Portland General Electric
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June 1, 2023

Via Electronic Filing

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

Re: Docket No. UM 2033, PGE Transportation Electrification Plan

Filing Center:

Portland General Electric (PGE or the Company) is pleased to submit a draft Transportation Electrification (TE) Plan to the Public Utility Commission of Oregon (OPUC or Commission) in compliance with ORS 757.357 and OAR Chapter 860, Division 87. The draft encompasses PGE's proposed portfolio of activities in support of TE for program years 2023-2025.

PGE's draft TE Plan is designed to support our customers, manage increasing electric vehicle load, and address market barriers in the transition to electric transportation. The proposed draft plan includes discussion of Commission-approved TE activities already underway, as well as applications for new programs and infrastructure measures and a portfolio-level TE Budget. The budget delineates proposed expenditures using revenues from the HB 2165 Monthly Meter Charge, the Clean Fuels Program, and other sources, with special emphasis on activities in support of TE for underserved communities.

The draft plan was informed by frequent discussions with Commission Staff, utilities, and stakeholders spanning Staff's investigation of a TE Investment Framework (Docket No. UM 2165) and the recent Division 87 rulemaking (Docket No. AR 654), as well as six stakeholder workshops the Company held to share specific concepts and solicit input on the content and scope of our plan. PGE thanks Staff and stakeholders for their thoughtful engagement and feedback in these processes.

As required under the Division 87 rules, we are submitting this three-year plan in draft form for public review by Staff and stakeholders. We will consider and respond to comments received during this review before filing a final plan for Commission acceptance in the coming months.

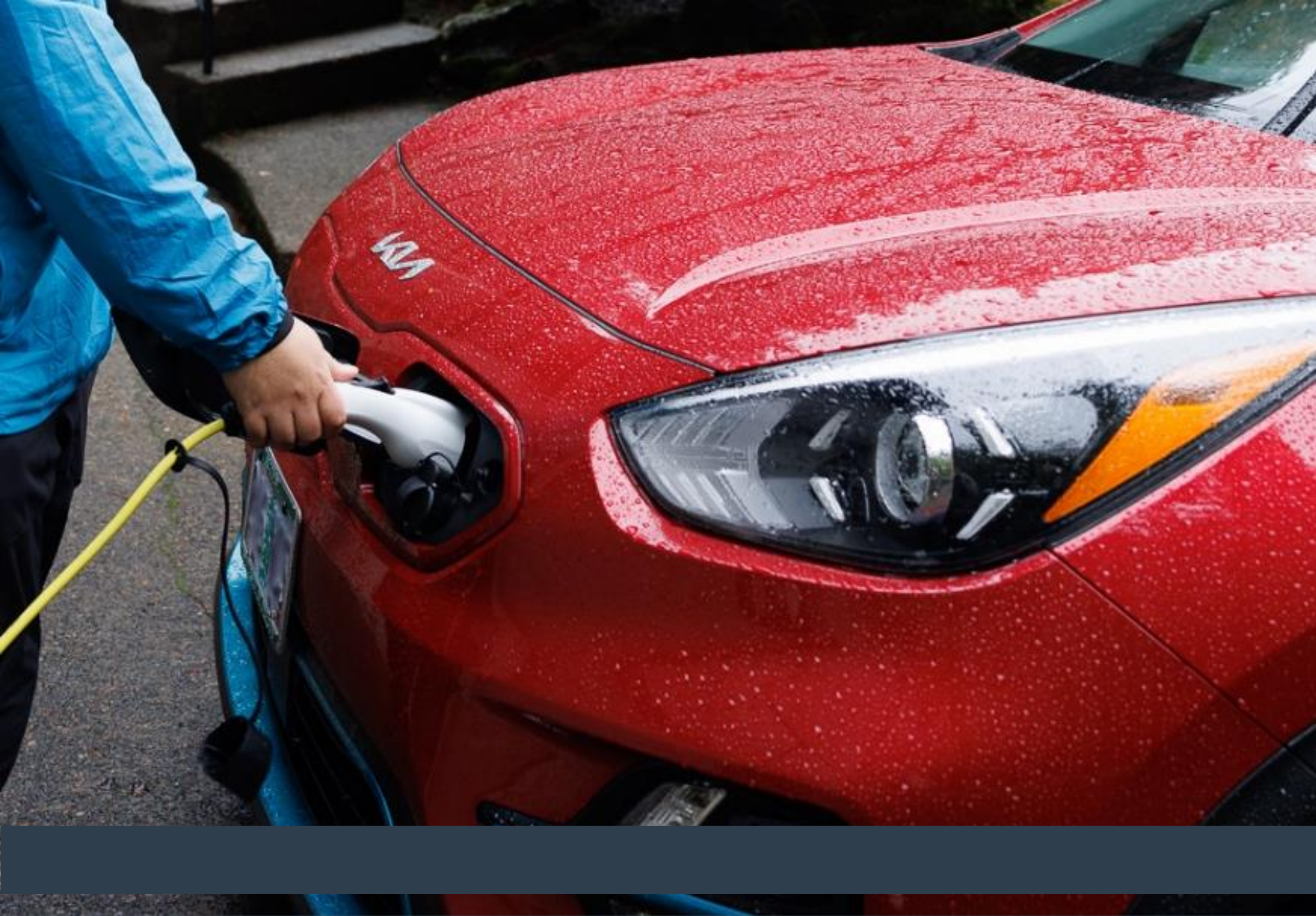
Please contact Steven Corson at 503-550-0857 if you have questions or require further information. Please direct all formal correspondence and requests to pge.opuc.filings@pgn.com.

Thank you,

/s/ Riley Peck
Riley Peck
Senior Manager, Regulatory Strategy and Engagement

ATTACHMENT

Cc: UM 2033, UM 2165, AR 654 Service Lists
Eric Shierman
Sarah HallU



2023 Transportation Electrification Plan

PGE

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Figures, Tables, Charts

Abbreviations

ACC ... Advanced Clean Cars II Rule

ACEEE ......American Council for an Energy Efficient Economy

ACT .... California's Advanced Clean Trucks

ADA ... Americans with Disabilities Act

ATE..... Association for Transportation Electrification

BEV..... Battery Electric Vehicles

BNEF.. Bloomberg New Energy Finance, or BloombergNEF

CBO ... Community-Based Organization

CaaS... Charging as a Service

CCS .... Combined Charging System

CEP .... PGE's Clean Energy Plan

CFC .... Clean Fuels Credit

CFP..... Oregon Clean Fuels Program

DAC ... Disadvantaged Community

DCF .... Drive Change Fund

DCFC . Direct Current Fast Charge

DEQ ... Department of Environmental Quality

DER(S) Distributed Energy Resource(s)

DLC .... Direct Load Control

DOE ... Department of Energy

DOT ... Department of Transportation

DR....... Demand Response

DSP .... PGE's Distribution System Plan

ECGD. Electric Car Guest Drive

EEI ...... Edison Electric Institute

EMV.... Euro Mastercard Visa

EPA..... Environmental Protection Agency

EPRI .... Electric Power Research Institute

EPS ..... Energy Performance Score

EQC ... Environmental Quality Commission

ESB ..... Electric School Bus Fund

EV .... Electric Vehicle

EVSE... Electric Vehicle Service (or Supply) Equipment

FTC..... Federal Tax Credit

GHG ... Greenhouse Gas

HB....... Oregon House Bill

HDV.... Heavy-Duty Vehicle

I-5........ Interstate 5

ICE ...... Internal Combustion Engine

IEC ...... International Electrotechnical Commission

IIJA ..... Infrastructure Investment and Jobs Act

IRA ...... Inflation Reduction Act

IRP ...... PGE's Integrated Resource Plan

ISO ..... International Organization of Standards

kW ...... Kilowatt

kWh .... Kilowatt-hour

L2........ Level 2

LADWP .... Los Angeles Department of Water and Power

LDV..... Light-Duty Vehicle

LEA ..... Line Extension Allowance

LMI...... Low and Moderate Income

MCS ... Megawatt Charging System

MDHDV ... Medium-Duty/Heavy-Duty Vehicle

MDV ... Medium-Duty Vehicle

MMC .. Monthly Meter Charge (aka TE Charge)

MW..... Megawatt

MWh .. Megawatt-hour

MYP .... PGE's Flexible Load Multi-Year Plan

NEC .... National Electric Code

NEEA.. Northwest Energy Efficiency Alliance

NEMA National Electrical Manufacturers Association

NESC . National Electric Safety Code

NEVI ... National Electric Vehicle Infrastructure

NSPM for DERs National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources

NREL .. National Renewable Energy Laboratory

NWS... Non-Wires Solution

O&M .. Operating and Maintenance

OCPP . Open Charge Point Protocol

ODOE Oregon Department of Energy

ODOT Oregon Department of Transportation

OEM... Original Equipment Manufacturer

OpenADR Open Automated Demand Response

OPUC. Oregon Public Utility Commission (see also PUC)

ORS .... Oregon Revised Statutes

PACT.. Program Administrator Cost Test (see also UCT)

PBOT . Portland Bureau of Transportation

PCT..... Participant Cost Test

PHEV .. Plugin Hybrid Electric Vehicles

POEM Pricing Options for Equitable Mobility

PUC .... Oregon Public Utility Commission (see also OPUC)

RAP..... Regulatory Assistance Project

REC .... Renewable Energy Credit

RFP ..... Request for Proposal

RIM ..... Ratepayer Impact Measure

ROW .. Right-of-Way

SAE..... Society of Automotive Engineers

SCC .... Social Cost of Carbon

SCT..... Societal Cost Test

SPM .... Standard Practice Manual

T&D .... Transmission and Distribution

TCO.... Total Cost of Ownership

TE........ Transportation Electrification

TE Charge Transportation Electrification Charge (aka MMC Charge)

TE Plan ..... Transportation Electrification Plan (see also TEP)

TEIF .... Transportation Electrification Investment Framework

TEINA. Transportation Electrification Infrastructure Needs Analysis

TEP ..... Transportation Electrification Plan (see also TE Plan)

Testbed ... PGE’s Smart Grid Testbed

TNC .... Transportation Network Company

TOD ... Time of Day

TOU.... Time of Use

TRC..... Total Resource Cost

TriMet Tri-County Metropolitan Transit Authority

UCT .... Utility Cost Test (see also PACT)

UL .... Underwriters Laboratory

UM...... Utility Miscellaneous (OPUC Docket)

USDOE .... U.S. Department of Energy

V2G .... Vehicle-to-Grid

V2X..... Vehicle-to -Grid, -Building, or -Home

VPP ..... Virtual Power Plant

WCCTC ... West Coast Clean Transit Corridor

WPP.... Western Power Pool

WRAP. Western Resource Adequacy Program

ZEV ..... Zero Emission Vehicle

Key Terms

Behind-the-meter pertains to components of the electrical system on the "customer side" of the electric meter, where the customer bears responsibility for design, construction, and maintenance (e.g., the electrical panel/switchgear, wiring to an electric vehicle charger).

Demand Response (DR) is a concept that reflects "Changes in [energy] usage by end-use customers from their normal consumption patterns in response to changes in the price of [energy] over time, or to incentive payments designed to induce lower [energy] use at times of high wholesale market prices or when system reliability is jeopardized."[1]

Flexible Load, or Flex Load is a dynamic form of DR capable of providing valuable grid balancing services. Grid balancing services are necessary for integrating high levels of renewable or variable energy resources. To supply grid balancing services, these demand-side resources must be available to grid operators throughout the day and capable of supplying several different types of energy products beyond peak load shifting.

Managed Load (also Managed Charging), in the context of Transportation Electrification, balances vehicle energy needs and energy control objectives. Managed charging can ensure that vehicles are properly powered when needed, while supporting a more reliable and resilient grid.[2]

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[1] FERC. *National Assessment and Action Plan on Demand Response.* Retrieved from https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential.asp.

[2] Federal Energy Management Program. *Managed Electric Vehicle Charging*. Definition adapted from a definition of Managed Electric Vehicle Charging. Original text retrieved from https://www.energy.gov/femp/managed-electric-vehicle-charging#:~:text=Managed%20electric%20vehicle%20(EV)%20charging,more%20reliable%20and%20resilient%20grid.

The following quick reference table on Electric Vehicle charger types was adapted from U.S. DOT and Alternative Fuels Data Center references[3,4]:

Table 1. Quick Reference: Charger Types and Key Characteristics

	Level 1	Level 2	Direct Charge Fast Charging
Connector Type[5]	J1772	J1772	CCS, CHAdeMO, Tesla
Voltage[6]	120 V AC	208-240 V AC	400-1000 V DC
Typical Power Output	1 kW	7-19 kW	50-350 kW
Estimated PHEV Charge Time from Empty[7]	5-6 hours	1-2 hours	N/A
Estimated BEV Charge Time from Empty[8]	40-50 hours	4-10 hours	20 minutes-1 hour[9]
Estimated Electric Range per Hour of Charging	2-5 miles	10-20 miles	180-240 miles
Typical Locations	Home	Home, Workplace, and Public	Public

[3] Adapted from U.S. DOT: https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds
[4] Adapted Alternative Fuels Data Center: https://afdc.energy.gov/fuels/electricity_infrastructure.html.
[5] Different vehicles have different charge ports. For DCFC, the Combined Charging System (CCS) connector is based on an open international standard and is common on vehicles manufactured in North America and Europe; the CHArge de Move (CHAdeMO) connector is most common for Japanese manufactured vehicles. Tesla vehicles have a unique connector that works for all charging speeds, including at Tesla's "Supercharger" DCFC stations, while non-Tesla vehicles require adapters at these stations.
[6] AC = alternating current; DC = direct current.
[7] Assuming an 8-kWh battery; most plug-in hybrids do not work with fast chargers.
[8] Assuming a 60-kWh battery.
[9] To 80 percent charge. Charging speed slows as the battery gets closer to full to prevent damage to the battery. Therefore, it is more cost- and time-efficient for EV drivers to use direct current (DC) fast charging until the battery reaches 80 percent, and then continue on their trip. It can take about as long to charge the last 10 percent of an EV battery as the first 90 percent.

About PGE

PGE's purpose is to power the advancement of society. We have served our customers with safe, reliable, and affordable power for over 130 years. We engage in robust planning, analysis, as well as stakeholder and community engagement, which collectively inform our investments in resources, customer programs, and the grid. We are committed to balancing affordability, reliability, and reductions in greenhouse gas (GHG) emissions across all of our planning efforts.

As Oregon's largest electricity supplier, we recognize our unique role in addressing climate change and leading an equitable clean energy transition in Oregon. We demonstrate this commitment in our climate-related goals and detailed disclosures of our progress in our annual environmental, social, and governance (ESG) report. Our commitment is aligned with the climate and clean energy goals of many of the customers and communities we serve. This Transportation Electrification Plan represents a continuation of our clean energy engagement, which we began years ago in response to customer demands, climate science, emerging technologies, and market opportunities.

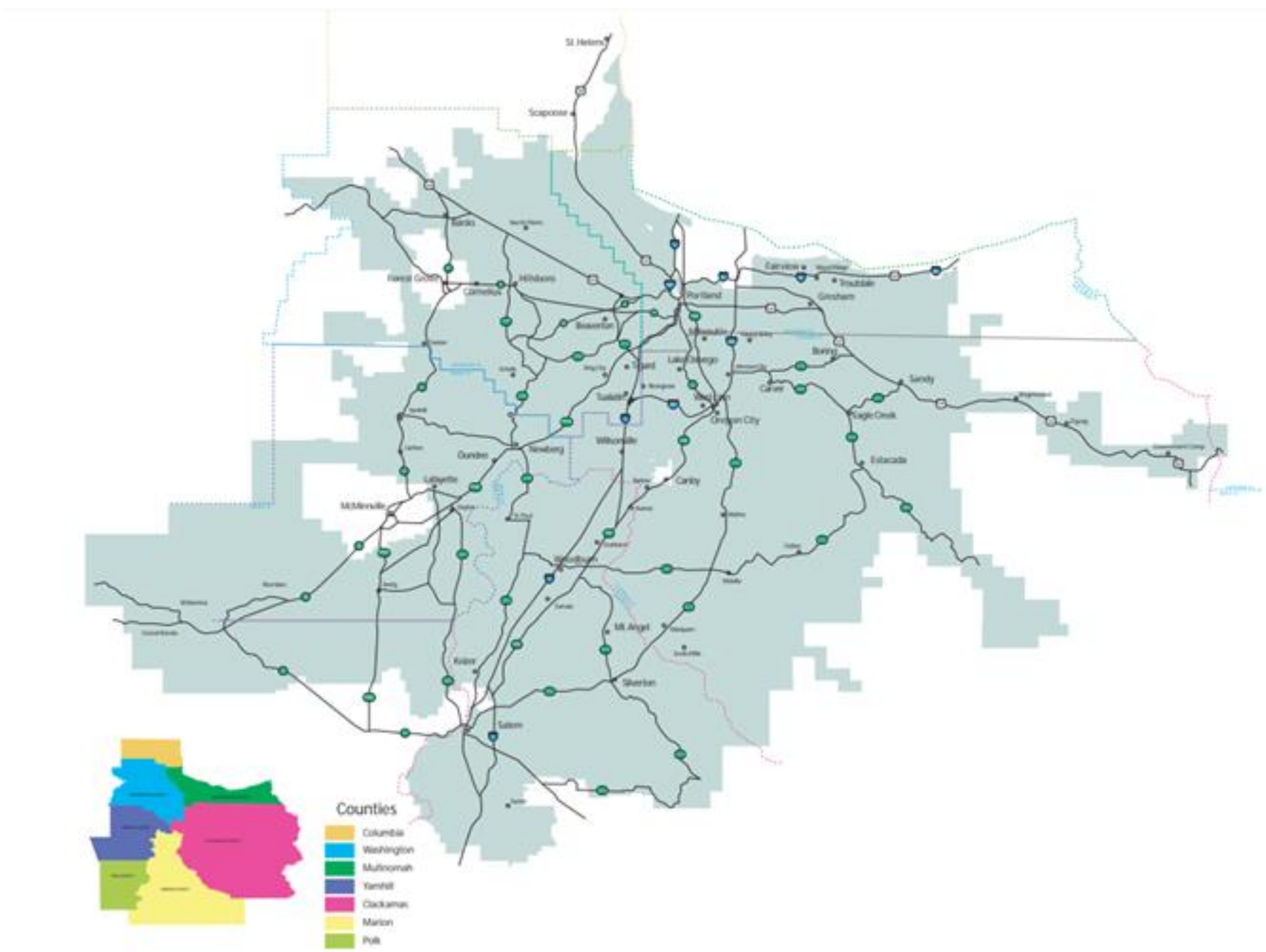

Figure 1. PGE Service Area

Summary for Policy Makers

Portland General Electric's (PGE or the Company) 2023 Transportation Electrification Plan (Plan or TE Plan) represents a continuation of the approach, strategy, and programmatic efforts found within PGE's 2019 TE Plan. The strategic elements of Rates, Programs and Infrastructure are incorporated into PGE 2023 TE Plan strategy of Plan, Serve, and Manage the load. In the 2023–2025 period covered by this Plan, PGE is directing $94 million into the transportation electrification (TE) market through four sources of funding: the Clean Fuels Program ($45.2 million), the Monthly Meter Charge ($21.4 million), existing/approved customer investment ($17.6 million), and an additional incremental investment requested herein from customers of $9.8 million.

This investment furthers existing activity and champions new activity in: Business and Multi-family Make-ready Solutions, Business EV (Electric Vehicle) Charging Rebates, EV-Ready Affordable Housing Grants, Fleet Partner Pilot, Public Charging – Municipal Charging Collaboration, Residential Smart Charging Pilot, Heavy Duty Charging Pilot, Clean Fuels Program including our grant work, Public Charging – Electric Avenue, and emerging technology. The portfolio of activity within our 2023 Plan directs 58 percent of the investment to meet the needs of underserved communities. Nearly every funded activity is designed with or is exploring how to manage and serve TE (Transportation Electrification) load. The activities detailed within the Plan are all designed to collect information to assist PGE's planning to serve and manage TE load. Whenever PGE makes an investment in TE infrastructure, PGE is requiring data sharing. This data will grant insights into load shapes, dwell times, rate of charge, charger utilization, charge up-time, state of charge, and customer challenges including cost. This design will be used by PGE to inform development of new rates and tariffs as we serve and manage TE load just as we do other major loads.

The portfolio of work is designed to meet customer needs while properly defining PGE's role in a swiftly evolving market. The market has changed significantly since our 2019 TE Plan. Automobile manufacturers have made significant investment and are offering an ever-growing array of new models. Electric vehicle service equipment (EVSE) manufacturers are investing in new charging sites and platforms. The federal government is adjusting regulation and has issued incentives to induce accelerated customer and market investment. Where the private market may not act, PGE's 2023 TE Plan makes the necessary investment to assure an equitable transportation electrification experience for all our customers. Our activities in these communities are meant to serve while demonstrating, attracting, and partnering with willing private market entities. Our investments detailed in this Plan situate PGE for new types and use of TE load. Through this TE Plan, PGE will further explore vehicle-to-grid (V2G) technology and the coordination of planning, investment, and siting of heavy-duty high-capacity charging.

PGE's 2023 TE Plan is the right investment at the right time, placed in proper context of further utility and community decarbonization investment. The portfolio of activity has an overall 0.15 percent customer impact across all rate classes. Our programs equitably assist businesses, fleet, communities, non-profits, residential customers, and municipalities in their shift to electric vehicles. The investments utilize existing funding mechanisms to the greatest extent possible while minimizing further customer investment. We have made adjustments to items such as incentives and covered make-ready costs within each of the programs to extend the value of every dollar deployed and to find the right balance of customer and PGE investment. This is why the portfolio holds a positive total resource cost score. Lastly, the portfolio of activity is designed to be flexible. If additional investment is necessary to meet market needs, PGE will engage with stakeholders and the Commission to adjust our activity throughout the 2023-2025 planning cycle.

Key Points

Market Movement

- Automobile manufacturers have significantly increased the number of electric vehicle models available to all types of customers.
- Federal incentives such as the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA) and state incentives are helping to drive electric vehicle adoption.

PGE's Strategy

Our strategy to **Plan, Serve, and Manage TE load** guides the proposed activity outline in this TE Plan.

- PGE has made investments to **Plan** for TE load, expanding our ability to model and forecast TE Load, which informs how best to serve that load.
- PGE has constructed a portfolio of activity meant to **Serve** emerging TE loads such as electric fleets while also meeting the needs of underserved communities through our multi-family and municipal charging programs. The portfolio of activity will inform our approach to serve TE load within our traditional business practices as we would any new load, our development of TE-specific rates and tariffs, and also TE load management.
- PGE is investing in and exploring approaches to **Manage** TE load, whether through telematics to the car or communications to the electric vehicle charger. Where possible, the TE activity funded through this Plan requires participating customers to partner with PGE to manage load. Investments in our Integrated Operations Center and Advanced Distribution Automation System will pair with our managed load programs to use TE load as a resource thereby enhancing our capability to reliably serve at least cost.

Funding

- PGE is directing $94 million into the transportation electrification (TE) market through four sources of funding: the Clean Fuels Program ($45.2 million), the Monthly Meter Charge ($21.4 million), existing/approved customer investment ($17.6 million), and an additional incremental investment requested herein from customers of $9.8 million.
- Fifty-eight percent of the TE Plan portfolio funding is directed to address the needs of underserved communities.
- Where PGE funds make-ready infrastructure, we require the exchange of data and the development of load management to enhance our resource capabilities and manage overall costs to serve TE Load.
- The overall rate impact of this TE Plan's new investment is equivalent to a 0.15 percent increase.

Flexibility

- The portfolio of activity is flexible enough to adjust to market conditions should they accelerate. PGE will re-engage with stakeholders and the Oregon Public Utility Commission (OPUC or Commission) during this funding cycle if additional activity is necessary to meet market needs.

Chapter 1. Introduction

Portland General Electric is pleased to share our draft 2023 Transportation Electrification Plan. This Plan describes the Company's current actions in support of transportation electrification for its customers and provides a roadmap of transportation electrification activities through 2025. This draft provides the Oregon Public Utility Commission and stakeholders an opportunity to engage prior to filing of the Plan later this year.

It has been three years since PGE's last filed TE Plan. The TE market is rapidly maturing, through accelerated EV adoption, automaker investment, and state/federal investment and policy action. The transition to electric vehicles is underway in Oregon, with the state surpassing 62,000 registered EVs in 2023[10] and EV's accounting for more than seven percent of new vehicles registered in Oregon in 2021, the fourth-highest percentage nationally.[11] As of 2023 the State of Oregon reports over 2,064 charging sites.[12]

PGE's 2019 TE Plan strategy and perspective informed significant investment to *accelerate* electric vehicle adoption. In 2022, following the Commission completion of their Oregon Administrative Rulemaking Division 87, PGE had planned to submit our draft 2022 TE Plan. Earlier that year, PGE's TE Team shared with stakeholders a portfolio of activity informed by the Oregon Department of Transportation's Transportation Electrification Infrastructure Needs Analysis study (TEINA), our own AdopDER[13] modeling, and the Commission's Transportation Electrification Investment Framework (TEIF) requirements. While PGE has a role in supporting adoption, in some limited cases accelerating adoption, PGE now recognizes the market is accelerating at a rate where PGE customers are best served by PGE focusing on planning for the service of this load and managing the load to the benefit of the system. This perspective is informed by our system planning and TE market development. The Plan proposes only modest incremental customer investment to target PGE activities that inform the proper role of the utility.[14] PGE does propose investment in activity which is ahead of market development (e.g., heavy duty charging, where PGE sees investment as necessary to understand the unique needs and challenges of these high-capacity chargers).

The 2023 TE Plan offered here proposes a portfolio of activities that facilitate PGE's ability to plan for, manage, and serve the TE loads that are rapidly coming to our system. In part this includes activities that will: inform rate design; enable data collection; explore whether unique transportation line extension allowances are needed; inform development of terms and conditions for service such as data sharing and communication system requirements for flex load development; collect lessons regarding how best to meet the needs of underserved communities and PGE's role respective of

[10] Oregon Department of Transportation. *Oregon Electric Vehicle Dashboard.* Retrieved from https://www.oregon.gov/energy/Data-and-Reports/Pages/Oregon-Electric-Vehicle-Dashboard.aspx.
[11] Wells Fargo (June 21, 2022). *Figure of the Week: EV Sales by State, 2021*.
[12] See footnote 10.
[13] AdopDER is a forecasting model that estimates adoption of electric vehicles, EVSE, and associated load impacts and is used for utility forecasting and planning efforts. ODOT's TEINA report is an assessment of public charging infrastructure (e.g., EVSE) requirements to support a given amount of EV adoption following the State's goals. Aside from methodological differences, which will be discussed throughout the section, this is an important distinction in scope between the two modeling efforts that should be emphasized up front.
[14] In limited cases, PGE envisions that role as one to accelerate EV adoption in markets such as underserved communities where private market actors may not yet be prepared to take action either independently or without utility partnership.

these needs. The Plan recognizes that PGE must develop standard practices, tool sets, and service structures which create a seamless transportation electrification experience.

The scope and funding proposed with this TE Plan reflect the needs of the TE market and PGE's need to prepare for associated TE load but are also designed in the context of PGE's other decarbonization activities. As illustrated in our combined March 2023 Integrated Resource Plan (IRP) and our first ever Clean Energy Plan (CEP), meeting the clean energy and GHG reduction targets outlined in HB 2021 will require significant resource investment. The scope and funding proposed with this TE Plan balance the needs of the TE market within that larger context of the clean energy transition.

The PGE's 2023 TE Plan further attempts to find proper balance between expenditure and market needs by optimizing use of Clean Fuels Credit revenues and Monthly Meter Charge funding while requesting a modest incremental customer investment. Our aim in so doing is to position PGE to meet the current emerging market while developing sustainable long term business practices to support transportation electrification.

Table 2, below, is a showing of previously approved budgeted activity. Some of this activity was approved through program proposals between 2020 and 2022. Some of the activity represented in this table was approved through our 2023 Monthly Meter Charge Budget filing.[15] Lastly, some of the items in Table represent Clean Fuels Program activity.

Table 2. Transportation Electrification Budget: Previously Approved Budget[16]

TE Portfolio Approved Spend	2023-2025 Approved Spend
Customer Ratepayer Subtotal	$14,022,907
Business & Multi-family Make-ready Solutions	$1,854,630
Fleet Partner Pilot	$7,821,324
Heavy Duty Charging Pilot	$3,620,453
Portfolio Support	$300,000
Residential Smart Charging Pilot	$426,500
Monthly Meter Charge Subtotal	$10,472,728
Business & Multi-family Make-ready Solutions	$692,500
Business EV Charging Rebates	$1,957,728
EV Ready Affordable Housing Grants	$1,000,000
Fleet Partner Pilot	$832,000
Portfolio Support	$1,511,500
Public Charging – Municipal Charging Collaboration	$3,742,000
Residential Smart Charging Pilot	$737,000
Deferral Subtotal	$3,629,968
Business EV Charging Rebates	$831,000
Public Charging – Electric Ave	$1,118,968

[15] Oregon Public Utility Commission. *Docket UM 2033 Portland General Electric's Proposed Monthly Meter Charge Budget for 2023*, Submitted March 23, 2023 retrieved from https://www.oregon.gov/puc/edockets/pages/default.aspx.
[16] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

TE Portfolio Approved Spend	2023-2025 Approved Spend
Residential Smart Charging Pilot	$1,680,000
Clean Fuels Program (2023 budget)	*$11,758,817*
Previously Approved Budgets + Clean Fuels Program (2023)	*$39,884,420*

Table 3, below, encompasses two perspectives regarding incremental funding. The first part of the table shows the incremental spending approval request of PGE's 2023 TE Plan. Though this TE Plan reviews the entire portfolio of work PGE will be conducting through 2025, PGE's 2023 TE Plan requests approval to spend $10.9 million of Monthly Meter Charge funds on program activity found in Table 3. These funds are anticipated to be collected through the Monthly Meter Charge mechanism. Commission's Division 87 rules require Commission approval of the program budgets before spending these funds. The 2023 TE Plan also requests an additional incremental ratepayer investment of $9.8 million to spend on activities noted in Table 3. Further programmatic detail is found within the Plan. The portfolio support line item includes activities such as education and outreach, administrative costs and technical assistance. Additional detail can be found within this Plan. Table 3 also shows a forecast of Clean Fuels Program revenue for 2024 – 2025. The lower section of Table 3 shows how PGE intends to spend $4.6 million of CFP revenue for our Business and Multi-family Make-ready Pilot.

Table 3. Transportation Electrification Budget: Incremental Budget

TE Portfolio Proposed Incremental Spend	2023-2025 Incremental Spend
Customer Subtotal	$9,763,949
Fleet Partner Pilot	$9,463,949
Portfolio Support	$300,000
Monthly Meter Charge Subtotal	$10,917,249
Public Charging – Municipal Charging Collaboration	$575,000
Portfolio Support	$6,266,527
Residential Smart Charging Pilot	$4,075,722
Total Clean Fuels Program Forecast (2024-2025 forecast)	*$33,467,693*
Business & Multi-Family Make-Ready Solutions	*$4,583,800*
Clean Fuels Program (2024-2025 forecasts)	*$28,883,893*
Incremental Budgets + Total Clean Fuels Program (2024-2025 forecast)	*$54,148,890*

1.1 Strategy Overview

This 2023 TE Plan retains the 2019 TE Plan's strategy in rates, programs, and infrastructure. This TE Plan proposed activity continues many of the program and infrastructure activities of 2019 TE Plan, while also collecting data to inform new rate and tariff design or rate adjustments. Many of the 2023 TE Plan's program activities have an infrastructure component to inform PGE's infrastructure role and what the role of utility program(s) should be as the market matures. In the 2019 TE Plan PGE showed how important it was for PGE to have role in developing TE charging infrastructure, most notably behind-the-meter infrastructure serving the chargers. Later in ORS 757.357 (HB 2165, 2021) codified PGE role in make-ready infrastructure behind-the-meter. Lastly, the 2019 TE Plan identified rates as a necessary component of utility TE activity. The 2023 TE Plan's strategy expands on that of the 2019 TE Plan by recognizing PGE's role is to plan for, serve, and manage TE load. The reader will find that within the 2023 TE Plan' strategy the main components of the 2019 TE Plan have been incorporated. For example, the rates component of the 2019 TE Plan has been incorporated into the Manage Load component of the 2023 TE Plan.

Below is a synopsis of the 2023 TE Plan strategy elements: **Plan for TE Load**, **Serve TE Load**, and **Manage TE Load**. Greater detail of the 2023 TE Plan Strategy can be found within the Executive Summary section of the TE Plan and throughout the 2023 TE Plan.

1.1.1 Plan for TE Load

PGE will **lead through planning and siting**. This work includes but is not limited to extending forecasting capabilities to provide insight into load, location and impact by feeder, EV class, and customer type. Additionally, PGE will influence siting of larger loads (e.g., medium-to-heavy duty and fleets) at feeders and substations with available capacity. The collection of this data will inform next steps in planning and program development, as well through which tools PGE serves the load.

PGE will focus on **coordinated corporate planning** by consolidating Distributed Energy Resource (DER) and TE forecasting, as well as consolidating planning of CEP, IRP, and TE Plan to ensure coordination across all efforts.

PGE will update TE forecasts to inform **distribution upgrades and planning**. This new practice will inform **capital planning** activities in a strategic manner

PGE's **state, local, and regional planning** will include parties involved in federal and corridor planning, including regional utilities, Oregon Department of Transportation (ODOT), Oregon Department of Environmental Quality (Oregon DEQ or DEQ), and Oregon Department of Energy (ODOE).

1.1.2 Serve TE Load

PGE will **build distribution and grid infrastructure to serve customers,** aligning those investments to support and serve ongoing TE customer load. PGE's advanced planning tools now incorporate IRA and IIJA data as well as meter data. As a result, our AdopDER model perspective is both broad enough to encompass market shifts and also granular enough to identify new usage and load pockets unique to TE load. These capabilities allow PGE to plan for TE load in a targeted manner, forecasting local TE-driven load growth and distribution system needs assessments ahead of load materializing.

Our planning tools also inform our need for new power generation balanced against trends in customer DER adoption, which PGE is seeing driven by federal tax credits and state incentives. This adoption of self-generation and energy storage is expected to help manage the need for new supply-side generation and TE-related distribution system upgrades. PGE is implementing site generation and storage similarly at our Electric Island facility. Investments such as these will be operationalized through our prior investments in our Integrated Operations Center and our Advanced Distribution Management System. These advanced capabilities enable PGE to harvest the grid benefits of TE load and the new smart grid capabilities of EV batteries and managed TE load, thereby enhancing how we will serve all TE load reliably, safely, and at "least cost". In addition, PGE will conduct work to inform how to better serve TE customers and how to incorporate both TE load and TE customer needs into current business practices and tools. PGE will pursue learnings from distinct, business, multi-family, municipal, and heavy-duty activities. PGE will look for opportunities to acquire TE load management through traditional tools like rate design and tariffs such as line extension allowances.

Figure 2, below, are a brief review of how the 2023 TE Plan proposed to serve TE load within four program areas. This is not the total portfolio or program activity. Greater detail can be found in the programs section and the appendices of the 2023 TE Plan. Figure 2 shows, at a very high-level, how these programs are structured to serve these different types of TE load:

Public Charging – Municipal Charging

- 180 pole chargers + 60 MR curbside by end of year 2025
- Schedule 50, similar to Residential Charging
- Underserved community partnership

Heavy Duty Charging

- Coordinated site development
- Co-siting of storage and local generation
- Distribution upgrade insights
- West Coast Clean Transit Corridor (WCCTC) coordination

Business and Multi-family

- 200 Level 2 (L2) ports by end of year 2025
- Rebate to support customer ownership
- PGE will support customer in determining rate charged to end-user

Fleet Partner

- Make-ready sites for Level 2 and DC Fast Charging (DCFC)
- 401 L2 and 101 DCFC make-ready ports by end of year 2025
- 13.2 MW of load capacity by 2028

Figure 2. How Proposed Programs Serve Different Types of Load

1.1.3 Manage TE Load

PGE seeks to **effectively manage TE load**, enabling and scaling managed charging with vehicle telematics and delivering flexible load and Virtual Power Plant (VPP) MWs.

PGE will **structure TE rates and tariffs to incent "grid-friendly" behaviors**, developing rates that motivate charging behavior, support grid health, load siting investment (e.g., make-ready), and meet policy requirements.

