will accelerate transportation electrification.

[38] Ibid.

2.3 Pilot Program Overview

2.3.1 Pilot Program Delivery Overview

The pilot program will provide incentives to PGE customers for the installation of qualifying connected EV home chargers[39] as well as annual performance incentives for participation in grid services. The pilot program is structured around delivery channels, qualified products, and incentives as detailed in the following sections.

2.3.1.1 *Delivery Channels*

PGE considered existing market realities, collaborative opportunities, and participation paths when identifying the delivery channels by which the pilot program will enter the market.

The first delivery channel will be a trade ally network for facilitated installations. The trade ally network will be trained on EVs, qualifying EV chargers, and incentives. PGE proposes to issue instant incentives (taken off the invoice from trade allies) to lower first costs for the customer. PGE expects the trade ally network and incentives will operate similarly to existing energy efficiency (EE) programs with qualified installers (e.g. Heating, Ventilation, and Air Conditioning technicians, plumbers, electricians, etc.).

The second delivery channel will be "bring-your-own charger", which will address self-directed installations. Customers may individually arrange the installation of qualifying chargers outside of the trade ally network. The customer will be responsible for meeting pilot program requirements and must provide supporting documentation. PGE will work with EV Service Providers (EVSPs) to promote the installation and grid services to new and potential buyers.

The third delivery channel will be for existing qualifying chargers. PGE will select qualifying chargers and work collaboratively with Original Equipment Manufacturers to enroll customers with existing qualifying EV chargers into the grid services component of the pilot program.

The fourth delivery channel will be via EV Dealers. PGE will recruit and train select EV dealerships (based on variables that include EV sales and willingness to engage) on EV charger rebates and the trade ally network. These dealerships will provide leads to installers in the spirit of meeting customer needs for an integrated EV charger product at the point-of-sale for EVs. Dealers are expected to play a vital role in bridging the gap between purchase of a car and solving the problem for obtaining access to fast and convenient charging infrastructure. By engaging with the customer at time of sale, PGE expects a better pilot program uptake rate.

2.3.1.2 *Qualified Product List*

Qualified products will be identified and listed to ease the charger selection process, as well as to ensure customer and pilot program success. A qualified product list will be established to ensure that customer needs are met, to allow for the customer to participate in grid services, and to earn additional grid services incentives.

PGE will establish a qualified connected charger product list before the official launch of the pilot program. Selection criteria will include:

[39] The exact characteristics of a qualifying charger will be based on an RFI and related responses by vendors.

- EVSPs with a sufficient number of chargers installed and/or are actively-selling and installing a sufficient number of chargers to households served by PGE;
- EVSPs that are committed to invest their own time and resources to connect the devices (EV chargers) via the EVSP cloud to PGE's Demand Response Management System (DRMS);
- EVSPs that allow PGE's DRMS to control the charging activity in PGE's customers' homes;
- EVSPs that are willing to collaborate with PGE and PGE's trade ally network in educating, training, distributing, and installing qualifying products in customer homes;
- EVSPs that are either initiating their own outreach activities and/or collaborative outreach activities to sell, install, and enroll customers into the pilot program; and
- EVSPs with charger products that meet minimum requirements to be connected and controlled via a DRMS.

Given the heavy financial investments, staffing needs, and information technology resources required to establish connectivity between the EVSP and DRMS, it is essential for PGE to be rigorous in its selection and commitments. The DRMS is used to dispatch participating chargers during grid service events. Chargers in the field will be connected to the EVSP's operating system via Wi-Fi. This standard practice allows customers to check on their charging status online or via an app. The EVSP operating system in turn will be connected to the DRMS. This connection allows the DRMS to manage the charger (within EVSP and pilot program parameters) during grid service events.

The factors mentioned above will be critical in establishing the qualified product list and the runway to bring additional vendors into the fold. Further, PGE may look for opportunities to partner with vehicle EVSPs to integrate vehicles directly into the DRMS.

2.3.1.3 *Incentives*

Incentives are used to overcome financial hurdles standing in the way of adoption of suitable chargers that meet customer needs. Incentives are also used to encourage collaboration by market actors (midstream incentive) as well as customers (grid service participation). The Residential EV Charging pilot program is comprised an installation incentive, a grid performance incentive, and a midstream incentive as detailed in the following sections.

2.3.1.3.1 Installation Incentive

The installation incentive is aimed at lowering the total costs involved in installing a qualifying connected EV home charger and is tiered depending on the participating customer's income level. Customers are eligible to receive an installation incentive of up to **$500** towards the installation of a qualified EV charger installed at the customer's home. Income-eligible customers are eligible to receive an installation incentive of up to **$1,000** toward the installation of a qualified EV charger installed at the customer's premise.

PGE explicitly reserves the right to adjust the installation incentive level during the pilot program period. In the event of such an adjustment, PGE would request this change from the OPUC through a tariff advice filing. The pilot

program design assumes that there will be an ability to reduce the incentive levels in future periods, if necessary, depending on the pilot program uptake and whether it is necessary to prevent any gaming of the incentive structure.

2.3.1.3.2 Grid Performance Incentive

PGE will utilize the grid performance incentive to keep the charger or vehicle connected to PGE's DRMS, participating in DR events and such possible future activities as daily load shifting and/or load following events providing auxiliary services. It will be paid annually to qualifying participating customers. The customer will be paid $50 per year for their successful participation over a 12-month period. Successful participation will be defined in a tariff as a combination of maintaining connectivity and participating in several events called over a pilot program year.

Grid services aims to primarily control the EV charger and leave open the opportunity to utilize EV batteries as well. The grid performance incentive is subject to change depending on the pilot program uptake and with the goal of encouraging participation in this component during the pilot program period.

PGE reserves the right to pay promotional incentives (estimated between $25 to $50) to customers towards the re-connection of chargers to communication devices (e.g. Wi-Fi) should an EV charger become unavailable for participation due to connectivity issues during the pilot program period.

By accepting the installation incentive, the customer will automatically agree to enroll into grid services as well. Those customers that have an existing qualifying EV charger installed at their premises but missed the installation incentive may enroll into grid services separately.

Note that customers with an existing installation of a qualified charger are *not* eligible to receive an installation incentive if the application for such an incentive is submitted 90-days or later after the equipment is purchased (for self-installs) and/or 90-days after the installation by a qualified trade ally has occurred (for trade ally installs).

2.3.1.3.3 Enrollment Incentive for Existing Charger Installations

Customers with existing qualifying chargers that have not received an installation incentive and are no longer eligible for one, but exhibit verified charging activity, are eligible for a grid service enrollment incentive between $25 to $50. Customers moving into premises with existing qualifying charger and verified charging activity, are eligible for a grid service enrollment incentive between $25 to $50.

Customers whose Wi-Fi connection between charger and the EVSP cloud has been disconnected for a prolonged period may become temporarily eligible for a promotional grid service enrollment incentive between $25 to $50. The reason for this eligibility is that the pilot program requires a sufficient number of chargers to participate in grid services to allow for the operation and evaluation of this pilot program component.

2.3.1.3.4 Midstream Incentives

PGE will utilize a midstream incentive to engage EV dealers and drive new EV buyers' adoption of the pilot program. PGE intends to pay midstream incentives to sales staff at auto-dealerships for customer referrals going directly to the trade ally network for the installation of qualifying EV chargers. These incentives are an established practice in the appliance industry to reward positive behavior and to provide guidance towards good customer

solutions. PGE intends to offer a midstream incentive of $100 per successfully installed qualifying charger for the duration of the pilot program. The incentive is intended to encourage cooperation by EV dealers, which should in turn increase customer uptake for qualifying chargers and enrollment into the pilot program.

Depending on the market response, PGE may change the midstream incentive. Other market actors such as EVSPs or electricians may also provide midstream incentives to EV dealers to strengthen the delivery channel.

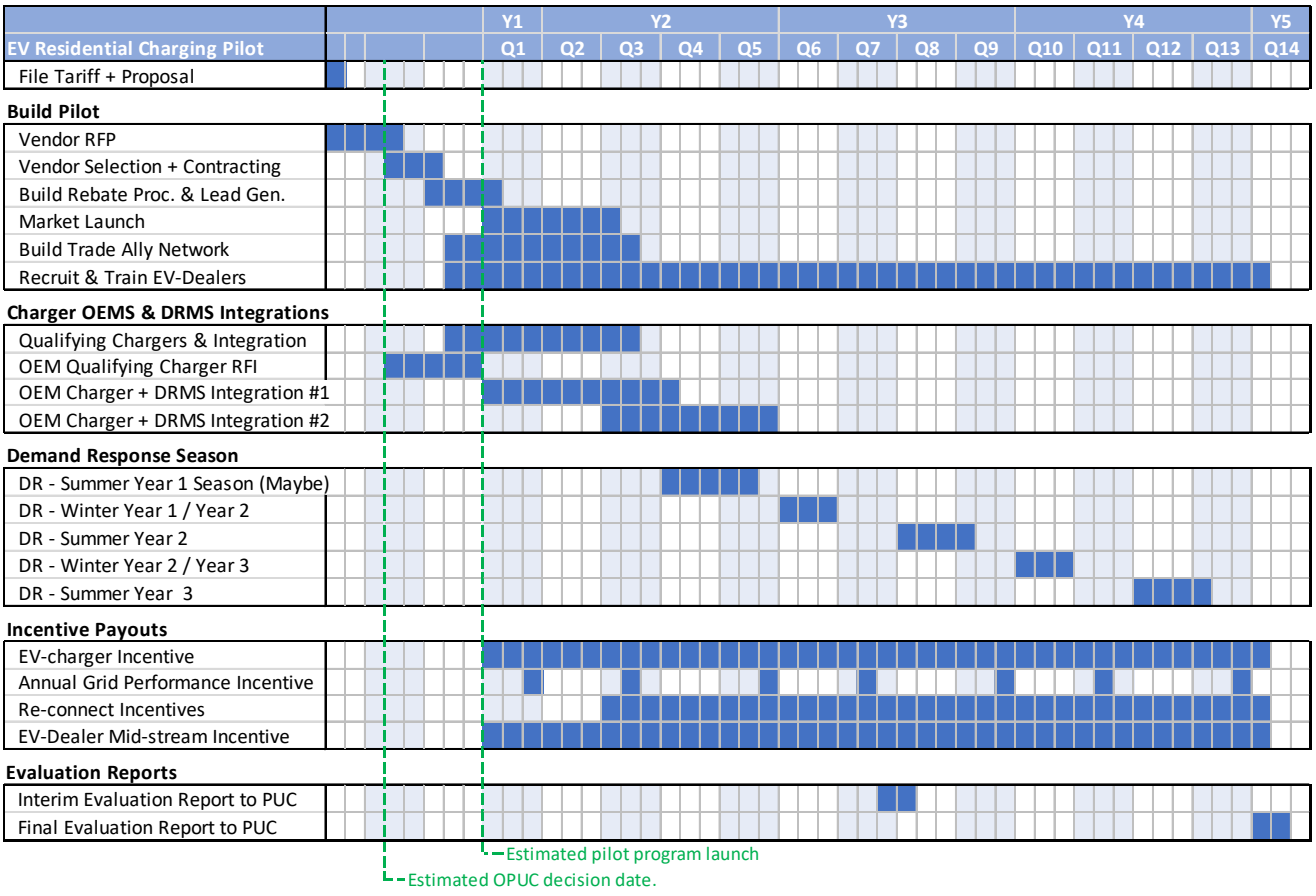
2.3.1.3.5 Cooperative / Collaborative Outreach Funds

PGE intends to make limited cooperative outreach funds available to third parties that are actively promoting EVs/ EV chargers or related products and services in the market place. The pilot program will use these cooperative efforts to create awareness and leads to support the installation of qualifying chargers as well as enrollments into the grid services. Similar tools have been used in EE outreach to support marketplace efforts. The goal is to bring customers into the pilot program at a lower cost per participant.

2.3.2 Pilot Program Management and Outreach

Table 5 below provides a draft timeline for the planning and implementation of the Residential EV Charging pilot program.

Table 5 Illustrative Pilot Program Schedule (Residential EV Charging)



There are several key takeaways regarding this schedule:

- The timeline between regulatory filing, building of the pilot program, and launch date is abbreviated. Any delay will push back the relative launch date of the pilot program;

- PGE intends to issue a request for proposal for an implementation contractor to deliver the pilot program in the field. The scope is going to center around EV dealer, EVSP, and trade ally-engagement to deliver the solution to PGE customers. In addition, the vendor will generate leads for new EV charger installations, a rebate processing system, and data services to adequately enroll and manage participating customers on an ongoing basis;

- The integration of chargers into a DRMS involves the active collaboration of EVSPs, DRMS vendor, and PGE Staff. PGE expects these integrations to take 10 months as chargers are new assets that the DRMS will need to learn to control;

- While grid services can be delivered year-round, PGE intends to specifically evaluate the DR benefit of chargers during the summer and winter seasons. PGE can only test EV chargers if the charger assets are integrated into the DRMS. PGE plans to have four seasons (two winter and two summer seasons) to establish grid services protocols and deploy chargers during DR events. PGE may run a summer season during Year 1, but this cannot be guaranteed; and

- PGE expects to provide the OPUC an interim evaluation report in Q7/8 and a final evaluation report in Q14.

2.3.2.1 *Grid Services and Demand Response*

This section provides a broad overview of the mechanics of grid services and DR. PGE intends to file an operational tariff to provide further details at a later date. PGE will integrate select EVSP's cloud services into its DRMS. The grid services component will then be available 24/7 all year.

The EV chargers will be used for DR events throughout the year. The evaluation seasons will encompass the summer season (June-September) and winter seasons (December-February). The specific use cases and DR protocols will need to be established as the pilot program rolls out. Upon completion of communications and controllability for DR events, the pilot program will aim to identify and deliver solutions for daily load shifting. PGE will implement the EVSP-to-DRMS integrations with this aspect in mind. This aspect cannot be guaranteed to become operational during the initial pilot program period and is not the primary purpose of that period. Load following is the most complex dispatch scenario and requires a very solid communication and control protocol. This aspect is the least likely to occur during the pilot program period due to the time and resource constraints.

2.3.2.2 *Outreach and Recruitment*

PGE will apply a variety of in-house and outside resources to facilitate customer uptake of installed qualified chargers and participation in grid services. The primary outreach targets are customers that are either actively buying a car and considering an EV, or customers that already own and drive an EV but may not have access to fast and convenient charging today.

The value proposition to drive customer recruitment is twofold. One centers around the purchase and installation of a qualified EV charger. The second focuses on the participation in grid services.

The Residential EV Charging pilot program plan is to employ the following outreach methods, amongst others:

- **Collaborative outreach with EVSPs and EV dealers.** PGE will work collaboratively with EVSPs and EV dealers to promote the Residential EV Charging pilot program, the purchase and installation of qualifying equipment as well as enrollment of existing qualifying equipment into the pilot program;

- **Residential EV Charging pilot program website and lead generator.** PGE will create an online place that educates, informs, and coordinates customers in need of EV home charging infrastructure by bringing customers, EV dealers, EVSPs, and PGE into one online location that allows customers to easily navigate the space and to take advantage of rebates. The website will be promoted via search engine optimization, online advertising, inbound EVSP links, and other tactics;

- **Targeted direct mail and email.** PGE will reach out to existing EV drivers in PGE's service territory to inform them about the Residential EV Charging pilot program;

- **Search engine optimization and advertising.** PGE will create visibility and exposure to the Residential EV Charging pilot program in the online and physical space;

- **Outreach staff.** PGE will use outreach personnel to engage, inform, and sign up EV dealers and trade allies into the pilot program;

- **EV dealerships.** PGE will establish a presence in EV dealerships for customers to learn about the Residential EV Charging pilot program rebates and how to participate easily, whether by facilitated installation service or via the bring-your-own charger pathway; and

- **PGE bill inserts, newsletters, etc.** PGE will create general awareness for the pilot program via its regular outreach channels targeting customers that are likely to either currently own or purchase an EV in the future.

2.3.2.3 Redesign of Sales Channels to Ease EV Charger Installation

The Residential EV Charger pilot program will work collaboratively with EV dealers to use the car-buying experience to extend the opportunity to deliver a seamless experience for the customer to take care of the customer's home charging needs.

Upon obtaining customer permission, dealers will be encouraged to transfer customer leads (new EV buyers) onto PGE's trade ally network. These leads and follow through will be monitored for performance by PGE and the implementation contractor. The qualified trade ally, an electrician, will promptly reach out to the new EV owner to discuss the proper charging equipment, installation costs, and to proceed with the actual installation within a short sequence. The intent is to implement a process that minimizes the time delay between the customer's purchase of an EV, the trade ally consultation, and the actual EV charger installation.

The trade ally network will take advantage of EV dealer generated leads, but also receive leads from the PGE Residential EV Charging pilot program website. The website will educate and inform customers about the Residential EV Charging pilot program, qualified products, applicable PGE incentives, where to buy the product, and trained contractors to install the proper equipment.

2.4 Cost Effectiveness

As detailed in Appendix C, for program cost-effectiveness PGE is utilizing the Transportation Electrification Assessment Methodology (TEAM), which is a modified Ratepayer Impact Measure (RIM) test. TEAM includes monetizable environmental and societal benefits from decarbonization, including revenue from the Oregon Department of Environmental Quality (ODEQ) Clean Fuels Program (CFP) as well as potential future decarbonization benefits. The first component of the Residential EV Charging pilot program is the home charger installation rebate, which increases electricity consumption (and consequently the need for electricity infrastructure). The second component is grid services, which shifts energy consumption (and consequentially reduces the need for electricity infrastructure).