Figure 3, below, provides a brief review of how the 2023 TE Plan proposed to manage TE load within three program areas. This is not the total portfolio or program activity. Greater detail can be found in the programs section and the appendices of the 2023 TE Plan. Figure 3 shows, at a very high-level, how these programs are structured to manage the different types of TE load.

Residential Smart Charging Pilot

- Scale enrollments, up from 2,200 in March 2023
- 2.6 MW managed charging by EOY 2025

Fleet Managed Charging Pilot

- Develop managed charging program for fleet customers beyond current time of day pricing

Heavy Duty Charging

- Coordinated site development
- Co-siting of storage and local generation
- Distribution upgrade control

Figure 3. How Proposed Programs Manage Different Types of Load

The following icons represent the central elements of PGE 2023 TE Plan Strategy. PGE created these icons to visually connect activity to the 2023 TE Plan Strategy.

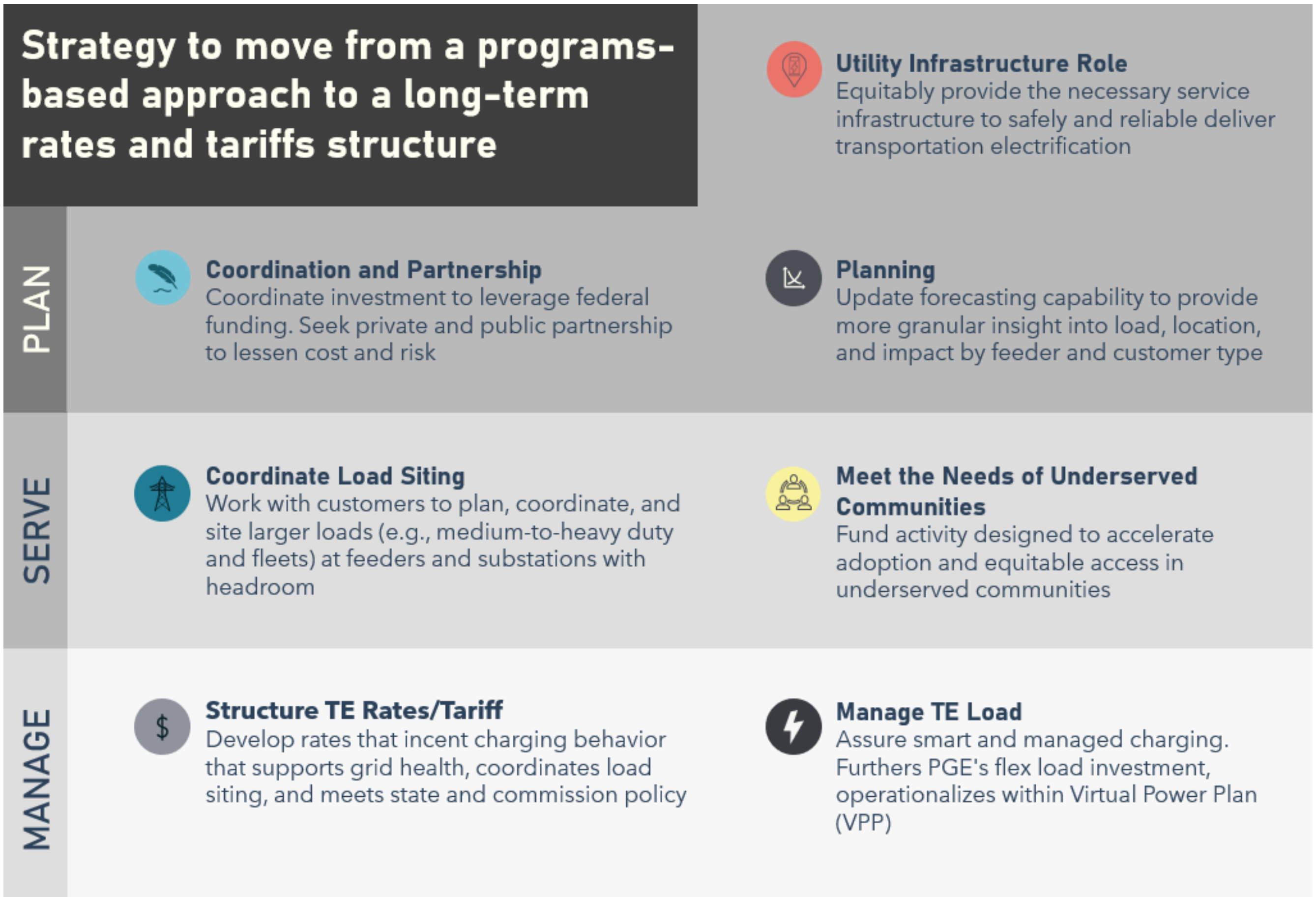

Figure 4. PGE 2023 Transportation Electrification Strategy

Each of the following intersecting components are part of each of the activities outlined within PGE's 2023 TE Plan. The consistence of these cross-cutting activities is a further reflection of the strategy outlined above. These activities include but are not limited to:

- Collect data Particularly load profile data, which informs how to manage TE loads and develop long-term, sustainable, traditional utility structures to incorporate how we serve TE loads into our rates and tariffs.
- Continue to collect market experience To meet the needs of this evolving market PGE must be a market participant, whether as a provider of electricity or other TE specific services. Though adoption is accelerating, additional use cases and needs may yet be identified.
- Cultivate partnerships PGE will continue to cultivate partnerships with private market entities, municipalities, non-profits, community-based organizations, and state, regional and federal entities to solve challenges, address barriers, provide solutions and meet customer needs.
- Meet current demands to inform how to evolve service PGE's 2023 TE Plan attempts to meet current demand in the program areas while carefully managing spending and market

presence. The focus of these activities is to collect information to shape a sustainable long-term approach to TE load.

- **Inform planning activities** Data is a foundational element in planning but market presence and market activity will also inform our planning activities. Our market presence, customer engagement and site development work will inform PGE's planning activities.
- **Learn how best to meet the needs of underserved communities** Underserved community TE needs may be unique and may outline a different role for PGE. Therefore, the TE Plan activities are structured to both serve the current need while informing how to meet evolving or emerging needs.

1.2 The Importance of Data

Data collected during the 2023 TE Plan will inform PGE on how to plan, serve and manage TE load. Data collected from the activities will also help create partnerships with the private market for enhanced and more efficient services in the years to come. However, unlike the private market, the data collected by PGE is protected under Commission oversight and its exchange is regulated by the Commission, statutes, and Oregon administrative rule. This fiduciary relationship with customer data is an important role of the public utility.

1.3 What it Means to Plan for TE Load

This is a period of dynamic change for the industry as federal, state, and local policies are driving a clean energy transition at a rapid pace. PGE must plan for TE load growth that is forecasted to accelerate in all categories through 2030 and beyond. To plan for this load growth PGE has developed a forecast model called AdopDER.[17] PGE is investing in updates to our AdopDER model to account for market changes such as federal action through the Infrastructure Investment and Jobs Act[18] and Inflation Reduction Act[19] and the recent announcement of the Environmental Protection Agency's (EPA) automobile tail pipe emission rulemaking.[20]

The following regulatory planning filings are directly affected by TE load development, each of which use the AdopDER model for forecasts and insights into when, where, what kind, and how much TE load is expected to materialize within PGE's service area:

- The IRP and CEP account for TE load growth in their assessment of resource need to meet future loads. The IRP and CEP's assessment assumes load management.
- The Distribution System Plan (DSP) takes a more granular look at TE load growth as it attempts to identify where on the distribution system that growth will appear, what type of TE load it will be, and when it will materialize. These insights help our distribution system planners and the Company understand what distribution infrastructure is necessary to meet this load and whether further distribution infrastructure investment might be needed.
- The Multi-year Plan (MYP) is PGE's flex load program planning filing, which in part outlines activities PGE is undertaking to better understand how to manage TE load and develop it as a flex load resource.

[17] See footnote 13 for additional detail on AdopDER.
[18] IIJA, retrieved from https://www.congress.gov/bill/117th-congress/house-bill/3684/text.
[19] IRA, retrieved from https://www.congress.gov/bill/117th-congress/house-bill/5376/text.
[20] EPA, rulemaking announcement retrieved from https://www.epa.gov/newsreleases/biden-harris-administration-proposes-strongest-ever-pollution-standards-cars-and.

- Lastly, the TE Plan is PGE's regulatory filing which outlines how PGE will address the TE market and what activities PGE will conduct to learn about, develop, and serve/manage this new load.

An overview of how these plans incorporate or address TE load can be found within this Plan in Section 3.8.3.

1.4 What it Means to Serve TE Load

PGE's AdopDER model shows significant growth of TE load through 2030 and beyond. PGE is undertaking efforts—through investments, in part, outlined in this plan, the DSP, and the MYP—to serve and manage the new load. TE load growth will require system investments, which we seek to manage by coordinating capital investments to meet multiple use cases wherever possible. PGE has made investments in our AdopDER model to increase granularity of data and accuracy. Our investments in the Integrated Operation Center and our Advanced Distribution Management System will provide real time visualization and the capability to utilize DERs to manage TE load or, in the future, bi-directional TE load as an energy resource capable of providing energy services the grid. Further, as outlined in this Plan, PGE is gathering information, data, and experience to develop rates, tariffs, practices, and processes that better align with the market and the needs of the different types of TE load. PGE's 2023 TE Plan activities all have components to inform infrastructure and service requirements and identify what adjustments or new approaches PGE will need to develop to meet the service needs and requirements of TE load. This TE Plan also outlines the importance of the customer-to-utility relationship as a pathway and necessary connection to communicate and educate both parties regarding how this new transportation fueling paradigm will work.

1.5 What it Means to Manage TE Load

Managing TE load is an important aspect of controlling costs to serve TE load and extracting system benefits. Simply serving TE load would not allow PGE to utilize it as a resource or manage it against system operating needs. Additionally, managing TE load also requires proper tariff design informed by TE load profiles. PGE's 2023 TE Plan activity is structured to give the utility insight into how to manage the load, whether through active management like DR-capable chargers, vehicle telematics, vehicle-to-building, or through rates specific to TE load types.

To meet our GHG targets in 2030 and beyond, we will need to meet additional load growth with non-emitting resources. Managing customer loads is critical to our ability to meet our goals and manage costs and reliability for our customers. PGE's Integrated Resource Plan (IRP) and Clean Energy Plan (CEP)[21] forecasts the need for load management and its role in incorporating higher level of non-emitting resources onto the PGE system. The 2023 IRP and CEP forecast investment in energy efficiency, community based renewable energy and flexible load. PGE's Distribution System Plan also identifies an important role for distributed energy resources (DER) advancing our grid modernization and decarbonization goals. The management of TE load is considered part of the DER under the sub-category of flexible load or demand response.[22] Further, PGE is investing in development of our virtual power plant (VPP). PGE's VPP is a combination of an operational structure and technology

[21] PGE (2023). *2023 Integrated Resource Plan and Clean Energy Plan.* Filed March 31, 2023 with Oregon Public Utility Commission under Docket LC 80, retrieved from https://apps.puc.state.or.us/edockets/DocketNoLayout.asp?DocketID=23636.
[22] PGE. *PGE Distribution System Plan Part I and Part II*. Filed with Oregon Public Utility Commission under Docket UM 2197, retrieved from https://apps.puc.state.or.us/edockets/docket.asp?DocketID=23043.

platform which incorporates DER into a coordinated system which can visualize, communicate, and operate these resources to the benefits of the customer and the grid.

1.6 The Importance of Market Experience

This TE Plan focuses on the specifics of how to serve the many different types of TE load that will eventually make up 177 aMW of demand by 2030. The meter and charger data exchanges outlined in PGE's 2023 TE Plan will enable the Company to collect insights into the timing, size, and shape of these new load types across customer sectors (residential, commercial, and industrial) and the different and unique customers that make up these sectors such as business charging, fleet charging, residential and multi-family (low, middle, and high income), and underserved communities (residential and businesses).

Data on business type and fleet size, EV model composition, EV model battery capabilities, battery sizes, dwell times, and charge rates will inform PGE of how to develop rates and tariffs which balance the needs of the customer and the grid. The data will help inform PGE of whether to explore new line extension allowance structures or interconnection-like agreements for larger or more dynamic loads. Load shapes and usage patterns have informed PGE that a review of interconnection and line-extension allowances is needed. PGE currently has a line extension allowance as part of Schedule 300, Rule I.[23] This allowance was not developed with transportation electrification in mind. Therefore, collecting data and usage information from our customers participating in each of the proposed 2023 TE Plan program areas will better inform our review of PGE's line extension allowance.

PGE recognizes that underserved communities may be the last to see the private market serve their charging needs. PGE is proposing two programs: the Business and Multi-family Make-ready and the Public Charging – Municipal Charging Collaboration to assist these communities. These programs are sized to meet current market need while also demonstrating to the private market the demand for services in these communities. These programs also demonstrate how the private market can meet these communities' needs through charger placement, rate design, and charger capabilities. Identifying the different types of EV load, and that there may be sub-sectors within each type, is an important aspect of understanding market needs.

Our work with the Electric Avenues supported through the 2019 TE Plan has informed PGE on how to build and operate public EV charging stations and how to form partnerships has informed PGE of how to conduct make-ready and how to form partnerships. It has also helped us understand our role in public charging and under what conditions a utility might need to step into the market. Our work with heavy duty charging at Electric Island and the partnership with Daimler Truck North America is helping PGE understand the challenges of serving this load and how to meet those challenges. Our initial pole charger pilot work helped us identify one approach to meeting multi-family, municipal, and underserved community charging needs.

1.6.1 Meeting Current Needs

While collecting market experience to inform PGE of how to plan, serve, and manage these future TE loads it is also important to meet the current needs. PGE's 2023 TE Plan attempts to meet the existing needs for Fleet, Business, Multi-family, Single Family residential, Municipal Charging, and Heavy Duty

[23] PGE. *Schedule 300, Rule I*, retrieved from https://assets.ctfassets.net/416ywc1laqmd/Z9SW1311yNz1OUSoi0Syr/17aaeff01ae3ec499b7ecdae6cb44e33/Sched_300.pdf.

while working intensely with these early adopters to collect important data, market, and customer experience.

1.7 The Importance of the Customer Relationship

Owning and fueling an EV is a paradigm shift for customers. PGE's direct relationship with our customers can be used to help smooth the transition to the new paradigm. EVs are primarily fueled at home or at place of business, which is a significant practice change and a wholly new experience for customers who now own, or will own, an EV.[24] The practice of planning ahead to assure enough range is reserved in the battery for the next day's usage is new. Further, the EV is now and is expected to continue to be the largest load in a customer's home and yet will likely be the most efficient appliance our customers own. Yet, as Ford, Nissan, and other EV manufacturers have found, the EV is also a resiliency investment for customers. PGE, auto manufacturers and others have identified the electric vehicle battery as a source of resilience service to the customer. This approach requires bi-direction chargers capable of sending power stored in the vehicle battery to the building or residence. This promising technology holds promise for a host of use cases which can be co-optimized to meet customer, community, local and system grid needs.

The 2023 TE Plan proposes programs that gather data to not only inform our planning, how we serve and manage the load but also to uncover insights into how customers respond to the TE paradigm shift, how to communicate with customers about fueling their vehicle, how to understand the new use cases customers and automobile manufacturers envision, and again what role PGE and electric system have in these new relationships. PGE cannot overemphasize how different EV ownership will be for our customers. In order to meet the needs of underserved customers and communities, and to incorporate the benefits to the system of EV adoption and transportation electrification promise, PGE must engage with customers through education and outreach, assisting our customers transition to this new transportation fueling paradigm. The exact role of PGE and the approaches to be used are reasons for this and future filings.

1.8 The Importance of Partnership

Partnerships, investments, and coordination among utilities, charging networks, businesses, local governments, states, fleets, and communities are essential to serve and manage EV load at the scale expected this decade. Through our ownership of chargers like those at Electric Avenues, PGE has learned the value of partnership with the private market to operate chargers. Charger providers whose business models are focused on maintaining EV charging infrastructure can be better equipped to manage the operations and maintenance challenges of public EV charger ownership. Similarly, our partnership with municipalities to deploy pole charging is a valuable relationship which can help meet local clean energy and decarbonization goals while also serving underserved community EV charging needs.

PGE has worked with other utilities to identify the need and placement of heavy-duty charging along the I-5 corridor. We have worked with the Oregon Departments of Transportation, Environmental Quality, and Energy to inform their planning, program development, and deployment of funds to support EV charging infrastructure. PGE worked with stakeholders and the Commission Staff in 2021-2022 on the development of the TEIF. Through the Smart Grid Testbed (or Testbed), PGE is currently pursuing managed charging partnerships with automobile manufacturers. In our partnership with

[24] California Air Resources Board. *DriveClean: Battery-Electric Cars*, retrieved from https://driveclean.ca.gov/battery-electric.

Daimler, PGE is learning about how to meet the demands of heavy-duty vehicle charging. Through our Clean Fuels activities we are partnering with community-based organizations to deploy charging and vehicles to various non-profits within our service area. We are also working with the Northwest Energy Efficiency Alliance (NEEA) to identify electric vehicle demonstrations projects that may benefit and be funded by NEEA's regional utility partners.

1.9 The Importance of Planning Flexibility

PGE has proposed activities within the 2023 TE Plan which the company views as necessary and prudent next steps. However, the market is accelerating quickly. New federal policies have been issued and further EPA action is expected by way of rulemaking. The State of Oregon may adjust EV purchase incentives. Automakers are adjusting purchase prices in response to competition and tax credit rules. PGE does not expect that the activity proposed within the 2023 TE Plan is the only activity necessary, nor do we expect it to remain static. Rather, PGE expects adjustments and new activity may be necessary. Where mid-cycle adjustments (those between TE Plans) are necessary, PGE will communicate with stakeholders before filing with the Commission.

Chapter 2. Executive Summary

The purpose of this executive summary is to inform the reader with context, strategy, theme and vision which the reader can carry throughout the document. This section ends with a high-level overview of the proposed activity, the cost of that activity and review of the regulatory actions to date.

2.1 Vision of the 2023 Plan

PGE is committed to building an Oregon in which all our customers, employees, and communities can thrive. We are committed to an economy-wide clean energy future where electricity powers more of our lives, displacing higher greenhouse gas (GHG)-emitting fossil fuels and expanding electricity's share of total energy consumption. Our customers and communities are electrifying their vehicles, homes, and workplaces, and the pace is accelerating. We are working harder and faster to enable this transition, partnering with school districts, transit districts, automobile manufacturers, government agencies, and our customers.

Electrifying transportation provides one of the most significant opportunities to reduce economy-wide GHG emissions. PGE supports this conversion through infrastructure investment, partnerships, and offerings that meet our customers' and communities' needs. PGE is working toward a transportation ecosystem where:

- Oregonians have the information they need to transition to EVs
- Charging is equitable, reliable, affordable, and accessible
- Transportation electrification helps organizations and municipalities achieve their emissions goals
- EVs are efficiently integrated into the electrical grid, minimizing growth in system peak energy requirements
- Electric mobility, from mass transit to micromobility, is equitable and available to all

PGE's role is to enable and support a seamless, end-to-end, grid-connected electric mobility ecosystem that is easy-to-use, affordable, and accessible to all. Our vision is that all customers share in the benefits and opportunities of a clean energy future, including access to clean, reliable, and affordable electric transportation "fuel". In this clean energy future, PGE is able to plan, reliably and safely serve, and manage TE load. PGE will accomplish this through well-constructed rates and tariffs which serve at least cost and outline the roles of the utility and the customers, whether bringing home an EV for the first time, or charging multiple electric long haul semi-trucks on a hot and dry August day.

2.2 The Purpose of the 2023 Plan

The purpose of the 2023 TE Plan is to advance PGE's ability to plan for, manage, and serve our customers and their emerging electric vehicle charging needs amidst a dynamic market environment. The portfolio of proposed activities, many of which are a continuation of existing programs and investments, meet the needs of our TE customers, while also reflecting our greater focus on enhancing the customer experience and managing TE load growth for the benefit of the system. The 2023 TE Plan also reflects our commitment to advancing social equity in the communities we serve. It positions a significant investment with underserved communities, over 45 percent of proposed spending is targeted to underserved communities or dedicated to meeting those communities' charging needs. PGE's 2023 TE Plan relies on four major funding pools:

- $45.2 million in Clean Fuels Program funds
- $21.4 million in Monthly Meter Charge (MMC) funds is inclusive of $10.5 million in previously approved MMC funds[25] and this request to approve $10.9 million in new MMC spending through the 2023 TE Plan
- $17.6 million existing/approved customer investment
- PGE requests an additional $9.8 million in customer investment in this TE Plan

This adds up to a total TE Plan request for approval of an additional $20.6 million in expenditures from Monthly Meter Charge (MMC) and base rate funding in 2024-2025. Clean Fuels Program expenditures will be adjusted annually to reflect actual credit sale revenues.

PGE will leverage these expenditures to better understand the different types of load we will be asked to serve in the near term, including residential single family, multi-family, business, municipal, heavy duty, and fleet. Insights gathered through the proposed programs will inform PGE of how to construct long term sustainable practices for planning, serving, and managing EV load. PGE anticipates our role in the market will need to change as it evolves, and private market entities gather the experience, capability, and trust of customers to meet their charging needs. Over the course of 2024-2025, PGE will further partnerships with the private market, non-profits, municipalities, state and local government, and community organizations to extend the benefits of PGE's work beyond that of any single customer's investment. PGE believes the Plan meets the requirements set out by the Commission in Oregon Administrative Rules Division 87, Transportation Electrification Plans.[26]

2.3 Changes Since the 2019 Plan

2.3.1 Market Changes

2.3.1.1 Vehicle Availability and Price, Charging Availability

The number of charging ports in the United States increased more in 2022 than in the preceding three years combined. In 2022 10,00 fast chargers and 54,000 level 3 chargers were added nationally. The increase in charging infrastructure has helped to address, not alleviate, one of the major concerns that consumers have had about electric vehicles, namely range anxiety. As of October 2022 there were 1.9 million EVs registered nationally or 0.7 percent of the 281 million passenger vehicles. Oregon is ahead of the national EV adoption rate with 62,455 EVs registered in the state, or 2 percent of the 3.2 million passenger vehicles as of March 2023.[27,28 ,29]

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[25] $10.5 million MMC dollars were approved by the Commission through docketed proceedings, detailed in Appendix H.
[26] Oregon Administrative Rules, Division 87, Transportation Electrification Plans. Retrieved from https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=4089.
[27] Oregon Department of Transportation. *DMV Facts and Statistics*. Retrieved from https://www.oregon.gov/odot/dmv/pages/news/factsstats.aspx#:~:text=Today%20in%20Oregon%20there%20are,Nearly%203.1%20million%20licensed%20drivers.
[28] Oregon Department of Energy. *Oregon Electric Vehicle Dashboard*. Retrieved from https://www.oregon.gov/energy/Data-and-Reports/Pages/Oregon-Electric-Vehicle-Dashboard.aspx.
[29] Lewis (January 9, 2023). Electrek. *Here's how many EV chargers the US has – and how many it needs*. Retrieved from https://electrek.co/2023/01/09/heres-how-many-ev-chargers-the-us-has-and-how-many-it-needs/.

In 2019, the EV market was already seeing significant growth, but it was still relatively small compared to traditional gasoline-powered vehicles. However, by 2023, the market has grown considerably and has become a more mainstream option for consumers. One of the major indicators of this growth is the number of electric vehicle models available: there were approximately 220 EV models available globally in 2018, while by 2021 that number had more than doubled to 450.[30] This increase in the number of models has helped to make EVs more accessible to a wider range of consumers, with options ranging from affordable city cars to luxury SUVs.

Along with the increase in models, the cost (adjusted for vehicle range) of EVs globally continued to decline from 2020 to 2021, accounting for the increase in average range per vehicle.[31] While still more expensive on average than the overall car market, strong consumer demand shows that customers value the benefits of driving electric. Moreover, up-front purchase price is not the only factor influencing customer decisions, and on a total cost of ownership basis EVs can be more compelling due to lower maintenance and fuel costs.[32]

The growth in the EV market has also been supported by an increase in the number of charging stations available. In 2019, there were approximately 500,000 charging stations globally, while by 2022, that number had grown to over 1.2 million.[33] In the U.S. cumulatively, by 2019 there were more than 78,000 charging ports at a total of approximately 26,000 EV charging stations.[34] By January 2023, S&P Global Mobility estimated that there were around 16,822 Tesla Superchargers and Tesla destination chargers in the United States, along with 126,500 Level 2 and 20,431 Level 3 charging ports.

As of September 27, 2022, all 50 states plus Washington, DC and Puerto Rico have approved state plans under the National Electric Vehicle Infrastructure (NEVI) formula program. The IIJA has made available $5 billion over five years to be spent on EV charging infrastructure across the US. President Joe Biden has pledged that the federal government will pay for the installation of 500,000 chargers.

New light-duty vehicle registration share for EVs reached 5.2 percent over the first 10 months of 2022, and rapid growth is expected, thanks to consumer demand, US government policy such as the IRA, which incentivizes EV purchases, and increasing interest and investment from the financial sector.[35]

As illustrated above, the EV market has seen significant growth and evolution between 2019 and 2022. The number of models available has increased dramatically, costs have declined, charging

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[30] International Energy Agency (2022). *Global EV Outlook 2022: Trends in electric light-duty vehicles*. Retrieved from https://www.iea.org/reports/global-ev-outlook-2022/trends-in-electric-light-duty-vehicles.

[31] Ibid. While the cost of BEVs and PHEVs have both increased in the US in that timeframe, the greater increase in vehicle range has led to a reduction in the average price-per-range, which is a useful way to compare EV prices given their different features.

[32] See Section 8.6 for detailed cost data on total cost of ownership savings for EV ownership.

[33] U.S. Department of Energy. *Alternative Fuels Data Center: Electric Vehicle Charging Station Locations*. Retrieved from https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest?fuel=ELEC.

[34] Note: Includes public and private EV charging ports. Trends from U.S. Department of Energy. *FOTW# 1174, February 22, 2021: Over 20,000 New Electric Vehicle Charging Outlets Were Installed in the United States in 2019*. Retrieved from https://www.energy.gov/eere/vehicles/articles/fotw-1174-february-22-2021-over-20000-new-electric-vehicle-charging-outlets#:~:text=Cumulatively%2C%20by%202019%20there%20were,and%20private%20EV%20charging%20outlets.&text=Trends%20from%20the%20Alternative%20Fueling,Second%20Quarter%202020%20%2C%20October%202020.

[35] S&P Global. *Mobility: Electric Vehicle Trends*. Retrieved from https://www.spglobal.com/mobility/en/topic/electric-vehicle-trends.html.

infrastructure has expanded, and government incentives and regulations have further supported adoption. PGE's AdopDER model shows growth will continue, as EVs become an increasingly mainstream option for consumers.

2.4 State and Federal Policies, Programs, and Actions

2.4.1 State Legislative Actions

The 2021 Oregon Legislature enacted House Bill (HB) 2165[36], introduced by Governor Kate Brown, to extend and improve Oregon's EV rebate and support utility investment in EV infrastructure. HB 2165 includes the following major elements:

- EV Rebate Improvements: The bill removes the 2024 sunset on Oregon's EV Rebate program and makes other targeted changes to better support underserved communities.
- Transportation Electrification Monthly Meter Charge: HB 2165 also requires PGE and Pacific Power to collect a charge set to 0.25 percent of the total revenues collected by the utility. The fee is collected as a Monthly Meter Charge from all customers through 2030. Funds from the charge must be used by each utility to support and integrate transportation electrification and must be spent on elements contained in a utility's TE plan. Budgets for the use of these funds must be approved by the OPUC. This charge is a minimum amount collected for utility transportation electrification activities. The utility must make reasonable efforts to spend not less than half the amount collected through this fee on TE in underserved communities.
- Updating current law on utility investment in TE infrastructure: HB 2165 also updates ORS 757.357[37] regarding Commission authority to allow cost recovery for transportation electrification infrastructure measures. The bill recognizes utility investments in TE infrastructure as a utility service, provided the investment both supports greenhouse gas reductions in the transportation sector over time and benefits utility customers. HB 2165 also codifies in statute that utility investment to support transportation electrification includes behind-the-meter infrastructure. Taken together, these changes and the regular monthly charge underscore that enabling and managing transportation electrification, in the eyes of the 2021 Legislature and Oregon law, is a core, ongoing, and recoverable component of utility business to serve customers.

The 2021 Oregon Legislature also enacted House Bill 2180[38], requiring that all new multi-family buildings (of five or more units) and new commercial buildings be made EV-ready, with provisions for electrical service capacity and conduit to serve 20 percent of parking spots. The bill allows local governments to require a greater percentage of parking spots be made EV-ready, and the Land Conservation and Development Commission adopted a rule in 2022 that requires cities within metropolitan areas to require 40 percent of parking spots be made EV-ready[39].

The 2021 Legislature also moved Oregon's previous deadline for 100 percent of new light-duty state-owned vehicle purchases to be ZEVs from 2029 to 2025 (HB 2027[40]). The Legislature also directed the

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[36] Oregon HB 2165, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2165.
[37] Oregon Revised Statute 757.357, retrieved from https://oregon.public.law/statutes/ors_757.357
[38] Oregon HB 2180 retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2180.
[39] Oregon Administrative Rules, Chapter 660, Division 12, Rule 660-012-0410 retrieved from https://secure.sos.state.or.us/oard/view.action?ruleNumber=660-012-0410.
[40] Oregon HB 2027, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2027.

State Parks and Recreation Department to allow for the installation and service of public EV charging stations in parking spaces in the state park system (HB 2290[41]).

In the 2022 Short Session, the Legislature supported both infrastructure and vehicle purchase incentives. House Bill 4139[42] established the Medium- and Heavy-Duty Electrification Charging Fund at the DEQ, which received $15 million in House Bill 5202[43] for a grant program supporting medium- and heavy-duty zero-emission vehicle charging and fueling infrastructure projects. The Legislature also appropriated an additional $15 million to the state's zero-emission and EV rebate program, which the DEQ awarded across the state in Spring 2023.

2.4.1.1 State Agency and Executive Actions

In March 2020, Governor Kate Brown issued Executive Order 20-04[44] directing state agencies to take actions to reduce and regulate greenhouse gas emissions. This order includes directives to the OPUC to encourage electric companies to support transportation electrification and achieve the state goals established in Senate Bill 1044[45]. The order also directs the DEQ to extend and expand the Oregon Clean Fuels Program and increase credits generated from electricity as a motor vehicle fuel.

In March 2021, the Environmental Quality Commission (EQC) adopted DEQ's revised Oregon Clean Fuels Program rules to increase the amount of clean fuels credits generated from EV charging.[46] The rules now allow additional clean fuels credits to be generated when renewable energy certificates are retired alongside EV charging for both residential and non-residential EVs. PGE takes advantage of this opportunity on behalf of our residential customers, generating $5,394,400 in 2021 credit revenues for the 2023 program year. The new rules also allow public entities like school districts and local governments to generate credits in advance of EV charging to help fund the purchase of EVs or related transportation electrification investments. In September 2022, the EQC adopted rules extending the Oregon Clean Fuels Program to 2035 and requiring a 37 percent reduction from 2010 levels in the carbon intensity of motor vehicle fuels.[47]

The EQC also adopted California's medium- and heavy-duty diesel engine standards, including the Advanced Clean Trucks (ACT) rule that requires manufacturers of medium- and heavy-duty vehicles to sell a certain percentage of ZEVs, beginning with the 2024 vehicle model year. In November 2022, the Oregon Environmental Quality Commission adopted California's Advanced Clean Cars II rule[48] in Oregon as permitted by the federal Clean Air Act[49], requiring that all light-duty vehicle sales in Oregon be ZEVs by 2035.

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[41] Oregon HB 2290, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2290.
[42] Oregon HB 4139, retrieved from https://olis.oregonlegislature.gov/liz/2022R1/Measures/Overview/HB4139.
[43] Oregon HB 5202, retrieved from https://olis.oregonlegislature.gov/liz/2022R1/Measures/Overview/HB5202.
[44] Oregon Executive Order 20-04, retrieved from https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf.
[45] Oregon SB 1044, retrieved from https://olis.oregonlegislature.gov/liz/2019R1/Downloads/MeasureDocument/SB1044/Enrolled.
[46] Oregon Administrative Rules, Chapter 340, Division 253, retrieved from https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1560.
[47] Oregon DEQ. *Clean Fuels Program Expansion 2022*. Filed September 23, 2022. Retrieved from https://www.oregon.gov/deq/rulemaking/Pages/cfp2022.aspx.
[48] California Air Resources Board. *Advanced Clean Cars II*. Retrieved from https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.
[49] United States Environmental Protection Agency. *Overview of the Clean Air Act and Air Pollution*. Retrieved from https://www.epa.gov/clean-air-act-overview.

2.4.1.2 Federal Actions

The IIJA and the IRA[50], both passed by Congress since PGE's last TE Plan, provide significant funding and incentives to support transportation electrification.

The IIJA provides both formula funds and flexible funds to states, including more than $52 million over five years for Oregon to deploy corridor fast charging under the NEVI program[51]. The IIJA also creates a variety of new and substantial competitive grant opportunities for transportation electrification, including for buses and heavy vehicles. The IRA made significant modifications to the EV tax credit, lifting the 200,000-vehicle manufacturer cap for the credit but adding new rules for the credit on domestic manufacturing, supply chain, and vehicle cost. The IRA also created a used EV vehicle tax credit, along with tax credits for commercial EVs and for the installation of EVSE in certain communities.

PGE expects that these funding sources will help drive transportation electrification in our service area, where interest and adoption of EVs is already significant, and complement the state programs and incentives. They also create opportunities for PGE to partner with our customers and communities on grant opportunities to gain external funding support for TE.

2.5 The 2023 TE Plan Reflects the Market Context and Utility Role

In previous TE meetings with stakeholders and Commission Staff, PGE shared concepts focused on accelerating transportation electrification. These earlier concepts of the TE Plan outlined significantly greater expenditures and service levels for the same activities now proposed in PGE's 2023 TE Plan. The company delayed the filing of our TE Plan until mid-2023. The new timing allows better sequencing of the TE Plan with the Company's IRP and CEP filings. Additionally, the new timing helps give OPUC Staff and stakeholders a clearer sense of how our TE Plan fits with our overall decarbonization strategy—for both PGE and our customers—as well as cumulative customer price impacts. PGE heard clearly from both Staff and stakeholders that they want to see the TE Plan in this larger context. PGE's 2023 IRP and CEP forecast the need for new generation, additional energy efficiency, and distributed energy resources. New system investments to meet greenhouse gas goals and investments in transportation electrification require that PGE balance and manage impacts to customers.

Thus, the TE Plan was reassessed for right size and context. The 2023 TE Plan undertakes the same programmatic and infrastructure measure activities shared with stakeholders earlier in 2022 but reduces the funding levels and maximizes the utilization of Monthly Meter Charge and Clean Fuels Funds prior to incremental customer dollars. Further, where the 2022 concept of the TE Plan was focused on charger deployment, the 2023 TE Plan is focused on understanding charger needs and how to best meet them, both now and long term, through more sustainable less programmatic approaches. Therefore, the reader will note a theme of collecting data and market experience through the 2023 TE Plan programmatic areas (fleet, multi-family, municipal, public, heavy-duty and single family residential) to inform the utility's market role, rate, and tariff designs. This change is

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[50] 117th Congress (2021-22) *House Rule 5376 Inflation Reduction Act of 2022*. Retrieved from https://www.congress.gov/bill/117th-congress/house-bill/5376.

[51] U.S. Department of Transportation, Federal Highway Administration. *National Electric Vehicle Infrastructure Formula Program*. Retrieved from https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm.

better structured to bring the planning, service, and management of TE load into the base business practices of the utility. PGE envisions this may be done through TE-specific rates or TE-specific line extension allowances. Program approaches are envisioned as tool to learn more about a market or technology or to meet policy goals which the private market does not have a process or driver to meet (such as to meet the charging needs of underserved communities or equitable access to transportation electrification).

2.5.1 PGE's Role

PGE envisions several roles for the utility in the present market. Some of these roles may change as the market matures. PGE sees the primary role of the utility in transportation to be planning, serving, and managing TE load. However, there are several other activities that the present market requires of PGE or that PGE proposes should be conducted to inform the utility on how to properly scope our role or provide insight into how best to plan, serve, and manage TE load in the future.

2.5.1.1 Plan for TE Load

As previously mentioned, PGE's planning processes such as the IRP and DSP identify when, where, what kind, and how much TE load will interconnect to the PGE system. In later portions of this TE Plan we illustrate how the AdopDER model forecasts TE load growth. We are undertaking efforts to enhance our modeling capabilities and are investing in the AdopDER model, whose information feeds into the abovementioned planning efforts, as well as the CEP, MYP and TE Plan. The higher fidelity, more granular data which PGE is able to harvest and work with, the better prepared PGE will be on several fronts. For example, this information may allow PGE to target infrastructure investment ahead of the load development or direct program offerings to TE load pockets that would otherwise strain distribution capacity. The 2023 TE Plan focuses on acquiring load profile data for different types of TE load, which can help PGE plan how to manage this load or develop specific rates and/or programs to target specific TE load types.

2.5.1.2 Serve TE Load

Make-Ready

For programs like multi-family, fleet, heavy duty, public, and business, PGE envisions a role in make-ready. In each case, the level of PGE involvement and investment may vary. In some cases PGE will provide the make-ready infrastructure, while in others it may be provided through the line extension allowance and additional incremental funding for make-ready infrastructure. However, in all cases PGE will provide the requirements for the interconnection of make-ready infrastructure to the PGE system. The make-ready activity embedded in the PGE 2023 TE Plan programs is designed to meet the needs of customers while informing PGE of how to structure our make-ready role.

Siting Load

Being informed and able to plan for TE load is also contingent on where load is sited, the size and demands of these sites, and, where possible, influencing site design and placement. An example of work PGE is conducting to understand TE load siting is our work with Daimler at Electric Island to better understand the service and site requirements for heavy duty vehicles. We are additionally working with the State of Oregon and others regarding the siting of high-powered heavy duty charging. These site loads are significant and can contribute to peak demand. On Electric Island, PGE is exploring how to reliably manage these large loads through the siting of local generation and energy storage. This partnership with Daimler on heaving duty charging site development will inform PGE how to plan and timelines for development of these types of sites. The addition of local generation and energy storage may be an import aspect of future heavy duty site development and possibly requirements. Early engagement with site developers is necessary to meet build-out timelines and customer expectations as these sites are large in terms of the capacity needed, the needed infrastructure, and the physical space to accommodate heavy duty vehicle traffic. Early insights such as those acquired from our Electric Island work help PGE understand how to develop site requirements for all types of interconnected TE load. These may include metering, communication, and/or infrastructure requirements as well as who pays for what portion of that infrastructure.

2.5.1.3 Manage TE Load

As TE load develops, PGE will seek to develop load management strategies. Development of practices and programs to manage TE load will harvest benefits and result in lower overall costs to serve and thus lower the cost of EV ownership. At present PGE has identified roughly four approaches for directly managing TE load: rate design, demand response charger control, telemetry to the car, and local generation/storage. Rate design can send the proper pricing signal to customers to align how they charge their car in accordance with grid needs. Time of use rate design such as PGE's Time of Day whole home residential rate is one potential avenue to accomplish this, as is Schedule 50, which PGE uses for public charging and similarly has a peak demand component. The activities proposed in this TE Plan will explore whether other time-of-use or dynamic rate designs might also be ultimately offered or required of certain TE loads.

Additionally, rates can be paired with flex load schemes to target load reductions or the delivery of other energy and capacity services from the vehicle to the building or the grid. These more active load management schemes can be targeted by location, time, and type of energy service needed. PGE will explore how to develop such capabilities through the activities proposed in the 2023 TE Plan.

Immediately, PGE is exploring two types of direct TE load control. First, through the residential smart charging program PGE is exploring demand response or peak load reduction through connected level two chargers. PGE is also currently testing a type of managed charging through vehicle telematics. The company is leveraging the PGE Smart Grid Testbed to explore how connection by way of an API to the vehicle will result in not only load reduction on peak, but also other more varied energy service the vehicle might be able to offer. Further exploration will require partnership with either the auto manufacturer or an entity who has partnered with the auto manufacturer to offer vehicle telematics. PGE is currently in discussions with several auto manufacturers to explore vehicle telematics partnership.

2.5.1.4 Underserved Communities

PGE is committed to understanding and serving the needs of underserved communities. Our role as a regulated entity is unique in that we report our activities through publicly available filings in an open adjudicatory process. PGE believes this process and the relationships the utility has built with the state and local governments, and diverse communities therein are unique and can be utilized to meet the needs of underserved communities. The ability of the utility to leverage patient capital is another benefit of having the utility active in the TE market.

The 2023 TE Plan investment directs over 45 percent of funds to activities to benefit underserved communities. Our municipal charging program is an example of our commitment to reach and meet the needs of underserved communities. It is one of the largest of the portfolio and deploys pole and pedestal charging through partnership with municipalities to primarily serve underserved and low-income neighborhoods in the PGE service territory market. Our multi-family program is also focused on installations in low-income and underserved communities. One reason for our focused investment in these communities is because the private market is not likely to choose these areas for first or second round investment. Secondly, PGE believes that these customers have unique charging needs and patterns. For example, many Uber and Lyft drivers live in multi-family buildings. These customers likely have higher than average charger utilization. This means these customers have a greater sensitivity to charger availability, charging costs, and rates of charge. The utility may be the right entity to identify and address this unique use case which seems to cross over with low income and underserved community charging needs.

Further, PGE's work can help seed the market, either pulling in the private market by demonstrating a business case or creating private market partnerships. PGE wants to invest early in transportation electrification for underserved communities to prevent them from falling behind other segments of the market. The Company will reassess our activity in these communities as the market matures and will continue to seek partnerships to lessen investment risks.

PGE acknowledges that, at present, it will need to own chargers to meet underserved community needs. However, PGE does not envision this role is necessary for more mature markets or where the use case for charger is well known and understood by the utility. The 2023 TE Plan does make investments or continues investment in markets that are maturing. However, the 2023 Plan is also making investments to learn about different load types, needs, and unique use cases.

Finally, as their energy provider, working with municipalities is a proper role for PGE. This role is facilitated by already existing, collaborative relationships and areas of mutual and overlapping interests and needs; notably, working directly with municipalities to meet their community and decarbonization goals through electrification, including in the transportation sector. The 2023 TE Plan invests in these relationships with the placement of pole- and pedestal- mounted chargers.

2.6 Synopses of Program Activity

The following tables provide synopses of the programs including a description of the work, changes proposed, the load management approach, the target market, and how the activity is funded. Greater detail can be found in Appendix A Summary of Current Activities and Appendix C New Activity Applications.

Table 4. Residential EV Smart Charge Pilot Overview

Activity	Residential EV Smart Charge Pilot			
Strategic Alignment	Manage TE Load, Structure TE Rates/Tariff, Equity			
Description	• $300 rebate towards purchase and installation of qualified L2 at-home charger ($1,000 income-qualified rebate) • $50 rebate for Tesla drivers with non-qualified chargers			
What has changed	• Pilot extended; enrollment cap expanded • Charger incentive decreased from $500 to $300 • Creation of managed charging program			
Load management	• $25 seasonal incentive (six-month season; Oct-Mar, Apr-Sep) for allowing PGE to pause EV charging during peak loads			
Target market	• Residential EV drivers residing in single family homes			
Funding ($MM)		Previously approved[52]	Requested with 2023 TE Plan	Total
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
	Total	2.42	4.08	6.5
	• 2022 MMC funds panel upgrade rebates and trade ally network development			

[52] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

Table 5. Public Charging – Electric Avenue and Municipal Charging Collaboration Overview

Activity	Public Charging – Electric Avenue and Municipal Charging Collaboration
Strategic Alignment	Utility Infrastructure Role, Coordinate Load Siting, Manage TE Load, Structure TE Rates/Tariff, Equity, Coordination/ Partnership
Description	• Collaborate with municipalities on equitable access to public L2 charging infrastructure in underserved communities • Deploy chargers more cost-efficiently via existing utility right-of-way assets. Informs potential private partnerships
What has changed	• Refocus from broader ownership of L2 infrastructure to helping provide infrastructure in underserved communities • Remove DCFC ports
Load management	• Schedule 50 rate, with time of use and +$0.19/ kWh at peak usage (3 to 8 PM weekdays, like TOD rate)
Target market	• +80 L2 ports focused on underserved communities (additional to 60 and 100 ports in the 2022-3 MMC budgets) • Total 240 L2 ports =12 percent of the total public L2 ports TEINA3 indicates needed by 2025

Funding ($MM)		Previously approved[53]	Requested with 2023 TE Plan	Total
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
	Total	5.29	6.27	11.5

[53] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

Table 6. Business and Multi-family Make-ready Solutions Overview

Activity	Business and Multi-family Make-ready Solutions
Strategic Alignment	Utility Infrastructure Role; Structure TE Rates/Tariff; Equity; Coordination/ Partnership
Description	• Support EV ownership and charging access for business and multi-family properties • PGE constructs make-ready • Customer owns/maintains chargers and receives rebate on purchase of qualified chargers
What has changed	• More support for EVSE deployment to the underserved MF segment • Reduced ports from +1,000 to 200 based on PGE and TEINA data showing that demand in underserved/low-to-medium income multi-family market is still developing • Focus on workplace, commercial, and multi-family segments (funded by 2023 MMC, with additional funding in this proposal for multi-family)
Load management	• Chargers able to respond to pricing or DR signals, but not subject to Schedule 50 • Provides data on multi-family charging profiles to develop the appropriate rate or future load management offering
Target market	• Workplace/commercial: 60 ports • Multi-family: 140 ports

Funding ($MM)

	Previously approved[54]	Requested with 2023 TE Plan	Total
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
Total	2.55	4.58	7.13

[54] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

Table 7. Fleet Partner Overview

Activity	Fleet Partner
Strategic Alignment	Planning Utility Infrastructure Role Coordinate Load Siting Manage TE Load Structure TE Rates/Tariff Coordination/ Partnership
Description	• Provide free upfront planning and technical services to reduce the complexity of planning for fleet electrification • Provide custom incentives to help lower the costs of building electric fleet depots • Better understand how fleet size and load profiles impact the grid • Networked EV charging for future managed charging and demand response programs
What has changed	• Reduce incentives by 50 percent, bringing the multiplier down from 15x to 7.5x in the following formula: *Year 5 usage x LEA x multiplier* • Lower maximum incentive cap from $750K to $400K • The above changes improve cost effectiveness and allow the pilot to reach more customers, sites, and ports while still providing an incentive to help overcome initial cost barriers faced by customers
Load management	• Require installed chargers be qualified & networked, with ability to perform demand response • Participants expected to participate in future PGE demand response programs
Target market	• Non-residential fleets, with ~450 ports (2021-24), an additional ~500 ports (2024-2025), for a total of ~950 make-ready ports[55]
Funding ($MM)	

	Previously approved[56]	Requested with 2023 TE Plan	Total
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
Total	8.65	9.47	18.12

[55] Port counts increasing due to decrease in incentive offered, allowing deployment to more sites.
[56] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

2.7 PGE's Grant Work

2.7.1 Connection to Strategy

Our grant activities connect to PGE 2023 TE Plan strategy several ways. Firstly, much of our grant work is focused on equity and partnership. Secondly, grant-funded activity also collects information and data[57] to inform our planning activity. An example of these strategic connections is our emerging technology work, which informs how we can serve and manage future TE loads and use cases.

2.7.2 Overview of PGE Grants

PGE funds its TE grants through participation in the Oregon Clean Fuels Program (CFP) on behalf of the Company's residential customers. The CFP is a statewide program administered by the Oregon DEQ that requires a reduction in the carbon intensity of transportation fuels. The DEQ quantifies the carbon intensity of fuel sources and sets an annual target. Fuels which produce emissions above the standard (e.g., diesel) create deficits, whereas those with emissions below the standard (e.g., electricity) generate credits.

PGE participates in CFP in several capacities, one of which is on behalf of residential customers who drive EVs. PGE must use the revenue from credit sales in specific ways.[58] PGE funds three grant programs with revenue from the CFP: the Drive Change Fund (DCF), the Electric School Bus Fund, and external matching funds. An overview of the programs follows, with additional information available in Appendix A.4.

2.7.3 The Drive Change Fund

The Drive Change Fund (DCF) is a competitive grant available to non-residential customers for transportation electrification projects that prioritize underserved communities, advance transportation electrification, and benefit residential customers. Since 2019, PGE has awarded over $8.92 million in DCF grant funding to 54 projects. PGE ran the fourth cycle of DCF in 2022, awarding $2.28 million to 15 community transportation electrification projects. 2023 will be the fifth year of the DCF.

2.7.4 Electric School Bus Fund

The Electric School Bus Fund (ESB) is a competitive grant to help public school districts in PGE's service area fund the incremental costs of purchasing electric school buses, with a focus on school districts serving underserved communities. Since 2020, PGE has awarded over $4.9 million in grant funding to purchase 19 electric school buses. In 2022, PGE allocated approximately $1.5 million to help school districts and school bus fleet operators acquire electric buses and charging infrastructure. PGE awarded grants to five districts to fund a total of six buses. 2023 will be the fourth year of the Electric School Bus Fund.

2.7.5 Matching External Funds

Matching external funds are available to public agencies, community-based organizations, nonprofits, educational institutions, and other partnerships applying to external funding opportunities. No successful grant matching bids were received in the first year of grant matching (2022) because the program was opened late in the year. That funding was put towards the 2022 DCF total. PGE expects an increase in matching opportunities in 2023.

[57] Possible since all chargers funded through PGE grants are DR-capable.
[58] Full overview of PGE's CFP funding program see Appendix A.4.

PGE coordinates closely with state and local agencies and other grant making bodies to ensure that available pools of funding are complementary and not duplicative. For example, the ESB funded four electric school buses for the Portland Public School District. In this case, the bus depot was located in PacifiCorp's service area. PacifiCorp was able to use their CFP-funded matching funds to support the make-ready and charging infrastructure needed to charge the ESB-funded buses.

2.8 Connecting Activities to the Strategy

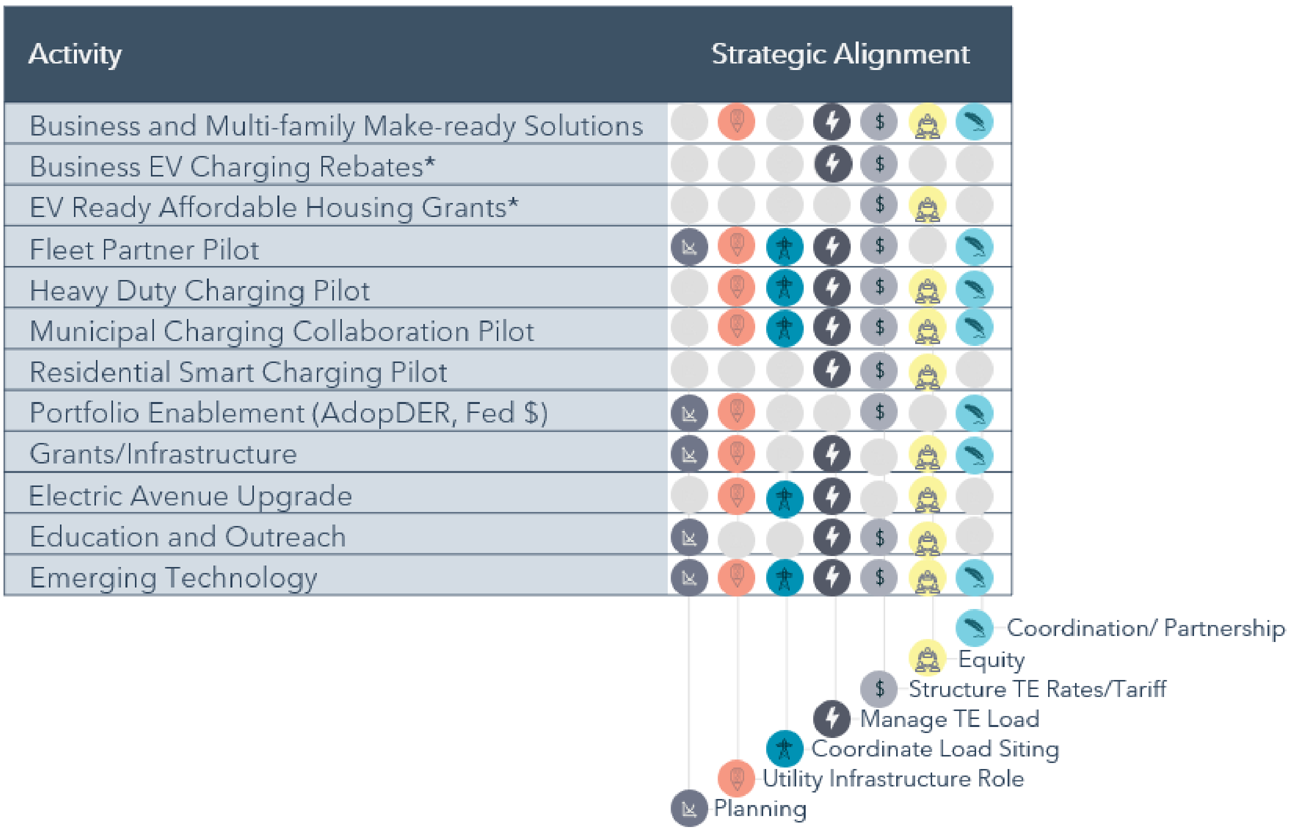

Figure 5. Connecting Transportation Electrification Activities to the Strategy

2.8.1 Providing the Right Customer Experience

PGE's market research and customer conversations have underscored a need for PGE to provide improved energy information and comprehensive engagement for residential and small business customers to make individual decisions about their service options.

We understand the need for the utility to play a strong role in identifying additional means to lower EV adoption costs as well as help customers overcome technical challenges to adoption of efficiency products[59] and, increasingly, grid-enabled products. PGE identifies customer needs through market research, interviews, surveys, and feedback from demonstration and pilot activities. These help us understand the diversity of customer needs and identify barriers associated with customers' experiences in achieving their goals. We build on this understanding of customer needs through stakeholder engagement and workshops. In exploring what is required to provide a holistic customer engagement for flex load adoption, PGE has identified the following customer priorities:

- Awareness and education for customers related to programs and rates that can help them better achieve their individual goals
- Accurate information on products that support the grid and how to use them
- Rebates/incentives and offering on-bill financing at the time of purchase
- Seamless enrollment into applicable flex load programs
- Additional affordability resources available to customers for whom energy costs are a greater burden
- Coordination of purchase, installation, and maintenance services
- Pathways for market partners to participate in offers and delivery
- Solutions for overcoming related hurdles such as the cost of electrical panel replacements
- Awareness and education of complimentary offerings such as EV Charging and TOD rates

A holistic customer experience means that our customers can find the information and/or service they need via their preferred channel at the time that is right for them. In considering our residential and small business customers' current engagement pathways with PGE, we have concluded that an integrated digital experience is necessary to help them complete the energy journey from awareness to education, adoption, and through to implementation and support. Without tackling the complexity of flex load adoption in an end-to-end manner, PGE risks losing customers along this journey, which will make it more difficult for PGE to meet our decarbonization targets. PGE is working to enhance our current digital customer channel for a more seamless flex load adoption experience. The development of this customer experience begins by ensuring customers have the right information to understand their bill and energy usage. Features such as enhanced rate comparison tools, load disaggregation, and improved user interfaces are important components of customer awareness and education that will help customers understand where there may be opportunities to engage programs that meet their needs.

Once a customer has chosen a device and/or a rate that meets their need, it is important that PGE provide tools necessary to overcome other acquisition barriers for adoption as part of the seamless experience. These include integration of applicable rebates, options for financing, the convenience of on-bill repayment, and integration with installers. As PGE implements this improved customer journey(s), we plan to seek to recover on this capital investment in our digital toolset through a future rate case filing(s). We are also seeking to identify advantageous financing terms and rates that can be provided to customers by a third-party lender, and plan to file a tariff for customer financing options.

[59] NEEA. *Energy Efficiency Financing: Barriers and Opportunities in the Small Utility Market Report #E16-298*; 2016. Retrieved from https://neea.org/resources/energy-efficiency-financing-barriers-and-opportunities-in-the-small-utility-market.

2.9 Plan Budget

The 2023 TE Plan includes a portfolio of programs, infrastructure measures, and rates/tariffs which are needed to execute PGE's strategy to plan, serve, and manage the TE load. Table 8 provides an overview of the proposed incremental TE Portfolio spend. Table 9 provides an overview of the TE Portfolio costs for currently approved TE programs.

Table 8. 2023-2025 TE Portfolio Proposed Incremental Spend

TE Portfolio Proposed Incremental Spend	2023	2024	2025	2023-2025 Incremental Spend
Customer Ratepayer Subtotal	-	**$3,336,856**	**$6,427,093**	**$9,763,949**
Fleet Partner Pilot	-	$3,036,856	$6,427,093	$9,463,949
Portfolio Support	-	$300,000	-	$300,000
Monthly Meter Charge Subtotal	-	**$4,585,863**	**$5,692,911**	**$10,917,249**
Portfolio Support	-	$287,500	$287,500	$575,000
Public Charging - Municipal Charging Collaboration	-	$2,991,526	$3,275,001	$6,266,527
Residential Smart Charging Pilot	-	$1,306,837	$2,130,409	$4,075,722
Clean Fuels Subtotal	-	**$13,713,904**	**$19,753,790**	**$33,467,693**
Business and Multi-Family Make-Ready Solutions	-	$2,144,739	$2,439,061	$4,583,800
Clean Fuels Program	-	$11,569,165	$17,314,728	$28,883,893
Grand Total	-	$22,275,098	$31,873,793	$54,148,890

Table 9. 2023-2025 TE Approved Spend for Current Programs[60]

TE Portfolio Approved Spend	2023	2024	2025	2023-2025 Approved Spend
Customer Ratepayer Subtotal	**$9,005,180**	**$4,565,325**	**$452,403**	**$14,022,907**
Business & Multi-Family Make-Ready Solutions	$1,854,630	-	-	$1,854,630
Fleet Partner Pilot	$4,426,760	$3,378,884	$15,680	$7,821,324
Heavy Duty Charging Pilot	$1,997,290	$1,186,441	$436,723	$3,620,453
Municipal Charging Collaboration	$426,500	-	-	$426,500
Portfolio Support	$300,000	-	-	$300,000
Monthly Meter Charge Subtotal	**$8,529,000**	**$1,943,728**	-	**$10,472,728**
Business & Multi-Family Make-Ready Solutions	$692,500	-	-	$692,500
Business EV Charging Rebates	$14,000	$1,943,728	-	$1,957,728
EV Ready Affordable Housing Grants	$1,000,000	-	-	$1,000,000
Fleet Partner Pilot	$832,000	-	-	$832,000
Portfolio Support	$1,511,500	-	-	$1,511,500
Public Charging - Municipal Charging Collaboration	$3,742,000	-	-	$3,742,000
Residential Smart Charging Pilot	$737,000	-	-	$737,000
Deferral Subtotal	**$2,646,059**	**$678,162**	**$305,747**	**$3,629,968**
Business EV Charging Rebates	$446,000	$385,000	-	$831,000
Public Charging - Electric Ave	$520,059	$293,162	$305,747	$1,118,968
Residential Smart Charging Pilot	$1,680,000	-	-	$1,680,000
Clean Fuels Program	**$11,758,817**	-	-	**$11,758,817**
Grand Total	$31,939,055	$7,187,215	$758,150	$39,884,420

[60] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

Activity	Strategic Alignment	Previously Approved	Incremental	Total
Public Charging - Municipal and Electric Ave		$5,287,468	$6,266,527	$11,553,995
Business EV Charging Rebates**		$2,788,728		$2,788,728
EV Ready Affordable Housing Grants**		$1,000,000		$1,000,000
Fleet Partner Pilot		$8,653,324	$9,463,949	$18,117,273
Heavy Duty Charging Pilot		$3,620,453		$3,620,453
Business and Multi-family Make-ready Solutions*		$2,547,130		$2,547,130
Residential Smart EV Charging Pilot		$2,417,000	$4,075,722	$6,492,721
Portfolio Enablement (AdopDER, Fed $)		$1,811,500	$875,000	$2,686,500
Subtotal Customer Rates		**$28,125,603**	**$20,681,198**	**$48,806,800**
Grants/Infrastructure				
Electric Avenue Upgrade				
Education and Outreach				
Emerging Technology				
Business and Multi-family Make-ready Solutions*			$4,583,800	$4,583,800
Clean Fuels (2023 + forecast 2024-2025)		**$11,758,817**	**$33,467,693**	**$45,226,510**
Total Budget		**$39,884,420**	**$54,148,890**	**$94,033,310**

**Funded from both Customer Rates and Clean Fuels*
***These activities are sunsetting*

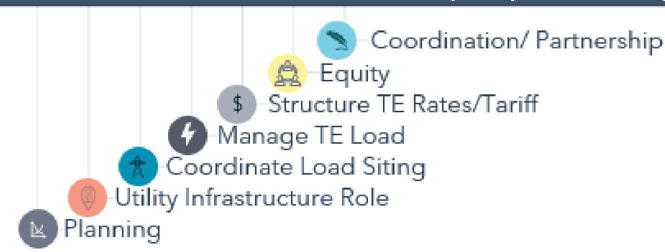

Figure 6. Transportation Electrification Budget[61]

[61] The figures shown in the "Previously Approved" column this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

2.10 Regulatory

2.10.1 Timeline of Regulatory Activity Since 2019 Plan

The following is a review of the regulatory activities affecting the development the 2023 TE Plan:

- April 16, 2019: OPUC adopts Division 87 rules prescribing the required elements of utility TE Plans and setting a deadline for new plans to be filed two years after Commission acceptance of the prior plans.
- September 30, 2019: PGE files its first formal TE Plan for Commission acceptance under the new rules.
- February 13, 2020: PGE 2019 TE Plan accepted by Commission, thus starting the two-year clock for PGE to file its next plan.
- March 18, 2020: Governor Brown issues Executive Order 20-04, which establishes new greenhouse gas emissions goals for the State of Oregon, directs state agencies to identify and prioritize actions to meet the goals, and directs the Commission to encourage electric companies to support TE infrastructure that supports GHG reductions and helps achieve TE goals set forth in SB 1044 (2019).
- January 28, 2021: Commission directs Staff (Order No. 21-026) to open an investigation to develop a TE investment framework, which Staff defines as a decision-making tool to provide guiding principles to establish the bounds and desired outcomes of utility TE investments, and the basis for their evaluation by the Commission.
- May 26, 2021: In Docket No. UM 2165 Staff holds the first of a series of workshops with utilities and stakeholders to investigate the TEIF, continuing through the summer and fall of 2021.
- May 26, 2021: Coincidentally on the same day as the first UM 2165 workshop, Governor Brown signs HB 2165 into law, amending ORS 757.357 to establish a new utility TE monthly meter charge with required expenditures on underserved communities and placing new importance on investment in charging infrastructure as distinct from programmatic activity in support of TE.
- December 14, 2021: Commission directs Staff (Order No. 21-484) to explore the implementation of the TEIF, open a rulemaking to revise Division 87 (Docket No. AR 654) to reflect statutory and state policy changes, and extend by twelve months the Division 87 deadline that would have required PGE to file a new TEP in February 2022, even as the TEIF and Division 87 revisions were in development.
- April 28, 2022: PGE holds the first of a series of six stakeholder workshops running through April 2023 to share information on its TEP development process and solicit input on its next TE plan.
- May 5, 2022: Staff presents draft Division 87 revisions to the Commission, which opens formal rulemaking.
- August 23, 2022: After further Staff-led workshops in UM 2165, the Commission adopts Staff's recommended guidance document for implementation of the TEIF and the Division 87 rule revisions, including performance metrics developed collaboratively by utilities and stakeholders as well as recommendations for the use of ODOT's Transportation Electrification Infrastructure Needs Analysis (TEINA) as a framework to help evaluate appropriate levels of utility investment in support of TE. In adopting this guidance the Commission also modifies Order No. 18-376, which

outlined principles for the use of Clean Fuels Program funds, to allow closer coordination of these revenues with other utility funding streams in support of TE.

- September 6, 2022: Commission adopts Division 87 revisions, establishing a three-year cycle for utility TE plan filings beginning in 2025, with annual reports and allowance for mid-cycle plan and budget updates if needed.
- October 18, 2022: Commission approves (Order No. 22-381) PGE's proposed 2022 MMC Budget and associated infrastructure measure applications as provided for in HB 2165 and the revised Division 87 rules.
- February 8, 2023: Commission grants (Order No. 23-034) a request from PGE for a further extension of its TEP filing deadline to June 1, 2023 to allow better alignment of its TEP planning process with its parallel IRP and CEP planning processes, so that Staff and stakeholders will have fuller context to evaluate the TEP and impact on customers once filed.
- April 18, 2023: Commission approves (Order No. 23-147) PGE's proposed 2023 MMC Budget and associated infrastructure measure applications as an update to its 2019 TEP, as provided for in the revised Division 87 rules.
- April 20, 2023: PGE holds a final workshop with Staff and stakeholders to share information regarding the content and scope of its in-development 2023 TEP and invite comments, questions, and input.
- June 1, 2023: In compliance with Division 87, PGE presents a draft of its second formal TEP to encompass its portfolio of programs and infrastructure measures in support of TE for calendar years 2023-2025, for Staff and stakeholder review and input. A final plan is slated for filing by August 25, 2023.

2.10.2 TEIF, TEINA, Division 87 Revisions

As noted in the above timeline, the Commission's Staff-led UM 2165 and AR 654 dockets overlapped and intertwined during 2021 and 2022, with significant redirection occurring with the passage of HB 2165 during the 2021 legislative session.

The TEIF was initiated with the goal of helping Staff, utilities, and stakeholders clarify the appropriate utility role and scope of activity in support of TE and to establish a basis for Commission evaluation of the next round of utility TE Plans. HB 2165 provided legislative direction that was critical to the UM 2165 investigation, but also extended the process as parties digested and adjusted to the new policy landscape created by the bill. The initial expectation that a TEIF would be adopted by the Commission in 2021 and inform utility TE plans slated for filing in the first half of 2022 proved unrealistic as the need for revisions to the Division 87 rules became clear. The Commission's decision to extend the utility TE Plan filing deadlines and allow further time for exploration of the TEIF flowed naturally from these overlapping developments and processes.

We believe that ultimately, the TEIF proposed by Staff and adopted by the Commission in tandem with the Division 87 rule revisions strives to create a holistic TE planning process for utilities. This process incorporates HB 2165 requirements within a framework that includes an infrastructure budget "guardrail" based on ODOT's TEINA methodology, performance area categories developed in collaboration with utilities and stakeholders, and benefit/cost analysis. We believe that the Commission intends the end result to be a comprehensive plan from each investor-owned utility that integrates their entire portfolio of near- and long-term TE actions, programs, and infrastructure measures—as well as their all-source budget—into a single document for Commission and stakeholder review.

The extensive discussions among Staff, stakeholders, and utilities that culminated in Staff's proposed TEIF guidance document and rule revisions were illuminating in many ways, not least of which was the magnitude of the challenge involved in the climate change-driven imperative to electrify the transportation system as a critical decarbonization strategy. At the same time, however, we saw that the market is evolving rapidly. The facts on the road, so to speak, have evolved from the those we faced as we developed our 2019 TEP. Application of the TEINA methodology, in isolation, could in principle be used to justify massive levels of utility investment in TE charging infrastructure with rate impacts that we determined, based on conversations, would be unlikely to gain support from policymakers or customers. The parties to the UM 2165 and AR 654 discussions and PGE's own TEP workshops enjoyed broad agreement on the importance of supporting the TE transformation and that utilities have a vital role to play in that transformation. Yet most parties also expressed the need for caution in balancing investment to keep pace with the market and promote rapid progress in TE with the need to maintain equity and affordability in electricity prices, especially in light of other investments utilities must make in support of decarbonization of the broader energy system.

2.10.3 PGE's Request for Extension

It was in this context that PGE made the decision in January 2023 to request an additional extension of the deadline to file its next TE Plan.

During most of 2022 PGE assumed—and expressed to Staff and stakeholders—that it would develop a new TE Plan in parallel with the AR 654 rulemaking process and file the plan soon after the Commission adopted the new rules. Indeed, the Company initially hoped the rulemaking process would be complete and our plan could be filed early in the third quarter of 2022. However, as the TEIF and rulemaking processes were extended, and as the Company discussed concepts and budgetary scope for the plan, it became clear that both Staff and stakeholders expected to evaluate the Plan in a broader context that would include PGE's proposals for its upcoming IRP and first-ever CEP as well, and more particularly the potential cumulative customer price impact of all three plans. The IRP and CEP, however, were not slated for filing until the end of March, 2023; more than a month after PGE's February 2023 deadline for filing the TE Plan.

As PGE evaluated its planning processes internally, the Company concluded it would be preferable for Staff and stakeholders to have the broader context of the IRP/CEP first. While the TE Plan is an important priority for PGE, its customers and stakeholders, the magnitude of investment involved in the TE Plan is modest compared to the needs addressed in the IRP/CEP. In addition to providing a more rational sequencing of the plans, the additional time allowed PGE to evaluate the fast-changing EV charging market and determine the optimal balance of priorities, investments, and costs associated with the TE Plan on its customers' behalf.

Thus, PGE formulated its request to the Commission, which was granted on February 8, 2023, for a June 1 deadline to present its draft TE Plan for Staff and stakeholder review. As part of that request, the Company also proposed to share 2023 budgets for expenditure of MMC revenues and Clean Fuels Program funds. In both cases, PGE shared drafts with stakeholders and invited feedback, questions, and suggestions prior to filing the 2023 budgets with the Commission. These interim measures will meet statutory requirements and provide program continuity while the full TE Plan goes through a review and acceptance process that is not expected to conclude until the third quarter of the year.

2.10.4 The Need for Flexibility Mid-Cycle

Our experience in developing this TE Plan in a rapidly evolving market and regulatory framework points to the value of one particular element provided for in the revised Division 87 rules: the allowance for plan and budget updates mid-cycle. Indeed, with its 2023 MMC budget, PGE has already exercised this aspect of the new rules by submitting a budget and infrastructure measure applications that, while complementary to the full 2023-2025 TE Plan, also constitute an update to the currently accepted 2019 TE Plan.

In AR 654, PGE advocated a three-year TE planning cycle, to which we remain committed as a way to promote program continuity, allow meaningful time for implementation and evaluation, and avoid needlessly overextending Staff, utility, and stakeholder resources. PGE is also committed to the portfolio approach that was universally endorsed by parties in UM 2165, namely that utility activities in support of TE are best understood and evaluated as a complementary suite of programs and measures driving overall progress across agreed-upon performance areas.

That said, the rapidly evolving market for EVs and charging infrastructure demands agility, and that will require mid-cycle adjustments to this TE Plan. PGE fully expects that as we implement the programs and activities described in our plan we will seek feedback and encounter market realities—positive and negative—necessitating program and budget refinements. We will hear from our municipal partners and from representatives of underserved communities what works and doesn't work in our pole-charging pilot, for instance, and may need to make changes to reflect that information and improve customer experiences. We intend to remain true to the portfolio-level approach envisioned in the Division 87 rules yet adjust as needed to meet the needs of our customers and fulfill our mandate in support of TE.

2.10.5 PGE's Plan to Bring Forward Revision and New Activity

These mid-cycle adjustments are expected to be limited and strategic in nature and offered thoughtfully to avoid overtaxing Staff and stakeholder review capacity—and to ensure PGE's own program staff are able to implement, seek input, evaluate, and plan activities appropriately. Ultimately, we expect our work under the 2023 TE Plan to be transitional, with heavy emphasis on data and information gathering. We will be applying lessons learned from activities approved in the 2019 TE Plan, scaling up and back as needed, and driving toward a goal of service stability.

2.10.6 Current Vision for the 2025 Plan

At one point in the AR 654 rulemaking process, PGE offered a comment on Staff's draft rule revisions to clarify that the TE Plan should include program or infrastructure measure applications, if any are proposed. In the current environment it may seem difficult to imagine a utility TE plan that proposes no new programs or infrastructure measures; however, we believe that will come to pass. Our expectation is that the work we're doing now and will continue under the 2023 TEP will help us establish a more complete understanding of the mature role of the utility in the TE marketplace. This will likely involve transitioning away from proposing a multitude of new programs and measures with each new Plan, instead focusing on the application of more traditional utility tools like rates, line extension allowances and tariffs.

Chapter 3. Planning

3.1 The Planning Environment State and Federal Policies, Programs, and Actions

3.1.1 Legislative History

Since 2016, Oregon law has called for utilities to invest in transportation electrification infrastructure. The 2016, the Oregon Legislature (Legislature) defined Transportation Electrification in statute for the first time and found that "transportation electrification … requires that electric companies increase access to the use of electricity as a transportation fuel," and should "assist in managing the electric grid and improving electric system efficiency and operational flexibility".[62] The bill directed the Commission to require utilities to file program applications to accelerate transportation electrification and outlined the considerations under which the Commission could allow cost recovery for program expenditures.