Table 6 Cost/Benefit Categories (Residential EV Charging)

	Cost/ Benefit Category	Rate Impact Measure Test RIM
1	Administrative Costs	COST
2	Avoided Costs of Supplying Electricity (DR Only)	BENEFIT
3	Bill Increases	
4	Bill Reductions	
5	Capital Costs to Utility	COST
6	Capital Costs to Participant	
7	Environmental Benefits	
8	Incentives Paid	COST
9	Increased Supply Costs	COST
10	Market Benefits	
11	Market Participation Revenue	BENEFIT
12	Non-energy/monetary benefits	
13	Revenue gain from increased sales	BENEFIT
14	Revenue loss from reduced sales	COST
15	Tax Credits	
16	Transaction Costs to Participant	
17	Value of Service Lost	

As per Table 6 above, new TE program include various benefits and costs.

Benefits include increased utility revenue from new electricity sales that cover the incremental supply costs (home charging stations only); increased utility revenues from market participation (including Clean Fuels Credit revenue, if applicable); and EV programs designed with DR components will provide the benefit of avoided supply costs (capacity and energy).

Costs of new TE programs include incremental supply costs (capacity and energy); pilot program administrative costs; participant incentives (rebates); and capital costs for the utility (where necessary, transformer upgrades to support pilot program implementation).

2.4.1 Recommended Plan Description and Key Assumptions

Table 7 shows the projected market size for EV Chargers, as well as the Residential EV Charging pilot program goals. The pilot program aims to provide rebates for L2 EV chargers to over 3,600 residential customers in approximately a three-year period. PGE assumes that 10% of the charger rebate participants will be income-eligible customers. PGE assumes that 80% of charger rebate participants will also choose to enroll in the grid services that PGE plans in conjunction with the charger rebate pilot program. The pilot program assumes 5% attrition per year. Each charger installed is assumed to have a useful life of 10 years.

Table 7 Projected Market Size for EV Chargers and Pilot Program Participation Goals (Residential EV Charging)

PARTICIPANT SUMMARY	Year 1	Year 2	Year 3	Year 4	Total
Forecast of Qualifying Rebate Participants					
Electric Vehicles	1,937	3,537	4,296	5,461	15,230
Qualifying Charging Stations	678	1,362	1,804	2,485	6,329
Rebate Participants	99	681	1,191	1,640	3,611
Rebate Participants					
Income-Eligible	10	68	119	164	361
Standard	89	613	1,072	1,476	3,250
Total Rebate Participants	**99**	**681**	**1,191**	**1,640**	**3,611**
Demand Response Participants					
Income-Eligible	8	54	95	131	289
Regular	72	490	857	1,181	2,600
Total DR Participants	**80**	**545**	**953**	**1,312**	**2,889**

2.4.1.1 *Administrative Costs*

Table 8 shows estimated administration costs for the Residential EV Charging pilot program. To reach the goal of incentivizing over 3,600 residential chargers, the pilot program must incur necessary up-front costs. The EV rebate pilot program will have costs for outreach and education, digital automation, rebate platform infrastructure, dealer outreach, dealer referral, project management, as well as measurement and verification. The DR pilot program will have costs for DRMS licensing, DRMS connectivity, and evaluation. These costs average $0.9 million per year for the first four years of the pilot program, with Year 5 comprising solely evaluation.

Table 8 Estimated Administrative Costs for the Pilot Program Period (Residential EV Charging)

ADMINISTRATIVE COSTS -- YEARS 1-5						
$000S	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Grid Services	**174**	**328**	**322**	**320**	**182**	**1,327**
EV	**519**	**527**	**594**	**636**	**55**	**2,331**
TOTAL	**693**	**855**	**916**	**956**	**238**	**3,658**

2.4.1.2 *Incentives Paid*

As detailed in Table 9 below, PGE will provide a $500 rebate to customers and $1,000 to income-eligible customers. Based on our costs of a Wi-Fi-enabled seven kW L2 charger, the standard rebates will cover more than one quarter of the total cost of a typical L2 charger equipment and installation. For income-eligible customers, the rebate represents over half of the forecasted equipment and installation costs:

Table 9 Estimated Average Cost to Install a Qualifying EV Charger (Residential EV Charging)

Charger Costs and Rebates	$/unit	%
Charger Costs		
Equipment Cost	700	38%
Installation Cost	500	27%
Drywall Repair	400	22%
Electric Panel Replacement	240	13%
Upfront Administrative Costs	-	0%
Total Charger Costs	**1,840**	**100%**
Low Income Rebate	1,000	54%
Regular Rebate	500	27%

For the grid services (DR) pilot program, PGE will pay participants an annual incentive to keep their charger connected to PGE's network and available to provide grid services.

2.4.1.3 *Capital Cost to Utility*

All rebates are assumed to be expensed, however transformer upgrades (when necessary) will be capitalized. A preliminary planning estimate is that 3.5% of the total participants will require a transformer replacement over the duration of the pilot program. PGE estimates an average cost of $3,315 to upgrade a 50kVa transformer to a 75kVA transformer.

2.4.1.4 *Increased Supply Costs*

As this pilot program increases PGE's load, the incremental cost of energy and capacity are two of the key pilot program costs. Incremental energy costs are based on the long-term power costs (1H18 Aurora forecast). Average hourly prices are matched with load shapes that correspond with Schedule 7 [40].

The cost of capacity is based on the real levelized cost of the simple cycle capacity resource in Schedule 201 Avoided Cost. The cost of $128.96 per kW per year ($2,020) is applied to the expected kW load of the L2 charger. Based on the 2018 Navigant EV study used in the 2019 IRP, the average incremental coincident load resulting from the addition of an L2 charger is 3.2 kW.

[40] Includes both TOU and volumetric block rate of Schedule 7. An update to the TOU rate was as PGE Advice No. 19-03 with an effective date of May 1, 2019.

2.4.1.5 *Revenue from Increased Sales*

The principal benefit of the EV Charger Rebate pilot program is increased utility revenue from new electricity sales. PGE is estimating 3,724 kWh per year usage for residential customers, which is based on an estimate in the 2018 Navigant study that assumes 11,370 miles per year at an electric efficiency of 0.3275 kWh per mile. Based on 3,724 kWh per year, the effective load factor for a seven kW L2 charger is 6.1%. Revenue is then computed by applying the kWh of load to the energy portion of the tariff in the given hour.

2.4.1.6 *Market Participation Revenue*

The proposed pilot program assumes no revenues from Clean Fuels Credits as credits for residential customers are already assigned to PGE.

2.4.2 Cost Effectiveness Results

2.4.2.1 *EV Charger Rebate Results*

Table 10 shows the benefit / cost summary based solely on electrification. The rebate component of the EV Charger Rebate pilot program has a benefit/cost ratio of 0.61. These results do not reflect the impact of grid services (i.e. DR). The project is challenged by a relatively low load factor (i.e. 6.1%) which generates just enough revenue to cover the cost of energy and capacity.

Table 10 Benefit/Cost Summary Based Solely on Electrification (Residential EV Charging)

RIM SUMMARY - NPV ($000S)	EV	%
Market Participation Revenue	-	0%
Avoided Cost of Supply	-	0%
Revenue Gain from Increased Sales	6,697	100%
Benefits	**6,697**	**100%**
Administrative Costs	2,226	20%
Capital Costs to Utility	497	5%
Incentives Paid	1,590	15%
Increased Supply Costs	6,639	61%
Costs	**10,953**	**100%**
Benefit/Cost Ratio	**0.61**	

Key Measures		EV
Participants		3,611
Total Rebates		1,986
AVG Energy Used/Avoided	kWh	6,747
AVG Capacity Used/Avoided	kW	5,798

Supply costs makes up over 60% of the total costs. Administrative costs make up almost 20% of total. The remainder of costs are comprised of incentives and transformer upgrades.

2.4.2.2 *Grid Services (Demand Response) Results*

Table 11 shows the benefit / cost summary solely based on grid services. The grid services component of the Residential EV Charging pilot program has a benefit/cost ratio of 1.16. In this analysis the only grid service included is DR. The main benefit in DR is the avoided cost of capacity due to the temporary reduction in customer demand when an event is called. We assume DR events contribute no reduction in energy consumed. For the purposes of this analysis we did not include any value for any ancillary services benefits, though such use cases may be demonstrated through the pilot program.

Table 11 Benefit/Cost Summary Solely Based on Grid Services (Residential EV Charging)

RIM SUMMARY - NPV ($000S)	DR	%
Market Participation Revenue	-	0%
Avoided Cost of Supply	2,724	100%
Revenue Gain from Increased Sales	-	0%
Benefits	**2,724**	**100%**
Administrative Costs	1,951	83%
Capital Costs to Utility	-	0%
Incentives Paid	402	17%
Increased Supply Costs	-	0%
Costs	**2,353**	**100%**
Benefit/Cost Ratio	**1.16**	

Key Measures		EV
Participants		2,889
Total Rebates		-
AVG Energy Used/Avoided	kWh	-
AVG Capacity Used/Avoided	kW	2,267

When a DR event is called, the reduction in customer load is measured against an historical baseline. As PGE has no existing EV DR pilot program, we are relying on the 2018 Navigant EV study for the value of demand reduction. Navigant estimated a 1.5 kW average coincident demand during the hours of 3:00 to 8:00 PM based on L2 home charging profiles. Navigant estimated a 1.5 kW average coincident demand during the hours of 3:00 to 8:00 PM based on L2 home charging profiles. Given the high uncertainty with the demand reduction value, the pilot program aims at establishing the DR protocols and evaluating the real DR demand reduction in pilot program participants. EV chargers are always connected by Wi-Fi to the network, and so we assume an availability factor of 85%.

Administrative costs for grid services are relatively low compared to those for rebates. Administrative costs include evaluation as well as DRMS connectivity costs and licensing fees. Incentive costs are also relatively low

compared to the charger installation rebate portion of the pilot program. The NPV of incentives is $402K, or $139 per participant.

2.4.2.3 *Total Pilot Program Results – EV Charging Rebate and Grid Services*

Table 12 shows the benefits and costs of the total pilot program which includes charger installation rebate and grid services rebate (effectively this is a combined look at Table 10 and Table 11, above). The combined benefit/cost ratio (rebate + grid services components) of the Residential EV Charging pilot program is 0.71.

Table 12 Blended Cost/Benefit Ratio Based on Combined Pilot Program Components (Residential EV Charging)

RIM SUMMARY - NPV ($000S)	EV	DR	Total	%
Market Participation Revenue	-	-	-	0%
Avoided Cost of Supply	-	2,724	2,724	29%
Revenue Gain from Increased Sales	6,697	-	6,697	71%
Benefits	**6,697**	**2,724**	**9,421**	**100%**
Administrative Costs	2,226	1,951	4,177	31%
Capital Costs to Utility	497	-	497	4%
Incentives Paid	1,590	402	1,993	15%
Increased Supply Costs	6,639	-	6,639	50%
Costs	**10,953**	**2,353**	**13,306**	**100%**
Benefit/Cost Ratio	**0.61**	**1.16**	**0.71**	

The pilot program is designed to be in the field for approximately three years. Each charger is assumed to have a life of 10 years. The total pilot program period stops 10 years after the last charger has been installed. While the initial number of participating chargers is increasing during the installation period (three years) the number of chargers participating in the pilot program is assumed to drop over time. Participation levels drop due to customers moving-in and moving-out out, the charger losing its Wi-Fi connectivity, and other reasons.

Table 13 shows the energy use, benefits, and cost overview of the Residential EV Charging pilot program.

Table 13 Energy Use, Benefits, and Cost Overview (Residential EV Charging)

PROJECT SUMMARY	NPV	Total Nominal														
	$000s	$000s	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Units																
Energy Usage	MWh		176	1,547	4,781	9,548	11,971	11,373	10,804	10,264	9,751	9,152	7,825	5,347	1,924	0
Capacity Usage	kW		151	1,330	4,108	8,205	10,288	9,773	9,285	8,820	8,379	7,865	6,724	4,595	1,654	0
EV Participant Balance	#		94	737	1,831	3,297	3,132	2,976	2,827	2,686	2,551	2,364	1,838	1,034	0	0
Benefits																
Market Participation Revenue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avoided Costs of Supplying Electricity	2,724	4,587	7	62	197	402	519	510	502	494	487	474	426	318	157	31
Revenue Gain from Increased Sales	6,697	11,112	18	163	514	1,048	1,341	1,299	1,260	1,221	1,183	1,133	989	689	253	0
TOTAL BENEFITS	**9,421**	**15,699**	**25**	**225**	**711**	**1,450**	**1,860**	**1,810**	**1,762**	**1,715**	**1,670**	**1,608**	**1,415**	**1,007**	**410**	**31**
Costs																
Administrative Costs -- EV	2,226	2,894	519	527	594	636	55	57	58	59	61	62	64	66	67	69
Administrative Costs -- Grid Services	1,951	3,047	174	328	322	320	182	186	189	192	196	199	198	192	184	184
Capital Costs to Utility	497	998	2	12	31	57	56	55	54	53	52	51	50	49	48	428
Incentives -- EV	1,590	1,986	55	375	655	902	-	-	-	-	-	-	-	-	-	-
Incentives -- Grid Services	402	641	2	18	56	115	60	59	58	57	56	54	49	36	18	4
Increased Supply Costs	6,639	11,073	18	155	491	997	1,311	1,283	1,243	1,220	1,196	1,150	1,024	719	267	0
Total Costs	**13,306**	**20,639**	**769**	**1,415**	**2,149**	**3,027**	**1,664**	**1,639**	**1,601**	**1,582**	**1,561**	**1,518**	**1,384**	**1,063**	**583**	**684**
Net Costs	**3,885**	**4,939**	**- 744**	**1,190**	**1,438**	**1,576**	**(196)**	**(171)**	**(160)**	**(133)**	**(109)**	**(90)**	**(30)**	**55**	**174**	**653**

2.5 Pilot Program Evaluation

2.5.1 Summary

The purpose of evaluation is to measure the effectiveness of the pilot program in meeting its objectives, areas for continuous improvements, and energy impacts on PGE's system. The following are some of the high-level learning objectives:

- Track customer participation and satisfaction levels with pilot program offerings (rebates, dealership assistance, and referrals);
- Understand the level of PGE's influence in customers' decisions to procure an EV and install charging;
- Document charging installation successes and challenges;
- Measure customer load impacts on PGE's system; and
- Identify pilot program implementation successes and challenges, and improvement opportunities. [41]

2.5.2 Evaluation Methods

PGE and its evaluation vendor will develop and implement a comprehensive evaluation plan that details the analysis methods to be used, including sampling and timing that are best suited to evaluate the pilot program. Following are brief descriptions of the anticipated evaluation methods.

2.5.2.1 *Process Evaluation*

Process evaluation of the pilot program will identify pilot program design and implementation success and problem areas. Process evaluation findings can provide periodic feedback to help the pilot program make continuous improvements. Expected process evaluation activities include:

[41] The program may also measure DR event energy impacts; to be determined later.

- Logic Model – Early in the pilot program evaluation, PGE and its evaluation vendor will review and update the logic model and pilot program objectives included with this application and adjust the evaluation activities as needed. The logic model will help organize all the evaluation activities and identify any gaps in the pilot program design where goals are not achieved.

- Data analytics – The evaluation will track and report pilot program participation levels by rebate type, charger type, acquisition source (partner dealer, bring-your-own-charger) and include demographic analysis to determine which types of customers are and are not participating.

- Pilot program staff interviews – PGE's evaluator will conduct annual in-depth interviews with PGE pilot program staff on a wide range of pilot program topics. The initial interviews will focus on the launched pilot program design, customer targeting and outreach activities, pilot program implementation and staff coordination. Subsequent interviews will focus on implementation successes and challenges, pilot program design or delivery changes enacted and anticipated, and lessons learned.

- Participant surveys – These brief surveys will inquire about pilot program awareness sources, auto dealership assistance, satisfaction with the installation process, prior charging used, experience using the new chargers, TOU rate participation, ease of pilot program participation, and other topics.

- Dealership interviews – These interviews will inquire about the effectiveness of PGE training and outreach, Electric Vehicle Service Equipment (EVSE) sales trends and remaining barriers, the value of PGE financial incentives, customer feedback and other topics.

- Electrician trade ally interviews – These interviews will cover satisfaction with PGE's training, successes and challenges installing EVSE, impacts on their businesses, and ease of pilot program participation.

- Attribution analysis – The surveys and interviews will include a series of questions to help gauge the level of PGE's influence on decisions to supply, purchase, or service EVSEs. These types of "self-report" questions cannot conclusively measure the value of PGE's pilot program to customers but can provide feedback to help shape the pilot program design.

2.5.2.2 *Impacts Evaluation*

PGE's evaluation vendor will analyze participating customer meter data to measure customer load impacts from new EVSEs, impacts to PGE's system, and the value of DR from the EVSE. Seasonal analyses will develop customer load shapes showing residential/system peak overlaps and peak to off-peak ratios.

2.5.3 Reporting

PGE expects to submit findings in an interim report to the OPUC after the winter season spanning 2020 and a final report to the OPUC in the spring of 2023.