When the OPUC accepted PGE's inaugural TE Plan in February 2020, the Oregon Clean Fuels Program at the Oregon Department of Environmental Quality (ODOE) was already generating Clean Fuels Credits for electric vehicle charging. The 2019 Legislature had also enacted Senate Bill 1044, establishing zero emission vehicle (ZEV) adoption goals for Oregon and strengthening ZEV purchasing requirements for state fleets.

Since that time, the Legislature and state agencies have continued to prioritize, fund, and require electrification of transportation. PGE has worked collaboratively with state agencies and legislators to inform and support transportation electrification policy that benefits PGE customers.

3.1.1.1 State Legislative Actions

The 2021 Oregon Legislature enacted House Bill (HB) 2165[63], introduced by Governor Kate Brown, to extend and improve Oregon's Clean Vehicle Rebate Program (also known as Oregon's EV Rebate Program)[64] and support utility investment in EV infrastructure. HB 2165 includes the following major elements:

- EV rebate improvements: The bill removes the 2024 sunset on Oregon's Clean Vehicle Rebate Program and makes other targeted changes to better support underserved communities.
- Transportation electrification monthly meter charge: HB 2165 also requires PGE and Pacific Power to collect a charge set to 0.25 percent of the total revenues collected by the utility. The fee is collected as a monthly meter charge from all customers through 2030. Funds from the charge must be used by each utility to support and integrate transportation electrification and must be spent on elements contained in a utility's TE plan. Budgets for the use of these funds must be approved by the Commission. This charge is a minimum amount collected for utility TE activities. The utility must make reasonable efforts to spend not less than half the amount collected through this fee on TE in underserved communities.
- Updating current law on utility investment in transportation electrification infrastructure: HB 2165 also updates ORS 757.357 to ensure clear Commission authority to allow cost recovery

[62] Oregon Revised Statute 757.357, retrieved from https://oregon.public.law/statutes/ors_757.357.
[63] Oregon House Bill 2165, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2165.
[64] Oregon DEQ. *Oregon Clean Vehicle Rebate Program*. Retrieved from https://www.oregon.gov/deq/aq/programs/pages/zev-rebate.aspx.

for TE infrastructure measures. The bill recognizes utility investments in TE infrastructure as a utility service, provided the investment both supports greenhouse gas (GHG) reductions in the transportation sector over time and benefits utility customers. HB 2165 also codifies in statute that utility investment to support TE includes behind-the-meter infrastructure. Taken together, these changes and the regular monthly charge underscore that enabling and managing TE, in the eyes of the 2021 Legislature and Oregon law, is a core, ongoing, and recoverable component of utility business to serve customers.

The 2021 Oregon Legislature also enacted House Bill 2180[65], requiring that all new multi-family buildings of five or more units, as well as new commercial buildings, be made EV-ready with provisions for electrical service capacity and conduit to serve 20 percent of parking spots. The bill allows local governments to require a greater percentage of parking spots be made EV-ready, and the Land Conservation and Development Commission adopted a rule in 2022 that requires cities within metropolitan areas to require 40 percent of parking spots be made EV-ready[66].

The 2021 Legislature also moved Oregon's previous deadline for 100 percent of new light-duty state-owned vehicle purchases to be ZEVs from 2029 to 2025 (HB 2027[67]). The Legislature also directed the State Parks and Recreation Department to allow for the installation and service of public EV charging stations in parking spaces in the state park system (HB 2290[68]).

In the 2022 Short Session, the Legislature supported both infrastructure and vehicle purchase incentives. House Bill 4139[69] established the Medium- and Heavy-Duty Electrification Charging Fund at the Department of Environmental Quality, which received $15 million through House Bill 5202[70] for a grant program supporting medium- and heavy-duty ZEV charging and fueling infrastructure projects. The Legislature also allocated an additional $15 million to Oregon's Clean Vehicle Rebate Program, which the DEQ awarded across the state in Spring 2023.

3.1.1.2 State Agency and Executive Actions

In March 2020, Governor Kate Brown issued Executive Order 20-04[71] directing state agencies to take actions to reduce and regulate greenhouse gas emissions. This order includes directives to the OPUC to encourage electric companies to support TE and achieve the state goals established in Senate Bill 1044[72]. The order also directs the DEQ to extend and expand the Oregon Clean Fuels Program and increase credits generated from electricity as a motor vehicle "fuel".

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[65] Oregon House Bill 2180, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2180.
[66] Oregon Administrative Rules, Chapter 660, Division 12, Rule 660-012-0410. Retrieved from https://secure.sos.state.or.us/oard/view.action?ruleNumber=660-012-0410.
[67] Oregon House Bill 2027, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2027.
[68] Oregon House Bill 2290, retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2290.
[69] Oregon House Bill 4139, retrieved from https://olis.oregonlegislature.gov/liz/2022R1/Measures/Overview/HB4139.
[70] Oregon House Bill 5202, retrieved from https://olis.oregonlegislature.gov/liz/2022R1/Measures/Overview/HB5202.
[71] Oregon Executive Order 20-04, retrieved from https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf.
[72] Oregon Senate Bill 1044, retrieved from https://olis.oregonlegislature.gov/liz/2019R1/Downloads/MeasureDocument/SB1044/Enrolled.

In March 2021, the Environmental Quality Commission (EQC) adopted DEQ's revised Oregon Clean Fuels Program rules to increase the amount of clean fuels credits generated from EV charging.[73] The rules now allow additional clean fuels credits to be generated when renewable energy certificates are retired alongside EV charging for both residential and non-residential EVs. PGE takes advantage of this opportunity on behalf of our residential customers, generating $5,394,400 in 2021 credit revenues for the 2023 program year. The new rules also allow public entities like school districts and local governments to generate credits in advance of EV charging to help fund the purchase of EVs or related TE investments. In September 2022, the EQC adopted rules extending the Oregon Clean Fuels Program to 2035 and requiring a 37 percent reduction from 2010 levels in the carbon intensity of motor vehicle fuels.[74]

The EQC also adopted California's medium- and heavy-duty diesel engine standards, including the Advanced Clean Trucks rule[75] that requires manufacturers of medium- and heavy-duty vehicles to sell a certain percentage of ZEVs beginning with the 2024 vehicle model year. In November 2022, the Oregon EQC adopted California's Advanced Clean Cars II rule[76] in Oregon[77] as permitted by the federal Clean Air Act[78], requiring that all light-duty vehicle sales in Oregon be ZEVs by 2035.

3.1.1.3 Federal Actions

The Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA)[79], both passed by Congress since PGE's last TE Plan, provide significant funding and incentives to support transportation electrification.

The IIJA provides both formula funds and flexible funds to states, including more than $52 million over five years for Oregon to deploy corridor fast charging under the National Electric Vehicle Infrastructure Formula program (NEVI)[80]. The IIJA also creates a variety of new and substantial competitive grant opportunities for transportation electrification, including for buses and heavy vehicles. The IRA made significant modifications to the EV tax credit, lifting the 200,000-vehicle manufacturer cap for the credit but adding new rules for the credit on domestic manufacturing, supply chain, and vehicle cost. The IRA also created a used EV vehicle tax credit, along with tax credits for commercial EVs and for the installation of EVSE in certain communities.

PGE expects that these funding sources will help drive transportation electrification in our service area, where interest and adoption of EVs is already significant, and complement the state programs

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[73] Oregon Administrative Rules, Chapter 340, Division 253. Retrieved from https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1560.
[74] Oregon DEQ. *Clean Fuels Program Expansion 2022*. Retrieved from https://www.oregon.gov/deq/rulemaking/Pages/cfp2022.aspx.
[75] California Air Resource Board. *Advanced Clean Trucks*. Retrieved from https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks.
[76] California Air Resource Board. *Advanced Clean Cars Rule II*. Retrieved from https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.
[77] Oregon DEQ. *Advanced Clean Cars II*. Retrieved from https://www.oregon.gov/deq/rulemaking/Pages/CleanCarsII.aspx.
[78] United States Environmental Protection Agency (1970). *Clean Air Act*. Retrieved from https://www.epa.gov/laws-regulations/summary-clean-air-act.
[79] 117th Congress (2021-22) *House Rule 5376 Inflation Reduction Act of 2022*. Retrieved from https://www.congress.gov/bill/117th-congress/house-bill/5376.
[80] U.S. Department of Transportation, Federal Highway Administration *National Electric Vehicle Infrastructure Formula Program*. Retrieved from https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm.

and incentives. They also create opportunities for PGE to partner with our customers and communities on grant opportunities to gain external funding support for transportation electrification.

The IIJA also established a new DOT and DOE Joint Office of Energy and Transportation[81] focused on EV infrastructure deployment, with which PGE has been in contact both through trade associations and directly to understand grant opportunities.

Synopsis of Infrastructure Investment and Jobs Act Relevant Transportation Electrification Funding

The IIJA provides a range of formula funds and flexible funds to states as well as a variety of new and substantial competitive grant opportunities for transportation electrification, including for buses and heavy vehicles. The following selected funding streams are particularly relevant for TE in PGE's service area:

- National Electric Vehicle Infrastructure formula program: This program provides $52 million in formula funding to Oregon over five years to deploy fast charging stations within a mile of designated federal highways. ODOT administers these formula funds, and under a federally approved state plan, plans to develop and/or upgrade approximately 65 DCFC stations across Oregon's roadways, totaling a minimum of 260 DCFC ports and doubling the number of DCFC ports in the state. PGE provided expertise and advice to ODOT as it developed its State NEVI plan.
- The Charging and Fueling Infrastructure Grant Program[82]: This five year, $2.5 billion program is split between highway-adjacent corridor public charging grants and community DCFC public charging grants. The program prioritizes rural areas, low-and moderate-income neighborhoods, and communities with low ratios of private parking, or high ratios of multi-unit housing. In recent months, PGE has been in discussions with Forth[83], state agencies, and cities we serve about this opportunity.
- Grants for Buses and Bus Facilities Low and No Emission Bus Grant Program: This combination of new and existing programs offers $5.25 billion for the procurement of buses and upgrades to bus facilities, including purchase of low- and no-emission transit buses. PGE is supporting a customer in their application for this year's funding opportunity for the Low No Emissions Bus Grant.
- EPA Clean School Bus Program: The EPA Clean School Bus Program provides $5 billion total for fiscal years 2022-2026 for a new program for the deployment of low- and no-emission school buses and related infrastructure. The first round of funding has been completed, with the Banks School District receiving funding for three electric buses, and many other districts in PGE service area on the waiting list.

These grant programs create opportunities for PGE to partner with our customers and communities on grant opportunities to gain external funding support for TE, which we detail further in Section 3.8.1.

[81] Joint Office of Energy and Transportation: https://driveelectric.gov/.
[82] U.S. Department of Transportation. *Charging and Fueling Infrastructure Grant Program*. Retrieved from https://www.transportation.gov/rural/grant-toolkit/charging-and-fueling-infrastructure-grant-program.
[83] Forth: https://forthmobility.org/.

Synopsis of Inflation Reduction Act Funding

The IRA extended, expanded, and modified the existing EV tax credit, lifting the 200,000-vehicle manufacturer cap for the credit but adding new rules for the credit on domestic manufacturing, supply chain, and vehicle price. New rules on vehicle cost (manufacturer's suggested retail price, or MSRP) and income limits will restrict who qualifies: vehicle cost caps for vans, SUVs, and pickup trucks are $80,000, while the cap for other vehicles is $55,000; annual income is limited to $300,000 per household, $150,000 per individual. A used EV credit is created through December 31, 2032, capped at the lesser of $4,000 or 30 percent of the sales price for a 2+ year old vehicle for incomes less than $75,000 for single filers and $150,000 for joint filers. The IRA also created tax credits for commercial electric vehicles and for the installation of EVSE in certain communities.

Starting in 2025, clean commercial vehicles will be eligible for a tax credit of 30 percent of the incremental cost of the clean vehicle relative to a fossil-powered alternative. The Alternative Fuel Vehicle Refueling Infrastructure Tax Credit[84] was extended 10 years, available in both individual and commercial versions. The IRA also supports battery and technology research and manufacturing through the Advanced Manufacturing Production and the Advanced Energy Project tax credits.[85] The Inflation Reduction Act also invests $1 billion to replace dirty heavy-duty vehicles with clean, zero-emission Class 6 and 7 vehicles[86], support zero-emission vehicle infrastructure, and to train and develop the necessary workforce. These funds will be distributed as grants or rebates through the EPA's Clean Heavy-Duty Vehicle Program[87], expected to launch in late 2023.

PGE expects that the tax policies included in the IRA will help drive transportation electrification in our service area, where interest and adoption of EVs is already significant, and also complement the state programs and incentives.

3.2 Regional

3.2.1 Western Resource Adequacy Program

Planning to be resource adequate means having enough generation, efficiency measures, and demand-side resources to serve load with a sufficient degree of reliability across a wide range of conditions. Amid questions about whether the region will continue to have an adequate supply of electricity during critical hours, the Western Power Pool (WPP) began implementing the Western Resource Adequacy Program (WRAP) in 2021. The WRAP includes a forward-showing planning mechanism requiring participants to submit a portfolio of resources seven months ahead of operational need and allows controllable and dispatchable demand response (DR) resources to be

[84] U.S. Department of Energy. *Alternative Fueling Infrastructure Credit*. Retrieved from https://afdc.energy.gov/laws/11180#:~:text=An%20income%20tax%20credit%20is%20available%20for%2050%25,may%20be%20carried%20over%20into%20future%20tax%20years.

[85] Office of Energy Efficiency and Renewable Energy. *Alternative Fuels Data Center: Federal Tax Credits for Solar Manufacturers*. Retrieved from https://www.energy.gov/eere/solar/federal-tax-credits-solar-manufacturers.

[86] Office of Energy Efficiency and Renewable Energy. *Alternative Fuels Data Center: Vehicle Weight Classes and Categories*. Retrieved from https://afdc.energy.gov/data/10380#:~:text=FHWA%20categorizes%20vehicles%20as%20Light,(GVWR%20%3E%208%2C501%20lb).

[87] U.S. Environmental Protection Agency. *Clean Heavy-Duty Vehicle Program*. Retrieved from https://www.epa.gov/inflation-reduction-act/clean-heavy-duty-vehicle-program.

considered for compliance.[88] Actively managed charging could potentially be used for WRAP compliance if it meets minimum testing criteria and aggregation requirements.[89]

3.2.2 West Coast Clean Transit Corridor

The West Coast Clean Transit Corridor Initiative refers to a collaborative effort between 16 West Coast utilities to support the development of EV charging facilities along Interstate 5 (I-5), from San Diego to British Columbia, for heavy and medium-duty freight haulers and delivery trucks. PGE is one of the 16 utilities with service areas along that corridor, and we are actively working together to plan and build these medium and heavy duty (MHD) truck charging sites. It is estimated that these sites will require upgrades to the PGE distribution network, with power requirements for each site beginning at 1.5 MW, with a five-year growth to 20 MW. The WCCTC model recommends a charging site every 50 miles along the I-5 corridor. In PGE territory, the WCCTC calls for three potential locations. One of these locations appears to be the most feasible, and we are working with our planning groups, the WCCTC, and a large trucking fuel agency to better understand the feasibility, scale, schedule, and cost of this site.

3.3 Service Territory Planning Environment

3.3.1 Number and Forecast of Electric Vehicles in PGE Service Area

PGE uses our AdopDER model to forecast EV growth and related charging demand. AdopDER is PGE's enterprise DER modeling tool used to forecast DER adoption and calculate expected load impacts for critical PGE business functions. PGE uses the tool to forecast DER growth and potential impacts from the bottom-up, aggregating site-level adoption up to the feeder and ultimately the bulk power system level. The tool is used to inform regulatory filings (CEP/IRP, DSP, MYP, and TEP), corporate load forecasting, revenue projections, energy trading decisions, and transmission and distribution (T&D) capital planning.

PGE uses our AdopDER model to forecast EV growth and related charging demand. Our aim in this section is to communicate the key components related to TE within the model (since the model forecasts other DER growth in addition to TE, such as solar PV and building electrification) and not give an exhaustive overview of the model's capabilities or results.[90] For consistency with other Company planning efforts, we focus on communicating results from AdopDER as it is the primary system of record for forecasting future load growth resulting from TE activities within PGE. We understand and appreciate the interest from Staff and other stakeholders in understanding differences between AdopDER and ODOT's TEINA methodology, and we footnote important

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[88] Western Power Pool. *Western Resource Adequacy Program Detailed Design, March 2023*,pp71-72. Retrieved from https://www.westernpowerpool.org/private-media/documents/2023-03-10_WRAP_Draft_Design_Document_FINAL.pdf.
[89] Ibid. at pp73 ("Customer resource can be aggregate to the […] minimum requirement of 1 MW") and at pp72 ("meet testing criteria for load reduction for periods of up to five continuous hours").
[90] For detailed overview of AdopDER, see PGE. *DSP Part I Appendix G*, as well as PGE. *DSP Part II,* Section 5.1, retrieved from https://portlandgeneral.com/about/who-we-are/resource-planning/distribution-system-planning/dsp-resources-materials.

distinctions accordingly throughout this section. We also provide a more thorough comparison of port count results in Section 3.4 stemming from these different modeling approaches.[91]

3.3.1.1 AdopDER Vehicle Sales Forecast Methodology

PGE uses our AdopDER model to forecast EV and related EVSE adoption over the short- and long-run planning horizons (1-20 years). Key outputs for system planning purposes are energy and capacity needs stemming from electrification of transportation. Given recent changes to state and federal policy, PGE undertook an update to our EV forecast in April 2023. Updates to the model were made to capture the IRA and the Advanced Clean Cars II rule, as well as to recalibrate the baseline regression model with additional data from 2020-2022 national EV adoption trends.

A summary of the TE related measures in AdopDER[92] is presented below:

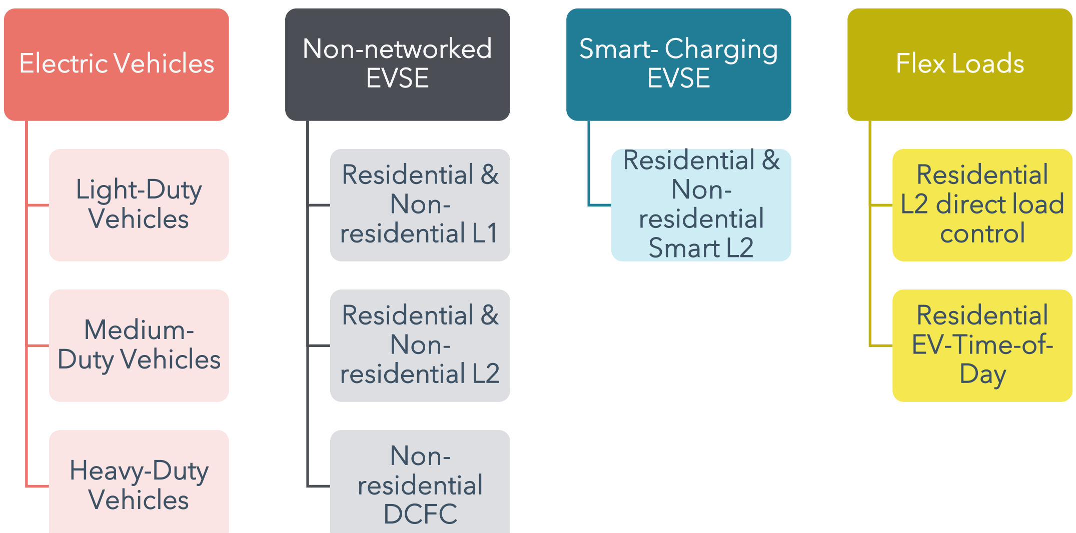

Figure 7. Transportation Electrification-related Measures in AdopDER

AdopDER's overall approach to forecasting EV growth is based on a robust methodology to identify the vehicles in PGE service area and apply detailed vehicle stock turnover and econometric modeling to identify growth trajectories based on underlying market factors. AdopDER blends a top-down econometric forecast of EV market share, which captures percent of new vehicles sold that will be electric in each year, with a bottom-up spatial allocation model to identify geographic clustering patterns useful for distribution system planning.

[91] AdopDER is a forecasting model that estimates adoption of electric vehicles, EVSE, and associated load impacts and is used for utility forecasting and planning efforts. ODOT's TEINA report is an assessment of public charging infrastructure (e.g., EVSE) requirements to support a given amount of EV adoption following the State's goals. Aside from methodological differences, which will be discussed throughout the section, this is an important distinction in scope between the two modeling efforts that should be emphasized up front.
[92] Currently, AdopDER forecasts on-road vehicles across the light-, medium-, and heavy-duty vehicle classes. PGE anticipates expanding AdopDER to include representation of potential impacts from non-road electrification, e.g., forklifts, agricultural equipment, marine, rail, and/or air transport in subsequent updates.

The top-down econometric model includes over 20 discrete variables that have been tuned to historical LDV EV adoption, however, the forecasts are the most sensitive to the following variables:

- Model availability
- Total incentives
- Vehicle and battery price declines

The rest of this section provides a detailed overview of each of these main forecast drivers and then connects the discussion back to the overall AdopDER model flow for TE forecasting.

Electric Vehicle Model Availability

As mentioned in Section 3.6.2.3, globally there were 450 EV models available for consumers to choose from as of 2021. When forecasting future EV adoption, we must account for expected future increases in model availability and incorporate only those models available to the US market. To accomplish this, AdopDER uses the Electric Power Research Institute's (EPRI) forecast of model availability through 2025 and extrapolates these trends through to 2030. Chart 1, below, shows the growth in expected models available in the US by vehicle type:

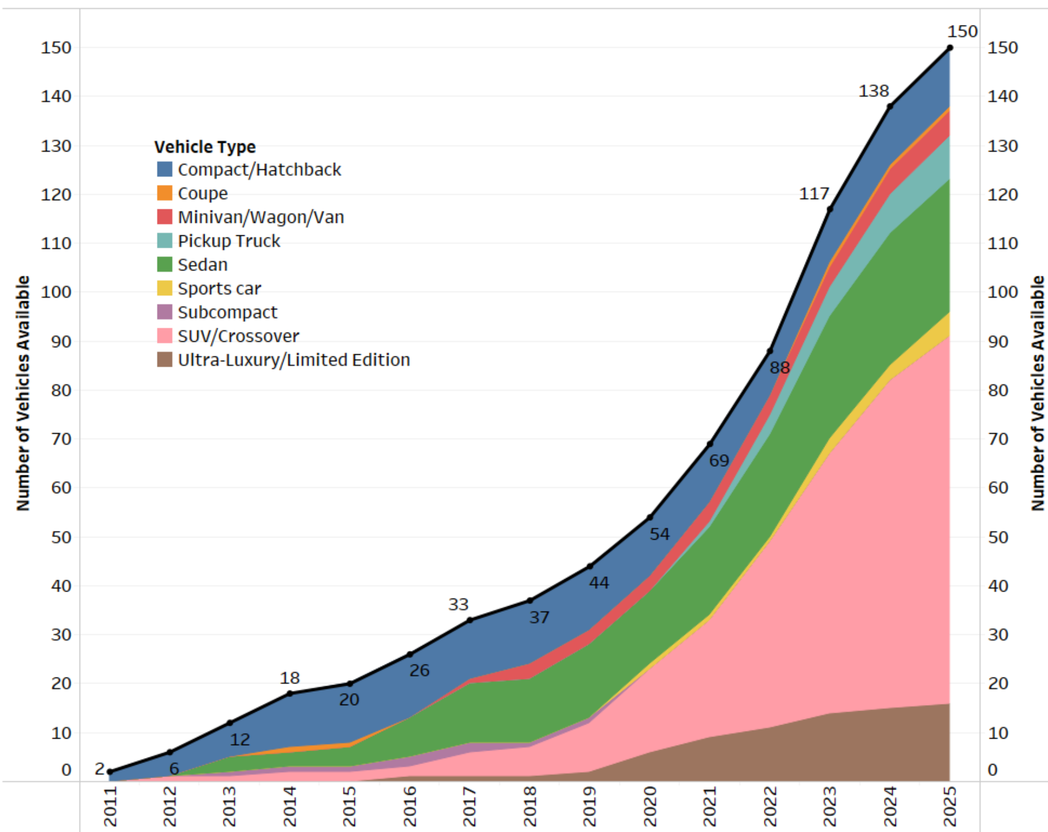

Chart 1. EPRI Forecast of Number of EV Models Available in the US by Vehicle Type

Total Incentives

The IRA is expected to significantly impact the vehicle market landscape. Although much remains to be seen about manufacturer response to some of the incentives (e.g., onshoring manufacturing supply chains) and, more importantly, the resulting effects on consumer retail price, the financial incentives from increased tax credits will nevertheless have an immediate impact.[93] Section 2.3.1.2 details the elements of the IRA related to the vehicle market. Here we only aim to highlight how these incentives have been incorporated into AdopDER.

Previously, AdopDER modeled the vehicle Clean Vehicle Credit as a weighted average of the federal tax credit (FTC) for which major vehicle manufacturers were anticipated to be eligible; accounting for the sales cap in place at the time (200,000 vehicles per manufacturer). Many vehicle makers had begun hitting the cap as early as Q1 in 2020 (Tesla) and as late as Q4 2022 (Toyota). The following table shows the sales-weighted Clean Vehicle Credit predicted before the IRA was passed. The IRA lifted the sales cap, however it also placed additional requirements on claiming the full credit based on final assembly in the U.S., battery mineral content, vehicle purchase price, and customer income.

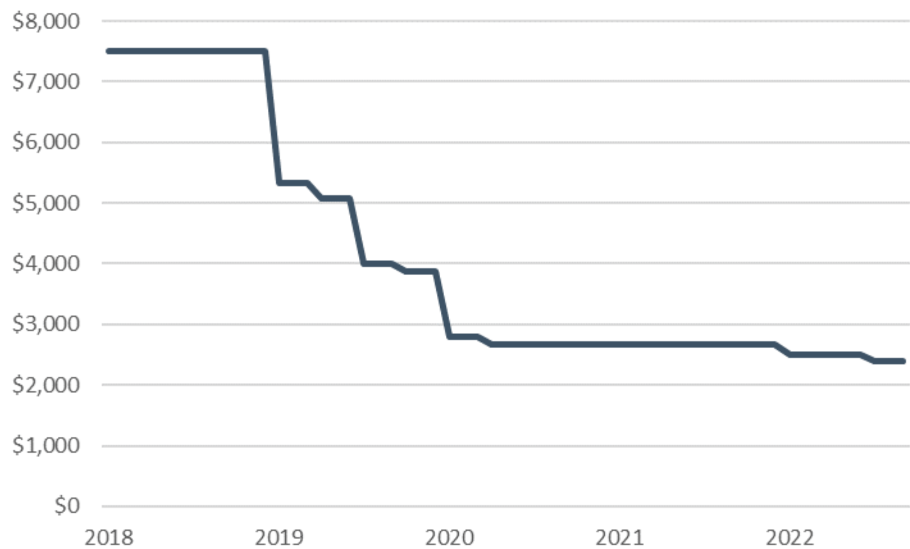

Figure 8. Weighted Federal Tax Credit with Manufacturer's Exceeding pre-IRA Sales Cap

Previously, we accounted for the statewide $2,500 rebate available through the Clean Vehicle Rebate Program.[94] Our recent model update incorporated additional rebates available for low and moderate income (LMI) customers through the Charge Ahead Rebate Program, which offers a rebate of up to $5,000 for the purchase or lease of a new or used EV for Oregon residents with income levels up to 400 percent of the federal poverty guideline.[95]

[93] We will continue to monitor progress and market changes stemming from the IRA with respect to vehicle costs, availability, and customer adoption trends. This includes various battery R&D efforts aimed at developing new battery chemistries, increasing battery charge acceptance rates, and increasing vehicle range.
[94] The state's Clean Vehicle Rebate Program was suspended May 1, 2023 as the program was oversubscribed for the funding available. There is uncertainty about the future funding status for this program and any resulting modifications to the credit.
[95] Oregon DEQ. *Oregon Clean Vehicle Rebate Program: Application Packet*. Retrieved from https://www.oregon.gov/deq/FilterDocs/evrebateapplication.pdf.

To properly account for benefits from both incentive programs, we calculate a weighted average of the two incentive levels based on state income data detailing the share of residents who qualify for the Charge Ahead additional incentive. In Oregon, 57 percent of residents fall below 400 percent of the federal poverty line as of 2021,[96] leading to a weighted average state incentive level of $3,548. All else equal, the increase in available incentives for low-income customers is expected to increase the EV adoption forecast.

Vehicle and Battery Price Declines

The last key driver of the forecast is vehicle price declines, which is largely a function of battery pack prices. We use the Bloomberg New Energy Finance (BloombergNEF or BNEF) Battery Price Survey[97] as a starting point to estimate downward price trends for EVs within the model, adjusting for forecast error in previous years of the baseline period. The following figure shows BNEF's forecast through 2030 for battery cost declines.[98]

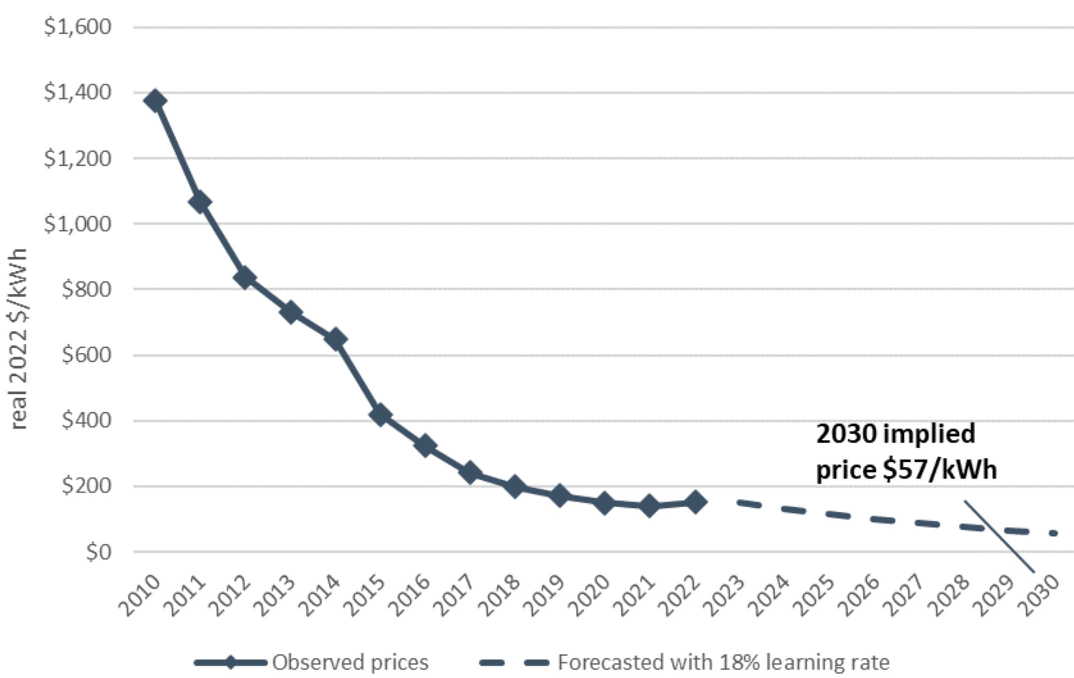

Figure 9. Bloomberg NEF Lithium-ion battery price outlook

[96] Kaiser Family Foundation. *Distribution of Total Population by Federal Poverty Level*. Retrieved from https://www.kff.org/other/state-indicator/distribution-by-fpl/?currentTimeframe=0&selectedDistributions=400percent&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D.
[97] Source: Brattle Group analysis. For BNEF historical battery pack prices and forecasted declines see: https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/ and for short-term impact on battery pack increased in 2022-23 see: https://about.bnef.com/blog/lithium-ion-battery-pack-prices-rise-for-first-time-to-an-average-of-151-kwh/. BNEF estimates that the 2022 increase due to supply chain issues will continue into 2023, but that will be short lived and prices will continue their decline thereafter.
[98] Note again that the primary influence captured in this model update from the IRA was change to the FTC. Changes to battery costs will be updated as more information becomes available about manufacturer response to the battery incentives in the IRA.

See Appendix G for the full list of variables used in the LDV regression modeling.

After completing our regression estimation, we compared our estimates of new EV sales to various publicly available forecasts adjusted to PGE service area, shown in the following figure[99]:

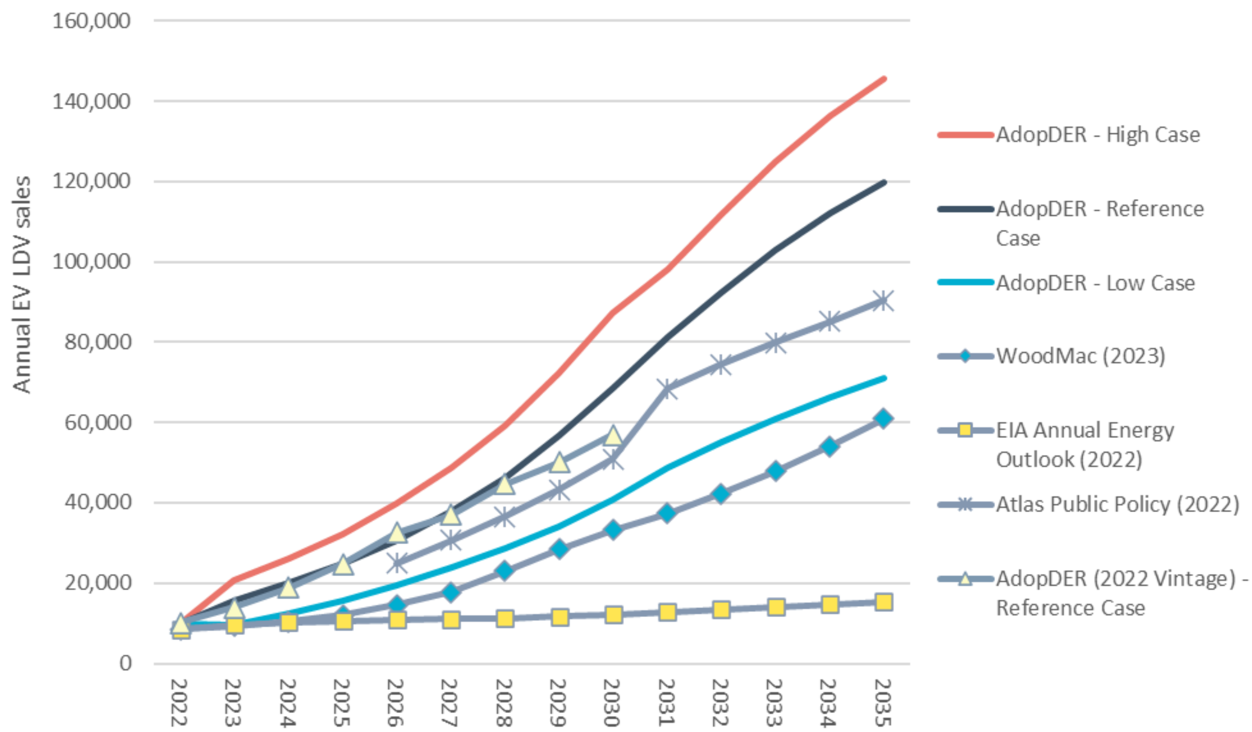

Figure 10. Benchmarking of Annual EV LDV Sales between AdopDER and Public Forecasts

For MDHDV, we leverage the annual percentage targets from the California Advanced Clean Truck rule for years through 2035, which Oregon EQC adopted in November 2021. For years beyond the ACT requirement window, we calibrate to our previous market share estimates for MDHDV derived from expert input under our DSP Part I.[100] The following figure shows the CA ACT rule annual percentage requirements for zero emission diesel engine sales during the 2024-2035 period.[101]

[99] Note that the publicly available forecasts are only available at the state level and not for PGE service area specifically. Therefore, we have applied the same percentage factor allocation of state-wide to PGE service area for purposes of comparison.