2.6 Case for Residential Charging

There is a clear need to increase the affordability and simplicity for customers to install connected home charging stations. By offering customers a rebate and a supporting ecosystem (dealers and trade allies), the pilot program will help accelerate EV adoption and will establish a flexible resource that will help efficiently operate PGE's system.

The proposed residential charging pilot program delivers on the criteria which the Oregon Legislature directed the Commission to consider when evaluating TE programs:[42]

- **The criteria that the program be in the utility's service territory** is addressed by the fact that the chargers will be installed in homes in PGE's service territory;
- **The criteria that the program be prudent** is ultimately at the discretion of the OPUC; however, PGE will work to ensure that all pilot program expenditures are reasonable and designed to maximize both benefits for customers and learnings from this pilot;
- **The criteria that the program is expected to be used and useful** is addressed by the fact that almost all customers with an EV are using the opportunity to charge at home. This pilot program will help lower the charging time for customers with EVs and alleviate some of their range anxiety. Further, PGE will use the assets to explore the value and operation of grid services;
- **The criteria that the program is expected to improve grid efficiency and operational flexibility (including renewable integration)** is addressed by the fact that PGE will work to enable new chargers to provide grid services such as DR, load shifting, and load following. These tools will support the integration of renewables on the grid; and
- **The criteria that the program is expected to stimulate innovation, competition, and customer choice** is addressed by the fact that the pilot program will facilitate and accelerate the adoption of EV chargers-and indirectly EVs-in PGE's service territory. It will support the market place and customer uptake for EV chargers.

[42] 78th Oregon Legislative Assembly, 2016 Regular Session. *Oregon Laws 2016*.

Section 3 Business Charging

3.1 Summary

PGE proposes offering a Business EV Charging pilot program to make it easier for business customers to deploy charging infrastructure while assembling a portfolio of DERs that will be able to create future system value:

- For business charging at workplaces, multifamily, multitenant, destination centers (e.g. big-box retail), and fleets, PGE proposes to install, own, and maintain the distribution and make ready infrastructure, as well as provide rebates for the customer-owned charging equipment. Make ready projects will be cost-capped based on the number of charging ports deployed, and a $575 rebate will be provided for each L2 port installed ($2,300 for qualifying income-eligible multifamily facilities).

- For public transit agencies electrifying their fleets, we propose to install, own, operate, and maintain the distribution infrastructure, the make ready infrastructure, and the EV charging equipment. Each project will be evaluated for cost-effectiveness, requiring participant payments to limit ratepayer impact.

By removing cost and complication from the process of deploying charging infrastructure, we aim to add approximately 600 EV charging ports at 90 charging sites in just over three years. Each participating charger will provide operational data to PGE and be enabled to participate in DR via PGE's Energy Partner program.

PGE aims to limit pilot program cost by requiring that customers sign over environmental credits (i.e. Clean Fuels Credits) to PGE which will be used to buy down pilot program costs. PGE estimates the pilot program NPV net benefit of $1.5M[43] with a cost-effectiveness result of 1.06.

3.2 Market Information

Business charging infrastructure necessarily impacts more than just business customers. Residential drivers often rely on charging stations at work, destination centers, or multifamily properties. As such, we must evaluate market challenges across multiple segments to ensure we address a variety of customers' needs.

3.2.1 Residential Customer Needs and Wants

PGE research into customer attitudes about EVs indicates that increased public charging options are desired by those customers that intend to, but have not yet purchased, an EV or Plug-in Hybrid EV (PHEV):[44]

- When presented with a statement indicating that PGE should make owning EVs more convenient by installing and maintaining public charging stations, 92% agree with the statement.

- Among people intending to purchase an EV/PHEV, 75% are either somewhat or much more likely to purchase an EV if they have access to workplace chargers.

[43] Note that the $1.5M net benefit is reflected in cost effectiveness tables as a negative net cost of $1.5M.

[44] Likely vehicle purchasers who select 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?"

- Conversely, only 18% of those respondents, intending to purchase an EV, said that they have an electric service outlet available where they park their car at work.
- 38% of current EV owners use public charging stations once a month or more.
- Of those owners, over a third (37%) have difficulties finding public charging stations.

Also, note that there are PGE residential customers who do not have access to off-street parking. PGE research indicates that nearly 350,000 customers live in multi-family, mobile homes, or rental properties and many others do not have access to an off-street garage. A lack of multifamily charging limits access to EVs for vulnerable[45] populations. To consider an EV, these "home charging challenged" customers need to be able to charge at their workplace or other public locations. Widespread charging infrastructure is key to overcoming the purchase barriers many potential EV drivers face.[46]

3.2.2 Business Customer Needs & Wants

Through customer interviews, PGE found that business owners at multifamily and multitenant facilities, and destination centers are interested in providing EV charging as an amenity for their customers or tenants; workplaces use charging as an employee benefit; and all constituents can leverage charging to support sustainability initiatives.

In conversations with heavy-duty vehicle manufacturers and customers, fleet and transit operators are interested in electrifying their fleets to lower their operating costs, enjoy greater fuel cost stability, and to be more sustainable. The vehicle and charging decision is made simultaneously and, in the case of transit, fueling companies typically provide all fueling infrastructure (i.e. own, operate and maintain the fueling source). These businesses need a solution customized to meet their needs.

PGE research, through business customer satisfaction surveys, illustrates that one of the barriers facing businesses as they try to make their decisions regarding EVs is familiarity with the options they have available to them. Less than one half of PGE business customers (43%) are familiar with options for using EVs as part of their business' fleet while around one quarter (26%) are familiar with options for installing charging stations at their business location. This suggests that there is room to improve customer awareness around these options. One of the barriers encountered with customers PGE interviewed is a lack of experience with EV charging technology and EV infrastructure development.

3.2.3 EV Sales Outlook

PGE expects approximately 100,000 passenger vehicles in our service territory will use electricity as a transportation fuel by 2025 up from roughly 11,500 EVs today.[47] In addition, an anticipated 8,500 fleet EVs (7,500 light duty and 1,000 medium/heavy duty) are anticipated by 2025, which is up from approximately 1,500 today

[45] Referred to by the legislature and commission as "low income" in various sources including:
- 78th Oregon Legislative Assembly, 2016 Regular Session. Chapter 28, 2016 *Oregon Laws; and*
- Office of the Governor, State of Oregon. (2017). *Oregon Executive Order 17-21*.

[46] Nicholas, M., Hall, D., Lutsey, N. (2019 January 13) *Quantifying the EV Charging Infrastructure Gap Across US Markets*. International Council on Clean Transport. Retrieved from https://www.theicct.org/publications/charging-gap-US

[47] Navigant (2019). *DER Potential Study*.

(predominantly light duty electric fleet vehicles).[48] PGE expects that expanding public charging with this pilot program will help accelerate EV adoption as well as address the growing need for more public charging.

3.3 Pilot Program Overview

PGE proposes to simplify customers' deployments of charging infrastructure and reduce their associated costs by offering a pilot program to build all enabling electrical infrastructure for a customer to install a DR enabled EV charger, and for transit agencies, build the charging station as well. This will expand the network of public charging, accelerate the adoption of EVs (mass market and fleet), and creating a robust network of future grid resources.

The pilot program will also gather and leverage data on charging behavior to further flexible load initiatives and to facilitate participation in PGE's Energy Partner program. Conditions of charging pilot program participation will be that participants provide data on their charger usage and select DR enabled charging equipment from a qualified list of suppliers. Participation in DR events will be managed and funded by Energy Partner.

3.3.1 Participants

The pilot program will target the following participants under Cost of Service and Direct Access rate classes:

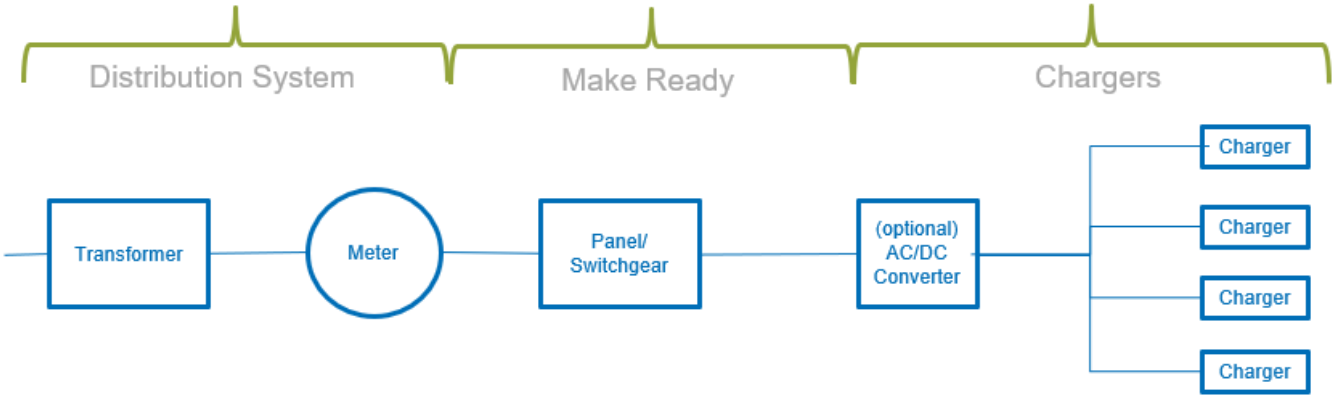
- Workplaces – Offices from 12 up to 500+ employees;
- Multifamily – Multiple separate housing units for residential inhabitants contained within one building or several buildings within one complex;
- Multitenant – Properties with multiple tenants, such as a large office building;
- Destination Centers – Facilities, such as retail, who want to provide charging for their clientele;
- Light, Medium and Heavy-Duty Fleets – Ranges from city inspection vehicles, transportation network companies, box trucks, long haul transportation; and
- Public Transit – City transit buses.

[48] Ibid.

3.3.2 Charging Site Enablement

As demonstrated in Figure 1 below, readying a site to install and operate charging equipment can be broken into three phases.

Figure 1 Site Topography (Business EV Charging)



Distribution System including line extension – utility-side of the meter infrastructure. Line extension includes distribution facility upgrades (utility side of the meter) to obtain additional capacity or a change in service conditions to serve new EV charging loads. This includes conduit, vaults, and pads. Excludes modifications to transmission or subtransmission voltage facilities or substations.

Make Ready – customer-side of the meter infrastructure up to the charger. Customer facility upgrades (customer-side of the meter) including conduit, wiring and panel/switchgear up to the charging station to "ready" a customer site for charging equipment installation.

Charger – Hardware that delivers power from the grid to the EV. This includes AC/DC converter when required for Direct Current Quick Charge (DCQC).

3.3.3 Structure & Incentives

PGE proposes two primary pilot program structures: one for workplace, multifamily, multitenant, destination centers, and fleets; and one for Transit agencies:

3.3.3.1 *Workplace, multifamily, multitenant, destination center, and fleet*

To offset the significant cost and effort a business owner considering installing EV charging faces, PGE will build, own, and maintain the distribution system upgrade/line extension and make ready infrastructure (all electrical infrastructure up to the charger). Through the pilot program, PGE will cover the full cost of the site build out, up to what is expected to be a sufficient funding level based on predetermined cost caps for this activity. The participant will select, install, own, and maintain the charging equipment from a list of pre-qualified vendors and PGE will help offset equipment cost with a rebate.

Rebate values are $575 per port for L2 chargers ($2,300 for income-eligible multifamily). This rebate value is intended to offset approximately 25% of the charger equipment cost for standard participants and 100% for

income-eligible multifamily participants. As a service to customers, PGE will offer an optional charger maintenance pilot program at a pass-through rate (i.e. the cost is comprised of the fees assessed by the third-party maintenance provider plus any associated fees for PGE oversight from a list of pre-qualified vendors).

3.3.3.2 *Public Transit*

For the public transit sector only, PGE would build, own, and maintain the entire charging ecosystem (distribution upgrades, make ready and the charger) to meet the unique needs of capital-constrained transit operators, who desire a third party to own and operate their fueling infrastructure (as is often the case with their current fueling ecosystem). Public transit refers to a public agency customer that operates buses or shuttles for public use in PGE's service territory. This pilot program creates an opportunity for PGE to partner with our customers (the transit agencies) to ensure that we select the best charging equipment to meet the transit agency's needs while limiting negative grid impact. This partnership will also enable us to educate our customers about key elements that impact their fuel cost (e.g. TOU rates, demand charges, load management).

This pilot program is custom, meaning that a transit participant will be billed a monthly equipment charge based on the total project costs and anticipated load. Higher equipment utilization (or lower project costs) yields a lower customer payment as PGE will be recovering more costs through charging revenues. For projects in which the project cost-effectiveness exceeds 0.9 the equipment charge will be zero. This will incentivize PGE and the customer to work together to ensure that charging infrastructure is sized correctly for the customer's use case. PGE will maintain the charger on behalf of the transit provider at a pass-through rate.

3.3.3.3 *Incentive Summary*

Table 14 details the incentives offered as part of the Business EV Charging pilot program:

Table 14 Pilot Program Incentives (Business EV Charging)

Commercial	Offer	Public Transit	Offer
Workplace, Multifamily, Multitenant, Destination Center, Fleet* - Level 2 (minimum 4 ports/site) - DCQC (excluded)	- PGE installs/owns/maintains line extension - PGE installs/owns/maintains make ready - Participant installs/owns charger Charger Rebate (L2): - $575/port - $2300/port (income-eligible multifamily) PGE offers optional charger maintenance at pass-through rate	Public Transit - DCQC (100 kW) - Potential Level 2	- PGE installs/owns/maintains line extension - PGE installs/owns/maintains make ready - PGE installs/owns/maintains charger Participant equipment cost is a function of total project cost and anticipated load PGE provides charger maintenance at pass-through rate

Note: Costs for line extension and make ready are capped. Participant pays 100% of charger maintenance (O&M).
*Non-exhaustive list of non-residential participants

The pilot program entails a site expenditure cost cap on a per-site basis for line extensions and make ready efforts as follows and retains the right to approve a site design to minimize costs and deliver a positive EV charging experience. If a customer chooses to exceed the allowable allowance, they must pay the amount in excess. Indicative pricing assumptions based on typical configurations are outlined in Table 15, below. Actual configurations will vary. If a site is configured outside of the iterations below (e.g. 5 X L2 ports), the site build-out

costs will be adjusted proportionally. PGE reserves the right to adjust site expenditure cost caps and rebate values throughout the duration of the pilot program as appropriate based on learnings.

Table 15 Site Cost Expenditure (Business EV Charging)

Maximum PGE Expenditures Per Charging Site *	Ports	Commercial Small 4XL2	Commercial Medium 8XL2	Commercial Large 10XL2	Public Transit 10XDCQC
New Service					
Line Extension	$/Site	40,200	41,000	42,000	157,400
Make Ready	$/Site	30,100	59,800	90,700	634,700
Charger	$/Site	N/A **	N/A **	N/A **	825,000
Total	$/Site	70,300	100,800	132,700	1,617,100
Existing Service					
Line Extension	$/Site	4,600	5,300	6,400	N/A***
Make Ready	$/Site	30,100	59,800	90,700	N/A***
Charger	$/Site	N/A **	N/A **	N/A **	N/A***
Total	$/Site	34,700	65,100	97,100	N/A***

** PGE reserves the right to determine site design and configuration including new or existing service*

*** Fixed charger rebate*

**** New service (entailing a new transformer among other components to enable sufficient capacity) is anticipated*

3.3.4 Qualified Product List

PGE will establish a qualified charging equipment product list before the official launch of the pilot program. The qualified product list will identify among other factors:

- EVSPs that are Open Charge Point Protocol (OCPP) compliant, supporting standard application protocol, or that have a sufficiently documented open application program interface (API) for communication between EV charging stations and a charging station network to meet requirements for data transfer and connection and control via a DRMS;
- EVSPs with a sufficient number of chargers installed and/or actively selling and installing a sufficient number of chargers in PGE's service territory;
- EVSPs open to educating customers about the PGE pilot program and driving awareness and enrollment;
- EVSPs that are either initiating their own outreach activities and/or collaborative outreach activities to sell, install, and enroll customers into the PGE pilot program; and
- EVSPs committed to investing resources to connect their vendor cloud to PGE's DRMS system.

Given the resources required to establish connectivity between the EVSE and a DRMS for subsequent participation in DR events via PGE's Energy Partner program, PGE seeks to be rigorous in qualifying products. Ensuring charging

equipment is OCPP compliant or has a sufficiently documented API for transmitting charger operational data, such as number of charging sessions, is also essential to meet the pilot program's goal of learning about charging behavior.

3.3.5 Ownership Structure

A synopsis of the ownership structure is listed in Table 16 below, which details the combinations of participant- and PGE-owned assets:

Table 16 Anticipated Asset Ownership (Business EV Charging)

Participant	Asset	Ownership
Commercial, Public Transit	Distribution Upgrades	PGE
Commercial, Public Transit	Make Ready	PGE
Commercial	Chargers	Participant
Public Transit	Chargers	PGE

3.3.6 Treatment of Clean Fuels Credits

PGE aims to limit pilot program costs to customers and maximize pilot program cost effectiveness by acquiring and monetizing self-generated Clean Fuels Credits[49] associated with energy used at EV charging sites funded by the pilot program. All participants will assign these credits to PGE as a requirement for participation; those credits will be monetized and applied towards the cost of the pilot program.