[100] For the MDHDV market share estimation methodology, see PGE. *DSP Part I,* Appendix G pp. 91-98. Retrieved from https://assets.ctfassets.net/416ywc1laqmd/1sMpwIkeZ0Imb9FuEA7F2i/128e4ffc0bc044f2fde8dcd7cbdc03c6/2021-09-17-pge-der-flex-load-potential-phase1.pdf

[101] ICCT (2020). *California's Advanced Clean Trucks regulation: Sales requirements for zero-emission heavy-duty trucks*. Retrieved from https://theicct.org/sites/default/files/publications/CA-HDV-EV-policy-update-jul212020.pdf

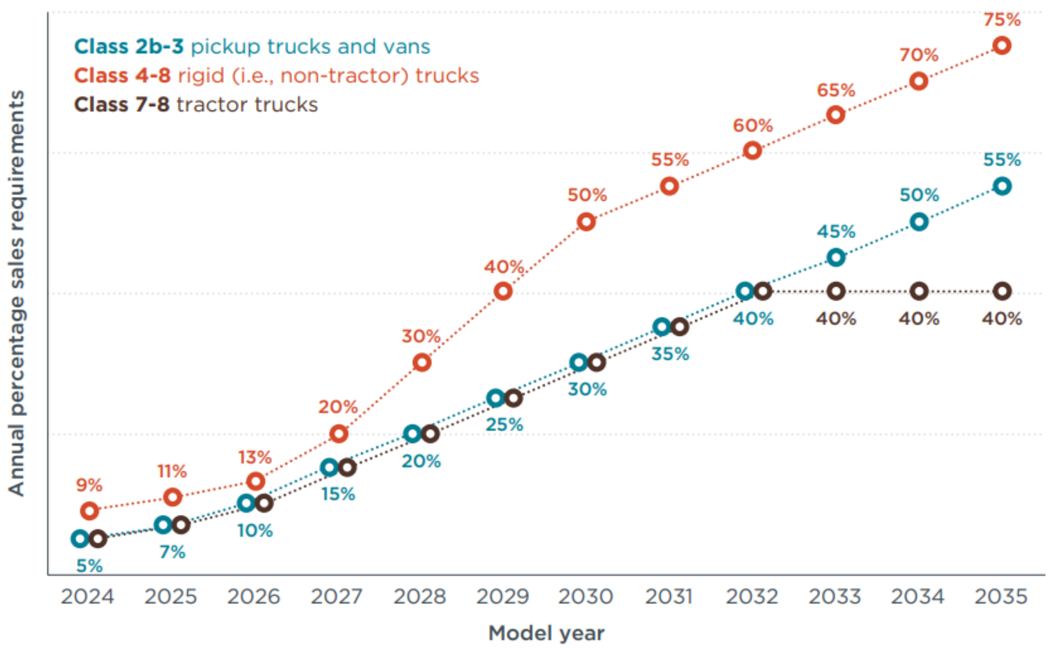

Figure 11. Zero-emission Sales Percentage Schedule for MDHDV by Vehicle Group and Model Year

To account for the overall market picture of HDVs operating in our service area, we partnered with EPRI to leverage national telematics datasets for trucks travelling throughout the state. With this data, we were able to geographically identify vehicle counts and major dwell times within PGE service area down to a 5-mile radius. The data represented HDV travel patterns during the busiest travel day of the year (June 27, 2019) and therefore reasonably approximates the total population of HDVs that will place future demands on the electric grid.[102]

3.3.1.2 AdopDER Vehicle Stock Turnover Modeling and EV Adoption

After developing our market share estimates of new EV sales described above, we must apply these to the proportion of new vehicles bought and sold each year. This is a function called stock turnover and depends on the average vehicle useful life. We begin constructing our stock turnover by taking the overall vehicle population, comprised of vehicle registrations obtained from ODOT, and matched to PGE service area and customer premises, for all vehicle fuel types and weight classes. We then augment the vehicle registration data with the additional HDVs from EPRI's telematics data, as noted above.[103] The following table shows the total count of vehicles across vehicle weight classes used to populate the stock turnover model within AdopDER.

[102] This is because the use of fleet telematics data encompasses both vehicles registered in Oregon and those that may be registered elsewhere but operating within PGE service area. This is particularly true for HDVs, many of which are registered outside of the state (and therefore not represented in the DMV registration data). HDVs must register for the Oregon Weight-Mile Tax but there is not sufficient data for geographic allocation within the state. For more information on the Weight-Mile Tax in Oregon, see DEQ. *Medium- and Heavy-Duty Truck Alternative Fuels Study*, retrieved from https://www.oregon.gov/deq/ghgp/Pages/Truck-Alternative-Fuels-Study.aspx

[103] The adjustments for EPRI's telematics data applies only to Class 7 and 8 HDVs.

Table 10. AdopDER: Vehicle Counts by Weight Class

Gross Vehicle Weight Class	Standardized Weight Class	Vehicle Counts
Class 1: 6,000 lbs. or less	LDV	50,390
Class 1A: 3,000 lbs. or less	LDV	83,587
Class 1B: 3,001 4,000 lbs.	LDV	136,482
Class 1C: 4,001 5,000 lbs.	LDV	806,508
Class 1D: 5,001 6,000 lbs.	LDV	475,924
LDV subtotal		1,552,891
Class 2: 6,001 10,000 lbs.	MDV	4,761
Class 2E: 6,001 7,000 lbs.	MDV	110,031
Class 2F: 7,001 8,000 lbs.	MDV	47,446
Class 2G: 8,001 9,000 lbs.	MDV	10,980
Class 2H: 9,001 10,000 lbs.	MDV	17,737
Class 3: 10,001 14,000 lbs.	MDV	17,871
Class 4: 14,001 16,000 lbs.	MDV	2,232
Class 5: 16,001 19,500 lbs.	MDV	2,846
Class 6: 19,501 26,000 lbs.	MDV	1,838
MDV subtotal		215,742
Class 7: 26,001 33,000 lbs.	HDV	27,552
Class 8: 33,001 lbs. and above	HDV	21,550
HDV subtotal		49,102
Total Vehicles		1,817,735

As of November 2022, Tesla was the most common vehicle make among PGE customers, in line with national sales trends, followed by Nissan and Chevrolet. Overall LDV EV adoption by manufacturer is shown in Chart 2, below:

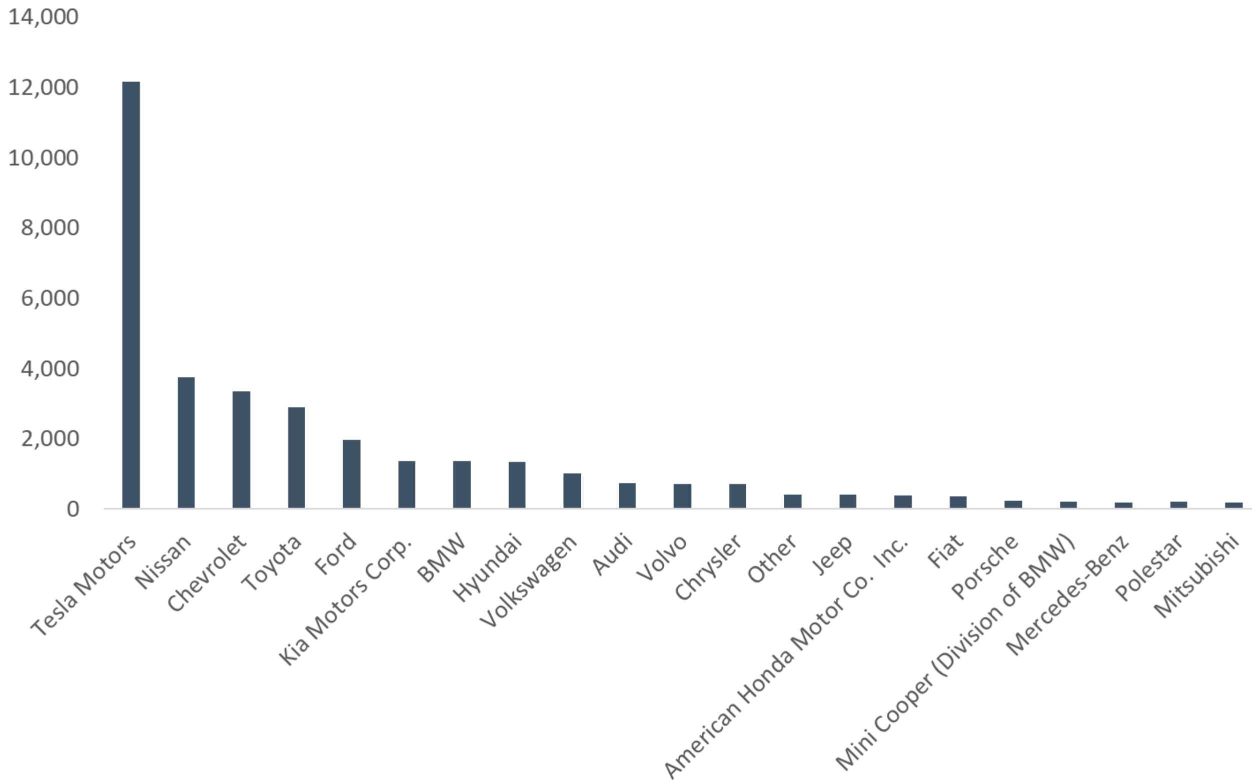

Chart 2. Count of Residential Commuter Electric LDVs in PGE Service Area by Manufacturer

Projecting forward into the forecast years, we then simulate the change in vehicle stock over time (i.e., stock turnover) as new vehicles enter the market and older vehicles are retired, applying the expected growth in EVs based on the econometric regression outputs. AdopDER is an agent-based model, with customer behavioral choices simulated at each time interval: a customer who adopts an EV then encounters a series of choices as to how they will charge the vehicle, what rate they charge at, and so on.[104] In addition, we apply customer data regarding site-level characteristics to constrain the EVSE adoption decision, which has a relationship to relative share of home versus public charging need.[105]

[104] Currently, AdopDER models EV adoption as a standalone customer decision point not related to other DER adoption. PGE is conducting research with EPRI to study co-adoption behavior among PGE customers across EVs, solar, and battery storage, and will include results into future modeling updates. Note that even though we model the adoption decision of EVs separate from other DER adoption decisions, the implications of a customer adopting an EV in the model still has important implications that are captured in the model, such as increasing the annual kWh on the customers' bill, which flows through the model to different bill savings calculations from other adoption decisions (e.g., TOU, flexible load programs, etc.)

[105] Site-level constraints for EVSE adoption include lack of on-site parking and lack of available service panel space. More detail on the site eligibility characteristics and adoption framework for AdopDER can be found in PGE. *DSP Part I*, Appendix G section 4.3.4 pp40-41. Note that site characteristics do not impact the EV adoption decision, which is governed by its own set of customer behavior drivers, but only the type of EVSE (public versus private) that the vehicle's energy demand of will be served with. We are also currently evaluating ways that panel upgrade incentives could change the customer adoption decision and will incorporate any learnings into future model updates.

Chart 3 depicts the change over time in the overall vehicle stock, with forecasted growth in the reference case of EVs increasing and the share of internal combustion engine (ICE) vehicles decreasing over time.

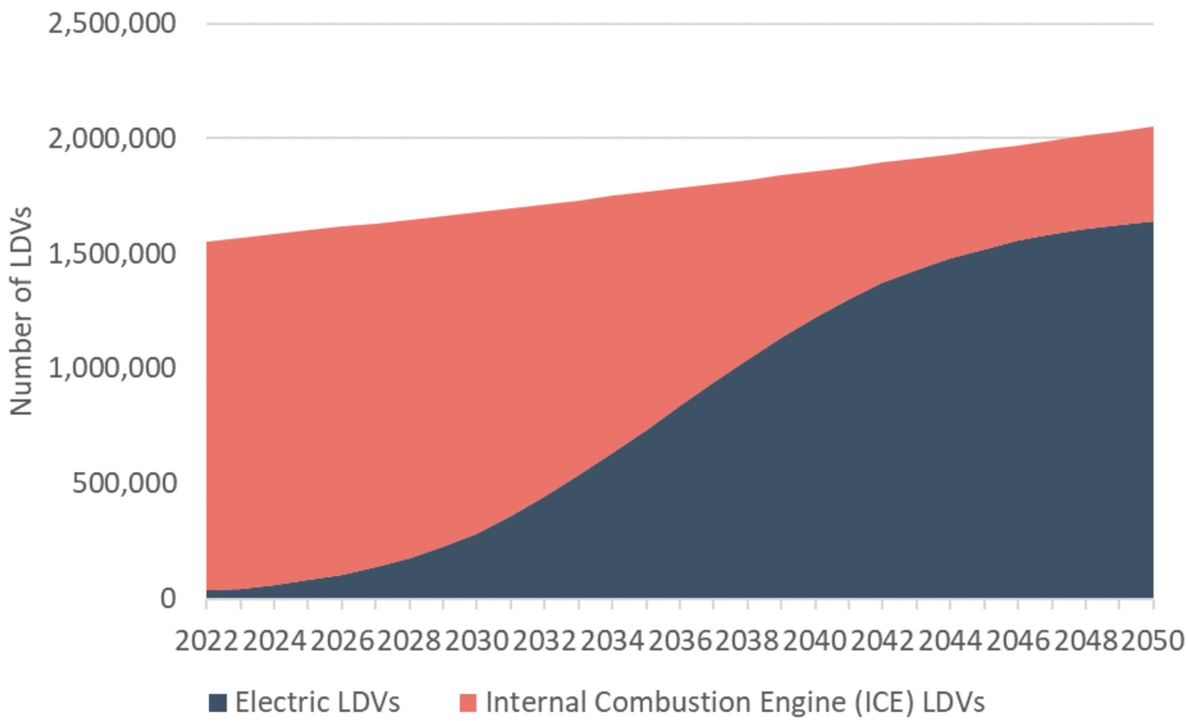

Chart 3. Vehicle Stock Turnover and EV Adoption from AdopDER April 2023 Reference Case LDVs

The following table shows the detailed forecast results for EV growth through 2033 across all vehicle classes, segmented by residential and non-residential uses:

Table 11. Forecast of EV Adoption in PGE Service Territory (AdopDER model Reference Case)

Market Segment	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Residential Light-Duty Vehicle (LDV) Plugin Hybrid Electric Vehicle (PHEV)	20,635	30,998	41,331	52,233	64,041	77,075	91,298	102,537	114,176	125,423	135,844
Residential LDV Battery Electric Vehicle (BEV)	43,775	64,526	86,801	111,299	139,107	171,644	209,692	259,528	316,787	380,838	449,817
Residential Subtotal	64,410	95,524	128,132	163,532	203,148	248,719	300,990	362,065	430,963	506,261	585,661
Non-Residential LDV BEV	4,659	7,428	10,418	13,507	16,797	20,842	25,544	31,598	38,541	46,113	54,190
Non-Residential LDV PHEV	1,925	3,172	4,349	5,628	6,883	8,182	9,589	10,491	11,287	11,851	12,200
Non-Residential Subtotal	7,601	12,530	17,886	23,579	29,970	37,635	46,341	56,422	67,552	79,518	91,860
LDV EV Type Subtotal	70,994	106,124	142,899	182,667	226,828	277,743	336,123	404,154	480,791	564,225	652,051
Heavy-Duty Vehicle (HDV)	355	796	1351	1935	2691	3603	4619	5856	7,156	8,608	10,018
Medium-Duty Vehicle (MDV)	662	1,134	1,768	2,509	3,599	5,008	6,589	8,477	10,568	12,946	15,452
Grand Total	72,011	108,054	146,018	187,111	233,118	286,354	347,331	418,487	498,515	585,779	677,521

AdopDER calculates TE load based on different charger use cases, each with different load profiles, charge speeds, and utilization rates. Chart 4 shows the daily load profiles for different residential charging levels.

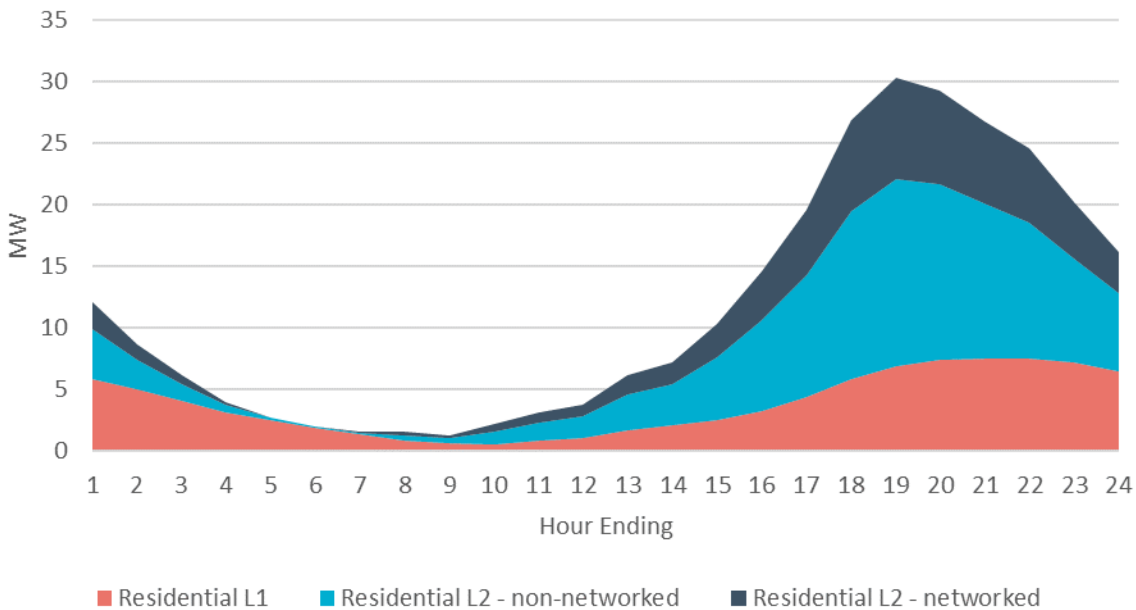

Chart 4. Residential EV Charging Load: Daily Load Profile for July 2023

The following table shows PGE's overall forecasted energy impacts from EV growth through 2030:

Table 12. Transportation Electrification Potential Forecasts (MWa)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030
High	19	36	57	87	119	158	203	252
Ref	17	29	43	63	83	110	141	177
Low	15	23	31	43	55	70	87	106

This forecast update represents an increase relative to the reference case TE load forecast in PGE's 2023 IRP of 66 aMW by 2030 (111 aMW in 2023 IRP forecast versus 177 aMW in the April 2023 update). Section 3.8.3.2 describes how the IRP treats TE load in the different Need Futures.[106] PGE will

[106] "Need Futures" refers to different hypothetical future scenarios that each have different levels of new resource needs to serve expected load. For example, a "High Need Future" would be one with higher load growth (e.g., TE) and lower resources growth (e.g., solar PV).

also be re-running IRP models with updated overall load forecasts in June 2023 as part of LC 80, which will include the updated TE load projections.

3.4 Needed Public and Private Charging Infrastructure

3.4.1 PGE's AdopDER Model Forecasts of Needed Public and Private Charging Infrastructure

PGE's AdopDER model also forecasts the commercial and residential charging ports that are needed to support the forecasted adoption of EVs. Table 13 shows the results for commercial EVSE adoption by charging use case.

Table 13. Summary of Commercial EV Port Counts (AdopDER Forecast Reference Case)

Use Case	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Public DCFC	676	924	1,124	1,328	1,560	1,840	2,156	2,364	2,592	2,820	3,024
Public/ Workplace L2	1,840	2,686	3,705	4,600	5,944	7,322	9,131	11,465	14,826	18,748	24,413
Fleet DCFC	240	479	875	2,154	3,349	5,181	7,243	9,761	12,725	16,343	19,928
Fleet L2	229	495	1,015	1,571	1,852	2,573	2,921	3,816	4,974	6,300	8,513
L1	247	435	498	581	740	962	1,176	1,410	1,483	1,525	1,891
Total	3,232	5,019	7,217	10,234	13,445	17,878	22,627	28,816	36,600	45,736	57,769

AdopDER determines residential charging needs on a site-by-site basis based on customer vehicle adoption and site-level eligibility criteria for home charging. We combine two primary data sources to estimate the amount of residential vehicle adoption that can be served by home charging: 1) presence of a garage or driveway, and 2) sufficient available breaker space on the home electrical service panel. In the model, we do not prevent a home from adopting an EV, but if either of these criteria are not met, then the model tracks the unmet home charging need and generates additional demand for public charging ports.[107]

Table 14 shows results of AdopDER's reference case adoption forecast. We break out the type of home charging between both charging speeds (L1 versus L2) and whether the L2 is networked or not. Networked L2, which are required in PGE programs, represent an opportunity for charging management.

[107] This marks an important difference from the TEINA methodology, which assumes a starting level of home charging access of 90 percent and decreases linearly to 60 percent by 2035. Note that in our April 2023 model update, we relaxed the criteria for home service panel upgrade barriers given the available rebates and incentives (both PGE's effort under the Smart Charging pilot and federal incentives expected to be available as a result of the IRA).

Table 14. Residential EVSE Adoption Forecast (AdopDER Forecast Reference Case)

Residential Charging Type	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Non-networked L1	15,220	24,171	33,863	43,947	54,715	66,343	78,841	92,563	107,207	122,118	136,954
Non-networked L2	9,825	11,675	13,315	14,956	16,417	17,525	16,801	17,413	17,920	17,965	17,825
Networked L2	5,957	10,409	15,769	22,014	29,096	37,060	47,277	56,586	66,629	77,507	88,365
Total Residential Chargers	31,002	46,255	62,947	80,917	100,228	120,928	142,919	166,562	191,756	217,590	243,144

3.4.2 TEINA Model Forecasts of Needed Public and Private Charging Infrastructure

PGE has also calculated a separate forecast of public ports needed to support the forecasted adoption of EVs in our service area, this time using ODOT's TEINA methodology. Per OPUC Staff's guidance, we are using this second port count forecast to inform the infrastructure "guardrail" to guide programmatic investments. In order to maintain consistency across foundational utility planning documents, PGE will continue to leverage AdopDER results from the two tables above to guide its DSP, IRP, and CEP work.

To conduct the adapted TEINA analysis, we took our LDV forecasts from AdopDER and ran them through the public-facing TEINA workbook provided by ODOT and the Rocky Mountain Institute. This provided the number of public charging ports needed by TEINA-specific charging use case for LDV adoption, including urban/rural LDV, corridor charging, and Transportation Network Companies (TNCs).[108] For MDHDV port needs, we relied upon supporting workbooks from ODOT (2021) containing the remaining use cases that were not included in the public-facing tool, including long-haul trucking, local MDV delivery, and school bus.

[108] Oregon Department of Transportation. *TENIA Study*, retrieved from https://www.oregon.gov/odot/Programs/Pages/TEINA.aspx.

Table 15 shows the public port counts resulting from applying the TEINA methodology (under the "Business as Usual" scenario) to our April 2023 reference case EV forecast using AdopDER.

Table 15. Public EV Charging Ports Needed in PGE Service Area (TEINA Methodology)[109]

TEINA Use Case	Charging Type	2020	2025	2030	2035
Urban/Rural LDV	Workplace L2	587	3,852	10,867	22,487
Urban/Rural LDV	Public L2	381	2,456	6,916	14,304
Urban/Rural LDV	DCFC	210	1,345	3,712	7,590
Corridor LDV	DCFC	117	405	466	770
Disadvantaged Community (DAC) (Adjusted)	Workplace L2	28	185	523	1,080
DAC (Adjusted)	Public L2	19	124	349	720
DAC (Adjusted)	DCFC	9	59	160	324
TNC (Optimized)	DCFC	2	18	136	155
Micromobility[110]	Workplace L2	-1	-55	-422	-1,596
Micromobility	Public L2	-1	-36	-279	-1,058
Micromobility	DCFC	0	-18	-131	-486
Long-haul Trucking	DCFC	0	6	71	236
Local Medium-duty, Delivery	DCFC	2	111	274	554
School/Transit Buses	Public L2	2	229	819	1,793
School/Transit Buses	DCFC	6	82	219	441
Subtotal Workplace L2		614	3,982	10,968	21,971
Subtotal Public L2		402	2,773	7,805	15,760
Total L2		1,016	6,755	18,773	37,731
Total DCFC		345	2,008	4,907	9,585

Chart 5 shows a comparison of the public charging estimates using AdopDER and TEINA methodologies, applied to the same underlying vehicle forecasts.

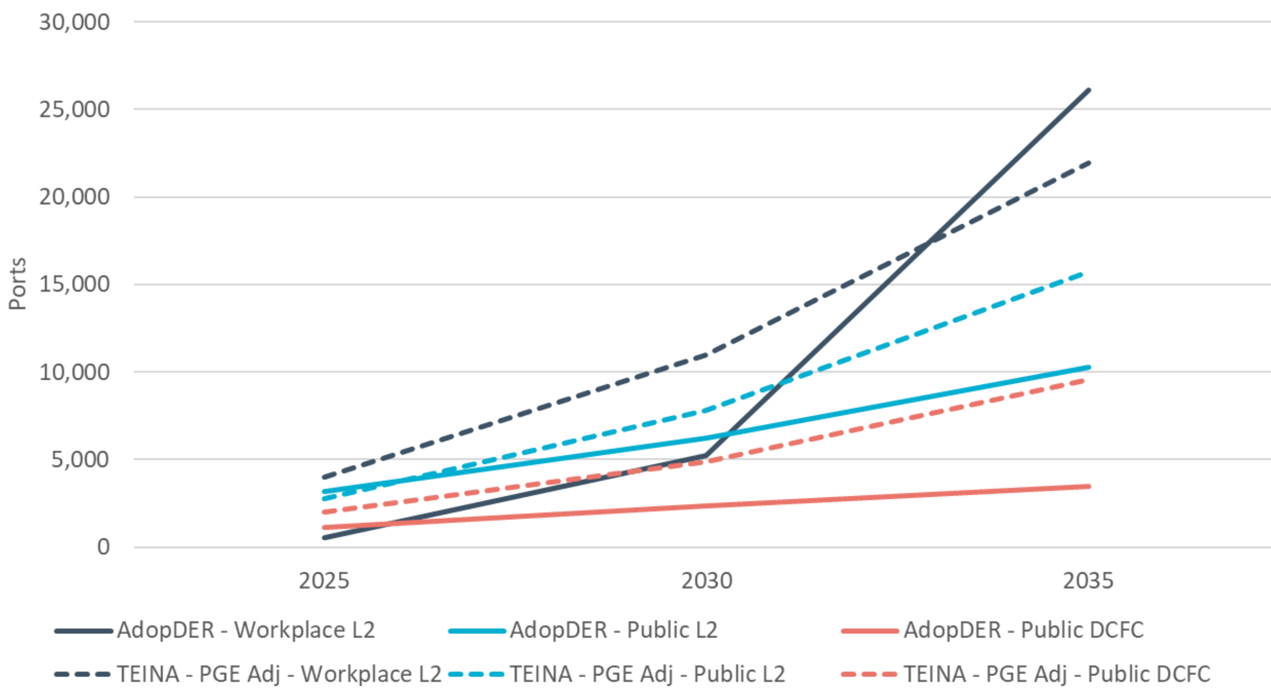

Chart 5. AdopDER and TEINA Public Charging Comparison

To summarize the results that PGE is using to guide this TE Plan: the application of the TEINA methodology to PGE's EV adoption forecast suggests that, by 2025, our service area will require 6,755 public and workplace L2 EVSE and 2,008 public DCFC EVSE. As referenced above, this compares to 1,019 public/workplace L2 EVSE in PGE's service area as of April 2023 (15 percent of the 2025 need), and 187 public DCFC EVSE (9 percent of the 2025 need).

3.5 Other TE Infrastructure

In addition to the light-, medium-, and heavy-duty on-road vehicles that PGE proposes to primarily support through this plan, other segments of the TE market are continuing to emerge and evolve (though many remain in nascent stages).

The following segments of the TE market and related infrastructure, while not proposed for active development and funding with this plan, are areas that PGE will continue to monitor and weigh when considering future proposals:

[109] The following TEINA use cases do not reflect public EV ports and have been excluded: Long-Haul Trucking; Local Medium-Duty, Delivery; and School/Transit Buses.
[110] Micromobility results are negative since they reduce overall port needs.

- Micromobility for equitable access to electric mobility through bicycles, scooters, and mopeds
- Electric aviation and rail
- Electric marine market, which includes passenger, cargo, and other vessels
- Electric farm and off-road equipment
- Electric ground service equipment at airports and seaports
- Megawatt Charging System for large battery EVs
- Autonomous, wireless, and mobile charging

As these technologies continue to mature, PGE will monitor their development through trade groups, research, and demonstration projects. Where appropriate, PGE also supports this work through CFP-funded programming and grantmaking like the Drive Change Fund and Emerging Technology Research and Development activity. The Oregon Clean Fuels Program provides PGE a pathway to engage with customers in these emerging areas to support adoption and understanding of new technologies for future program development.

3.6 Market Barriers

In PGE's inaugural 2019 TE Plan, the Company described the market barriers to EV adoption. With the current plan, we have organized the barriers into the categories of education and awareness, market, equity, and technology. Additionally the Infrastructure Fueling and Infrastructure Availability barriers identified in the 2019 plan are now combined into a single barrier (Fueling Infrastructure and Availability) to reflect their interrelatedness. We also describe a new Vehicle Availability barrier to reflect global supply chain issues affecting the TE market. In the table below PGE's ability to influence the identified barriers are ranked by high, medium, or low. A discussion of the market barriers following with details on how the barriers fit into PGE's strategy to plan for, serve, and manage load.

Table 16. TE Programs Addressing Market Barriers to EV Deployment

Barrier Categories	Specific Barriers to EV Deployment	Utility Ability to Influence	Business EV Charging Rebates	Business and Multi-family Make-ready Solutions	PGE Clean Fuels	Fleet Partner	Heavy Duty Charging	Public Charging – Municipal Charging Collaborations	Residential Smart Charging
Education and Awareness	Customer Awareness	High	✓	✓	✓	✓		✓	✓
Market	Cost	High	✓	✓	✓	✓	✓	✓	✓
	Fueling Infrastructure and Availability	High	✓	✓	✓	✓	✓	✓	✓
	Channel/ Sales Process	Low							✓
	Vehicle Availability	Low							
	Incentives and Policies	High	✓		✓	✓			✓
Equity	Equitable Access	Med	✓	✓	✓			✓	✓
	Vehicle Functionality	Low							
Technology	Vehicle Range	Low							
	Infrastructure Reliability	High	✓	✓				✓	✓

In this section, we detail the above market barriers affecting EV adoption, discuss PGE's role in addressing each barrier, and identify the components of this plan that do so.

3.6.1 Barrier Category: Education and Awareness

This barrier category reflects the lack of information about EVs or charging. It also includes perceptions about electric transportation and factors that complicate the ability to choose to invest in EVs. PGE is one actor of many in this space and will calibrate our activities as the market evolves. It is critical that other market actors such as auto and Electric Vehicle Service Equipment manufacturers also allocate resources to general education about EVs. Examples include:

- Lack of awareness about EV costs, incentives, performance, and availability. Between 2018 and 2022, for those customers who intended to purchase a vehicle within the next five years, their awareness of EVs increased from 76 to 80 percent. However, this increased awareness of EVs still lagged behind awareness of gasoline vehicles (94 percent).[111]
- Range anxiety, defined as a lack of confidence in the ability of an EV to drive a specific distance, or the perception that a driver will be unable find charging along a route or at a destination.

PGE can help address this barrier via targeted program components that facilitate customer familiarity with electric transportation. Within PGE's transportation portfolio this includes total cost of ownership (TCO) tools for residential and non-residential customers, technical assistance and planning support, support for the statewide education campaign, Oregoin' Electric (see Section 6.2.2.7), Ride-and-Drive events (see Section 6.2.2.8 and Appendix A.4, and support for community electric transportation projects through the Drive Change Fund (see Section 6.2.2.6) and Electric School Bus (see Section 6.2.4.7) funds. Additionally, program budgets include specific outreach and education needs for those activities.

3.6.2 Barrier Category: Cost and Market

This category covers the often-significant upfront costs for EVs and installing EVSE infrastructure and also includes global supply chain challenges for certain technologies. Examples include:

- Higher manufacturer's suggested retail prices for EVs across classes compared to a similar ICE vehicles
- High EVSE and installation costs
- EV fueling infrastructure and availability
- Inadequate or unavailable financial incentives to help with upfront EV costs
- EV channel/sales process
- Limitations of EV inventory including lack of available EVs at dealerships
- Long lead times for EVSE, as well as supporting make-ready infrastructure

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[111] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Figure 2. Respondent Familiarity with Vehicle Fuel Types, by Survey Wave and Segment. pp27 filed May 19th, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.

- Lack of trained specialized workforce to provide EV and EVSE maintenance, repairs, and installation
- Limited cost effectiveness for public EVSE at today's EV adoption levels
- Broad market supply chain challenges

The cost of EVs and supporting infrastructure is an established market barrier that PGE can help address through rates and program design. By providing equitable/affordable rates, utilities have a large influence on the TCO of EVs. Schedule 50[112] and PGE's Time of Day rate[113] can materially influence the TCO of EV ownership, whilst also sending price signals to drivers about the most grid-friendly times to charge. PGE can help mitigate high upfront EVSE costs by providing incentives for EVSE (as via PGE's Residential Electric Vehicle Charging pilot[114]) and also supporting make-ready infrastructure.

The cost of an EV purchase (and potentially EVSE) was the single largest barrier mentioned by customers surveyed in the Company's annual customer survey. Between 2018 and 2022, the percentage of customers who listed this as the top barrier to purchasing or leasing an EV or plug-in hybrid increased from 31 to 36 percent.[115] In September 2022, Kelley Blue Book reported that the average transaction cost for an EV was $65,291, compared to $48,094 for ICE vehicles.[116] At an August 2022 Ride-and-Drive event, 70 percent of PGE customers surveyed listed purchase price as a barrier preventing the purchase or lease of an EV.[117] While more affordable EVs exist, especially when including used vehicles, cost remains a significant a barrier to EV adoption.

3.6.2.1 Fueling Infrastructure and Availability

Customers reported that charging infrastructure availability was the second-highest barrier to purchasing or leasing an electric vehicle or plug-in hybrid.[118] Among customers who were not considering an EV or plug-in hybrid for their next purchase, charging infrastructure availability was the

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[112] PGE Schedule 50, retrieved from https://assets.ctfassets.net/416ywc1laqmd/2hNjMQ203TEcCmZttyKCTt/60e36b07499f89b45856a4576d4107ec/Sched_050.pdf.
[113] PGE Schedule 7, retrieved from https://assets.ctfassets.net/416ywc1laqmd/6RgTNk5RU1bldl0LdPpIY9/798481eb9f1171e4ec8ce5ce648bc47f/Sched_007.pdf.
[114] PGE's Schedule 8, retrieved from https://assets.ctfassets.net/416ywc1laqmd/2CrkwfPNPaDoM1tiVX68k0/6e29d4c934d17d55f7911aebba73606d/Sched_008.pdf.
[115] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Figure 3. Unprompted Barriers Mentioned to Purchasing or Leasing an EV or PHEV, By Survey Wave and Segment. pp37 filed May 19th, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.
[116] Kelly Blue Book. *Electric Car FAQ: Your Questions Answered: 10. How Much Are Electric Cars?* Retrieved from https://www.kbb.com/car-advice/electric-car-faqs/#link10.
[117] PGE (2022). *PGE Transportation Electrification Pilot Program 2022 Electric Car Guest Drive and EV Charger Exhibit Intercept Survey Results*. Table 7, pp7.
[118] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Figure 15. Unprompted Barriers Mentioned to Purchasing or Leasing an EV or PHEV, By Survey Wave and Segment. Page 39. Filed May 19th, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.

top concern, with almost half (45 percent) of customers suggesting this as the primary barrier[119]. For detail on how PGE activities address this fueling infrastructure and availability, see:

- Public Charging - Municipal Charging Collaboration (Section 6.3.1.2 and Appendix C.1)
- Business and Multi-family Make-ready Solutions (Section 6.3.3 and Appendix C.2)
- Residential Smart EV Charging (Section 6.3.1.1 and Appendix A.1)

3.6.2.2 Multi-Channel/Sales Process

Only 15 percent of EV owners surveyed ranked their dealership salesperson as "very high" in EV knowledge.[120] Customers reported partner dealerships with an average score of 6.7 out of 10 in informativeness.[121] The most popular EVs (the Tesla Model 3 and Model Y) are both sold online, and other vehicle manufacturers are considering changes to the purchasing experience.[122] This may streamline the sales process and result in a better customer experience as shoppers rely on internet research and fixed pricing to make buying decisions. While PGE has a low level of influence in this process, PGE coordinates with Chargeway to engage with local dealers and ensure they can direct customers to PGE programs. We will continue to assess the right engagement with dealers to help assist with training and knowledge of PGE programs.

3.6.2.3 Vehicle Availability

Two components of vehicle availability have diverged significantly since the 2019 TE Plan: the number of unique models for sale in the U.S. and the ability to purchase available models. The number of unique battery electric and plug-in hybrid models for sale has increased from 29 to 132 between 2016 and 2022[123]. As of 2022, the Ford F-150 (the best-selling vehicle in America for 40 consecutive years[124]) comes in an electric version, and other electric pick-ups are available as well[125], filling a major gap in available EV types.

However, supply chain concerns continue, with U.S. domestic auto inventories hovering at historic lows (down from 537,000 in April 2020 to 84,000 vehicles two years later[126]). Common configurations

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[119] Ibid. Figure 15. Unprompted Reported Changes Necessary to Consider EV or PHEVE for Next Vehicle amount Non-Considerers, by Survey Year (Multiple Responses Allowed). pp32 UM 1938 Evaluation of PGE's Transportation Electrification Pilot, filed May 19, 2022. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.

[120] Plug-in America (Feb 2022). *The Expanding EV Market: Observations in a year of growth*. Retrieved from https://pluginamerica.org/wp-content/uploads/2022/03/2022-PIA-Survey-Report.pdf.

[121] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Table 11. Proportion of EV Owners Who Visited Partner Dealers, Rated Level of Informativeness of Dealer, and Proportion of EV Owners Shown the Educational Kiosk. Pp47. Filed May 19, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.

[122]Trop (June 2, 2022). *TechCrunch+. Ford Wants to Restructure Its Dealership Model to Boost EV Sales*. Retrieved from. https://techcrunch.com/2022/06/02/ford-wants-to-sell-evs-online-only-and-at-a-set-price/.

[123] U.S. Department of Energy. *Alternative Fuels Data Center: Light Duty AFV, HEV, and Diesel Models Offerings by Technology/Fuel*. Retrieved from https://afdc.energy.gov/data/10303

[124] Owusu (December 2, 2021). TheStreet. *Ford F-150 is Top U.S. Car Sold for 40th Straight Year, Top Truck for 45th Straight.* Retrieved from https://www.thestreet.com/investing/f150-top-us-car-brand-again

[125] See Rivian R1T: https://rivian.com/r1t

[126] U.S. Bureau of Economic Analysis. *Gross Domestic Product, First Quarter 2023 (Advance Estimate)*. Retrieved from https://www.bea.gov/data/gdp/gross-domestic-product#collapse86.

of the most popular electric sedans (Tesla Model 3) and compact electric SUVs (Tesla Model Y) have lead times of three to nine months respectively.[127] As a result, many consumers currently experience difficulty purchasing the EV they desire. At a recent PGE Ride-and-Drive, participants listed "lack of available EVs for purchase or lease" as the second-most-cited barrier (after cost) to purchasing an EV.[128]

The availability of the vehicles that customers will want to drive/buy depends upon the decisions and functioning of the automotive industry. PGE alone has no impact on automotive supply chains, though PGE can work with industry trade groups to have a larger voice with Original Equipment Manufacturers (OEMs). Details regarding automotive manufacturers' investments in electric vehicles are included later in this section.

3.6.2.4 Incentives and Polices

This barrier encompasses incentives and policies spanning local, federal, global, and other states as discussed in Section 2.4 above. While the EV market is now largely driven by OEM production and consumer behavior, major policy changes are expected to have a dramatic impact on vehicle availability, speed of transition, and infrastructure deployment in our region. Oregon expanded elements of the state's EV rebate in 2021[129] but the Clean Vehicle Rebate Program was suspended May 1, 2023 as the program was oversubscribed for the funding available. At the time of publication, there is uncertainty about the funding status and any resulting modifications to the program, and therefore the availability of rebates to PGE customers.

The IRA made significant modifications to the federal EV and fueling equipment tax credits in 2022. The IRA expansion of tax credits toward the purchase of used EV purchases create opportunities for more equitable transitions to electric vehicles for a larger variety of consumers. The updates to the Alternative Fuels Infrastructure Tax Credit[130] help with fueling equipment expansion in non-urban areas. The IRA extends the residential EVSE equipment tax credit through 2032 as well as provides a tax credit toward panel upgrades, if needed to support residential EVSE installations.

While the new IRA policies and updated Oregon rebates will undoubtably support the transition to EVs in the long-term, in the near-term they may cause confusion in regard to which vehicles qualify for different incentives. To mitigate this, PGE continuously updates its online tools for fleet and residential EV cost and savings calculations when policies change and rebates become available (or have their funding depleted). PGE will aim to address confusion around changing policies through outreach and education.

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[127] See EVAdoption: https://evadoption.com/.

[128] PGE (September 15, 2022). *Table 7. PGE Transportation Electrification Pilot Program 2022 Electric Car Guest Drive and EV Charger Exhibit Intercept Survey Results.* pp7.

[129] Oregon DEQ (January 7, 2022). *DEQ implements changes to Oregon Clean Vehicle Rebate Program*. Retrieved from https://deqblog.com/2022/01/07/deq-implements-changes-to-oregon-clean-vehicle-rebate-program/.

[130] U.S. Department of Energy. *Alternative Fuels Data Center: Alternative Fuel Infrastructure Tax Credit*. Retrieved from https://afdc.energy.gov/laws/10513.

3.6.3 Barrier Category: Equity

We recognize the inequities that can occur as we transition to a clean energy future. Often our vulnerable communities experience the most barriers. In this section, we discuss the ongoing barriers that historically excluded communities face in accessing electric transportation. Examples include:

- Lack of affordable EVs
- Limited or low inventory of used EVs
- Older model used EVs have lower battery ranges
- Complicated incentive structures or lack of awareness of incentives
- Perception of EVs as only for wealthy individuals

PGE can help address this issue by providing awareness and education around TE and EVs, as well as incorporating an equity lens into the company's TE rates and program offerings. Using an equity lens can assist in reducing barriers to our customers and the communities we serve. For example: for renters or those without access to off-street parking, public charging at utility-owned charging stations can provide price parity similar to the residential rates paid by those charging at home.

3.6.3.1 PGE EV Customer Survey Results

PGE's 2022 EV customer survey identified several challenges to entering the EV market, with 63 percent of EV purchasers reporting the inability to charge at home as a major barrier.[131] We also found that current EV owners had a higher level of home ownership, with 94 percent owning their home (compared to 67 percent of all respondents).[132] We also found that only 3 percent of current EV owners surveyed lived in multi-family housing (compared to 22 percent of all respondents).[133] These data points illustrate an issue with equitable access for non-homeowners.[134] This was supported by our finding that current EV owners reported higher household incomes, with 59 percent of reporting household income of over $100K (compared to 25 percent of all respondents).[135]

Based on the survey results, PGE will continue to engage with underserved communities to obtain feedback to inform development of EV programs that help reduce barriers and improve access to electric transportation. The Public Charging - Municipal Charging Collaboration pilot is one pathway to work on equitable access to charging for underserved communities. The portfolio also proposes

[131] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Figure 14. Prompted Barriers Mentioned to Purchasing or Leasing an EV/PHEV, by Survey Wave and Segment. Pp38. Filed May 19th, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.
[132] Ibid. Figure 31. Respondent Housing Tenure, by Survey Wave and Segment. pp49.
[133] Ibid. Figure 32. Respondent Housing Type, by Survey Wave and Segment. pp50.
[134] We recognize that non-homeowners are a varied socioeconomic population, some of whom might not meet the common definition of an Underserved Community. In our TE planning, we use HB 2165's definition of Underserved Communities which, for the purposes of TE, encompasses all renters and occupants of multi-family residences, whom they deem to have relatively less access to charging infrastructure than do homeowners.
[135] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Figure 34. Respondent Household Income, by Survey Wave and Segment. pp51. Filed May 19th, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.

working with low-income multi-family properties on installing make-ready infrastructure and providing a rebate for their purchase and ownership of chargers. With input from community members, we will continue to shape our offerings as well as future rates/tariffs which will better serve the needs of underserved community members.

3.6.4 Barrier Category: Technology

This category includes barrier areas where EV or EVSE technology or performance limitations decrease the likelihood of EV adoption. Examples include:

- Class and style of vehicles offered by automakers
- Absence of EVSE standardization
- Multiple EV charging connector types
- EVSE network requirements
- EVSE reliability

PGE has minimal influence over what types of vehicles or chargers manufacturers produce. PGE's ability to exercise influence is achieved primarily through engagement in industry associations such as the Edison Electric Institute (EEI), the Electric Power Research Institute (EPRI), and the Association for Transportation Electrification (ATE). The Company can also incorporate technical requirements and institute competitive bidding processes to support specific technologies and performance outcomes.

3.6.4.1 Vehicle Functionality

The availability of product with features that customers expect is dependent on the automotive industry. PGE alone has no impact on automotive supply chains and the features OEMs offer. As mentioned previously, PGE can work with industry trade groups to have a larger voice with OEMs.

Manufacturers are committed to developing EVs with additional range and other features to make them more desirable for consumers.

3.6.4.2 Battery Costs

Battery costs are one of the key variables in the price of an EV. As discussed later in this section, battery costs are expected to decline and drive decreases in the overall cost of EVs over time though prices are currently experiencing an increase due to inflation and supply chain issues[136]. If longer term cost reductions do not materialize, affordability barriers to EV adoption may continue for longer than expected.

3.6.4.3 Vehicle Range

Between 2017 and 2021, the global average EV range increased from 150 miles to 217 miles.[137] The most popular electric sedan (Tesla Model 3) and compact electric SUV (Tesla Model Y) in the U.S.

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[136] BloombergNEF (December 2022). *Lithium-ion Battery Pack Prices Rise for First Time to an Average of $151/kWh*. Retrieved from https://about.bnef.com/blog/lithium-ion-battery-pack-prices-rise-for-first-time-to-an-average-of-151-kwh/.

[137] Carlier (June 8, 2022). statistica. *Average driving range of electric vehicles worldwide bye 2017 and 2021, by type*. Retrieved from https://www.statista.com/statistics/1312369/average-ev-range-worldwide-by-type/.

market both offer over 250 miles of range[138],[139]. However, when prompted with different potential barriers, customers still reported EV range as their single largest concern (80 percent of respondents).[140] More than half (57 percent) of respondents reported that a range of greater than 250 miles would be required to alleviate their concern.[141] Despite the fact that currently available EVs are capable of delivering this range, this remains a perceived barrier.

PGE expects that used EVs will become increasingly popular with the addition of recent federal incentives. For low-income customers, a used EV becomes even more tempting in combination with Oregon's own Charge Ahead rebate. PGE recognizes that used EVs typically offer a lower range in comparison to similar new vehicles. While range anxiety might therefore be a larger concern with used EVs, PGE hopes that properly placed chargers (such as those installed as part of the Public Charging - Municipal Charging Collaboration) can help mitigate that anxiety for used car owners.

3.6.5 Emerging Challenges

PGE has identified the following emerging challenges to transportation electrification:

3.6.5.1 Load Profiles from COVID-19

The COVID-19 pandemic has impacted nearly all aspects of daily and economic life since March 2020. PGE has observed changes in public charging utilization (see Chart 6), and regional transit utilization has also been affected (see Chart 7). PGE has also observed impacts on charging infrastructure, electrical equipment, and vehicle infrastructure availability, detailed in previous sections and below. Since PGE's Residential Smart EV Charging pilot only launched in October of 2020 (mid-pandemic), we do not yet have direct historical data to assess the impacts of the pandemic on home charging.

Electric Avenue charging has made strong recovery since facing sharp usage declines as the COVID-19 pandemic began. Since Oregon lifted the majority of COVID-19 restrictions in July 2021, overall Electric Avenue usage has increased 72%.

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[138] Argonne National Laboratory. *Light Duty Electric Drive Vehicles Monthly Sales Updates.* Retrieved from https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates.

[139] Tesla Model 3 Rear-Wheel Drive has an estimated range of 267 miles, Tesla Model Y Long Range has an estimated range of 318 miles. See Tesla Model 3 and Model Y at: https://www.tesla.com/model3/ and https://www.tesla.com/modely/.

[140] Opinion Dynamics (2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs: 2021 Annual Report*. Figure 14. Prompted Barriers Mentioned to Purchasing or Leasing an EV/PHEV, by Survey Wave and Segment. pp38. Filed May 19th, 2022 under OPUC Docket UM 1938. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.

[141] Ibid. Figure 15. Unprompted Reported Changes Necessary to Consider EV or PHEV for Next Vehicle among Non-Considerers, by Survey Year. pp40.

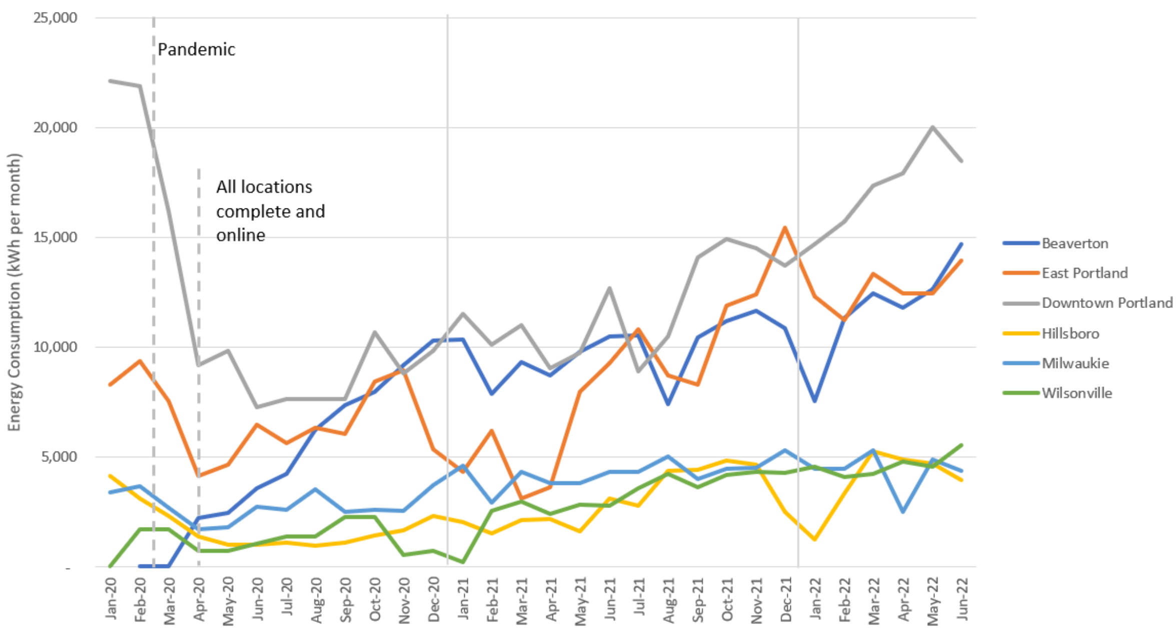

Chart 6. Effects of Pandemic on Electric Avenue Energy Usage

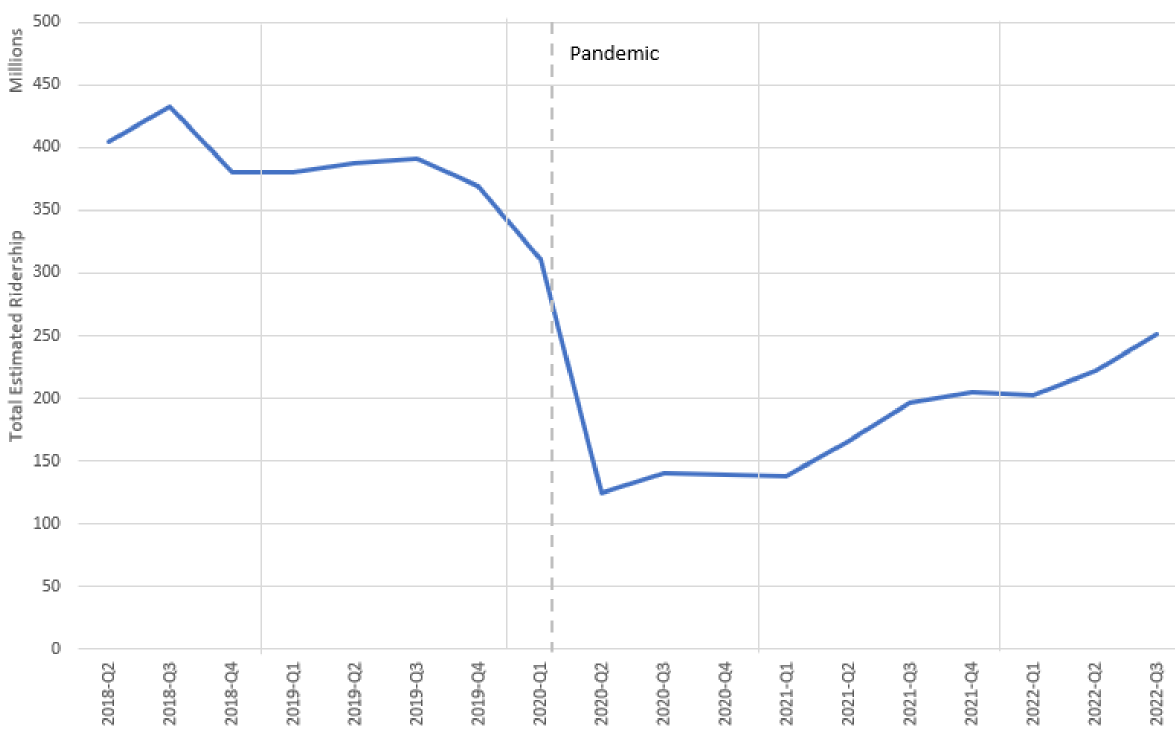

Chart 7. Effects of Pandemic on Pacific U.S. Transit Ridership[142]

[142] American Public Transport Association (October 6, 2022). *PTA Ridership Trends. American Public Transportation Association*. Retrieved from https://transitapp.com/APTA.

3.6.5.2 Supply Chain Challenges

In 2022, PGE observed significant increases in electrical equipment lead times for components like panels/switchboards, meter bases, and current-transformer enclosures. PGE has also observed longer than normal lead times for charging infrastructure (especially DC fast charging equipment). Supply chain challenges have generally complicated the shipping of products from overseas and the availability of products that utilize semiconductors[143],[144]. These factors are challenging the pace and scale of EV infrastructure deployment globally. PGE is adopting strategies in vendor engagement and project management within our TE programs to help overcome this barrier.

3.6.5.3 Charging Infrastructure Reliability

A number of publications have recently detailed the challenges faced by drivers who rely on public charging infrastructure.[145,146,147] PGE has observed and corroborated findings on charging infrastructure reliability issues with peer utilities and others and has developed a reliability strategy in response. In 2022, PGE established a maintenance team to service Electric Avenue chargers and partner with contractors to maintain PGE workplace chargers. That team is preparing for maintenance of pole chargers and anticipates the need to scale as PGE charger populations grow. The team has found that charger maintenance requires a skillset unique from other electrical work, which can impact the ability to staff this work. Learnings from the first year of team operations include challenges obtaining parts for legacy/first generation chargers, and also that reliability has improved with subsequent models. The team continues to address vandalism of chargers (e.g., graffiti on the units and damage to display screens) and theft of components (e.g., copper wire in charger cables).

3.7 Charging Station Availability, Reliability, and Usage

Understanding charging needs in PGE's service area begins with an assessment of current charging availability. This analysis informs our role in more fully developing the charging infrastructure that is needed both today and into the future.

Charging infrastructure in PGE's service area is insufficient to meet the needs of current EV drivers, let alone new EV drivers in the next several years. As illustrated in the following table, on a per-vehicle basis, EV charging availability has substantially worsened in PGE's service area since our last TE Plan (2019). As noted in Section 3.6.2.1, fueling infrastructure and availability remain one of the top barriers to potential EV drivers' adoption of an EV.

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[143] Jones (May 3, 2022). Reuters. *Snarled up Ports Point to Worsening Global Supply Chain Woes Report*. Retrieved from https://www.reuters.com/business/snarled-up-ports-point-worsening-global-supply-chain-woes-report-2022-05-03/

[144] Consumer Reports (June 2022). *Global Chip Shortage Makes it Tough to Buy Certain Cars*. Retrieved from https://www.consumerreports.org/buying-a-car/global-chip-shortage-makes-it-tough-to-buy-certain-cars-a8160576456/

[145] Wired (April 2022). *Broken Charging Stations Could be Stalling the EV Movement*. Retrieved from https://www.wired.com/story/ev-charger-broken-us-electric-cars/.

[146] Rempel, Cullen, Bryan, Cezar (April 7, 2022). *Reliability of Open Public Electric Vehicle Direct Current Fast Chargers*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4077554.

[147] Hogan (April 23, 2021). Road and Track. *EV Charging Infrastructure in America Still Sucks.* Retrieved from https://www.roadandtrack.com/news/a36175755/ev-charging-infrastructure-in-america-still-sucks/

Table 17. Publicly Available Charging Ports in PGE Service Area (as of April 2023)

	2019[148]		2023[149]			
Port Type	Installed and Planned Ports	Registered Vehicles per Port	Installed Non-Tesla Ports	Installed Tesla Ports	Total Ports	Registered Vehicles per Port[150]
L2	822	31	928	91	1,019	40
DCFC	157	162	113	74	187	216
Total	927	27	1,041	165	1,206	34

By contrast, ODOT's TEINA study suggests that in order to support the state's goal of 250,000 EVs by 2025, the state will need 11,494 workplace and public L2 ports and 4,411 public DCFC ports, ratios of 21 and 56 vehicles-per-port, respectively. EV charging has not materialized at a level that meets current and future EV driver needs.

3.7.1 Availability, Reliability, and Usage of Customer-Owned Electric Vehicle Chargers

As most chargers in PGE's service area are owned by PGE customers or third parties, PGE lacks insight into the reliability and usage of much of the charging infrastructure referenced above. To gain more insight, in the last couple years PGE has developed and launched TE programs such as Fleet Partner, Business EV Charging Rebates, and Residential Smart Charging which are beginning to provide data to help us better understand the local EV charging landscape. PGE looks forward to sharing insights from this data in its next TE Plan Report.

3.7.2 Availability, Reliability, and Usage of PGE-Owned Electric Vehicle Chargers

PGE has gained valuable insights into the utilization patterns and performance of public, workplace, and transit heavy duty charging infrastructure via a decade of experience in equipment ownership and operation. The following sections detail insights PGE has gleaned from our work with the Electric Avenue Network and workplace, transit, and public pole charging infrastructure.

3.7.2.1 Utilization and Performance of PGE Electric Avenue Network

PGE built, owns, and operates a network of seven public charging locations with four 50 kilowatt (kW) DCFC ports and two 7 kW L2 ports per site (exception: Salem Electric Avenue has two 50 kW DCFC ports and two 7 kW L2 ports). Six of these sites were built as part of PGE's UM 1811 pilot (Electric Avenue Network Expansion).

[148] PGE (2019). PGE's 2019 Transportation Electrification Plan, pg. 33.
[149] *USDOE: Alternative Fuels Data Center*. See: https://afdc.energy.gov/. Accessed April 23, 2023
[150] Registered Vehicles per Port includes both Tesla and non-Tesla models.

Since commissioning the final location in April of 2020, PGE has observed the following network-wide trends:

- Year-over-year energy use increased across the network, with 2021 showing 41 percent more energy dispensed than 2020.[151] PGE dispensed approximately 487,695 kilowatt hour (kWh) in 2021, powering an estimated 1.5 million miles of electric travel.
- Utilization varied greatly by location, with the least utilized location (Hillsboro) providing just one quarter the energy of the highest utilized location (Downtown Portland) in 2021.

Customers were highly responsive to a peak time pricing signal of an additional $0.19/kWh from 3 PM to 8 PM on weekdays (PGE Schedule 50).[152]

Table 18. 2022 Electric Avenue Energy Output by Location (kWh)

Station ID	Q1	Q2	Q3	Q4	Total
Beaverton	31,349	39,143	37,961	42,828	**151,281**
East Portland	36,882	38,836	39,528	50,409	**165,655**
Downtown Portland	47,783	56,351	56,179	74,666	**234,979**
Hillsboro	9,887	13,546	15,865	24,640	**63,938**
Milwaukie	14,317	2,973	15,247	15,416	**47,953**
Wilsonville	12,938	14,940	19,794	23,421	**71,093**
Total	153,156	165,789	184,574	231,380	734,899

PGE faced the same reliability issues as many other network operators in the industry, with many units falling below PGE's uptime targets in 2020 and 2021. PGE took the following actions in response to these issues:

- Acted on approximately 180 maintenance tickets
- Established performance improvement plans and equipment refurbishment campaigns with vendors
- Received and installed warranty replacement units

151 Note that some of this increase can likely be attributed to low utilization at the height of the COVID-19 pandemic (see Section 3.6.5 for more detail on the effects of COVID on TE activities).
152 PGE (2021). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs 2021 Annual Report*, retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf, and also PGE (2020). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs 2020 Annual Report*, retrieved from https://edocs.puc.state.or.us/efdocs/HAQ/um1938haq14233.pdf.

- Held regular check-in meetings with vendors to address ongoing issues
- Increased equipment testing and inspection activities

These actions have improved network performance and resulted in improved customer scores on PlugShare[153]. Despite improvements from working with the vendor and replacing some faulty equipment, multiple sites have experienced intermittent downtimes for a variety of reasons. In a recent survey, Electric Avenue respondents stated concerns with charger reliability at six of the seven sites. PGE has replaced several chargers through warranty replacement and worked with the vendor on solutions to fix their first generation charging infrastructure. To further improve reliability as Electric Avenue utilization continues to increase, PGE will need to replace the chargers with updated technology that meets customers' needs. PGE is exploring whether chargers can be replaced as part of the Clean Fuels Public Charging Infrastructure project.

3.7.2.2 Utilization and Performance of PGE Workplace Charging Infrastructure

PGE built, owns, and operates approximately 108 Level 2 workplace charging ports across 20 PGE locations. Ports typically offer approximately 7 kW of output and were installed incrementally over the past decade as charging technology evolved and employee and fleet use of EVs increased. PGE has observed the following trends:

- Workplace charging was dramatically impacted by changes in work from home patterns, with a steep decrease in utilization seen in April of 2020
- Workplace charging infrastructure was generally reliable and required significantly less effort to maintain than DCFC public charging infrastructure, with only 69 tickets created since PGE began tracking in 2021.

3.7.2.3 Utilization and Performance of PGE Transit Charging Infrastructure

PGE owns and operates three electric transit bus charging systems on behalf of the Tri-County Metropolitan Transit Authority (TriMet). One such system is located at Sunset Transit Center and serves as an on-route pantograph (overhead) charger, recharging buses at rates up to 450 kW as they complete each service loop. The remaining two charging systems are located at TriMet's Merlo Garage and charge buses overnight at rates up to 150 kW. PGE has observed the following trends:

- On-route charging infrastructure was highly utilized and, based on the design and structure of the electric buses and charging routines, provided most energy required to serve the electrified bus route.
- Overnight charging was lightly utilized, as bus battery and charging technology was optimized for on-route charging. Future bus deployments may rely more on overnight charging as bus battery sizes increase and the need for on-route charging decreases.
- On-route charging infrastructure was generally reliable, while overnight charging systems suffered reliability issues. Sustained work with charging vendors helped improve performance.

"Early production" electric buses also suffered from reliability issues, decreasing utilization of both on-route and overnight charging infrastructure. Subsequent servicing has increased bus reliability. Future bus deployments are expected to improve reliability further.

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[153] Electric Avenue's average PlugShare score has improved from 7.5 to 8.8 of a maximum score of 10 over the period for which PGE has collected data (April 2021 to October 2022).

As Tri-Met considers future electrification options, PGE can use the charging patterns from both the short-range and long-range buses to help plan for grid needs, rates, tariffs, and managed program effectiveness. As future rates, tariffs, and managed charging programs are created, PGE will use lessons learned from the pilot (i.e., ability to charge during off-peak hours due to battery size and routes of buses) to determine ability to manage the load since short-range buses have less flexibility in charging during off-peak timeframes.

Table 19. 2022 Transit Energy Output by Location (kWh)[154]

Station ID	2022 Q1	2022 Q2	2022 Q3	2022 Q4	2022 Total
Sunset TC (450 kW on-route)	6,896	66,341	47,334	32,596	**153,167**
Merlo Garage 1 (150 kW depot)	1,621	5,420	11,258	20,776	**39,075**
Merlo Garage 2 (150 kW depot)	1,904	19,344	20,474	23,278	**65,000**
Total	10,421	91,105	79,066	76,650	257,242

3.7.2.4 Utilization and Performance of PGE Public Pole Charging Infrastructure

PGE owns and operates two Level 2 charging ports installed on utility poles in the City of Portland. Each port is capable of approximately 7 kW of output. PGE observed that pole charging utilization increased 83 percent from 2021 to 2022. Pole chargers also had higher utilization than other PGE-owned Level 2 chargers at Electric Avenue locations.[155] The high utilization of these chargers and the relatively low cost to install them (in comparison to the more common pedestal chargers) illustrates that pole charging is a cost-efficient way for PGE to deploy level 2 charging infrastructure. PGE believes that deploying Level 2 pole charging is even more effective in underserved areas, where public charging infrastructure and private off-street parking may be lacking. Deployment of pole chargers in those areas may help underserved communities enjoy the myriad of benefits of owning an EV, including but not limited to charging close to their residence.

[154] Bus performance has had a large impact on variations in energy use across quarters.
[155] Shrestha (PGE) *Pole-Mounted EV Charger Whitepaper*. November 2020, retrieved from https://edocs.puc.state.or.us/efdocs/UAA/adv1081uaa17201.pdf) surmised that the relatively higher utilization rate of pole chargers might be due to the fact that pole charging was provided free-of-charge. However, utilization has continued to outperform Electric Avenue even after PGE began charging for it in October 2021. While a formal evaluation has not yet been performed, preliminary analysis indicates that customer preference for residential locations may be driving higher pole charger utilization.

Table 20. 2022 Pole Charging Energy Output by Location (kWh)

Station ID	Q1	Q2	Q3	Q4	Total
SE 29th Ave	4,893	5,633	4,605	4,820	**19,951**
SE 35th Place	5,242	1,975	307	2,916	**10,440**
Total	10,135	7,608	4,912	7,736	30,391

3.8 Coordination

3.8.1 Federal Funding

As referenced in the Federal Actions Section 2.4.1.2, the IIJA and the IRA provide multiple sources of federal funding to support the transition to electric transportation. PGE has created an internal team to track these various federal grant partnership opportunities. Outside entities are also working with our partners on grant applications requiring PGE support to assess areas where potential charging infrastructure may be located, were the grant approved. PGE provides input on distribution system impacts and also tracks these potential future infrastructure sites to help inform grid planning.

To date, PGE has worked with the Portland Bureau of Transportation (PBOT) and multiple other parties on a USDOE grant which would support our Public Charging – Municipal Charging Collaboration and testing out permitting processes for right-of-way (ROW) charging. This year, PGE has been collaborating with Forth and a group of cities we serve to support a Charging and Fueling Infrastructure grant application for the 2023 funding opportunity.[156]

Most federal funding grants require a public entity to be the primary applicant on a grant application. Multiple cities have expressed to PGE that they are interested in applying on grants for electric transportation infrastructure but have neither the bandwidth nor staff, or are not aware of all the opportunities. PGE was approved to use grant coordination funds through the 2023 Monthly Meter Charge budget filing.[157]

[156] Charging and Fueling Infrastructure Grant The U.S. Department of Transportation (DOT) Federal Highway Administration (FHWA) Charging and Fueling Infrastructure Discretionary Grant Program (CFI Program) offers funding to deploy publicly accessible electric vehicle charging and alternative fueling infrastructure in urban and rural communities and along Alternative Fuel Corridors (AFC). The CFI Program offers two types of funding opportunities: the Community Charging and Fueling Grants (Community Program) and the Alternative Fuel Corridor Grants (Corridor Program).

Infrastructure deployments funded by the Community Program must be located on public roads or publicly accessible locations, including public parking facilities, public buildings, public schools, or public parks. Low-income, underserved, rural, and high-density communities will be prioritized for Community Program funding. Corridor Program grants are available to infrastructure deployments along designated AFCs. Eligible applicants include metropolitan planning organizations; U.S. territories; special purpose districts and public authorities; and state, local, and tribal governments.
Retrieved from https://afdc.energy.gov/laws/12732

[157] PGE. *Proposed Monthly Meter Charge Budget for 2023*. Retrieved from https://apps.puc.state.or.us/edockets/edocs.asp?FileType=HAH&FileName=um2033hah162334.pdf&DocketID=22127&numSequence=54.

PGE also partners with other utilities and public partners on activities beyond grant opportunities. Since the release of the West Coast Clean Transit Corridor report[158], PGE has worked with other utilities to identify the need and placement of heavy-duty charging along the I-5 corridor. We have also worked with ODOT to inform its program design for its recently-announced Community Charging Rebates Program, and provided information about cost of installation for DCFC chargers to be installed through the NEVI formula program. PGE has also worked with the Oregon DEQ to inform their planning, program development, and deployment of grant funds to support medium and heavy duty EV charging infrastructure. We have also engaged with the Portland Clean Energy Fund Community Benefits Fund[159] as they draft their Climate Investment Plan.

PGE will continue to seek external grant opportunities to maximize funding for deployment of the TE Portfolio. PGE expects these federal and state funding sources will help drive transportation electrification in our service area and create opportunities for PGE to partner with customers on grant opportunities to gain external funding support for TE.

3.8.2 Northwest Energy Efficiency Alliance and Energy Trust of Oregon

Regional partnerships are key to promoting beneficial electrification and enabling flexible load. Building electrification and transportation electrification are beneficial if they result in cost savings for customers, enable better grid management, and reduce negative environmental impacts. Decades of investment in energy efficiency via customer funded Energy Trust of Oregon programs and Northwest Energy Efficiency Alliance (NEEA) market transformation efforts, have served to demonstrate these benefits. According to the American Council for an Energy Efficient Economy's (ACEEE) 2022 State Energy Efficiency Scorecard, Oregon remains a "national leader in energy efficiency through strong transportation policies, newly adopted appliance standards, and a greater focus on energy equity through utilities and state government processes." [160]

PGE continues to expand the scope of partnership with Energy Trust of Oregon to promote energy efficiency as a least cost/least risk resource and further enable flexible loads like electric vehicles. In addition to drawing inspiration from, and aligning to, Energy Trust's EV-ready electrical and charger installation requirements[161] and their Energy Performance Score (EPS) New Construction Net Zero and Energy Smart Home Incentives[162], which include an EV-ready rebate, PGE also has sought to leverage Energy Trust's trade ally network for its electric panel upgrades and associated rebates.[163] PGE seeks to build upon this partnership to deliver additional enabling technologies to further its decarbonization and electrification goals. Additionally, PGE sees an opportunity for EVs to provide

[158] West Coast Clean Transit Corridor Initiative (June 2020). *Interstate 5 Corridor California, Oregon, Washington Final Report*. Retrieved from https://westcoastcleantransit.com/resources/Final%20Report%20Files.zip.
[159] Portland Clean Energy Community Benefits Fund: https://www.portland.gov/bps/cleanenergy.
[160] ACEEE. *Oregon EE Scorecard (2022)*. Retrieved from https://www.aceee.org/sites/default/files/pdfs/State_Scorecard/2022/one-pagers/Oregon.pdf
[161] Energy Trust. *EV-Ready Residential Construction Recommendation* (2022). Retrieved from https://insider.energytrust.org/wp-content/uploads/EPS-EV-Ready-Installation-Requirements_2022-2.pdf.
[162] Energy Trust. *Net Zero and EHS Requirements Guide* (2021). Retrieved from https://insider.energytrust.org/wp-content/uploads/Net-Zero-and-EHS-Requirements-Guide.pdf#:~:text=The%20home%20must%20meet%20Energy%20Trust%20Electric%20Vehicle,Product%20List%20installed%20at%20the%20time%20of%20construction.
[163] PGE. *Charging Your EV at Home*. Retrieved from https://portlandgeneral.com/energy-choices/electric-vehicles-charging/charging-your-ev/charging-your-ev-at-home.

locational peak relief and equity benefits within grid constrained areas, such as in the design and deployment of non-wires solutions (NWS) with Energy Trust.