[49] Oregon Department of Energy. *Oregon Clean Fuels Program*. Retrieved from https://www.oregon.gov/deq/aq/programs/Pages/Clean-Fuels.aspx

3.3.7 Forecast

Table 17 shows the projected site and port forecasts for the Business EV Charging pilot program. Preliminary projections outlining the number of sites and number of ports are reflected below. Year 1 is envisaged as a ramp up period of one quarter of projected enrollments. Given the nascence of this market, it is challenging to predict the actual number of sites and the pace of enrollments and installations. As such, we anticipate there may be quite a bit of variability between our projections and the actual pace of these deployments.

Table 17 Projected Site and Port Forecast (Business EV Charging)

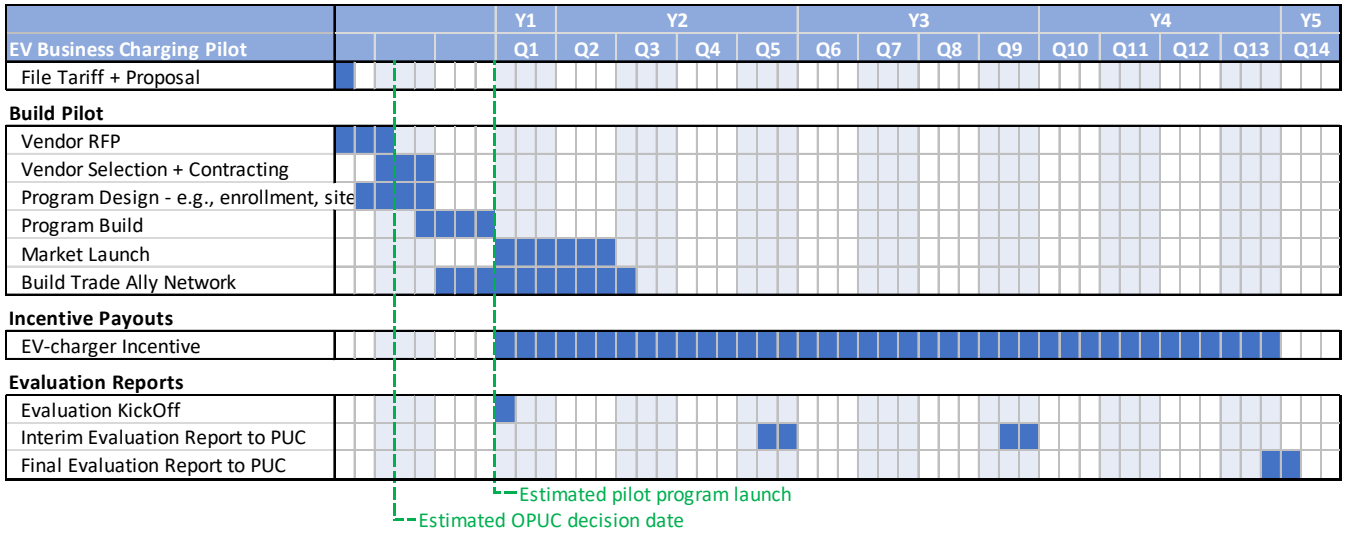
Sites	Year 1 (1 quarter)	Year 2	Year 3	Year 4	Total
Commercial	2	8	21	56	**87**
Public Transit	0	1	1	2	**4**
Total	2	9	22	58	91

Ports	Year 1 (1 quarter)	Year 2	Year 3	Year 4	Total
Level 2 (Commercial)	12	52	138	366	568
DCQC (Transit)	0	10	10	20	40
Total	12	62	148	386	608

3.3.8 Timeline

Table 18 outlines an illustrative project schedule, with Year 1 envisaged as including one quarter of projected enrollments.

Table 18 Illustrative Project Schedule (Business EV Charging)



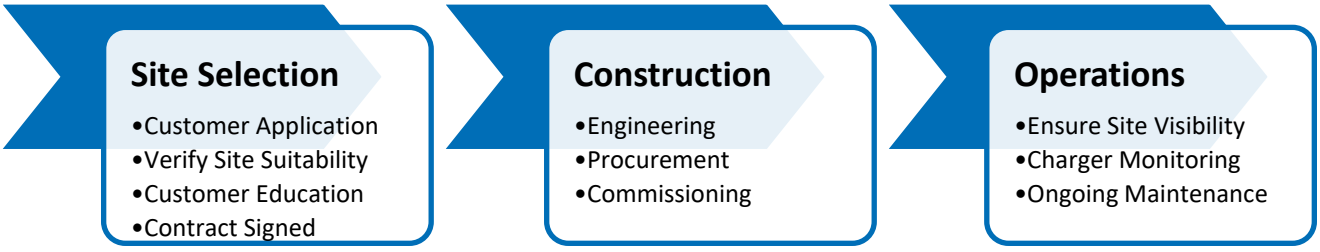
3.3.9 Site Selection and Operations

As shown in Figure 1, PGE proposes a process flow comprised of the following stages:

- Site Selection – When the customer applies for site consideration;

- Construction – When the site infrastructure is built out, chargers are installed and commissioned, and a driver can charge their vehicle; and
- Operations – When a site is 1) made visible to EV drivers (e.g. through charging apps or other as appropriate), 2) utilized to charge vehicles, and 3) maintained and operating in good standing.

Figure 2 Pilot Program Process Overview (Business EV Charging)



3.3.9.1 *Site Selection*

PGE provides educational information to drive awareness about EV use and, more specifically, the Business EV Charging pilot program, so potential applicants can see how EV charging might meet their needs, what PGE offers, what resources they might need to contribute and determine if they apply.

Customer applies for participation in the charging pilot program, providing information on their business composition to help gauge viability of the site as an EV charging location and to identify the appropriate charging equipment (L2 or DCQC). Information requested to evaluate site appropriateness may include, but is not limited to:

- Proposed site location to ensure it is within PGE service territory;
- Applicant creditworthiness;
- Confirmation applicant has legal right to allow charging equipment to be installed at a site (i.e. Owns the site or has permission from site owner);
- Number of EV drivers associated with a proposed site;
- Number of tenants (multifamily) considering purchasing an EV (income-eligible is exempt from this requirement);
- Anticipated load factor;
- Demonstrating ability to purchase, install and manage charging equipment;
- Geographic location;
- Typical dwell time (length of time EV drivers parked);
- Presence of onsite amenities accessible to drivers while charging; and

- Additional criteria used to select PGE Electric Avenue[50] charging sites may be leveraged.

PGE evaluates site suitability based on information supplied in the application and through customer consultation. PGE works with the applicant to address questions as to how EV charging can benefit their operations and ensure they understand key considerations with building and operating a charging site including: rate schedules (including TOU), demand charges, capital and operations and maintenance (O&M) commitments, charger data management, working with EVSPs on resale of electricity, maintenance options, and other as appropriate.

A customer site design typically includes: distribution upgrades/line extension, make ready and charger equipment and placement may be developed by PGE in collaboration with the applicant. PGE retains final decision-making authority on site design, to ensure an efficient expenditure of funds and positive charging experience for the EV driver. For transit agencies, PGE will complete a custom project cost effectiveness analysis including anticipated load and energy usage among other considerations. The analysis will inform how much a participant pays for the charging equipment. PGE works to ensure that no one customer within the Commercial group takes more than 20% of appropriated funding and, to maximize learnings, strives to ensure that at least two Public Transit customers are served.

3.3.9.2 *Construction*

Upon participant signature of a site agreement, site work commences. Site agreement may include but not be limited to:

- PGE's responsibility to install distribution upgrades, make ready and, if appropriate, to procure and maintain charging equipment, overall O&M plan, and budget.
- Participant's responsibility including approval for PGE to secure an easement providing site access, acknowledgment that PGE has final approval on charging site design including (distribution upgrades, make ready and charger style, number and placement), acknowledgement of cost caps on site build out in excess of which participant assumes cost, acknowledgement that pilot program funds are solely applicable to EV charging infrastructure as per site design, access to charger operational data, and assignment of Clean Fuels Credit to PGE to offset the Business EV Charging pilot program costs.

For the 10-year contract term, the participant commits to reimburse PGE's share of EV site costs on a pro-rata basis if 1) the participant does not fulfill obligations in the pre-construction period, or 2) the site permanently ceases charging activity post-construction prior to the end of the term, subject to negotiated terms as circumstances warrant. Participant obligations include but are not limited to installing chargers as agreed upon (number, style, and type) and keeping charging site maintained and operating in good standing for commercially reasonable standards so drivers can charge their vehicles. If a property with EV charging equipment supplied by the pilot program changes ownership, the new owner may assume the right to keep the charging equipment functional and the site agreement can be reassigned to the new owner (assuming they meet the program

[50] Electric Avenue is PGE's public, high-speed charging network consisting of four DCQC and one 2-port Level 2 charger. There is one Electric Avenue operational presently, and up to six more are anticipated by the end of 2019.

participation requirements). PGE site costs may include capital for line extensions and make ready infrastructure as well as rebates to cover charger costs. For Public Transit, capital expenses may also include charging equipment.

In the event the participant does not comply prior to charger installation and commissioning, they will pay PGE the total costs PGE expended specific to that EV charging site upon termination of site agreement. In the event the participant does not comply after the charging equipment is operational, the participant will reimburse PGE one-tenth of the total site costs for each remaining year in the 10-year contract (subject to negotiated terms as circumstances warrant). Site costs include all applicable rebates, distribution upgrades/line extensions, make ready and charger expenses.

Upon completion of charging equipment installation, a PGE representative visits the site and confirms it is commissioned and able to charge vehicles. At that point, the participant receives the rebate where applicable.

3.3.9.3 *Operations*

Participant will determine the charging pricing for their customers or employees (if applicable). PGE will work with the customer and participating charging service providers to ensure that the default pricing that a participant chooses to charge their users is built on a TOU rate. Though the customer can choose to change the rate, PGE will encourage the charging owner to pass those price signals onto the EV drivers.

Participant and PGE will collaborate to provide visibility to charger (e.g. inclusion in charger apps, signage). Participant will also provide PGE access to charging data in a prescribed format on an ongoing basis including but not limited to: charger usage by timeframe (e.g. hour, day of week), number and length of charging sessions. Participant will also consider participation in PGE's Energy Partner program.

3.3.10 Public Transit Considerations

Public Transit participants have a minimum contracted load requirement for which they will be billed monthly. In the event usage falls below the projected value, the participant must still pay for the agreed upon value monthly. Clean Fuels Credits, because of pilot program load, will also be agreed upon at the start of the contract. If a customer has not met their Clean Fuels Credit allocation at the end of each calendar year, there will be a true up and the customer must reimburse PGE if the quantity of Clean Fuels Credits is below that agreed upon threshold.

3.3.11 Direct Access Customer Considerations

The pilot program is open to both direct access and cost-of-service customers, but participation is not mandatory (i.e. a customer can install EV charging equipment independently from the pilot program). In the event a direct access customer chooses to participate in the pilot program, EV charging energy must be separately metered to track energy usage associated with charging, and the energy used to fuel the charger purchased on a cost-of-service basis. These requirements have been established to create a pathway towards attaining a net benefit for all of PGE's customers. As designed, one of the primary pilot program benefits associated with this pilot program is incremental revenues associated with the new charging loads (which may apply downward pressure on all customer rates). Because PGE's investment in this pilot program is borne by all PGE customers, new charging loads (associated with this pilot program) must be served on cost-of-service to ensure that they receive the pilot program benefits as well. As with all pilot program participants, PGE would cover the cost of installing that separate meter as part of the distribution system upgrade.

If a customer (direct access or cost-of-service) who installed the EV charging equipment as part of the pilot program subsequently chooses to purchase that energy on a direct access basis, the participant commits to reimburse PGE's share of EV site costs on a pro-rata basis (i.e. the participant will reimburse PGE one-tenth of the total site costs for each remaining year in the 10-year contract). Site costs incudes all applicable rebates, distribution upgrades/line extensions, make ready and charger expenses.

3.3.12 Outreach and Recruitment

The pilot program may employ the following methods, among others, for outreach and recruitment:

- **Outreach staff.** Leverage outreach personnel to engage, inform, and sign-up customers, engage municipalities and bring and trade allies into the pilot program.
- **Website.** Create an online forum that educates customers about the pilot program and generates leads by enabling them to request a follow-up conversation. The website will be promoted via search engine optimization, social media and online advertising, and email outreach as appropriate.
- **Direct mail and email.** Reach out to interested customers in PGE service territory to inform them about the pilot program and provide links to the website.
- **PGE newsletters, etc.** Create general awareness for the pilot program via its regular outreach channels targeting customers interested in a charging pilot program.
- **Events and trade shows.** Leverage EV driver events, targeted industry events and tradeshows to drive awareness of the pilot program.
- **Trade ally network.** Make EVSPs and electricians aware of the pilot program and provide support so they can direct potential customers to PGE regarding pilot program participation.
- **EV fleet and transit network.** Partner with EV fleet manufacturers and dealers to bring attention to the pilot program during the sales process of EV fleets.

3.4 Cost Effectiveness

As discussed in Appendix C, PGE is utilizing the TEAM, which is a modified RIM test. TEAM includes monetizable environmental and societal benefits from decarbonization, including revenue from the ODEQ CFP as well as potential future decarbonization benefits. As this pilot increases electricity consumption, it also increases the need for electricity infrastructure (rather than avoiding it as in DR). The cost effectiveness framework focuses on the incremental impact of the EV charging sites incentivized by the Business EV Charging pilot program.

Table 19 Rate Impact Measure Test (Business EV Charging)

	Cost/ Benefit Category	Rate Impact Measure Test RIM
1	Administrative Costs	COST
2	Avoided Costs of Supplying Electricity (DR Only)	BENEFIT
3	Bill Increases	
4	Bill Reductions	
5	Capital Costs to Utility	COST
6	Capital Costs to Participant	
7	Environmental Benefits	
8	Incentives Paid	COST
9	Increased Supply Costs	COST
10	Market Benefits	
11	Market Participation Revenue	BENEFIT
12	Non-energy/monetary benefits	
13	Revenue gain from increased sales	BENEFIT
14	Revenue loss from reduced sales	COST
15	Tax Credits	
16	Transaction Costs to Participant	
17	Value of Service Lost	

As per Table 19 above, new TE programs include various benefits and costs.

Benefits of new TE programs include increased utility revenue from new electricity sales to offset the increased supply costs; increased utility revenues from market participation (including Clean Fuels Credit Revenue); and EV pilot programs designed with DR components will provide the benefit of avoided supply costs (capacity and energy).

Costs of new TE programs include incremental supply costs (capacity and energy); pilot program administrative costs; participant incentives (rebates); and capital costs for the utility (to build line extensions and the make-ready component of the EV sites).

3.4.1 Plan Description and Key Assumptions

As shown in Table 20, the pilot proposes incentivizing 91 EV charging sites over a little more than a three-year period. Each site has a useful life of 10 years. While many sites will use L2 chargers, DCQC quick chargers will be used in Public Transit. We assume attrition of 4% per year for Commercial sites and no attrition for Public Transit sites.

Table 20 Projected Site Configurations and Forecast (Business EV Charging)

Projected Sites By Year Ports	Commercial Small 4XL2	Commercial Medium 8XL2	Commercial Large 10XL2	Transit 10XDCQC	TOTAL
Year 1	1	1	-	-	2
Year 2	4	2	2	1	9
Year 3	10	6	5	1	22
Year 4	27	16	13	2	58
Total	**42**	**25**	**20**	**4**	**91**

Site configurations by port are indicative and likely to vary

Some sites will require new service (entailing a new transformer among other components) to enable sufficient capacity or to optimize site design. Line extension costs for existing service are lower than those of new service. As a result, the cost per site for new service is ~$32,000 higher. For this analysis we assumed approximately 10% of sites would require new service.

3.4.1.1 *Administrative Costs*

The project must incur significant up-front costs for education, outreach, project management, and measurement & verification. These costs average $0.9 million per year for the first four years of the pilot program and are detailed in Table 21 below.

Table 21 Administrative Costs (Business EV Charging)

ADMINISTRATIVE COSTS -- YEARS 1-5*						
$000S	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
TOTAL	**483**	**893**	**961**	**1,288**	**280**	**3,905**

*Excludes O&M

3.4.1.2 *Capital Expenditures*

Table 22 shows the capital expenditures and rebates for the Business EV Charging pilot program. For both components of the pilot program (Commercial and Public Transit), PGE proposes to build and own 100% of the line extensions and make ready facilities. In addition, PGE will own the chargers for Public Transit sites.

Table 22 Capital Expenditures and Rebates (Business EV Charging)

CAPEX + Rebates	$000s
Line Extension	1,303
Make Ready	7,616
Chargers	2,999
Rebates	428
Total	12,347

Our cost-benefit analysis assumes a 10-year useful life. Book depreciation rates are based on PGE's most recent depreciation study. For purposes of the economic analysis, capital carrying costs with depreciation lives longer

than 10 years are truncated in year 10.[51] Chargers are depreciated straight line over 20 years for book and seven years Modified Accelerated Cost Recovery System (MACRS) for tax. The clear majority of line extension and make ready infrastructure is underground conduit and will be depreciated over 55 years for book and a 20-year MACRS for tax as is the current practice for distribution system equipment.

3.4.1.3 *Rebates*

For Commercial sites, PGE proposes to provide the customer a rebate based on 25% of the estimated cost of the charging equipment. For income-eligible multifamily participants PGE's rebate will cover 100% of the charger equipment cost. All rebates are assumed to be expensed.

Table 23 shows a detailed breakdown of the estimated costs of each charging site. For most customers PGE anticipates covering over 80% of the site costs. For Public Transit sites, PGE anticipates covering 100% of the site costs.

Table 23 Estimated Costs by Site (Business EV Charging)

SITE COST SUMMARY New Service		Commercial			Transit*
		Small	Medium	Large	
	Ports	4XL2	8XL2	10XL2	10XDCQC
Line Extension	$/Site	36,585	37,260	38,205	143,100
Make Ready	$/Site	27,338	54,338	82,418	577,000
Charger	$/Site	12,400	24,800	31,000	750,000
Total	$/Site	76,323	116,398	151,623	1,470,100
PGE Ownership	$/Site	63,923	91,598	120,623	1,470,100
Rebates	$/Site	2,300	4,600	5,750	-
Total Incentives	$/Site	66,223	96,198	126,373	1,470,100
PGE -- Share of Costs		87%	83%	83%	100%
Customer -- Share of Costs		13%	17%	17%	0%
Total		100%	100%	100%	100%

**Public transit site configuration above anticipated to require new service*

SITE COST SUMMARY Existing Service		Commercial		
		Small	Medium	Large
	Ports	4XL2	8XL2	10XL2
Line Extension	$/Site	4,185	4,860	5,805
Make Ready	$/Site	27,338	54,338	82,418
Charger	$/Site	12,400	24,800	31,000
Total	$/Site	43,923	83,998	119,223
		-	-	-
PGE Ownership	$/Site	31,523	59,198	88,223
Rebates	$/Site	2,300	4,600	5,750
Total Incentives	$/Site	33,823	63,798	93,973
PGE -- Share of Costs		77%	76%	79%
Customer -- Share of Costs		23%	24%	21%
Total		100%	100%	100%

Cost estimates were based on PGE experience with its L2 sites at employee sites, the DCQC Electric Avenue site at the World Trade Center location, other Electric Avenue DCQC sites under development in the Charging Station pilot program now underway, and the pilot project with TriMet. In addition, PGE also consulted with other utilities in California which have active make-ready and rebate charging pilot programs.

3.4.1.4 *Reimbursements*

Participants will be contractually obligated to reimburse PGE for the costs incurred if their site is no longer functioning, subject to negotiated terms as circumstances warrant. We assume that we can recover 50% of the costs for Commercial customers.

[51] The truncation refers to the year-14 capital costs listed in Tables 22 and 26. More specifically, the truncated amounts represent the remaining cost of PGE-owned make-ready work, line extensions, and EV chargers, which have longer lives than the assumed useful life of the pilot. A different approach would be for the Commission to issue an accounting order approving accelerated depreciation for these assets, so the costs are spread evenly over the life of the pilot rather than all be incurred in the final year of the pilot.

3.4.1.5 *Increased Supply Costs*

As this project increases PGE's load, the incremental cost of energy and capacity are two of the key project costs. Incremental energy costs are based on the long-term 1H18 Aurora forecast. Average hourly prices are matched with load shapes that reflect expected usage of workplace charging and public transit charging. Workplace charging peaks at 8:00 AM and declines steadily over the work-day. Public Transit charges primarily 10:00 PM to 6:00 AM.

The cost of capacity is based on the real levelized cost of the simple cycle capacity resource in PGE's Tariff Schedule 201 (Avoided Cost). The cost of $128.96 per kW per year ($2,020) is applied to the expected coincident peak demand of the charging facilities. Based on PGE's experience with its own L2 workplace charging sites, we have applied a 42% probability that the full rated capacity of the site chargers will be used during the 3:00 PM-8:00 PM peak. Based on information from TriMet about their bus charging plan, we have applied a 5% probability that the full rated capacity will be utilized during the 3:00 PM-8:00 PM on-peak period.

3.4.1.6 *Revenue from Increased Sales*

Table 24 shows the projected load factors for the Business EV Charging pilot program. One of the key benefits of the pilot program is sales revenue to PGE, which offsets the increased supply cost. Based on an analysis of the three anticipated Commercial site configurations (Small, Medium, and Large) and assumed load factors, we are assuming that most customers will choose to be on PGE's Tariff Schedule 38. Public Transit customers will likely be on PGE's Tariff Schedule 85. For each charging site, kWh of load is forecasted based on the product of the load factor and the capacity rating of the charging facility. Load factor represents the percent of actual charge divided by the total possible in all hours of the day. The 38% load factor for Public Transit is based on data from a local transit company that showed its chargers fully discharging over eight hours per day. Revenue is then computed by applying the kWh of load to the energy portion of the tariff and the effective capacity usage to the demand charge portion of the tariff.

Table 24 Projected Load Factors (Business EV Charging)

Forecasted Load Factors				
	Commercial			Transit
	Small	Medium	Large	
	4XL2	8XL2	10XL2	10XDCQC
Year 1	3%	3%	3%	38%
Year 2	7%	6%	6%	38%
Year 3	9%	9%	8%	38%
Year 4	12%	11%	11%	38%
Year 5	14%	13%	13%	38%
Year 6	16%	15%	14%	38%
Year 7	17%	16%	15%	38%
Year 8	18%	16%	16%	38%
Year 9	18%	17%	16%	38%
Year 10	18%	17%	17%	38%

Note that we do not assume any increased revenues beyond the charging sites participating in this pilot program. If a workplace charging site deployed as part of this pilot program and influences some customers to buy an EV, we do not attribute revenues from those customers' home charging in this analysis.

3.4.1.7 *Market Participation Revenue*

PGE will contractually require customers that participate in the pilot program to assign to PGE all self-generation credits generated from the charging sites. Revenue generated from such credits will be applied to offset the cost of the pilot program. This will provide another key benefit and source of revenue for the pilot. PGE currently generates Clean Fuels Credits from Electric Avenue and participates in market transactions. PGE also receives credits from residential customers that drive EVs. The forecast of credit prices was developed in conjunction with PGE's Power Operations team which transacts credits, based on prices recently observed in the market and an expected rise over time as the Department of Environmental Quality (DEQ) determined clean fuel standards tighten through 2025. We assume prices remain flat after that period. We have forecasted conversion rates for Commercial using DEQ assumptions for light duty vehicles and Public Transit using assumptions for diesel transit vehicles.

3.4.1.8 *O&M Revenue*

For Public Transit customers, PGE intends to pass through to the customer O&M costs for the charging site on a time and materials basis as it currently does with the current contract with TriMet. So, in this analysis, Charger O&M costs are offset entirely by Charger O&M revenue.

3.4.2 Plan Results

As shown in Table 25 below, the Business EV Charging pilot program is cost-effective, demonstrating a Cost/Benefit Ratio of 1.06 and a net benefit of $1.5M[52]

In addition to tariff revenue from increased load from the charging sites, the project also benefits from Market Participation Revenue from the monetization of the Clean Fuels Credits. Clean Fuels Credit revenue makes up just over half of the revenue. It should be noted that the cost-effectiveness of the pilot is highly contingent on Public Transit revenues from both Clean Fuels Credit sales and energy sales.

Table 25 Cost Effectiveness (Business EV Charging)

RIM Summary	NPV - $000s	
Market Participation Revenue	12,824	51%
Charger O&M Revenue	1,459	6%
Rev from Increased Sales	11,002	44%
Benefits	**25,285**	**100%**
Capital Costs to Utility	13,602	57%
Incentives Paid (Net of Reimbursements)	122	1%
Increased Supply Costs	3,908	16%
Charger O&M Cost	1,459	6%
Administrative Costs	4,684	20%
Costs	**23,775**	100%
Net Cost (Costs minus Benefits)	**(1,510)**	
Benefit/Cost Ratio	**1.06**	

Capital Costs to the Utility (line extensions, make ready, and chargers) together with Incentives (rebates) make up over half of the NPV of the pilot program costs. The next largest cost category is Administrative Costs which represents almost a quarter of the costs. Cost of Supply makes up only 17% of the costs. For Commercial, energy costs are fairly low due to low load factors in Commercial (12% to 13%) and capacity costs are more substantial due to an assumed 42% coincident peak. For Public Transit, the cost of energy is high due to high load factors (37.5%) but the cost of capacity is low due to the predominantly off-peak nature of charging.

Table 26 shows costs and benefits over the life of the pilot program. As previously stated, in Year 14, Utility Capital Costs includes truncated amounts which represent the remaining cost of PGE-owned make-ready work, line extensions, and EV chargers, which have longer lives than the assumed useful life of the pilot program. A different approach would be for the Commission to issue an accounting order approving accelerated depreciation for these assets, so the costs are spread evenly over the life of the pilot program rather than all be incurred in the final year of the pilot program.

[52] Note that the $1.5M net benefit is reflected in cost effectiveness tables as a negative net cost of $1.5M.

Table 26 Cost and Benefits over Pilot Program Life (Business EV Charging)

PROJECT SUMMARY	NPV	Total Nominal													
	$000s	$000s	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Units																
Energy Usage	MWh		11	1,794	5,643	12,578	17,667	18,002	18,249	18,233	18,147	17,993	15,876	11,664	4,716	-
Capacity Usage	kw		42	766	2,431	5,681	7,857	7,752	7,668	7,514	7,374	7,227	6,412	4,796	1,952	-
Sites	#		2	11	33	90	86	85	82	79	76	72	61	43	-	-
Benefits	-															
Clean Fuels Revenue	12,824	21,830	1	234	749	1,650	2,341	2,437	2,508	2,507	2,499	2,485	2,187	1,591	641	-
Revenue from Sales	12,461	21,401	4	206	661	1,531	2,214	2,309	2,394	2,440	2,476	2,501	2,256	1,700	705	4
TOTAL BENEFITS	**25,285**	**43,232**	**5**	**440**	**1,410**	**3,182**	**4,555**	**4,746**	**4,902**	**4,947**	**4,975**	**4,987**	**4,442**	**3,291**	**1,346**	**4**
Costs																
Administrative Costs	6,143	9,062	573	1,058	1,149	1,583	557	469	546	557	569	544	556	419	276	205
Capital Costs to Utility	13,602	28,994	-	14	310	724	1,666	1,606	1,541	1,482	1,426	1,372	1,320	1,271	1,224	15,037
Incentives Paid	122	82	9	38	103	260	(109)	(14)	(56)	(67)	(31)	(29)	(19)	(4)	-	-
Increased Supply Costs	3,908	6,793	2	54	180	440	672	708	735	770	796	811	771	600	255	-
Total Costs	**23,775**	**44,931**	**584**	**1,164**	**1,742**	**3,007**	**2,786**	**2,769**	**2,766**	**2,742**	**2,759**	**2,699**	**2,629**	**2,286**	**1,756**	**15,243**
	(0)		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cost	**(1,510)**	**1,699** -	**579**	**725**	**332**	**(175)**	**(1,770)**	**(1,977)**	**(2,136)**	**(2,205)**	**(2,216)**	**(2,288)**	**(1,813)**	**(1,005)**	**410**	**15,239**

3.5 Pilot Program Evaluation

The purpose of evaluation is to measure the effectiveness of the pilot program in meeting its objectives, areas for continuous improvements, and energy impacts on PGE's system. Following are some of the high-level evaluation learning objectives:

- Track customer participation and satisfaction levels with pilot program offerings (incentives, installation assistance);
- Understand the level of PGE's influence in customers' decisions to install charging and/or (as appropriate) operate EV fleets;
- Document charging installation successes and challenges, and customers' perceptions of working with PGE;
- Document new charging utilization, and customer load impacts;
- Document the impacts of new business charging on employee decisions to own/lease EVs;
- Identify pilot program implementation successes and challenges, and improvement opportunities; and
- Understand how the chargers deployed under this pilot program have impacted mass market EV adoption.

3.5.1 Evaluation Methods

PGE and its evaluation vendor will develop and implement a comprehensive evaluation plan that details the analysis methods to be used, including sampling and timing that are best suited to evaluate the pilot program. Following are brief descriptions of the types of evaluation methods that are anticipated.

3.5.1.1 *Process Evaluation*

Process evaluation of the pilot program will make the impact estimates actionable by identifying pilot program design and implementation success and problem areas. Process evaluation findings can provide periodic feedback to help the pilot program make continuous improvements. Expected process evaluation activities include:

- Logic Model – Early in the pilot program evaluation, PGE and its evaluation vendor will review and update the logic model and pilot program objectives included with this application and adjust the evaluation activities as needed. The logic model will illustrate how the pilot program's planned activities should lead to a set of expected short-term outcomes, followed by longer-term outcomes. The logic model will help to structure all the evaluation activities and can help to identify any gaps in the pilot program design if pilot program goals are not achieved.

- Data analytics – The evaluation will track and report pilot program participation levels and include firmographic analysis to determine which types of customers are and are not participating.

- PGE pilot program administrator interviews – PGE's evaluator will conduct annual in-depth interviews with PGE pilot program staff and implementation partners on a wide range of pilot program topics. The initial interviews are anticipated to focus on the launched pilot program design, customer targeting and outreach activities, pilot program implementation and staff coordination, with subsequent interviews focused on implementation successes and challenges, pilot program design or delivery changes enacted and anticipated, and lessons learned.

- Pilot participant in-depth interviews and web surveys – Topics may include: sources of pilot program awareness, ease of enrollment and participation, the project development process and successes/challenges, experience working with PGE, the effectiveness of participant outreach to their employees or customers about EVs and charging, charger utilization, energy bill impacts and tariff changes (if any), impact of EV charging on fleet operations (when applicable), and other elements.

- Employee, Customer, and Tenant surveys - Brief web-based surveys will be administered to a sample of current and/or potential EV drivers supplied by pilot participants. Topics may include: how new charging has affected EV purchase considerations and actions, charging utilization, charging experiences and satisfaction, and awareness of PGE's project involvement.

- Attribution analysis – The business owner surveys and interviews will include a series of questions to help gauge the level of PGE's influence on their decisions to install EV charging and/or operate EV fleets. These types of "self-report" questions cannot conclusively measure the value of PGE's pilot program to customers but can provide feedback to shape the pilot program design.

3.5.1.2 *Impacts Evaluation*

As a condition of participation PGE will request that pilot program qualified EVSE vendors, EVSPs or business customers provide PGE with periodic charger utilization data (e.g. daily charging times, number of sessions in a prescribed format) so PGE can track charger level utilization over time.

In addition, PGE's evaluation vendor will analyze customer meter data for a sample of customers to further assess customer load impacts and impacts to PGE's system (e.g. on-peak to off-peak ratios). This will include both master-metered sites and sub-metered sites.

3.5.2 Reporting

PGE's evaluation vendor will submit annual reports with impact evaluation findings to PGE and the end of pilot program Years 2, 3 and 4.

3.5.3 Evaluation Budget

Table 27 shows the estimated evaluation timeline and budget for the Business EV Charging pilot program.

Table 27 Estimated Evaluation Timeline and Budget (Business EV Charging)

Year	Budget	Activities
Year 1 Q1	$95,000	Messaging Focus Group(s), Kickoff Meeting, Work Plan, Documents Review, Logic Model, Staff/Partner Interviews, Design of interview guides and surveys
Year 2	$90,000	Conduct customer interviews/surveys, employee surveys, charger utilization/ Advanced Metering Infrastructure (AMI) impacts analysis, staff interviews, reporting
Year 3	$100,000	
Year 4	$110,000	
Total	**$395,000**	

3.6 Case for Business Charging

EV drivers and prospective EV drivers need access to more charging infrastructure, and our business customers want to support them by deploying workplace and public charging. The proposed pilot program will make it cheaper and easier for business customers to deploy EV charging infrastructure and to make a commitment to electrifying their own fleets. By supporting the deployment of over 600 new charging points in our service territory, this pilot program will accelerate EV adoption and create a network of edge-of-grid resources that can be utilized to support efficient grid operations and renewables integration.

The proposed business charging pilot program delivers on the criteria which the Oregon Legislature directed the Commission[53] to consider when evaluating TE programs[54]:

- **The criteria that the program be in the utility's service territory** is addressed by the fact that the pilot program will only support the deployment of charging stations physically located inside PGE's service territory;
- **The criteria that the program be prudent** is ultimately at the discretion of the OPUC; however, PGE will work to ensure that all pilot program expenditures are reasonable and designed to maximize both benefits for customers and learnings from this pilot;

[53] 78th Oregon Legislative Assembly, 2016 Regular Session.
[54] Ibid, Sec. 20.4.

- **The criteria that the program be reasonably expected to be used and useful** is addressed by the fact that infrastructure will not be deployed without customer commitments to invest in charging stations (or vehicles, in the case of transit). Further, site selection criteria have been designed to ensure charging sites will be utilized and kept fully operational (e.g. number of EV drivers per port, projected utilization, O&M commitments). For instances where customers do not fulfill pre-construction obligations or wish to pull the charging equipment out of service, those participants commit to reimbursing pilot program capital and incentives on a pro-rata basis, subject to negotiated terms as circumstances warrant. Similarly, rebates will not be paid until a site is confirmed to be operational;

- **The criteria that the program be reasonably expected to support the grid, improve grid efficiency, and improve operational efficiency** is addressed by the fact that EVs can create system value for all customers by supporting flexible loads and increase PGE's ability to meet our customers' clean energy goals. Through this pilot program, we aim to create a portfolio of over 600 connected grid assets that will be able to provide grid services in the future. All chargers will provide PGE valuable data allowing us to better understand charging impacts to the system and opportunities for system value. All chargers will be DR enabled to ensure that we can easily integrate those chargers in the future with PGE's Energy Partner program.