Historically, PGE customer funding for NEEA flows through Energy Trust of Oregon. This partnership, though indirect, has given rise to permanent market changes that drive energy efficiency in the region. In addition to funding provided to core projects, PGE advocated for expansion of NEEA's scope, and plans to fund a special project that will serve to demonstrate the resource adequacy and customer value of flexible load management in the Pacific Northwest. Accelerating technology advancement in sensors, controls, and communications is lowering their cost, increasing their efficiency, and creating new opportunities for load flexibility. These technologies are being integrated into end-use devices and buildings so they can be activated to support flexible grid needs. They can also support the ability to aggregate and control a multitude of smaller end-use loads, creating significant capacity resources. While providers of generation-based flexible resources face growing challenges, flexible demand resources are relatively untapped in the Northwest. They can enable low-cost energy storage in electric water heaters (thermal storage) and EVs, signal smart thermostats to heat and cool off-peak (or work on the edges), and provide sub-hourly pricing information to consumers. There is a role for NEEA to play as both convener/developer of Northwest use cases and in employing its existing Emerging Technology scanning processes to identify appropriate products, solutions, and potential interventions, such as EV flex communications and operations such as vehicle-to-building or vehicle-to-grid.

3.8.3 Related Plans

3.8.3.1 Distribution System Plan

PGE's Distribution System Plan (DSP) provides a more granular look at the forecast of electric vehicle adoption and the effects of TE load on the distribution system. In our DSP Part II filing we highlighted our methodology for allocating EV forecasts to the individual feeder level and provided projected TE load by substation through 2030.[164] The forecast vintage that fed into the DSP Part II filing has been incorporated into our 2024 transmission and distribution capital planning process. This means that PGE is now developing future grid investments with consideration of forecasted TE load growth on a locational basis.

In Chapter 3 of the DSP Part II, we provided an overview of the annual load allocation process conducted by PGE's Distribution Planning engineers. This annual planning process provides an opportunity to assess changes to demand patterns on a regular basis (e.g., new service requests or planned customer expansions) that will include updates to our TE forecast going forward. In line with that cadence, we have updated our AdopDER model (discussed in Sections 3.3 and 3.4) in April 2023 to inform the 2025 T&D capital planning process. Figure 12 shows a high-level process flow of how the AdopDER forecast flows into DSP and annual capital planning processes:

[164] PGE (2022). *DSP Part II: Section 3.5 and Appendix M*. Retrieved from https://portlandgeneral.com/about/who-we-are/resource-planning/distribution-system-planning/dsp-resources-materials.

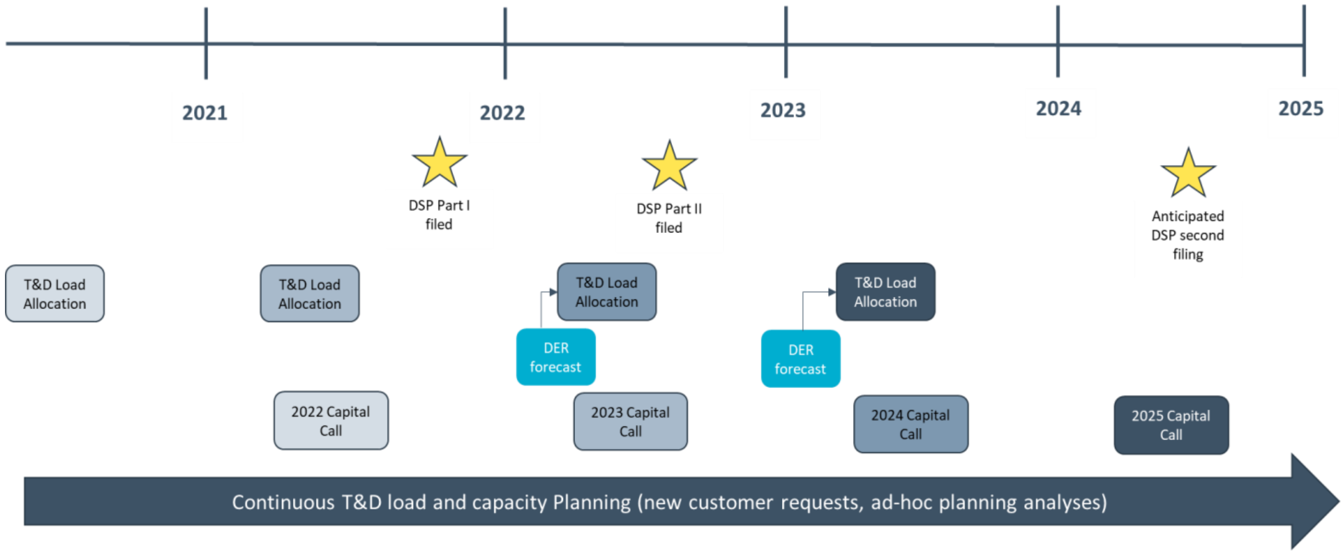

Figure 12. DSP Timeline with Overlay of DER Forecast and Annual T&D Capital Planning Cycles

We discussed in Sections 3.3 and 3.4 how the improvements we are making to our TE forecasting will continue to increase the granularity with which we can anticipate and plan for localized TE growth. For example, we will continue to work with telematics vendors and research partners like EPRI to identify areas of high medium- and heavy- duty vehicle traffic and what the anticipated loads will look like for the distribution grid. In addition to better telematics data and associated understanding of vehicle dwell locations on the grid, PGE is also engaging with EPRI and other utilities to complete a "Wide-Area Distribution Assessment" study that has the following high-level outcomes:

- Assessing electrification opportunity across PGE's service area
- Identifying under-utilized assets to incentivize fleet electrification
- Identifying high-priority feeders for grid-strengthening measures
- Helping prioritize infrastructure investment to proactively anticipate fleet electrification

Key among the research tasks with EPRI is to conduct more granular and extensive hypothetical load modeling of different HDV charging profiles under different managed and un-managed scenarios that will inform future model updates.

Staff also highlighted in their DSP memo[165] an interest in more analysis and discussion around the sensitivity of proposed grid investments to different levels of EV adoption. In our current 2025 T&D capital planning, PGE will evaluate grid needs utilizing both a reference and a high EV adoption scenario. We will present results of this analysis to Staff and stakeholders through our DSP Learning Labs to help inform solution identification, and will include a more robust discussion of EV-related distribution investments in our next DSP filing.

The TE forecast produced in Q2 2023 is utilized for the 2025 capital planning cycle (2024 planning cycle concludes in Q2 2023). This forecast is combined with the full AdopDER output (spanning LDV, MDV, and HDV growth at the feeder-level), as well as known load additions outside of EVs (e.g., large

[165] OPUC. Docket 2197, Order 23-069. Retrieved from https://apps.puc.state.or.us/edockets/docket.asp?DocketID=23043.

customer additions), to produce a comprehensive load forecast to utilize in distribution planning studies.[166]

3.8.3.2 Integrated Resource Plan/Clean Energy Plan

How TE was modeled in the IRP

The 2023 IRP evaluates three need futures to determine a wide range of resource needs. As shown in the following figure, each need future is the aggregate impact of load growth, distributed energy resources (DERs), and market access assumptions. The DER impact includes PGE's assumptions for:

- Transportation electrification, which increase resource needs, and
- TE-related demand response programs such as managed charging and time of use rates, which decrease resources needs

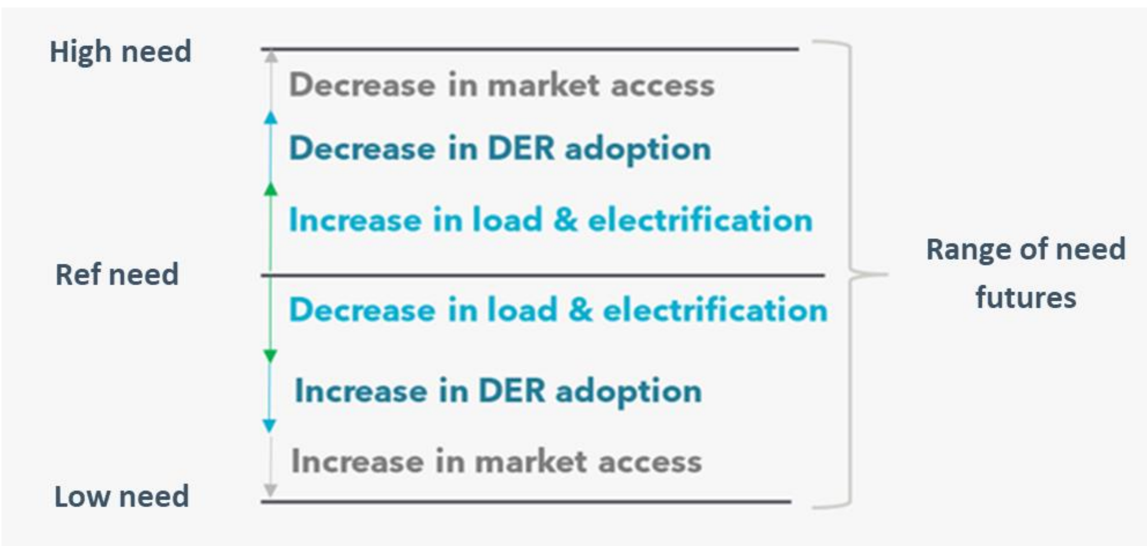

Figure 13. Visualizing the Need Futures

PGE's IRP leverages the analytical work within PGE's DSP Part 2 to determine the energy demand impacts of TE. The expected impact is illustrated in Figure 14.[167]

[166] These studies will follow the DSP process and include community engagement and NWS evaluation. Separately, a high level, statistical analysis will be performed to determine when feeders and transformers may exceed their limits based on the load forecast. From there, conceptual mitigations and project costs will be developed with the intention to include this information in a mid-cycle update for the TE Plan. In order to ensure that infrastructure is ready for the TE growth, regulatory changes may be required to build infrastructure based on the forecast, without a committed customer or TE installation.
[167] Additional detail on Need Futures available in PGE (2023). *Clean Energy Plan and Integrated Resource Plan 2023*. pp74. Retrieved from https://edocs.puc.state.or.us/efdocs/HAA/lc80haa8431.pdf#page=174

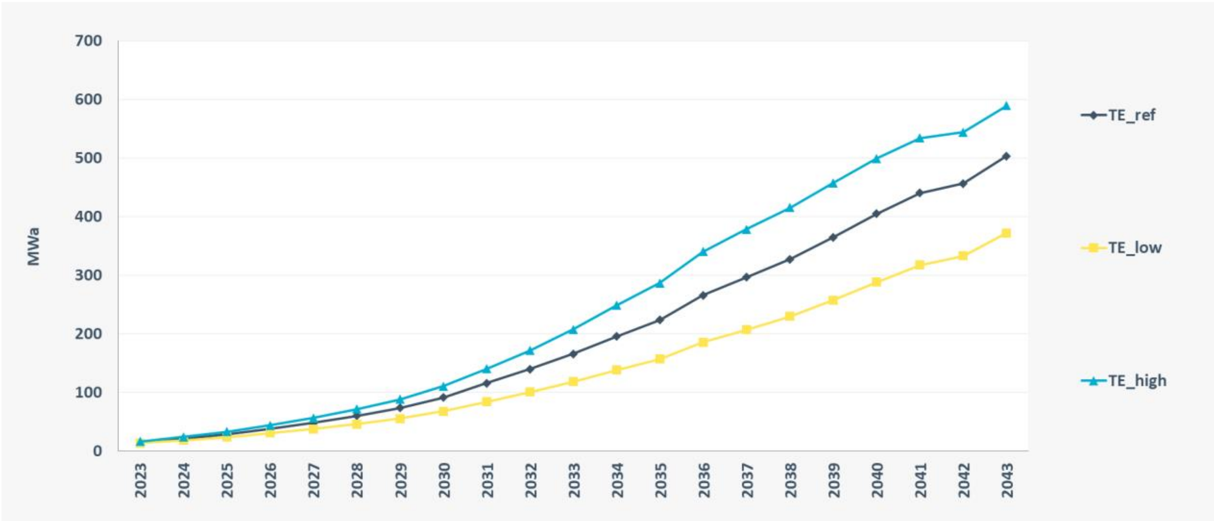

Figure 14. MWa Impact of Transportation Electrification Over the Planning Horizon

In addition to capturing this within the IRP need futures, PGE also performed a need sensitivity to capture the potential impacts of the Advanced Clean Cars II policy in addition to Climate Protection Program[168] for both accelerated MDHDV electrification and additional building electrification. This sensitivity only looks at the change in resource need. It does not include additional energy efficiency and demand response opportunities that will result from this increase in electrification. Additional details are available in the IRP.[169]

3.8.3.3 PGE's Flexible Load Multi-Year Plan

PGE Flexible Load Multi-Year Plan (MYP) is informed by the DSP and the resource acquisition goals set in the IRP and CEP. The MYP reviews these materials to determine what activity the PGE Program Team will undertake to acquire flexible load. Flexible load is an important component of managing TE load. The PGE TE and Programs teams are working cross functionally to develop activities which inform how best to manage TE load. This work includes the Smart Grid Testbed activities.

[168] Oregon DEQ. *Climate Protection Program*. Retrieved from: https://www.oregon.gov/deq/ghgp/cpp/pages/default.aspx.

[169] Accelerated load growth sensitivity is available PGE (2023). *Clean Energy Plan and Integrated Resource Plan 2023*. pp135. Retrieved from https://edocs.puc.state.or.us/efdocs/HAA/lc80haa8431.pdf#page=135

Chapter 4. Stakeholder Engagement

4.1 Stakeholder Engagement

PGE believes that planning the transition to electric transportation requires broad engagement, including utilities, regulators, private charging providers, government agencies, advocates, customers, and the communities we serve. In the spirit of engagement, PGE participated in active dialogue among those previously mentioned in 2021 and 2022 during the OPUC's investigation into the development of a transportation electrification investment framework for utilities (TEIF filed under Docket No. UM 2165) and the subsequent revision of the Commission's Division 87 rules governing utility TE plans and programs (Docket No. AR 654). PGE found these proceedings a valuable forum to gather input, not only to inform the Commission's regulatory policies and processes, but to also give PGE and other utilities insight into stakeholder expectations, concerns, and priorities about utility TE plans. PGE's participation in these dockets and the information and comments shared has informed our TE-related planning processes and is reflected in this plan, our TE budget, and the associated program and infrastructure measure applications.

Under the previous Division 87 rules, we expected to file our TE Plan in February of 2022. However, to be better aligned and to develop the plan with the guidance expected to emerge from UM 2165, we received a waiver to delay our TE Plan filing. Midway through the investigation, the Oregon Legislature passed HB 2165. This caused the OPUC to reevaluate the investment framework, delay plan filings, open AR 654, and revise the Division 87 Rules. Although utility and stakeholder efforts were redirected to these issues, this process fostered dialogue about many of the same questions and issues that would have surfaced in TE plan-focused outreach and engagement efforts.

PGE continued to engage with stakeholders throughout UM 2165 and AR 654 to identify and work towards consensus on the appropriate metrics. This led to establishing benchmarks, tracking progress, and measuring our TE portfolio performance.

Additionally, PGE facilitated six public TE Planning workshops in 2022 and 2023. These multi-hour workshops were well attended and focused on the deep nuances of TE planning at a utility. This included everything from high level strategy to market research to detailed discussions of technical standards. PGE is grateful to the more than 100 stakeholders on the TE Planning stakeholder distribution list for their time and thoughtful feedback through these discussions. When added together this is more than thirteen hours of public discourse on the scope, scale, and size of PGE's TE portfolio. The workshop materials and recordings remain publicly available on PGE's TE planning website.[170]

PGE also engaged individually with key stakeholders and leveraged other PGE outreach and engagement efforts to learn more about stakeholder perspectives and needs relevant to TE. This TE Plan incorporates information from this and other community outreach and engagement efforts in the company's DSP work, as well as experience gleaned from the other PGE outreach and engagement efforts to learn more about stakeholder perspectives and needs relevant to TE. Thus, our TE plan incorporates what we have learned from the company's community outreach and engagement efforts in the company's Distribution System Planning work, as well as experience gleaned from the Smart Grid Testbed and Flexible Load Multi-Year Planning processes. This section describes the various means by which PGE has engaged with stakeholders at the portfolio level. This engagement included

[170] PGE. *Transportation Electrification* Planning. Retrieved from https://portlandgeneral.com/energy-choices/electric-vehicles-charging/electrifying-transportation/transportation-electrification-planning.

a rapid needs assessment, real-time feedback in TE Plan workshops, written correspondence, informal conversations, surveys, and focus groups. The following figure provides an overview of the stakeholder feedback process, which is discussed in further detail below.

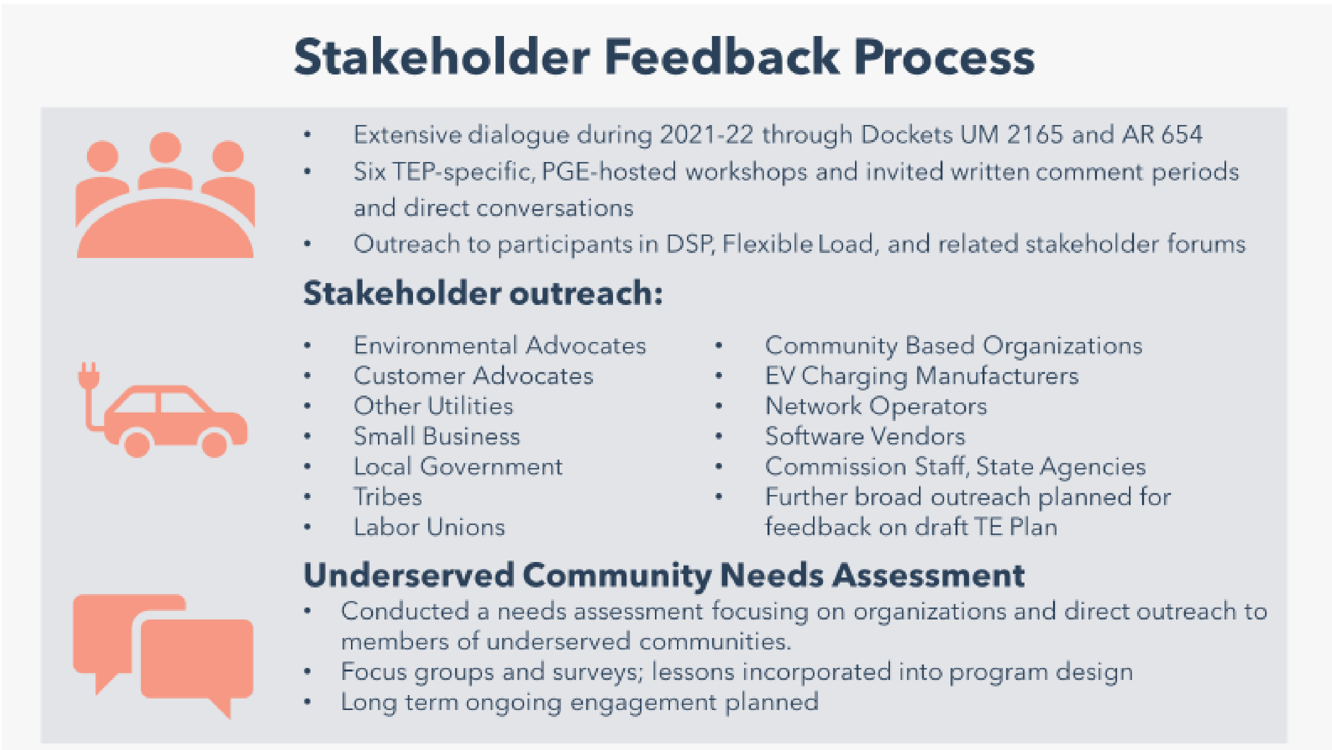

Figure 15. Stakeholder Feedback Process

Appendix A and Appendix C address stakeholder engagement unique to existing and new activities, respectively. Additional granularity on stakeholder comments and PGE's responses are provided in Appendix D. PGE continues to invite stakeholder engagement and comments on this draft TE Plan.

Sections 4.1.1 and 4.1.2, below, provide additional detail on PGE's efforts to engage communities beyond the traditional utility stakeholder organizations.

4.1.1 Community Outreach and Engagement

As an essential service provider, PGE is committed to serving our communities. We believe community engagement is based on the belief that those impacted by a decision, program, project, or service system need to be involved in the decision-making process. This belief supports PGE's community engagement principle "nothing about me without me", which guides how we conduct and evolve our equitable community engagement practices. Additionally, we believe that an affordable and equitable clean energy future requires a commitment to diversity, equity, and inclusion throughout our business.

During this process PGE contracted Espousal Strategies, LLC, a consultant with expertise in collaborative problem solving, equity and inclusion, and community engagement to assist with our engagement and outreach efforts. Espousal Strategies performed a rapid needs assessment, which included leading focus groups, conducting surveys to community-based and community-serving organizations, and direct outreach to members of underserved communities. This assessment provided insight and a starting point for more comprehensive TE community engagement in August 2022. Key information from the assessment are incorporated into this filing. Targeted engagement efforts are summarized in Sections 4.1.3 and 7.4, with further detail found in the program and infrastructure measures applications in the Appendices.

This work builds upon information previously gathered through other PGE community outreach and engagement efforts and invites a deeper understanding of the TE needs of individuals within specific communities. This work is one of many ways in which PGE can build a stronger understanding of the diverse needs of individuals, as well as establishing meaningful relationships with these communities.

In discussions on how best to engage, stakeholders recommended PGE to include community group capacity-building[171] in our TE planning. In this context, capacity-building means providing long-term support and compensation for their time and contributions, and also building up their understanding of utility regulatory process so they might participate in additional OPUC engagements. We plan to execute this strategy as follows:

- Adopt the best practices co-developed with community-based and community-serving organizations leading up to the recent DSP I and II filings.
- Leverage the PGE Community Engagement Framework the Greenlining Institute's Mobility Equity Framework, and the City of Portland's Pricing Options for Equitable Mobility (POEM) framework (a local guide to equitable mobility) to guide our work.
- Commit to an iterative approach that will lean on the guidance and expertise of a local, minority-owned and -led third-party facilitator which we will hire through the in-progress Request for Proposal (RFP) for long-term engagement work.
- Convene a TE community working group for sessions at least semi-annually to delve into programs at various stages. These work group sessions will focus on gaining specific feedback to make program implementation and future planning more accessible and equitable.
- Compensate individuals for their participation using funds from the HB 2165 Monthly Meter Charge and the Oregon Clean Fuels Program.

Section 7.3 describes in more detail on how we plan to execute on this input through our long-term engagement plans.

4.1.2 Community Learning Labs

Community Learning Labs are a public meeting space created for an introductory audience which includes, but is not limited to, community-based organizations (CBO), community-serving organizations, environmental justice advocates, other community collaborators and individuals. We designed our Community Learning Labs to foster an interactive experience for participants to learn about energy-related topics such as the TEP. Community Learning Labs aim to build awareness as well as inform and collaborate with both communities and individuals on specific topics and seek feedback from participants.

On April 20, 2023, the TE team presented at the Community Learning Lab and discussed the following topics with stakeholders: the Clean Fuels Program, TE portfolio revision, and the TE budget. The intention of the presentation was to provide updates to attendees and solicit feedback on areas

[171] National Council of Nonprofits define capacity building as, "an investment in the effectiveness and future sustainability of a nonprofit." https://www.councilofnonprofits.org/tools-resources/what-capacity-building.

of opportunities and considerations before the draft filing. Participants were engaged throughout the Lab and asked critical questions and offered thoughtful comments. These are summarized in Appendix D.

4.1.3 Acting on Feedback from Stakeholder and Community Outreach and Engagement

Appendix D collects specific stakeholder input PGE received in response to our six workshops, as well as stakeholder comments gathered from filings in UM 2165 and AR 654. Appendix D also addresses how PGE has incorporated or otherwise addressed the relevant comments in our plan.

In response to stakeholder feedback and the rapid needs assessment of underserved communities, we adjusted our TE Plan. Below are actions we took from the input received through stakeholder feedback and the rapid needs assessment:

- We reduced the scope of our TE plan in response to concerns about the cost and rate impact of the proposal and have implemented a phased approach so that some programs launch in 2024 instead of 2023.

We were asked to consider requiring customer cost-sharing where appropriate and have added this feature to

- Business and Multi-family Make-ready Solutions program, with a tiered cost sharing structure to promote charging that is open to the public and/or serves underserved communities.
- In response to comments from stakeholders, we have affirmed that we will not require a minimum 150 kW power level for customer-owned DCFC that PGE helps incentivize.

In the

- Business and Multi-family Make-ready Solutions program, we will offer a higher rebate amount to all multi-family dwellings, as well as offer a reservation of rebate funds in advance to help address financial barriers often faced by underserved communities. In addition, this program will include more targeted outreach and education to underserved communities to help address the education barriers of EV charging incentives available to non-residential customers. Finally, we will work with CBOs to conduct outreach and assist in identifying potential multi-family locations as well as more targeted education and awareness directly at multi-family sites in underserved communities.
- Undertake long-term engagement with underserved communities and explore an electric micromobility strategy funded by the Oregon Clean Fuels Program. This reflects the need to determine PGE's role for non-drivers and also those for whom an EV is out of reach. Additionally, the Drive Change Fund and Electric School Bus Fund grants will include increased outreach to, and prioritization of, underserved communities in grant evaluation.
- In the Public Charging - Municipal Charging Collaboration program, we will help build awareness and education specifically to underserved communities where chargers are installed. To address feedback that education and knowledge are one of the largest barriers to TE that underserved communities face, PGE will provide additional targeted outreach and education that addresses how to use pole chargers and provides more information Schedule 50. The Company will use data gathered during the administration of this program to inform possible updates to Schedule 50 that might benefit customers. Additionally, we will partner

with municipalities communicate effectively with underserved communities regarding this offering.

- For Fleet Partner, we will track the percentage of infrastructure built in underserved communities and conduct communications and outreach events for general fleet electrification once a project is in service. Additionally, we will add targeted outreach and education to transit agencies, school districts, and other fleets in underserved communities.
- The Residential Smart EV Charging program addresses financial and education barriers through program changes. To help remove financial barriers, we will explore both point-of-purchase rebates (as opposed to post-purchase rebates) and also ongoing support throughout the installation process. We have offered a higher rebate amount for income-eligible customers and increased income eligibility from 80 percent of area median income to 120 percent of state median income.
- We added more targeted outreach and education to underserved communities across multiple programs in response to feedback on knowledge barriers in underserved communities.

Chapter 5. Foundations

This chapter addresses cross-cutting portfolio work such as evaluations, line-extensions and make-ready. The Chapter is meant to explain these activities so the reader has context before moving into the portfolio's program activities.

5.1 Role of Demonstrations

PGE is conducting a managed charging demonstration to actively control the time, rate, and/or duration of electric vehicle charging. PGE will test this using on-board telematics to optimize charging around grid considerations such as wholesale prices, bulk capacity needs, distribution congestion, and equipment health. PGE will control the timing of EV charging, whilst ensuring that vehicles meet the operational needs of participants such as that state of charge remains at or above minimum requirements at planned departure time. The objective of this demonstration is to better understand how managed charging can reduce the negative impacts of high EV adoption and turn them into an operational asset.

PGE is evaluating options for a Vehicle-to -Grid, -Building, or -Home (V2X) demonstration to assess the use of vehicle-based energy storage as a source of grid services. This research will focus on improving our understanding of the technical paths for bi-directional management of EV charging, as well as the associated costs, performance, and limitations. This work may span multiple customer segments including single family, multi-family, commercial and/or fleet and may overlap with other Smart Grid Testbed research areas. Research in this area will be used in close coordination with the broader TE team to ensure that project learnings support broader programmatic efforts to scale these offerings across a broader customer base.

5.2 Evaluation

After completing a competitive RFP process, PGE contracted with Opinion Dynamics in March 2023 to conduct process and impact evaluations of four TE pilots and programs. Following are key learning objectives associated with the four ongoing evaluations:

5.2.1 Evaluation Activities

5.2.1.1 Residential Smart EV Charging

Process Evaluation:

- Is Residential Smart EV Charging meeting enrollment targets? How effective has outreach and education been?
- What are the characteristics of enrollees (e.g., low income, in underserved communities)?
- What percent of enrollees purchase new EVSE versus bring their own EVSE?
- Does the panel upgrade rebate increase customers' willingness to enroll?
- What is customer satisfaction with the participation experience, including communications, charging app usage, and incentive payments?
- What challenges have customers had purchasing or installing their EVSE?
- What challenges have customers had participating in Smart Charging/DR events?
- How has internet connectivity affected DR event participation?
- Have customers changed their charging or plug in patterns over time?

- When and why do customers opt out of DR events?
- Why do customers un-enroll?

Impacts Evaluation:

- What are the daily and seasonal MW impacts from DR events?
- How do evaluated DR savings compare to planning assumptions?
- What are the typical weekday load shapes for EVSE and evPulse enrollees, and how do they compare to PGE's system peaks?
- When is non-coincident peak load for enrollees?
- How often do enrollees opt out of DR events? What are the impacts on DR savings?
- Are there any key charging pattern differences between any enrollee segments?

5.2.1.2 Business EV Charging Rebates

Process Evaluation:

- How is PGE progressing towards its participation and expenditure goals?
- How are customers learning about Business EV Charging Rebates? How effective has PGE's outreach and education been?
- What types of customers are participating?
- What percentage of ports are located in underserved communities?
- How influential are the rebates in customers' decisions to install EV charging, and as appropriate, operate EV fleets?
- How effective has assistance from PGE and/or EVSE vendors been? Could this be improved in any way?
- Are customers satisfied with their EVSE choices?
- How many customers have un-enrolled and for what reasons?
- Have enrollees had any challenges procuring, installing, and maintaining their chargers?
- Who is able to access charging at participant sites?

Impacts Evaluation:

- What are the typical weekday load shapes for participants' chargers; how do they compare to PGE's system peaks?
  - How do the load shapes vary by type of business or user mix?
  - How does charging vary for L2 versus DC fast chargers?
- What is the total monthly energy consumption from all participants?
- What is the non-coincident peak load for participants' charging in aggregate, and by business/user type?
- What is the average load factor (utilization) across all participants, and range of load factors?

5.2.1.3 Fleet Partner

Process Evaluation:

- How effective has PGE's outreach and education been in generating awareness and interest for Fleet Partner?
- Are any participation steps and requirements unclear to customers?
- How is PGE progressing towards its participation goals?
  - What percentage of ports are located in underserved communities, which may have adverse air quality?
  - How many customers are electrifying transit, shuttle, and school bus vehicles?
- Why do customers that are aware Fleet Partner decide not to participate?
- How many customers have withdrawn and for what reasons?
- Is the custom incentive for make-ready infrastructure set appropriately?
- How effective are PGE's internal customer tracking processes?
- How accurate are cost estimates in the preliminary designs? What are the main causes of deviations?
- How accurate are estimated construction schedules? What are the main causes of deviations?
- How effective has technical assistance from PGE and/or charging vendors been?
- What challenges have customers had regarding siting, permitting, designing, and building charging infrastructure?
- How satisfied are customers with the different participation phases?
- Are participants achieving their business goals?

Impacts Evaluation:

- What are the average daily and total monthly energy consumption by customer and in aggregate? How does this vary for L2 versus DC fast chargers?
- What are the typical weekday load shapes for participants' chargers; how do they compare to PGE's system peaks?
  - How do load shapes vary by business/organization type?
  - How does charging vary for L2 v. DC fast chargers?
- What is the average number of charging sessions per day for each customer?
- What are customers' non-coincident peak loads individually and in aggregate?
- What is the average load factor across all customers, and for each charging site?
- What is the charging demand coincident with PGE's summer and winter system peaks, for each site and all charging stations combined?

5.2.1.4 Drive Change Fund

Process Evaluation:

- How effective has PGE's outreach and education been in generating awareness of the Drive Change Fund?
- What types of organizations and customers are the Drive Change Fund serving? Are there any notable gaps in customer types or geographies?
- Are residential customers benefiting?
- How easy/difficult is the application process? Could it be improved? Do any project requirements need adjusting?
- How useful is PGE's project scoping and application assistance?
- Could the application review and selection process be improved in any way?
- What challenges do grantees have completing their projects, and how can PGE provide further assistance? Does this vary by project type?
- What successes have grantees achieved for their organizations and constituents? Would they recommend the Drive Change Fund to peer organizations?
- What lessons has PGE learned through multiple rounds of applications and grant awards? Have any best practices been developed?

Impacts Evaluation:[172]

- What is the average load factor (utilization) for grantees' installed chargers, and range of load factors?
- What are the typical weekday load shapes for grantees' installed chargers, and how do they compare to PGE's system peaks?
- How do the load shapes vary by type of organization or vehicle mix?
- What is the total monthly energy consumption for each grantee, and from all grantees?
- What is the non-coincident peak load for grantees' charging in aggregate, and by individual grantee?

5.2.2 Evaluation Reporting and Budget

PGE expects to submit comprehensive evaluation reports to the OPUC in early 2024 and 2025. For Residential Smart EV Charging and Fleet Partner, PGE will receive interim memos in summer 2023 to inform the planning assumptions and incentive levels for those efforts.

The following table shows how the contracted evaluation costs are allocated by pilot/program and year.

[172] Pending charging sessions data availability. DCF customers do not have to provide these data as a condition of participation.

Table 21. Contracted Evaluation Costs by Pilot/Program and Year

Pilot/Program	2023	2024	2025	Total
Business & Multi-Family Make-Ready Solutions	[redacted]	[redacted]	[redacted]	[redacted]
Business EV Charging	[redacted]	[redacted]	[redacted]	[redacted]
Fleet Partner	[redacted]	[redacted]	[redacted]	[redacted]
Public Charging - Municipal Charging Collaboration and Electric Ave	[redacted]	[redacted]	[redacted]	[redacted]
Residential Smart EV Charging	[redacted]	[redacted]	[redacted]	[redacted]
Drive Change Fund	[redacted]	[redacted]	[redacted]	[redacted]

5.3 Line Extension/Make-Ready

The Line Extension process is PGE's mechanism for providing additional utility infrastructure to meet a customer's request for new electric service. The Line Extension Allowance (LEA) is the part of this process which provides a discount to the customer on the upfront cost of the utility infrastructure, based on the forecasted energy consumption from the new electric service. It is PGE's responsibility to provide electric service to the service point at the location requested by the customer, which is where PGE places the meter. The customer is responsible for designing, constructing, and maintaining infrastructure "behind-the-meter". The following figure illustrates the delineations between these components when connecting an EV charger to PGE's distribution system:

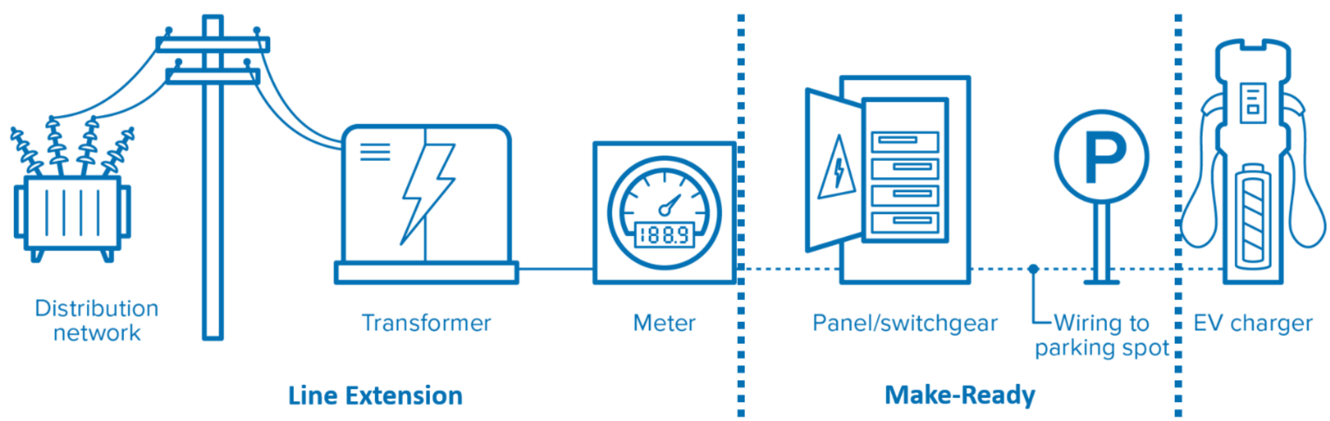

Figure 16. Delineations between Line Extension, Make-Ready, and EV Charger

Unfortunately, it is common for commercial customers to add new electrical load to their existing service without notifying PGE if the building capacity can support the additional charging load. In these cases, PGE has no visibility into what the new load is, when it was added, its power capacity, its typical operating hours, or the energy consumption of that individual load. This is how many EV chargers have been installed at commercial properties to date, which makes it challenging for PGE to understand and influence how EV chargers are impacting the grid.