    - The pilot program also provides an important touchpoint between PGE and our customers. We will be able to use the opportunity to educate our customers about TOU rates and demand chargers and will work with the customer and participating charging service providers to ensure that the default pricing that a participant chooses to charge their users is built on a TOU rate.

    - Further, as the cost-effectiveness analysis suggests, we believe that broad EV adoption presents opportunity to create a net-benefit for all PGE customers.

- **The criteria that the program be expected to stimulate innovation, competition, and customer choice** is addressed by the fact that the proposed pilot program will support business customers by helping them choose the charging equipment that meet their needs. This will allow EV charging equipment and service providers the opportunity to compete for such work. Further, by supporting the build-out of a broader EV network, we will be reducing barriers to EV adoption; in turn we expect this will create more demand for EV related products and services.

Section 4 Cost Recovery

Pursuant to ORS 757.259, PGE will request authorization to defer for later ratemaking treatment the costs and revenues associated with the two EV Charging pilot programs. In addition, the deferral will support an automatic adjustment clause rate schedule for the recovery of deferred operation and maintenance costs and the "tracking" of capital-related costs into prices after the assets close to plant (i.e. placed in service).

PGE will periodically update the tariff rate schedule to incorporate the capital-related costs and the remaining undepreciated costs in customer prices (including the return "on" and "of") as the capital investment is placed in service.[55] Only non-capital-related expenses will be subject to the deferral application.

O&M costs that will be subject to the deferral application are provided in Table 28.

Table 28 Estimated O&M Deferral Costs (Residential and Business EV Charging)

O&M DEFERRAL COSTS	NPV $000s	Total Nominal $000s	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
EV Residential																
Administrative Costs -- EV	2,226	2,894	519	527	594	636	55	57	58	59	61	62	64	66	67	69
Administrative Costs -- Grid Services	1,951	3,047	174	328	322	320	182	186	189	192	196	199	198	192	184	184
Incentives -- EV	1,590	1,986	55	375	655	902	-	-	-	-	-	-	-	-	-	-
Incentives -- Grid Services	402	641	2	18	56	115	60	59	58	57	56	54	49	36	18	4
Supply Costs (Energy Only)	1,711	2,896	4	35	113	226	324	327	316	322	325	316	296	212	80	0
Total O&M Costs	**7,880**	**11,464**	**754**	**1,283**	**1,740**	**2,199**	**622**	**627**	**621**	**630**	**638**	**632**	**607**	**506**	**349**	**256**
EV Business																
Administrative Costs	6,143	9,062	573	1,058	1,149	1,583	557	469	546	557	569	544	556	419	276	205
Incentives	122	82	9	38	103	260	(109)	(14)	(56)	(67)	(31)	(29)	(19)	(4)	-	-
Supply Costs (Energy Only)	2,631	4,615	0	36	118	268	422	460	486	526	556	575	555	428	183	-
Total O&M Costs	**8,896**	**13,759**	**582**	**1,133**	**1,370**	**2,112**	**871**	**914**	**976**	**1,016**	**1,094**	**1,091**	**1,092**	**843**	**459**	**205**
Total																
Administrative Costs	10,320	15,004	1,266	1,914	2,065	2,539	795	711	793	809	826	806	818	677	527	458
Incentives	2,114	2,708	65	431	814	1,277	(49)	44	2	(10)	25	26	30	33	18	4
Supply Costs (Energy Only)	4,342	7,511	4	72	231	494	747	786	802	847	881	892	851	640	263	0
Total O&M Costs	**16,776**	**25,222**	**1,336**	**2,416**	**3,110**	**4,310**	**1,493**	**1,542**	**1,597**	**1,646**	**1,732**	**1,724**	**1,699**	**1,349**	**808**	**461**

[55] This process "tracks" the capital-related costs into prices after the assets have closed to plant. PGE has used similar tracking mechanisms on several occasions for renewable resources and most recently for the Carty generating plant as part of the UE 294 general rate case.

Section 5 Conclusion

The proposals to increase deployments of EV charging infrastructure are necessary and in our customers' interest. The proposals are in line with Oregon's climate goals and the legislative findings of SB 1547 and are likely to accelerate EV adoption by increasing the access to and the use of electricity as a transportation fuel. The proposals will create a network of over 4,000 grid-connected resources that will be able to support efficient grid integration.

The Residential EV Charging pilot program will expand the value proposition for customers considering an EV purchase and will give PGE access to an important and rapidly-growing customer asset.

The Business EV Charging pilot program will increase access to and awareness of the use of electricity as a transportation fuel by accelerating the deployment of public and workplace charging. We anticipate these chargers will provide valuable grid services in the future through PGE's Energy Partner program. Further, the pilot program will also reduce the barriers that businesses and transit agencies face when making investments to electrify their fleets.

We have taken appropriate steps to right-size these pilot programs such that they meaningfully impact the EV market while still safeguarding PGE customers. Further, both pilot programs have a pathway towards cost-effectiveness and will yield learnings that inform future program and system planning.

As reflected by the letters of support included in Appendix B, these pilot programs also have support from a broad swath of stakeholders reflecting a variety of interests in the community and EV industry.

The time to decarbonize Oregon's transportation sector is now. PGE has a unique role to place in supporting EV adoption and grid integration, and we believe these pilot programs will help move the state in that direction. We look forward to the opportunity to work with Staff and stakeholders to move these proposals forward accelerate our path to a clean energy future.

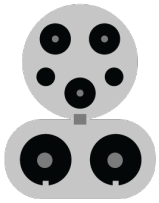
Appendices

Appendix A Additional Terms and Descriptions

Table 29 Electric Vehicle Terminology[56]

Term	Description
Level 1 Electric Vehicle Charger	AC Level 1 EVSE (often referred to simply as Level 1) provides charging through a 120-volt (V) AC plug. Most, if not all, plug-in electric vehicles (PEVs) will come with an AC Level 1 EVSE cord set so no additional charging equipment is required. Level 1 charging yields 2 to 5 miles of range per 1 hour of charging. Plugging in at home using a standard outlet requires a dedicated circuit. Alternatively known as Chargeway Level 1. 
Level 2 Electric Vehicle Charger (L2)	AC L2 equipment (often referred to simply as L2) offers charging through 240V (typical in residential applications) or 208V (typical in commercial applications) electrical service. Most homes have 240V service available, and because AC L2 EVSE can charge a typical EV battery overnight, they will commonly be installed at EV owners' homes for home charging or are used for public charging equipment. This charging option can operate at up to 80 amperes and 19.2 kW. However, most residential AC L2 EVSE will operate at lower power. Many such units operate at up to 30 amperes, delivering 7.2 kW of power. These units require a dedicated 40-amp circuit. L2 charging typically yields 10 to 20 miles of range per 1 hour of charging. Some vehicles such as the Mercedes B Class electric and Tesla models and can charge at 40-80 miles per 1 hour of charging, respectively. All major auto manufacturers have adopted the SAE J-1772 Plug as a standard connector for both Level 1 and L2 Charging. Alternatively, known as Chargeway L2. 
Direct Current Quick Charger (DCQC)	Direct-current (DC) quick charging equipment, sometimes called DC L2 (typically 208/480V AC three-phase input to the charger), enables rapid charging along heavy traffic corridors at installed stations. Charges at a rate of 50 kW, though higher power units are coming to market (100-350 kW). There are three types of DC fast charging systems, depending on the type of port on the vehicle: a J1772 combo, CHAdeMO, or Tesla.

[56] Table 29 was compiled from a variety of sources including:
- United States Department of Energy, Energy Efficiency and Renewable Energy. *Alternative Fuels Data Center*. Retrieved from http://www.afdc.energy.gov/vehicles/electric.html
- Open Charge Alliance. *Appraisal Open Charge Point Protocol*. Retrieved from http://www.openchargealliance.org/about/appraisal/
- University of Delaware. *The Grid-Integrated Vehicle with Vehicle to Grid Technology*. Retrieved from http://www1.udel.edu/V2G/

Term	Description
	DCQC yields 50 to 70 miles of range per 1 hour of charging. Alternatively known as Chargeway Levels 3-7. 
CHAdeMO Charger Port	 The CHAdeMO port was the first internationally used DCQC Standard connector and communications system, introduced by Nissan in Japan and then used by Nissan, Kia, and Mitsubishi in U.S. deployment of their vehicles.  Alternatively known as Chargeway BLUE
J1772 (SAE Combo) Charger Port	 European and U.S. auto manufacturers developed a new standard connector that they brought to the Society of Automotive Engineers to be adopted as the official SAE Standard. This connector uses the SAE-J1772 communications standard with added conductors for the DC high power charging. The SAE Combo connector is sometimes referred to as the Combined Charging System or CCS Combo.  J1772: Alternatively known as Chargeway GREEN (Levels 1-2) CCS/SAE Combo: Alternatively known as Chargeway GREEN (Levels 3-7)
Tesla Charger Port	 Tesla developed its own connector standard and offered to allow all manufacturers the ability to use this connector with no patent fees. This is used on the Model S, Model X, and upcoming Model 3. Tesla has a different connector unique to the Tesla Roadster. Tesla also made an adapter to charge the Model S, 3 and X using a CHAdeMO charger. It is anticipated that they may make an adapter for the CCS Combo as well.  Alternatively known as Chargeway RED
Range	The maximum amount of distance that a vehicle can travel on a single charge.
Electric Vehicle (EV)	EVs use a battery to store the electric energy that powers the motor. They receive electricity by plugging into the grid, and they store it in batteries. They consume no petroleum-based fuel while driving and produce no tailpipe emissions.
Plug-in Hybrid Electric Vehicle (PHEV)	PHEVs are powered by an internal combustion engine that can run on conventional or alternative fuel and an electric motor that uses energy stored in a battery. The

Term	Description
	vehicle can be plugged into an electric power source to charge the battery. Some can travel more than 70 miles on electricity alone, and all can operate solely on gasoline (like a conventional hybrid). Some types of PHEVs are also called extended range electric vehicles (EREVs).
Vehicle to Grid (V2G)	Electric-drive vehicles, whether powered by batteries, fuel cells, or gasoline hybrids, have within them the energy source and power electronics capable of producing the 60 Hz AC electricity that powers our homes and offices. When connections are added to allow this electricity to flow from cars to power lines, we call it "vehicle to grid" power, or V2G. Cars pack a lot of power. One properly designed electric-drive vehicle can put out over 10kW, the average draw of 10 houses. The key to realizing economic value from V2G are grid-integrated vehicle controls to dispatch according to power system needs.
Open Charge Point Protocol (OCPP)	OCPP is a freely available open standard that enables component vendors and network operators to “mix and match” interoperable hardware and software. It was first defined and deployed, as version 1.2 in 2010, and is a proven way to optimize the cost and risk of networked infrastructure investments. New versions of OCPP are collaboratively defined within an open industry alliance to ensure that the protocol continues to meet evolving market requirements. Today charging network operators and service providers in more than 50 countries rely on OCPP to manage more than 10,000 charging stations.

Appendix B Stakeholder Letters of Support

Office of Mayor Ted Wheeler
City of Portland

February 8, 2019

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

Ted Wheeler
Mayor
City of Portland
1221 SW 4th Ave, Ste 340
Portland, OR 97204

Dear Commissioners:

The City of Portland ("City") strongly supports Portland General Electric's ("PGE") proposed Business and Residential Electric Vehicle (EV) Charging Station Pilot Programs.

In December of 2016, City Council unanimously adopted Portland's EV Strategy in support of the City's Climate Action Plan. In July 2017, Portland City Council adopted a 100% Renewables resolution establishing a commitment to meet 100 percent of community-wide energy needs with renewable energy by 2050. The City of Portland has also committed to achieve zero net emissions by 2050 as part of the Paris Climate Accord and Global Covenant of Mayor's for Climate and Energy Agreements. Switching to low carbon fuels, such as electricity, is a key strategy to meet the City's carbon reduction and renewable energy goals.

PGE's Business and Residential Electric Vehicle Charging Station proposals support the following priority areas and commitments embedded in Portland's sustainability plans:

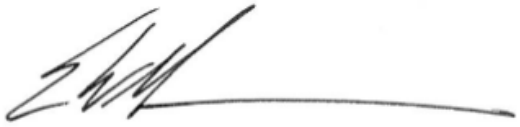
- Providing clean, affordable transportation options for low-income communities and people of color.
- Electrifying public transit to improve air quality and livability by reducing harmful emissions and transit-related noise.
- Electrifying fleets and providing workplace charging programs.
- Leveraging the State's EV Rebate and Charge Ahead programs by providing EV charging incentives to decrease the cost of chargers for EV rebate recipients.
- Increasing access to EV charging in multi-family residential buildings.

1221 SW Fourth Avenue, Suite 340 ♦ Portland, Oregon 97204
MayorWheeler@PortlandOregon.gov

We are not just excited about the opportunities that PGE's proposals create, but also believe that PGE's proposals play a critical role in meeting our climate and equity goals. We are committed to working with PGE to make their pilots a success.

The City of Portland fully supports PGE's proposed efforts and recommends that the Commission approve them.

Sincerely,



Ted Wheeler

1221 SW Fourth Avenue, Suite 340 ♦ Portland, Oregon 97204
MayorWheeler@PortlandOregon.gov

Beaverton
OREGON

February 4, 2019

Denny Doyle, Mayor

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

Dear Commissioners:

The City of Beaverton ("City") supports Portland General Electric's ("PGE") proposed transportation electrification pilots as proposed in Docket 1811.

The City strongly supports sustainability throughout our community in numerous ways including transportation, energy efficiency and consumption. Creating greater access to affordable transportation options is critical to improving economic opportunity, wealth building and upward mobility. PGE's Business EV Charging Pilot proposal aligns with our commitments and desires to create mobility solutions that are equitable, empowering, and clean.

- PGE's proposal will increase the availability and accessibility of public charging infrastructure. As we've seen in areas with existing Electric Avenues, public charging increases awareness of and conversations about electric vehicles. Additional public charging stations will open doors for individuals who otherwise would have nowhere to charge to consider purchasing an EV (e.g. multi-family residents). Having additional, visible public charging infrastructure is greatly needed and will encourage citizens in Beaverton to adopt electric vehicles and hopefully facilitate a greater use of electric vehicles in fleets as well.

- Finally, changing the perception of electric vehicles from expensive to accessible to all income levels will help bring the benefits of cleaner, lower cost transportation to more households. By offering education and outreach, PGE will raise awareness that there are electric vehicles available on the market that can meet any car buyer's needs.

We are not just excited about the opportunities that PGE's proposals create but believe that these proposals are necessary for us to reach our sustainability goals. We are committed to working with PGE to make their pilots a success.

The City of Beaverton fully supports PGE's proposed efforts and recommends that the Commission approve them.

Sincerely,

Dennis Doyle
Mayor

City of Beaverton • PO Box 4755 • Beaverton, OR 97076 • www.BeavertonOregon.gov
ph: 503.526.2481 • fax: 503.526.2571

The Best of Oregon

February 4, 2019

To: Public Utility Commission of Oregon

201 High Street, SE, Suite 100

P.O. Box 1088 Salem,

OR 97308-1088

Re: Letter of support from EVBox for Portland General Electric's Proposed Electric Transportation Pilot

EVBox is headquartered in Netherlands and is a manufacturer of Electric Vehicle (EV) charging equipment and related cloud-based services with an installed base of over 65,000 Level 2 and 700 DC fast chargers, in 45 countries. EVBox was acquired by the European utility ENGIE in 2017. EVBox continues to make strides in North America. It was selected by the California utility, Pacific Gas and Electric Company, as the first supplier for the utility-owned portion of the EV Charge Network program. The contract includes EVBox installing up to 2,560 stations and 10 years of network services in the service territory of Pacific Gas and Electric Company.

Electric utilities and regulators play key roles in the efficient deployment of EV charging infrastructure. Utility investments in grid infrastructure are required to enable transportation electrification, and several state regulators are considering proposals by utilities to develop and operate EV charging infrastructure and structure customer rates to effectively manage EV charging. We believe that Portland General Electric (PGE) has done an admirable job of building a comprehensive suite of programs which will lower barriers to the adoption of EVs while allowing the utility to learn more about the potential impact of EVs on its system.

1. **The scale of the program is required for Oregon to meet its transportation electrification goals**

One of the major deterrents for customers to buy EVs is range anxiety. Developing charging infrastructure is therefore a potential prerequisite to significant growth in EVs. While EV growth is expected to be rapid in Oregon,[1] EV infrastructure has not kept pace with the needs of the increasing number of EV drivers on the road. Currently, Oregon has 1,250 public charging stations.[2] The number of stations has to be ramped up because in 2020, the state will require a 10-fold increase to meet the charging needs for EV drivers. PGE's program is a step in the right direction to bridge this gap.

2. **The residential charging program serves ratepayers and the grid**

EVBox supports the proposed residential charging program in in which PGE will provide a rebate and annual participation payments for residential customers installing Level II chargers in exchange for participation in grid services. This is extremely helpful to EV drivers

[1] There are roughly 17,000 EVs registered in Oregon, according to the Oregon DEQ. The state aims to grow this number to 50,000 cars by 2020.

[2] https://goelectric.oregon.gov/charge-your-ev/

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since they conduct more than 80% charging at home. In addition, controlled charging allows a utility to allow charging to better correspond to the needs of the grid, much like traditional demand response programs. California utilities like Southern California Edison and San Diego Gas and Electric have been administering similar pilots. The impacts of residential charging to customers and the grid can be significant. Residential charging can more than double the load of a residential customers. The learnings from this pilot can help design a larger residential program which will ensure customer benefits in the form of charging at the most economical time and utility benefits in the form of better grid management

3. **The non-residential make-ready component of the program encourages competition**

Utilities can take on a larger role in developing EV charging infrastructure by assuming more of the costs and spreading them across all ratepayers. Under the "make-ready" approach, the utility could cover the cost of connecting the charging infrastructure up to the point where the charger connects to the grid. This approach could reduce the cost of building charging infrastructure, which could increase the economic viability of that infrastructure. The make-ready infrastructure expansion would support widespread transportation electrification by providing access to charging infrastructure across priority market segments like workplace and fleets. Additionally, for EVs to be truly an option for everyone, all customers, including those who rent their homes or live in multi-unit dwellings (MUDs), must have readily available charging stations. We believe that the proposed program will begin to remove barriers in MUDs and look forward to future efforts to support the segment. In offering make ready infrastructure for chargers, the PGE program encourages competition and retains customer choice. Customers can chose any qualified charger while relying on the make-ready infrastructure to low overall total cost of ownership.
We urge the Commission to approve this application and believe that that will lead to increased long-term EV adoption for all customer classes and all EV charging technologies.

Sincerely,

Megha Lakhchaura

Director, Policy and Utility Programs

EVBox, North America

megha.lakhchaura@evbox.com

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Grand Central Tech
New York, NY 10017, USA

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CITY OF Salem
AT YOUR SERVICE

MAYOR'S OFFICE
555 Liberty St SE / Room 220 • Salem, OR 97301-3513 • 503-588-6255 • Fax 503-588-6354

February 6, 2019

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

Dear Commissioners:

The City of Salem ("City") strongly supports Portland General Electric's ("PGE") proposed transportation electrification pilots as proposed in Docket 1811.

The City of Salem has a history of being an environmentally, sustainably, and fiscally thoughtful community. Salem has integrated environmental projects throughout our community in numerous ways including Willow Lake Water Treatment Plant, energy efficiency through installation of LED streetlights, EV charging stations at City facilities, and as a Gold-level participant in PGE's Clean Wind program. This pilot creates greater access to affordable transportation options and aligns with our commitments and desires to create mobility solutions that are equitable, empowering, and clean.

- PGE's proposal will increase the availability and accessibility of public charging infrastructure. Public charging increases awareness of and conversations about electric vehicles. Additional public charging stations will open doors for individuals who otherwise would have nowhere to charge to consider purchasing an EV option. Having additional, visible public charging infrastructure is greatly needed and will encourage citizens in Salem to adopt electric vehicles and hopefully facilitate a greater use of electric vehicles in fleets as well.
- Finally, changing the perception of electric vehicles from expensive to accessible to all income levels will help bring the benefits of cleaner, lower cost transportation to more households. By offering education and outreach, PGE will raise awareness that there are electric vehicles available on the market that can meet any car buyer's needs.

PGE's proposal creates more options for residents and businesses within the City of Salem. The City of Salem fully supports PGE's proposed business EV Pilot and recommends the Commission's approval.

Sincerely,

Chuck Bennett

Chuck Bennett
Mayor

CITY OF GRESHAM 1333 NW Eastman Parkway | Gresham, OR 97030 | 503-661-3000

February 8, 2019

Chair Megan Decker
Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

Dear Chair Decker and Commissioners:

When I began serving as Mayor of Gresham in 2007, one of my first actions was signing the US Conference of Mayors Climate Protection Agreement, committing the City of Gresham to pursue clean, renewable, and sustainable operations.

We have pursued this commitment by heavily reducing power consumption in our municipal functions, be it creating one of the first net-zero wastewater treatment plants in America, or converting our 8,000 streetlight fixtures to LED. We've also installed an electrical vehicle (EV) charging station at City Hall, and worked to convert our city fleet to leverage technology and reduce our environmental footprint.

This latter effort is focus of my letter to you today. I am aware of Portland General Electric's (PGE) proposed transportation electrification pilot effort (Docket 1811), which would provide incentives for EV charging at workplaces, multitenant, multifamily, and destination center locations, as well as areas to support fleets and public transit. I believe strongly that the proliferation of green technology remains one of our best opportunities in public policy to assist the work of reducing carbon pollution and assisting the expansion of sustainable transportation.

PGE has been a strong and important partner in Gresham's sustainability efforts, and I support their work in expanding the visibility and convenience of EV charging infrastructure, particularly in areas that are densely populated, but traditionally underserved. I urge your favorable consideration.

Best Wishes,

Shane Bemis
Mayor of Gresham

MAYOR SHANE T. BEMIS | OFFICE OF MAYOR AND CITY COUNCIL
503-618-2584 | GreshamOregon.gov

February 11, 2019

Aaron Milano, Director

Electric Mobility Strategy

Portland General Electric

121 SW Salmon Street

Portland, OR 97204

Re: Proposed Residential and Business EV Charging Pilots

Dear Aaron:

The Alliance for Transportation Electrification, as you know, is a broadly-based non-profit industry association established in early 2018 with several goals, including to promote a strong and robust utility role in transportation electrification, addressing the growing infrastructure gap, and promoting interoperability and open protocols. We work with many of our member companies, including you, to share information on technology, best practices for program and tariff design, and regulatory practices. We have been reviewed at a high level your new proposed pilot program, broken down in three components, and believe them to be well designed, scope, and with an appropriate budget. The three components are: a residential charging pilot program; a Business EV charging pilot for workplace, multifamily housing, and fleet; and a Business EV program for public transit. Accordingly, the Alliance is pleased to offer our support to these programs.

The programs build on the foundation established by earlier pilot programs approved by the Commission in February 2018, and the legislation (SB 1547) in Oregon that set forth an overall framework for utilities to file plans to support "widespread transportation electrification." In that sense, these proposed programs are part of a continuum of strategies and programs that the utility has been working on for several years. In its Order last year, the Commission recognized that additional investments in EV infrastructure were necessary to achieve these goals. We believe that such a consistent, longer term approach is appropriate and necessary in the early development stages of the market for EV infrastructure. In fact, the Commission Order that largely approved the multi-party settlement agreement last year called for several "unfinished pieces of business" – namely, that the utility would propose both a residential charging pilot within a year, and also that you would develop and file a workplace and fleet charging program within a year. You have done that with these programs.

Regarding the residential charging pilot program, it is well designed and scoped. We believe that the target number of 3,250 incentivized installation with a $500 rebate are both reasonable numbers for your service territory at this stage of market development. It is roughly similar, for example, to a recently approved (by the Michigan PSC) program for residential installations for CMS Energy in Michigan. In addition, the one-time incentive of $1,000 proposed for income-eligible EV installations is an innovative approach and hopefully will spur adoption for this population segment. Finally, we

believe that grid services incentive ($50) is an important component of the program to test demand response (DR) approaches and load shifting and following.

Regarding the public transit program, the Alliance is glad to see that you are pursuing the ownership and operation model (including the charger, or EVSE) for this particular business case. Tri-Met and other transit agencies in Oregon are leaders nationally in moving from diesel to all-electric buses, and your program to both design and build, but also operate the make-ready as well as the charger, should provide to be a good model. The cost-effectiveness criteria that you propose seem appropriate to assess a potential customer payment, and the assignment of any Clean Fuel credits from the customer to PGE should lower overall program costs.

Regarding all other Business EV charging use cases, such as workplace, multi-family and multi-tenant housing, and fleets, we believe it is appropriate to use a model of 100 percent of the line extension and the make-ready costs, but not the ownership and operation of the charger. However, you provide ore optionality to the customers by allowing you to maintain the chargers and pass on that cost. The levels of rebate for the Level 2 chargers are in line with other programs in jurisdictions around the country. However, we believe that based on the challenges faced by other utilities in program implementation for multi-family units, it might be prudent to consider a certain amount of own and operate for this particular use case as this program is implemented. Again, the use of the Clean Fuel Credits from the customer to you should work to offset some portion of the program costs.

In summary, the Alliance supports these three types of innovative pilot programs as proposed, and look forward to working with you, and other stakeholders, during the coming review and approval process.

Sincerely,

Philip B. Jones, Executive Director

Alliance for Transportation Electrification

1402 Third Avenue, Suite 1315

Seattle, WA 98101

Tel: 206-453-4157

February 11, 2019

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

RE: Portland General Electric's proposed transportation electrification pilot programs

Dear Commissioners:

The City of Wilsonville has a strong commitment to supporting the development and deployment of alternative-energy infrastructure with greatly reduced carbon emissions to sustainably address the long-term detrimental impacts of climate change. Since 2015, Wilsonville has been a participant in the U.S. Environmental Protection Agency's "Green Power Communities" program with both municipal and community purchases of 'Clean Wind" power from Portland General Electric (PGE) meeting key thresholds.

Wilsonville's South Metro Area Regional Transit (SMART) agency was only one of 51 transit agencies nationwide to win a highly competitive 2017 grant for $1.45 million by the Federal Transit Administration (FTA) for the purchase of new electric-powered buses. Funded by the U.S. Department of Transportation's "Low or No-Emission (Low-No) Bus Program Projects" and other grant funds, SMART is purchasing three 35-foot battery-electric buses and working with PGE to install charging infrastructure.

As the representative of the Cities of Clackamas County to Metro regional government's Joint Policy Advisory Committee on Transportation, Wilsonville was an actively engaged partner in the creation of the Portland metro region's Climate Smart Strategy. This Strategy encourages a major move to the use of more fuel-efficient vehicles, including electric vehicles (EVs), to significantly reduce carbon emissions and create a cleaner future. Improving access to affordable and efficient transportation options is critical to improving economic opportunity and reducing the impacts of climate change.

The City recently signed an agreement for the installation of a PGE "Electric Avenue" charging-station hub at the popular Wilsonville Public Library, conveniently located in the town center area near shopping and park facilities. PGE's Electric Avenue program is increasing the availability and accessibility of public charging infrastructure. Highly visible

CITY OF WILSONVILLE • WILSONVILLE CITY COUNCIL
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council@ci.wilsonville.or.us

EV charging stations raises public awareness and increases the public's ability to utilize EVs as a real transportation option.

The proposed transportation electrification proposals by PGE align with Wilsonville's strategy for EVs and commitment to create mobility solutions that are sustainable.

- PGE's proposals to collaborate with TriMet and Transportation Network Companies (TNC) support the metro region's transportation hierarchy for people movement: prioritizing shared transportation over private vehicles. By engaging TNC drivers, PGE can grow a network of EV ambassadors that advocate for benefits of electric transit. By collaborating with TNC networks and transit agencies, both of whom play important roles in providing transportation services to underserved communities, PGE's proposal helps to bring electric transportation to a broader audience.

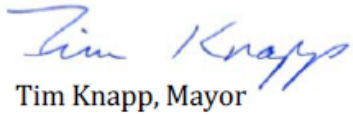
- PGE's planned support for the deployment of more charging stations in the public realm and at employers' workplaces can increase market acceptance of EVs. The proposed business EV Charging Pilot Program aims to reduce the financial and technical barriers of EV charging, thus increasing access to more public and workplace charging, and to diminish the initial cost for fleet- and transit-operators seeking to electrify their operations.

Today EV drivers lack visible public charging opportunities, and many consumers do not even consider owning an EV because they are "home-charging challenged," meaning they don't have access to a charger at home—*e.g.,* no off-street parking, multifamily community, older homes with inadequate panel capacity, etc. Further, business customers are looking to offer charging as an amenity for employees and customers but are not sure how to go about doing so. Other business customers are looking for opportunities to electrify their fleet for sustainability goals, cost savings, and fuel-cost price stability. Many customers are capital constrained, and unable to make meaningful investments in EV charging infrastructure.

We are not just excited about the opportunities that PGE's proposals create but believe that PGE's proposals are necessary for us to reach our Climate Smart Strategy goals. The City of Wilsonville fully supports PGE's proposed efforts and recommends that the Commission approve them.

Thank you for your time and consideration.

Sincerely,



Tim Knapp, Mayor
City of Wilsonville

February 8, 2019

Chair Megan Decker
Public Utility Commission of Oregon
201 High Street, SE, Suite 100
Salem, Oregon 97301-4028

Dear Chair Decker:

On behalf of the Hillsboro City Council I write in support of Portland General Electric's (PGE) proposed transportation electrification pilot, Docket 1811. Supporting the transition to electrified transportation in our community remains a priority for Hillsboro, and it is reflected in our community goals. We have developed substantial public electric vehicle (EV) charging infrastructure in our community over the past ten years, most recently working with PGE to develop a pod of fast EV chargers in an area of our community with relatively limited access to EV charging infrastructure.

We are actively working on solutions and strongly support the imperative to improve access to EV charging for community members with limited or no option to charge at home. This includes removing barriers to and incentivizing installation of EV chargers in new multi-family properties and in parking lots and structures. The proposed pilot would support those efforts. We see this as a crucial need as EV's become more prevalent and affordable as the used EV market grows.

We have installed fleet charging at several City facilities to enable continued adoption of EV's in our City fleet. We are seeing greater adoption of EV's in our own workforce, and with our major employment base in Hillsboro we appreciate the potential for new incentives for employers to install EV chargers for their fleets and employees. Public and private fleets represent a great opportunity to facilitate the transition to electrified mobility, for both business use and also as a means to introduce people to EV's through their workplace.

We believe that this is an important time to expand EV charging infrastructure. We hope that you agree and we urge you to support the PGE pilot proposal.

Sincerely,

Steve Callaway
Mayor

cc: Hillsboro City Councilors
Robby Hammond, City Manager
Andy Smith, Government Relations Manager

Mail 150 E Main Street, Hillsboro, Oregon 97123-4028 Phone 503.681.6100 Fax 503.681.6232 Web www.hillsboro-oregon.gov

Deborah Kafoury
Multnomah County Chair

501 SE Hawthorne Blvd., Suite 600
Portland, Oregon 97214
Phone: (503) 988-3308
Email: mult.chair@multco.us

February 12, 2019

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

Dear Commissioners,

Multnomah County supports Portland General Electric's ("PGE") proposed transportation electrification pilots as proposed in Docket 1811, and we ask that you do the same.

Multnomah County's 2015 Climate Action Plan established a clear pathway and commitment to reducing carbon emissions community-wide and in County operations. In 2017 Multnomah County adopted the 100 by 50 Resolution, which makes a commitment to achieving 100% clean and renewable electricity by 2035 community-wide, and 100% of all sources of energy by 2050.

Carbon emissions from the transportation sector are the largest and fastest growing sources of emissions in the region. Rapidly decarbonizing our transportation sector through electrification is a critical part of meeting our climate and energy goals. PGE's electric vehicle (EV) proposal will provide crucial support to this by investing in improved access to EV charging facilities at workplace, multifamily, and destination center locations, and for fleets and public transit.

All too often climate policies only consider equity as an afterthought, but we are actively working with PGE and community partners to ensure that the renewable transition is a just transition. That includes creating greater access to affordable transportation options. PGE's EV proposal aligns with our commitments to create mobility solutions that are equitable, empowering, and clean. We particularly appreciate the following provisions of the pilot program:

- PGE's proposal will increase the availability and accessibility of public charging infrastructure. Additional public charging stations will make it more likely that people who live in multi-family housing will consider purchasing an EV.
- PGE will also offer education and outreach to raise awareness that there are electric vehicles available in the market that can meet any car buyer's needs, and that incentives are available to support purchase of these vehicles by low income households. This work will help to change the perception of electric vehicles from expensive luxury items to an accessible option for households at many income levels and bring the benefits of cleaner, lower cost transportation to more people.

We are excited about the opportunities that PGE's EV proposal presents, and believe that this proposal is necessary for us to reach our climate and energy goals. We are committed to working with PGE to make this program a success and ask that you support its adoption.

Sincerely,

Deborah Kafoury
Multnomah County Chair

February 12, 2018

Public Utility Commission
201 High Street SE, Suite 100
Salem, OR 97301

Re: Letter of Support for Portland General Electric EV Charging Programs

Dear Commissioners,

Greenlots is pleased to offer this letter of support for Portland General Electric's Business and Residential EV Charging Pilots.

Greenlots is a leading provider of grid-focused EV charging software and services. The Greenlots network supports a significant percentage of the DC fast charging infrastructure in the Pacific Northwest and North America, and is increasingly supporting deployment and execution of programs in the fleet, workplace, retail, and residential Level 2 spaces. Greenlots' smart charging solutions are built around an open standards-based focus on future-proofing while helping site hosts, utilities, and grid operators manage dynamic EV charging loads.

As we shared in the pilot EV program dockets of Portland General and PacifiCorp, Greenlots firmly believes that utility ratepayer investment in charging infrastructure is critically important to accelerating transportation electrification, and scaling the market to the benefit of all market participants. Quite simply, there is not currently a private market business case for investing in, installing, and operating charging infrastructure, and therefore the infrastructure that is necessary to drive EV adoption is not being deployed at a rate or volume necessary to accelerate the market. Strong utility engagement in infrastructure deployment benefits the market and is key to managing the charging load to the benefit of the system and ratepayers.

Greenlots is a strong advocate of open standards and communication protocols, and a standards-based market. In this ecosystem, competition and innovation can thrive and be ever present, as hardware and software can be easily interchanged. Direct or utility-facilitated procurement of EV charging software, equipment, and services represents the purest form of competition in our industry, as providers compete on the basis of features, functions, and cost. Importantly, this also drives innovation to be best competitively positioned for selection and implementation.

We look forward to the engaging in the regulatory process around these programs and being a resource to stakeholders and the Commission. We will strongly recommend the Commission's approval of these programs.

Sincerely,

Thomas Ashley
VP, Policy

Greenlots \ 777 S. Alameda Street 2nd Floor, Los Angeles, CA 90021 \ (424) 372-2577

Mark Gamba, Mayor
City of Milwaukie
10722 SE Main Street
Milwaukie, OR 97222

February 7, 2019

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-1166

Re: PGE EV Support Letter

Dear Commissioners:

The City of Milwaukie ("City") strongly supports Portland General Electric's ("PGE") proposed transportation electrification pilots.

Last October, the City Council unanimously adopted a strategy within a city-wide Climate Action Plan that encourages a shift to electric vehicles to reduce carbon emissions and become a fully carbon-neutral city by 2050. Improving access to affordable and efficient transportation options is critical to improving economic opportunity, wealth building, and upward mobility. PGE's transportation electrification proposals align with our strategy for electric vehicles and commitment to create mobility solutions that are equitable, empowering, and clean.

- PGE's proposals to collaborate with TriMet and Transportation Network Companies (TNC) support the City and the Portland Metro Region's transportation hierarchy for people movement: prioritizing shared transportation over private vehicles. By reducing TriMet's first cost to electrify their bus fleet, PGE will enable TriMet to purchase a fifth electric bus and electrify an entire bus route. By engaging TNC drivers, PGE will grow a network of electric vehicle ambassadors that will advocate for benefits of electric transit. By collaborating with TNC networks and transit agencies, both of whom play important roles in providing transportation services to underserved communities, PGE's proposal helps bring electric transportation to a broader audience.

- PGE's Electric Avenue program will increase the availability and accessibility of public charging infrastructure. As we will see in the City with Electric Avenue, public charging increases awareness of and conversations about electric vehicles. Additional public charging stations will open doors for individuals who otherwise would have nowhere to charge and to consider purchasing an electric vehicle (e.g. multi-family residents and TNC drivers). Additionally, visible public charging infrastructure is greatly needed in the City and will help residents adopt electric vehicles and facilitate the City's increasingly electrified fleet.

- Finally, changing the perception of electric vehicles from expensive to accessible to all income levels will help bring the benefits of cleaner, lower cost transportation to more households. By offering education and outreach, PGE will raise awareness that there are electric vehicles available on the market likely to meet any car buyer's needs.

We are not only excited about the opportunities that PGE's proposals create, but believe that PGE's proposals are necessary for us to reach our Climate Action Plan goals. We are committed to working with PGE to make their pilots a success.

The City of Milwaukie fully supports PGE's proposed efforts and recommends that the Commission approve them.

Sincerely,

Mark Gamba, Mayor
City of Milwaukie

CITY OF **MILWAUKIE** • 10722 SE Main St, Milwaukie, OR 97222 • www.milwaukieoregon.gov

February 14, 2019

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301

Dear Commissioners:

Forth is a non-profit trade organization working to accelerate the growth of the electric and smart mobility industry and promote greater adoption of these technologies. We have over 160 members representing automakers, EVSE suppliers, industry partners, utilities, local governments, nonprofits, and many other stakeholders within the transportation electrification space.

Governor Brown's ambitious commitment to meet state climate goals by getting 50,000 EVs on the road by 2020 provides an urgency to take action to increase EV adoption. Meeting this goal would provide enormous air quality and economic benefits for our entire region. This will not be an easy task to manage, however. Utilities are uniquely positioned to be a valuable resource to their customers in providing information about electric vehicles but, perhaps more importantly, in deploying charging infrastructure to meet customer needs while also ensuring that these technologies can safely and efficiently support the grid.

Among many other factors influencing consumer's decisions to purchase EVs, the perceived and actual availability of charging infrastructure is one of the largest barriers to widespread adoption. As vehicles with longer range enter the market to meet demand, existing electric infrastructure in single family homes does not support charging fast enough. Providing an incentive to offset the added costs of purchasing a faster home charger is one way to address these barriers. Further, providing charging infrastructure in public locations such as workplaces and businesses will not only provide greater visibility of these technologies, but will also help support the charging needs of customers that may not have access to home charging such as those living in multi-unit dwellings and low-income drivers.

Forth has been actively involved in the passage and rulemaking process of SB 1547. We have been in close conversation with Portland General Electric as they have developed their Transportation Electrification Plans. This letter is to demonstrate our support of Portland General Electric's UM 1811 compliance filing. We believe the proposal being submitted reflects the opportunity and imperative that exists for utilities to invest in accelerating transportation electrification. Additionally, we feel this proposal provides PGE the opportunity to keep up with innovation that is prevalent in this space and support a competitive market for charging station providers.

Forth supports the proposed residential and business EV charging pilot programs and would be happy to provide additional insight and support as this and future proposals move forward.

Sincerely,

Jeanette Shaw
Director, Government Relations
Forth
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TRIMET

February 8, 2019

Public Utility Commission
201 High Street SE, Suite 100
Salem, Oregon 97301-3398

Dear Commissioners,

By providing bus, light rail and commuter rail transit services in the Portland, Oregon, metro area, TriMet connects people with their community, while easing traffic congestion and reducing air pollution – making the Portland area a better place to live. Over 98 million trips are taken on TriMet each year, including 15 million trips by seniors and people with disabilities. TriMet has long been a leader in the Portland region's efforts to reduce air pollution, including expanding transit service and investing in clean technology to reduce bus emissions.

Through our Non-Diesel Bus Plan adopted in September 2018, we have committed to converting to a non-diesel bus fleet by or before 2040. We have received two grants through the Federal Transit Administration's Low or No Emission Vehicle Program (Low-No program). The first five battery electric buses will be deployed on our Line 62-Murray Blvd–Beaverton this year, utilizing a close partnership with PGE for battery charging equipment. The second five battery electric buses funded through the Low-No program will be added to our Line 20-Burnside/Stark, connecting Beaverton to Portland and Gresham. Over the next five years, we plan to buy up to 80 additional electric buses to deploy throughout our system but primarily in the East Portland and East Multnomah County areas.

As we move towards this vision of a non-diesel fleet, partnership with our electric utility is crucial. Planning our systems together helps ensure optimal design and right-sizing infrastructure in the best possible locations to meet our reliability needs. Through this relationship we will better manage costs and continue to provide low-cost, clean, reliable transportation service to the community.

We support PGE's application seeking PUC approval to invest in electric bus charging infrastructure. We believe this plan is structured in such a way as to benefit all PGE customers and promote the efficient utilization of the bus-charging infrastructure, while providing an appropriate backstop should TriMet utilization of the infrastructure fall below anticipated levels. The proposed approach allows PGE and TriMet to move forward in a mutually advantageous way that also supports the broader customer base, advances transportation electrification and provides the foundation for future innovative use of battery storage to maximize the value of renewables, support grid stability and resiliency. We look forward to our continued collaboration with PGE on battery electric bus planning and operations into the future.

Sincerely,

Doug Kelsey
General Manager

Tri-County Metropolitan Transportation District of Oregon
1800 SW 1st Avenue, Suite 300, Portland, Oregon 97201 • 503-238-RIDE (7433) • TTY 7-1-1 • trimet.org

Appendix C Cost Effectiveness Memo

This memo is intended to provide PGE's recommendations for determining cost effectiveness and attribution methodologies for TE programs. These methodologies are intended to balance the economic regulation mission of the OPUC, with the clearly stated policy direction of the legislature for utilities to accelerate the TE market.

Background

Oregon Laws 2016, Chapter 28, and corresponding Oregon Administrative Rule 860 Division 087 have created the opportunity for utilities to demonstrate to the OPUC and to regulatory stakeholders that TE programs can result in a net benefit for customers of the electric utility:

> *"Deploying transportation electrification and electric vehicles creates the opportunity for an electric company to propose, to the Public Utility Commission, that a net benefit for the customers of the electric company is attainable;"*[57]

Although the Legislature – in its direction for utilities to accelerate the TE market – contemplated TE's ability to create net benefits for utility customers, net benefits were not one of the six factors established for the Commission to consider in approving utility programs. However, as noted in a 2012 Commission order [suggest including cite to this order], net benefits may be a consideration when considering prudency, which is one of the six factors.

In 2018, the OPUC approved TE pilots for PGE and PAC (the "companies"). The OPUC directed both companies to work together to develop cost effectiveness and attribution methodologies:

> *"PGE is to hold workshops with Staff and intervenors to develop cost effectiveness and attribution methodologies for TE programs. PGE is encouraged to work with Pacific Power to coordinate or co-develop these models."*[58]

Further, Paragraph 15 of the stipulation requires PAC to support and fund the development of an attribution model and cost-effectiveness framework that will inform future evaluation efforts and programs. The development of this model is to be coordinated with similar efforts made by Portland General Electric, with input from stipulating parties.[59]

On October 17, 2018, PGE and PAC held a workshop – attended by OPUC Staff, Oregon Department of Justice (DOJ), Climate Solutions, ChargePoint, Forth, Oregon Citizens' Utility Board (CUB), Natural Resources Defense Council (NRDC), and GreenLots – to discuss cost effectiveness and attribution methodology. During this workshop, there was discussion of whether or how the Commission should use economic indicators to evaluate concepts such as cross-sector decarbonization, and whether or how the concept of "identification of highest value" should be evaluated.

[57] Chapter 28, Oregon Laws 2016 Section 20. (2) (f)
[58] Order No. 18-054 (UM 1811)
[59] Order No. 18-075 (UM 1810)

Cost Effectiveness and Commission Mission

PGE is proposing a framework for assessing costs and benefits to utility customers that can inform the size, scale, and direction of future investments designed to accelerate TE. This basis of this framework is drawn from the cost effectiveness methodologies outlined in California's *Standard Practice for Cost-Benefit Analysis of Conservation and Load Management Programs* (1983), which describes cost-tests and approaches for determining cost effectiveness. The cost benefit test options outlined are in Table 30.

Table 30 Cost Effectiveness Tests

Test	Acronym	Approach	Focus
Ratepayer Impact Measure	RIM	Comparison of administration costs and potential bill reductions to a supply-side resource	What are the economic benefits of the program compared to the costs of a supply-side resource?
Total Resource Cost	TRC	Determination of whether the total costs of energy in the utility service territory will decrease.	Builds on the economic foundation of the RIM test, in some states, this test can include the monetized benefits of avoided emissions or other resource-driven savings
Societal Cost Test	SCT	Determination of whether the municipality/state/nation is better off due to the program	Includes economic principles, like the RIM and TRC costs. Can also include non-cash costs and benefits such as environmental impact
Participant Cost Test	PCT	Will the participants benefit from this program?	Comparison of the costs and benefits of the customer participating in the program.

Source: Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects

While Oregon has established methodologies that differ from the tests in the California Standards and Practice Manual, we believe that the Manual provides a usable basis for economic cost effectiveness tests that are nationally recognized, and that fit within the mission of the OPUC, as described in statute. The Ratepayer Impact Measure test – which focuses on what the economic benefits of the program are when compared to a supply-side resource – provides this economic basis.

Per Oregon Revised Statute (ORS) 756.040, the Commission has the overarching responsibility to promote and support core public policy objectives: fair and reasonable prices and utility practices, universal access for all customers, and safe and secure operations. We also read Commission responsibility to include:

- Ensuring high-quality service at fair and reasonable rates;
- Advising the Legislature; and
- Executing state and federal policies as directed in legislation and executive order

Thus, we realize that the basis of cost effectiveness tests in Oregon must focus on economic regulation – fair and reasonable prices – first and foremost. However, we also acknowledge the opportunity for rapid cross-sector decarbonization that can be achieved through TE, as directed by the legislature. We believe that these factors can and should be considered on a limited basis as an extension of the "executing state and federal policies" responsibility.

In contrast to traditional utility investments, including other customer-sited technologies, utility involvement in accelerating TE is a relatively new and emerging area nationally, and methods to assess prudence are evolving in turn.

The framework is informed by best practices, studies, and research:

- State and local policymakers set EV sales goals;
- Discussions with stakeholders;
- Studies in other jurisdictions (California, Seattle, and other Pacific Northwest utilities) quantify net benefits of EVs;
- Independent researchers develop EV sales forecasts based on market factors.

Analyzing the cost effectiveness of TE investments requires a different framework than traditional energy efficiency and DR programs because TE:

- Increases electricity consumption;
- May increases the need for electricity infrastructure;
- Involves substituting electricity for gasoline, diesel, and other combustible fuels;
- Includes mobile technology, which may:
    - travel in and out of a utility's service territory;
    - provide locational flexibility (ability to add an energy sink or source at varying locations on the utility's system); and
- Includes several demonstrable benefits (environmental, health, economic, etc.) attributable to reducing emissions from another sector.

The Companies propose to evaluate cost effectiveness with a RIM test as an economic basis, modified to include analysis of specific environmental and societal benefits that can be brought to the region through cross-sector decarbonization, such as revenue from the Oregon Department of Environmental Quality CFP and potential future decarbonization benefits. This approach, the Transportation Electrification Assessment Methodology (TEAM), recognizes the legislature's direction for utilities to accelerate the market. To calculate the TEAM, the Companies should account for all ratepayer benefits and costs added to the system:

- Benefits of new TE included are:
    - Increased utility revenue from new electricity sales
    - DR and/or flexible load capability
    - Additional benefit streams for programs and portfolios may be included for a portion of EVs based on program design (e.g. TOU rates, Ancillary services/Power quality, Vehicle to Grid):
        - Avoided supply costs (capacity and energy)
        - Revenues from market participation
        - Reduced particulate matter or other air quality metrics
    - Marginal environmental benefits because of carbon legislation – as currently used in the approved Resource Value of Solar (RVOS) methodologies and in each company's IRP
- Costs of new EVs included are:
    - Necessary system upgrades to support new EV loads
    - Incremental supply costs (capacity and energy, including any incremental compliance costs)
    - Applicable EV program costs:
        - Program administrative costs
        - Participant incentives
        - EV-related infrastructure costs

Table 31 shows how PGE would modify a standard RIM test to include additional factors and achieve a TEAM analysis:

Table 31 TEAM vs. RIM factors

Component	RIM	Additional Factors	TEAM
Increased energy and capacity supply costs	Cost		Cost
Monetized Environmental Benefits (e.g. Carbon)		Benefit	Benefit
Increased Retail Revenue	Benefit		Benefit
Program Overhead costs	Cost		Cost
Market Participation Revenue (e.g. CFP)	Benefit		Benefit
Incentive Payments	Cost		Cost
Bill Savings	Cost		Cost
Incremental equipment costs (as applicable; separate from incentive payments)		Cost	Cost

How the TEAM should be calculated and applied:

- Per vehicle: The TEAM should be evaluated on a per vehicle basis for utilities to understand the value (or cost) to the grid for an EV coming to the system. This value will not be inclusive of program costs.
- Forecasted Fleet: The TEAM will be evaluated for all forecasted EVs expected to come to the utilities' service territories for utilities to understand the value (or cost) to the grid/ratepayers for foreseeable EVs coming to the system. This value will not be inclusive of program costs.
- Program: The TEAM will be evaluated for each new program proposed. The TEAM will modify the Forecasted fleet option, above, by including program costs and additional program benefits for the TE participants.
- Portfolio: the companies will track an ongoing/updated portfolio TEAM that includes forecasted TE adoption, planned TE program costs, and estimated TE program benefits.

Note: attribution will be investigated as a part of program evaluations but will not be applied in cost effectiveness calculations.

The utilities will work towards developing a portfolio of customer-funded programs to accelerate TE with total costs less than the total benefits from all EVs on the system. In addition to calculating TEAM for evaluating the benefits of EVs to the grid, the companies will also estimate greenhouse gas emissions reductions from the transportation sector because of TE.

Attribution

Attribution estimates the degree of influence that utility programs have had on customer actions. This is achieved through an analysis of what would have happened in the absence of the program(s) (i.e. the "counterfactual" situation) and comparison of this to what happened with the program(s). The counterfactual can never be perfectly known, it could only be estimated. Program impacts can also be separated into direct and indirect impacts. Direct impacts occur when utility customers are personally exposed to program activities, which influence their decision-making. Indirect impacts occur when customers are influenced by the decisions made by others who interacted with the program and are harder to measure. As an example, in the electric car market, this could occur when a residential customer that was not exposed to utility activities (e.g. marketing, new charging facilities) is influenced by new workplace charging that resulted from utility efforts.

Specific tools for calculating and estimating attribution will vary by program and will be proposed with each future program filing.

Portland General Electric Company
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