ORS 757.357 (HB 2165, 2021) allows PGE to extend utility ownership to behind-the-meter assets, like make-ready, for Transportation Electrification projects. By making PGE responsible for additional infrastructure, it allows the customer to focus on the parts of the project that most impact their business—the chargers and vehicles—while also allowing PGE to gather additional information and set additional requirements.

The utility fulfills the following roles for make-ready infrastructure:

- Ensures sites are properly metered and ready for an EV rate:
  - At present we believe a separate meter is needed to have clear data from which to learn and develop new approaches to TE Loads. However we are not sure that a separate meter is necessary for all types of TE load now or in the future. The activities funded through this Plan require a separate meter for sites where make-ready is necessary. For smaller EV loads, such as where an electrical contractor builds the circuit interconnecting the TE load to the system behind-the-meter, PGE is pursuing a load disaggregation approach or other usage data.
- Site Development:
  - Can help identify whether distribution system upgrades can be avoided by incorporating solutions into make-ready design (e.g., right-sizing charging, battery storage, load management).
  - Where PGE dollars have been used to install make-ready, the utility can also impose terms and conditions. In the case of Business Make-Ready PGE can require public access to some portion of the chargers on site. This is how utility dollars can be leveraged to assure equitable access to charging.
- Standards, which ensure that chargers meet PGE's technical requirements and industry standards for safety, interoperability, and demand-response capability:
  - In the future, these same technical requirements may also include more sophisticated forms of managed charging and V2G.
- Data, which provides PGE with data for each individual charging port, including energy use, peak power, session duration, unique users, session cost:
  - This continually informs PGE of how its rate structures are affecting how EV owners fuel their vehicles and whether a unique use case is emerging.
- Education and Partnership, as having a role in make-ready means early engagement with our customers:
  - This gives PGE more advance notice of future TE load and a load ramp over 5-10 years
  - This allows PGE to help customers right-size their charger(s) and educate them on grid-friendly charging behavior.
- Facilitate TE, as make-ready enables electrification:

  - Early partnership with customers may create opportunity for more efficient/effective EV expansion at the site if it was made ready for additional chargers.
  - If the benefits of TE load are valued and recognized within the structure of a TE line extensions, the system can provide make-ready cost-share so more businesses can make the financial case for EV charging
- Seamless Customer Experience, making it easy for customers to choose electric "fuel":
  - Reduces customer friction and provides peace of mind for customers that they don't have to manage design, construction, maintenance
  - May improve project timelines because PGE is an expert in the plan/build process

As PGE contemplates the evolution of PGE-owned make-ready infrastructure and how it may be incorporated into the Line Extension process, a key component will be the process to estimate expected energy consumption associated with the new electric service.

For typical Line Extensions today, PGE receives an electrical load sheet in the customer's new service request. This identifies the connected load (kW) of all electrical devices on the new service. PGE uses this information to estimate demand load (kW) and to size transformers appropriately. PGE has also identified standard utilization factors (also called Combined Factors) based on the type of facility (e.g., 0.17x for hotels, 0.29x for hospitals). These Combined Factors were developed based on years of historical usage data and are used to estimate annual energy consumption based on the total demand load and the annual operating hours.

When PGE began to receive requests for new services with only EV charging (no building), PGE found it challenging to estimate annual energy consumption absent a clear Combined Factor. In 2021, PGE analyzed available historical data for existing EV charging stations and determined a standard Combined Factor to use for EV-only services. However, there was limited data available. The 2023 TE Plan requirements for meter data should provide learnings to assist this issue.

When PGE launched Fleet Partner in 2021, the program estimated energy consumption differently. Since the chargers were to be primarily used by fleet vehicles owned by the customer, PGE could estimate energy consumption based on the vehicle miles traveled, fuel efficiency (kWh/mi), and an estimated 10 percent in losses between the meter and the vehicle. PGE plans to validate this estimation method using actual data from Fleet Partner chargers but believes this method to be more accurate than the Combined Factor method. It should be noted that the accuracy is also improved because the customer legally agrees to using the estimated energy consumption in the Fleet Partner Participation Agreement.

Unfortunately, the vehicle miles traveled method for estimating energy consumption only works when there is a predictable schedule of vehicles using the chargers. For public charging, this method is less applicable, so PGE plans to use the Combined Factor method while gathering data through its various EV programs to improve the accuracy of the Combined Factor method (or create a different method for estimating energy consumption).

To aid in the development of future EV rates, PGE plans to use insights collected through make-ready programs. Every EV charging use case (fleet, multi-family, public L2, public DCFC, public heavy-duty) has its unique characteristics. These characteristics will be critical to identify during the rate design process. Each use case may vary by:

- Daily load profile hourly average and peak kW

- Charger-to-vehicle ratio
- Nameplate kW per charger by vehicle type
- Annual energy consumption per charger or vehicle
- Utilization factor/combined factor (energy usage based on demand load)
- Demand factor by charger quantity (demand load based on connected load)
- Off-peak versus on-peak usage
- Site load ramp (year-by-year)

Many of the products proposed in this Plan are built on the foundation that more data, insights, and customer engagement is needed for each of the EV charging use cases to effectively build full-scale programs and rates that address barriers and cost-effectively incorporate TE load onto the system.

Chapter 6. Transportation Electrification Portfolio

In this chapter, we detail PGE's current portfolio of activities and our envisioned portfolio over the 2023-2025 timeframe. This portfolio is designed with a focus on addressing the market barriers discussed in Section 3.6, and on meeting the needs of the following underserved communities described in HB 2165: residents of rental or multi-family housing; communities of color; communities experiencing lower incomes; tribal, rural and frontier communities; other communities adversely harmed by environmental and health hazards; and communities in areas with a low density of public charging stations.

Our portfolio also integrates load management, leveraging different approaches as appropriate for different use cases, and ensuring the buildout of networked, flex load-capable charging infrastructure. Our portfolio is intended to support residential customers at and near their homes, in public, at work, and on the go, no matter their form of transportation. The portfolio supports businesses small and large as they adopt EVs and install charging for their customers, employees, residents, and fleets. We have designed our portfolio to support our broad constituencies of urban, suburban, and rural communities. And most importantly, the portfolio is flexible: as we execute this Plan, we plan to continue to evaluate the market and conduct customer insights work to ensure that the portfolio supports all our customers and their varied needs. Additionally, we plan to continue to update activity between TE Plan cycles. PGE will keep stakeholders and Staff abreast of planned or necessary changes before making a filing requesting the activity change.

6.1 Portfolio Management

This section describes PGE's three primary mechanisms to support EV adoption: rates, infrastructure, and programs. These mechanisms inform PGE's TE strategy and underpin the activities described in latter parts of this chapter (Sections 6.2 and 6.3).

6.1.1 Rates

Electricity is an EV driver's "fuel". Changes to PGE's pricing structure (i.e., the cost of the "fuel") can reduce the long-term cost for EV operation and maintenance, encourage grid-supportive charging behaviors through pricing signals, and bring down the TCO of EV ownership across customer classes. An important part of the 2019 TE Plan Strategy which carries to the 2023 TE Plan Strategy is the development and utilization of rates to manage load, charging behavior, customer expectation, customer costs, and system costs. The work outlined in the 2023 TE Plan is designed to acquire data to inform future rate design. At present, PGE has identified the following initial market and customer sectors which may require specific rate design: residential (single and multi-family), business, fleet, public (including municipal and third party EVSE), and heavy duty. PGE's 2023 TE Plan proposes program activity directly in these areas.

6.1.2 Infrastructure

Charging stations and supporting electrical infrastructure are essential to develop charging reliability, reduce range anxiety, expand equity and access, and, ultimately, to meet the state's EV adoption targets.

Infrastructure investment will be necessary to support transportation electrification. The necessary infrastructure investment and the role PGE plays in that investment will vary based on the expected size and various load shapes presented by LDV, MDV, and HDV transportation. As the market matures, the level and type of support which PGE provides will also change. In these early years, PGE anticipates using a greater percentage of TE activity funds for make-ready, managed load, and site development coordination. Early work will inform PGE regarding how much cost sharing for make-ready the PGE system will need to carry and how much should be carried by those looking to construct vehicle charging. Presently, PGE foresees utilization of line extension allowances as a way to balance infrastructure costs while including terms for service such as site coordination, site building and development standards, communication network requirement, metering requirements, and public access.

Make-ready infrastructure is a proper role for the utility. Make-ready infrastructure encompasses the electrical equipment, wiring, and conduit from the existing grid to the EV parking area.[173] In typical installations, the utility owns the equipment up to and including the meter and the customer owns the equipment "behind-the-meter". In some of PGE's current and proposed programs, PGE owns, or plans to own, some or all of the customer-side make-ready equipment, in some cases including the EVSE (charger) itself. Many of the proposed TE activities in this plan are infrastructure measures as defined by the Commission's Division 87 Rules and are thus designated accordingly. As proposed in the 2023 Plan, these infrastructure measures are colloquially referred to as programs. This is purposeful, as PGE views many of the infrastructure measures in the 2023 TE Plan as programs which the Company needs in the near term to inform development of more traditional and sustainable electricity service approaches (i.e., TE-specific rates and tariffs). The infrastructure measures to be undertaken in the 2023-2025 timeframe are largely meant to meet an emerging market while collecting data and information to inform evolution from program to rates and tariffs.

Table 22. New and Existing Transportation Electrification Activities by Segment and Approach

Customer Segment	Approach	Activities
Residential	Rates	Time-of-Day Rate (Sch. 7) Public Charging Rates (Sch. 50) Residential EV Rate
	Infrastructure Measures	PGE Public Charging Residential Smart Charging Pilot (Sch. 8) Public Charging – Municipal Charging Collaborations Program
	Programs	EV Costs and Savings Calculator Drive Change Fund

[173] See Figure 13,on page 89 above, for an illustration of make-ready components to connect an EV charger to PGE's distribution system.

<table>
<tr><th>Customer Segment</th><th>Approach</th><th>Activities</th></tr>
<tr><td></td><td></td><td>Oregoin' Electric Campaign
Outreach and Education</td></tr>
<tr><td rowspan="3">Business and Multi-family</td><td>Rates</td><td>No-Demand Charge Rate (Sch. 38)
Commercial EV Rate</td></tr>
<tr><td>Infrastructure Measures</td><td>Business EV Charging Rebates (Sch. 52)
Affordable Housing EV-Ready Funding
Business and Multi-family Make-ready Solutions</td></tr>
<tr><td>Programs</td><td>Technical Assistance</td></tr>
<tr><td rowspan="3">Fleet</td><td>Rates</td><td>No-Demand Charge Rate (Sch. 38)
Commercial EV Rate</td></tr>
<tr><td>Infrastructure Measures</td><td>Fleet Partner (Sch. 56)
Heavy-Duty Charging Demo Sites (Sch. 53)
Business EV Charging Rebates (Sch. 52)</td></tr>
<tr><td>Programs</td><td>Energy Partner (Sch. 26)
Fleet TCO Tool
Clean Fuels Credit Optimization (Sch. 328)
Electric School Bus Fund
eFleet Charging Software Solution</td></tr>
<tr><td colspan="2">Emerging Opportunities</td><td>Matching External Funds
Emerging Technology Research and Development
Micromobility Strategy</td></tr>
<tr><td colspan="2">Other TE Activity</td><td>PGE Workforce Development
Statewide Workforce Development
PGE Fleet Electrification</td></tr>
</table>

6.1.3 Programs

TE programs can address barriers, reduce total cost of ownership, increase awareness, and support the grid whether they are focused on education and outreach, supporting customers in acquiring vehicles, wrap-around services to add customer value, flex load to create incremental grid value, or other objectives.

While PGE's current and proposed 2023-2025 program activity includes work the Commission Division 87 rules define as infrastructure measures, as we have outlined above, the programs category of work should evolve to support adoption, education, awareness, etiquette, load management, data collection, discrete small technology demonstration, community development, and low income or underserved community work.

In this portfolio of current and proposed activities, we apply these mechanisms across different customer segments. We also discuss current and planned company-wide activities designed to holistically advance our TE strategy.

6.2 PGE's Current Portfolio

6.2.1 PGE's 2023 -2025 Program Concentration Area Rationale

Oregon ranks overall third in the nation for electric vehicle adoption, just behind Washington (#2) and California (#1).[174] The Inflation Reduction Act and other federal and state funding has increased EV adoption which can be seen driving EV adoption in PGE's service area. As outlined and discussed above, this Plan's activity is designed to address current emerging and underserved community needs, but also to collect data, practice, and experience to inform longer-term sustainable practices.

One item of focus in our 2023 TE Plan is fleet development. There are several reasons for this work. Oregon followed California's adoption of the Advanced Clean Truck Rules in 2021. Alongside these policy changes, multiple manufacturers rolled out their first electric semi-trucks in 2022.[175] This governmental action is also helping to transition light- and medium- duty vehicle fleets to electric models. Lastly, fleets representing medium- and heavy- duty loads are generally clustered on the system and represent a unique load shape from other more transient or dispersed use cases such as residential or public charging.

The Advanced Clean Cars II rule in Oregon is furthering the availability of EVs, which puts pressure on OEMs to supply affordable passenger vehicles and light-duty fleet vehicles. This highlights the need to coordinate with customers seeking to locate larger charging sites. The ability to connect with customers early (before fleet site design and location has been solidified) is important to managing the costs TE loads may impose on the system.

Other Plan activities such as Public Charging - Municipal Charging Collaboration, Residential Smart EV Charging, PGE Fleet Electrification, and Business and Multi-family Make-ready Solutions inform PGE how to build more sustainable approaches to serve and manage TE load. For example: PGE has seen a large growth in the Residential Smart EV Charging pilot enrollments, from 480 enrollments in 2021 to 2,298 enrollments in 2022. This enrollment tells us two things: new EV owners want level 2 charging and are willing to participate in flex load programs.

We expect to see similar participation in Business and Multi-family Make-ready Solutions, which also includes a managed charging component. It is important to PGE—and necessary to meet the State's

[174] Atlas. *EV Hub: State EV Registration Data*. Retrieved from https://www.atlasevhub.com/materials/state-ev-registration-data/

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[175] Oregon Administrative Rules 340-261: https://secure.sos.state.or.us/oard/displayDivisionRules.action;JSESSIONID_OARD=H3uxiJ2FwQtSqw1U8YCtGxii4B4RyiwOHMjaUp8ikYOv0Kchzmkw!1684782157?selectedDivision=6697

clean energy goals—that we continue to cultivate a structured relationship with customers such that they understand the utility role in transportation electrification.

PGE also proposes to expand our pole charging activity under our Public Charging - Municipal Charging Collaboration program. This will help meet the needs of underserved communities and those residing in either low income housing or housing without access to either garage parking or dedicated parking.

Our ownership of Electric Ave charging sites has illustrated the importance of partnership to manage maintenance and operations of EVSE. These sites have and continue to provide valuable usage data and a place for PGE test new approaches to public charging.

6.2.2 Residential customers

PGE's current portfolio of TE offerings for residential customers spans home and public charging rates; a growing fleet of public charging locations; a connected charger program with the capability to lower EV charging demand during on-peak events; and numerous tools, campaigns, and events for public education.

6.2.2.1 Time of Day Rate (Schedule 7)

While PGE has had TOU rates for residential and commercial customers for many years, in 2021 we introduced a new Time of Day (TOD) rate that gives residential customers more choice and control in how they manage their energy use. The rate uses pricing signals to encourage customers to voluntarily shift energy usage from high demand hours to off-peak periods when demand is lower and renewable resources are more plentiful. This offers customers like EV drivers, who can shift significant portions of their load to overnight hours, potential cost savings on their energy bill, and thereby reduces the TCO of driving an EV. Designed with simplicity in mind, pricing on TOD is less than our Basic Service at all hours and days except for the on-peak timeframe of 5–9 PM Monday-Friday. The following chart provides additional detail regarding PGE's current TOD pricing:

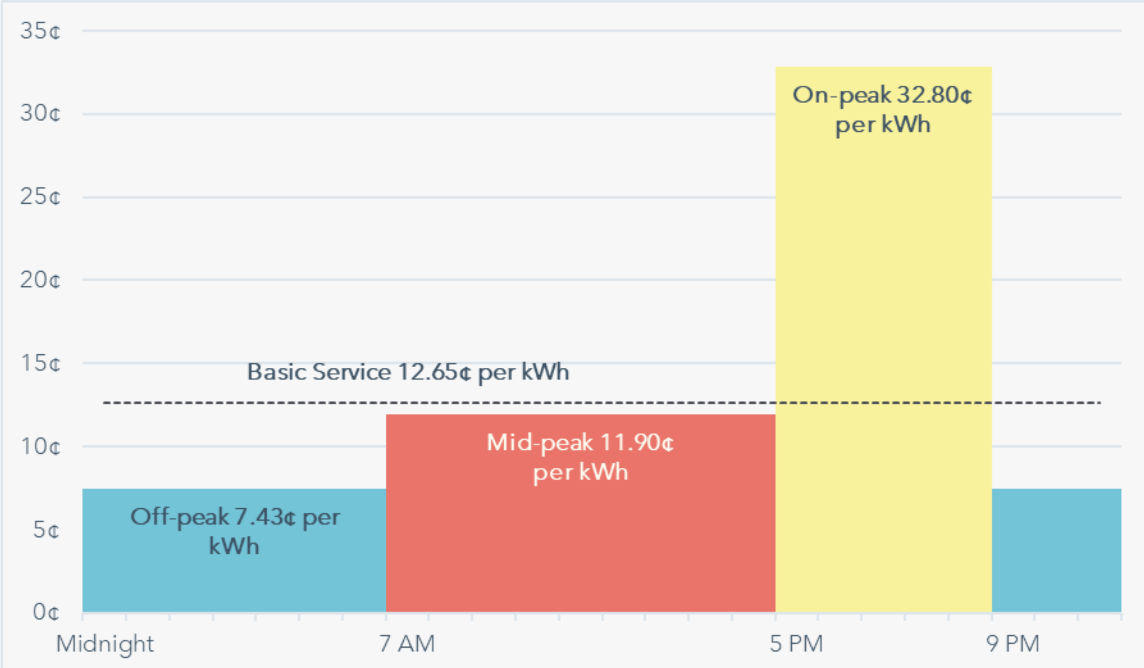

Chart 8. PGE's Time of Day Pricing[176]

Thus far into the deployment, the program team has learned that building awareness and educating EV customers about the value of TOD is foundational to the success of this offering, and lower-than-expected customer response confirms this to be true (8,716 enrollments to date including 1,102 EV owners as of March 31, 2023). To support our ambitious growth goals, PGE is refocusing our efforts on increasing rate awareness and recently introduced an online rate comparison tool that enables customers to compare personalized savings on TOD versus Basic Service. Targeted outreach to EV customers will follow as awareness and customer receptivity increases, and we estimate residential market adoption will reach 100,000 customers by 2030.

Preliminary analyses indicate that approximately half of EV owners in PGE service area could save on their bill via the new rate without any behavioral changes, and a lesser proportion could save given some modification to their usage patterns. It is, however, important to note that TOD is not strictly a TE product: the rate is revenue-neutral, and its design and implementation were budgeted through PGE's Multi-Year Plan[177]. These costs are therefore not considered part of PGE's TE portfolio budget.

6.2.2.2 Public Charging Rates (Schedule 50)

PGE's public charging rate, Schedule 50, is the OPUC-approved tariff applied at the company's public EV chargers. Schedule 50 is designed with the following priorities in mind:

- **Simplicity:** Schedule 50 is designed to be easy to understand for EV drivers

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[176] Prices shown reflect energy, transmission, and distribution costs. Over 1,000 kWh there is an extra 0.36¢ charge.

[177] PGE (2021). *PGE's 2021 Multi-Year Plan*. Filed under OPUC Docket 2141 on November 3, 2021. Retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um2141had16243.pdf.

- Grid-Efficient: Schedule 50 contains an on-peak surcharge to encourage drivers to charge during off-peak times
- Equity: Schedule 50 is designed to result in a price per kWh (relatively similar to residential rates) as it is implemented at sites designed and located to meet the needs of drivers who lack the ability to charge their EV at home

Schedule 50 pricing for EV charging is as follows:

- A flat $3 per charging session fee for L2 chargers
- A flat $5 per charging session fee for DCFC
- As an alternative to the flat fee, drivers may elect to pay a $25 per month subscription fee (applicable only at Electric Avenue sites)
- Regardless of whether the driver pays the flat fee or uses the subscription, a surcharge of $0.19 per kWh is applied during peak hours (3–8 PM on weekdays, excluding holidays)

PGE is analyzing Schedule 50 usage with the aim to transition to an effective per-kWh pricing in 2023 and may revisit Schedule 50 pricing in 2024. Our objective remains to offer simple, grid-friendly, and equitable rates for PGE-owned public charging under Schedule 50.

The 2023 TE Plan activity is designed to gather load profile data for residential (single and multi-family), business, fleet, public, and heavy-duty to inform further development of Schedule 50 or other time of use rate structures. This work is a major component of PGE's 2023-2025 TE strategy.

The load profile data for PGE L2 and DCFC public charging will also help identify a public charging rate outside of Schedule 38 to help encourage charging at optimal times and mitigate demand charges, which can be hard for public charging and workplace charging customers to plan for and manage.

6.2.2.3 PGE Public Charging

PGE offers public charging within its service area via the Electric Avenue Network, Oregon Electric Byways, and our Pole Charging pilot, described below:

Electric Avenue Network: PGE built, owns, and operates a network of seven public charging locations with four 50 kW DC fast charging ports and two 7.2 kW Level 2 charging ports per site (exception: Salem Electric Avenue has two 50 kW DC fast charging ports and two 7.2 kW Level 2 charging ports). Six of these sites were built as part of PGE’s 2016 Transportation Electrification Plan, while the seventh site at WTC is a legacy utility investment. Sites are located in Downtown Portland, East Portland, Milwaukie, Beaverton, Hillsboro, Wilsonville, and Salem. The network delivered approximately 487,695 kWh in energy to drivers via 28,734 charging sessions in 2021, powering an estimated 1.5 million miles of electric travel. Lessons learned include:

- Public DCFC infrastructure is still an evolving technology and requires a comprehensive maintenance strategy to ensure high equipment uptime.
- Drivers are highly responsive to peak-time pricing, providing PGE an effective tool to shape utilization patterns.
- Location matters to utilization, which can vary by a factor of four based on location.

Oregon Electric Byways: PGE took ownership of eleven public charging locations developed as part of Oregon Electric Byway in the mid-2010s. PGE worked with vendors and site hosts to keep aging equipment functional and to retire locations that were no longer appropriate for charging infrastructure. Since 2021, PGE has worked with site hosts to replace equipment at end-of-life with new, more reliable, and higher-powered charging infrastructure. This work has been funded by proceeds from PGE's Clean Fuels program. Sites that are not upgraded will be retired. Lessons learned from this work include:

- Charging technology has dramatically changed since the manufacture and installation of the equipment of these sites nearly a decade ago. Much of the equipment is now at end-of-life and may not even be supported by the manufacturer. PGE is addressing this issue by replacing or retiring equipment.
- Location matters. Sites that originally seemed promising may become difficult for drivers to utilize as property owners change and/or adjacent facilities are modified.
- Multiple fast charging ports make locations more attractive to drivers. Oregon Electric Byway locations have only a single DCFC port, resulting in potentially long wait times for drivers who arrive while others are already charging.
- Site host engagement was a particular challenge with upgrade projects. These sites needed updated agreements and negotiating that process proved difficult, with some properties having gone out of business or changed ownership since the original installations.

PGE has found great value in our work with the Electric Avenue Network and the Oregon Electric Byways. Learnings include how to serve this market, the challenges of developing charging sites, the many partnerships necessary to develop a site, and how to manage the charging infrastructure. While there are advantages to a utility owning chargers, PGE envisions that the private market is better positioned to own and maintain public chargers, and that the utility role is to support that private market charger ownership. However, PGE may need to own chargers in limited capacity such as:

- where the private market is slow to act
- where ownership would inform PGE of best practices to address the needs of a market
- new TE load type
- where utility charger ownership supports equitable access to transportation electrification
- where customer experience necessitates

Even in the above cases, PGE will seek charger ownership partnerships to lower costs.

Pole Charging Pilot: PGE owns and operates two Level 2 charging ports mounted on utility poles through a demonstration project in the City of Portland. The neighborhood where the chargers are located is residential, with a high proportion of multi-family dwellings, rentals, and single-family homes that lack off-street parking. It is also within walking distance of a popular commercial district. PGE's pole chargers remain popular with drivers, delivering 32,750 kWh, which outperformed all other PGE-owned public Level 2 chargers in 2021. Lessons learned from the demonstration include:

- Charging ports that serve on-street parking are popular with drivers.

- Installing L2 charging equipment on utility poles is more cost efficient than installing L2 charging in a parking lot.
- Working with municipalities in the right-of-way allows PGE to have one site host agreement governing multiple sites, which makes the installation process faster and more affordable.
- Installing charging equipment on utility poles requires that hardware and installation be compliant with National Electric Code (NEC), National Electric Safety Code (NESC), PGE Electric Service Requirements, and PGE standards. These requirements significantly limit the selection of hardware for these sites. To date, PGE has found only a single equipment provider that can meet all these codes and standards.

PGE's work on pole mounted chargers, including our outreach and work with the municipalities, has illustrated that pole-mounted chargers may be the best, least cost approach for PGE to provide underserved communities, multi-family, and rentals with equitable access to EV charging. PGE will also be seeking charger ownership partnership to meet this market.

6.2.2.4 Residential Smart EV Charging Pilot

PGE’s Residential Smart EV Charging pilot launched in 2020, and, at the close of April 2023, had 2,982 enrollees. The current pilot is available to up to 5,000 eligible residential customers. PGE proposes to extend the pilot through the end of 2025, reduce the charger rebate amount from $500 to $300, and eliminate the enrollment cap. PGE proposes this pilot extension to continue to learn more from the current pilot and to leverage learnings from the Smart Grid Testbed’s EV Charging Study towards the creation of a managed charging program. The Residential Smart EV Charging pilot rewards participants for shifting or reducing their home EV charging at peak times. Enrolled customers are eligible for a $25 seasonal reward by participating in flex load events. During these events, PGE sends a signal to automatically pause customers’ charging for the duration of the event, either through their qualified charger or through cloud-based vehicle telematics. This pilot is intended to explore how PGE can use flex load from residential EV charging.

Customers have three ways to enroll in the pilot:

- Customers receive a $500 rebate ($1,000 for income-eligible customers) for the purchase and installation of a qualified Level 2 charger at their home. PGE proposes to reduce the charger rebate amount from $500 to $300.
- If customers purchase and install a Level 2 charger prior to it being added to PGE’s Qualified Products List, they can still receive a $50 rebate.
- Customers that drive a qualified vehicle but have a non-qualified EV charger can enroll through vehicle telematics (evPulse) and receive a $50 rebate. These customers are then enrolled in the Residential Smart EV Charging pilot and, like those that receive the charger rebate, have flex load events called.

This pilot has also included dealership incentives to help enroll prospective EV buyers in the Residential Smart EV Charging pilot. These dealerships have Chargeway Beacons, which are kiosks that provide customers with information on EVSE locations, trip-planning, and also details on how to enroll in the pilot. Based on learnings from the past two years, we are re-assessing the dealership referral program.

In 2022, PGE allocated $738K of the 2022 Monthly Meter Charge[178] to enhance this pilot. There were no 2023 Monthly Meter Charge dollars allocated to the Residential Smart EV Charging pilot. These enhancements from 2022 provide an additional rebate for customers who require an electric panel upgrade when installing a Level 2 charger in their home. Customers who apply for the Residential Smart EV Charging pilot can also qualify for the electric panel upgrade rebate. Those customers who apply for the standard rebate can receive up to $1,000 towards the cost of the panel upgrade. Income-eligible customers can apply to receive up to $5,000 towards the cost of their panel upgrade. This enhancement was added to break down financial barriers to help support EV adoption and make it easier for income-eligible customers to install a Level 2 charger in their home[179].

As of October 2022, there are 1,491 customers enrolled in the pilot. After the first demand response season ended on April 30, 2022, PGE found that over 80 percent of evPulse customers participated in the Smart Charge events and about 70 percent of other customers participated. By the end of the current pilot, PGE anticipates the pilot will have 2.25 MW of enrolled capacity across 5,000 connected vehicles. PGE anticipates an evaluation memo of the first two demand response seasons of the pilot in July 2023 to analyze the capacity and results.

With this TE Plan, PGE proposes a budget increase of $3.4 million to extend the pilot by one year (through the end of 2025), which will allow the integration of 2,000 additional vehicles (9,399 total) and 0.90 MW additional flexible load capacity (for a program total of 3.15 MW) as well as cover the on-going seasonal incentives current pilot participants can earn. Please see Appendix A.1 for additional details.

6.2.2.5 EV Costs and Savings Calculator

PGE launched its Electric Vehicle Costs and Savings Calculator in June 2022. This online, interactive calculator enables the public to better understand the TCO of acquiring an EV. Customers can enter basic information about their future vehicle purchase desires and quickly receive results that show the economic and environmental costs and savings of switching to electric. The tool also allows customers to explore the rebates and cost offsets they are eligible for, view information about vehicle charging, and see suggestions of other PGE programs they may be interested in, such as Time of Day or Green Future Choice (PGE's renewable program for residential customers). Since launch, there have been about 19,000 visitors to the calculator, with about 95 percent reporting that they are more likely or just as likely to purchase an EV after using the calculator. Customer satisfaction with the tool

[178] PGE's 2022 Monthly Meter Charge filing, retrieved from https://edocs.puc.state.or.us/efdocs/HAH/um2033hah1673.pdf.

[179] Requirements to qualify for the Panel Upgrade Rebate: For those who require an electric panel upgrade, PGE offers a Standard Panel Installation Rebate of up to $1,000 and an Income-Eligible Panel Installation Rebate of up to $5,000 for income-eligible customers. The panel upgrade must be done by a licensed electrician and the Level 2 charger must be hardwired. Participant must include a copy of receipt or invoice in the exact dollar amount of the cost of the panel upgrade work with their installation rebate application. The panel must be upgraded to at least 200 Amp service. Participant must meet all eligibility requirements and be accepted into the Residential Smart EV Charging pilot to qualify for the panel upgrade rebate. This is not a stand-alone rebate. The panel upgrade must occur on or after November 16, 2022. Any panel upgrades performed prior to November 16, 2022 are not eligible for this rebate. In order to claim the electric panel upgrade rebate, customers must replace an existing main electric breaker panel with a 200 Amp (or higher) main breaker panel with a minimum of 30 slots and 40 circuits (equivalent or better). The rebate can be applied to cover the following costs, among others (at PGE's sole discretion): Replacing the main electric panel and breakers; Replacing or relocating the electric meter main panel and associated conduit; Wiring from the meter base to the panel; Wiring from the meter base to the weatherhead; Code required wiring upgrades.

has been high. We have learned to promote the calculator through outreach and education. This includes having the calculator available at the February 2022 Portland Auto Show and Ride-and-Drive events.

6.2.2.6 Drive Change Fund

The Drive Change Fund is focused on electrifying transportation in Oregon and in support of underserved communities. PGE uses revenue from the sale of residential credits from the Oregon Clean Fuels Program to provide grants for projects that include acquiring EVs, installing charging infrastructure, education or outreach campaigns, and innovative projects accelerating the adoption of transportation electrification. Nonprofit, private, and public organizations are invited to apply for this competitive grant fund as long as they demonstrate a community benefit, with a further focus on environmental justice communities. Projects are eligible to receive up to 100 percent funding for a project, with single awards capped at $750,000. The DCF has been available for four years and has funded $8.92 million to 52 organizations in Oregon. The 2023 budget for DCF is $4.5 million and will be the fifth year DCF.

In this TE Plan, PGE is proposing to continue the Drive Change Fund through 2025, with forecasted annual budgets of approximately $4.5 million in 2023, $3.5 million in 2024, and $5.0 million in 2025.

6.2.2.7 Oregoin' Electric Campaign

PGE continues to work with PacifiCorp to deliver Oregoin' Electric, a brand-neutral statewide transportation electrification campaign launched as part of the 2020 PGE Clean Fuels program portfolio. The goals of the campaign are to engage and educate all Oregonians on transportation electrification and accelerate transportation electrification in the state.

The 2021 messaging campaign focused on reaching underserved communities, including non-English speaking, rural, and also black, indigenous, and people of color (BIPOC) communities. It highlighted real stories, quotes, and members of the community sharing their reasons for choosing electric transportation. The campaign had over 8 million views and was successful within key demographics such as Oregon's Hispanic population, which represented around 10 percent of total views.

In 2022, PGE Clean Fuels program funds covered the creation of a statewide website meant to serve as a central hub for TE in Oregon[180]. This website launched in Q4 2022. Additional funds from PGE's 2022 Monthly Meter Charge Budget will cover purchased media, earned media outreach, narrative development, storytelling, creative assets, social media management, and dealership engagement. The campaign will continue to deliver the following messages:

- Electric transportation is available today for everyone in multi-modal applications that meet a variety of transportation needs including rural, urban, on-road, off-road, micromobility, and public transit applications
- Transportation electrification is a critical piece of meeting the state's environmental and climate goals

[180] Oregoin' Electric, see: https://oregoinelectric.com/

Where possible, PGE will continue to work with industry, dealerships, advocacy groups, state agencies, and other utilities to add to the overall budget and extend the reach of the campaign.

6.2.2.8 Outreach and Education

Oregon ranks overall third in the nation for electric vehicle adoption, just behind Washington (#2) and California (#1).[181] With more and more drivers considering EVs, there is a significant education and awareness need to help drivers understand electricity as the new "fuel" for their vehicles. This paradigm shift is substantial and requires customers to consider a new relationship with PGE. Customers will no longer fill up at the corner gas station in five minutes or less, but will instead need to plan ahead to charge their cars at home and on the go.

Reaching PGE's clean electricity targets relies on managing new charging and electrification load such as EV smart charging and time of day. As such, we are launching a multi-year "Path to 2030" strategic brand outreach and education campaign to build awareness, help customers understand the mission, reinforcing that it will take all of us working together, and the role(s) they play. As part of this campaign, EV adoption, charging, and energy management will be at the forefront of how customers can make a difference. To achieve this, we need customers to become co-creators of our shared clean energy future we'll need consumers to actively participate in energy management.

A major workstream of this campaign will be specific to EV/TE education and awareness and its connection to our larger decarbonization commitments. We will come back mid-cycle with specifics on scope, schedule, and budget.

PGE also conducts regular and ongoing education and outreach work to customers and community members about TE. PGE was the primary sponsor of the Electric Avenue showcase (no relation to PGE's Electric Avenue network) at the 2022 Portland International Auto Show. PGE collaborated with PacifiCorp, Clark Public Utility District, Forth, Chargeway, and the Oregon Auto Dealers Association to host an expanded EV showcase featuring several available EV models, residential and commercial charger displays, and a comprehensive exhibit of available EVs, all staffed by volunteers from the above-mentioned companies. PGE directly engaged with more than 100,000 attendees on the benefits of EVs, including many in-depth conversations related to ownership, charging, rebates, and incentives.

In another example, PGE once again partnered with Electric Car Insider to host a two-day Ride-and-Drive called the Electric Car Guest Drive (ECGD). This was the first PGE Ride-and-Drive event since the beginning of the COVID-19 pandemic. The ECGD allows prospective EV buyers the opportunity to learn about operating and acquiring (purchasing or leasing) an EV. The 2022 ECGD featured an educational EVSE exhibit highlighting six residential and six commercial grade EVSE, with accompanying information and literature. PGE joined with Portland Community College to host the ECGD at the Sylvania campus on August 12-13, 2022. The first day focused on commercial customers, while the second day was designated for residential customers. Customers took 460 test drives during the event, and 89 percent of attendees reported that they were "very likely" to purchase an EV for their next vehicle. PGE plans to hold three more Ride-and-Drive events in 2023.

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[181] EVHub data from Atlas EV Hub. *State EV Registration Data*. Retrieved from https://www.atlasevhub.com/materials/state-ev-registration-data/.

6.2.3 Business and Multi-family Customers

PGE's current portfolio of offerings for business and multi-family customers now contains offerings for make-ready and charger rebates. This is funded by the 2023 MMC, which targets 100 ports at multi-family, commercial, and workplace locations. Over one-third (40 percent) of those ports will specifically be targeted to multi-family locations. PGE views these investments as ultimately supporting residential customers' charging equity (particularly in the multi-family segment) and we therefore focus a substantive portion of our portfolio expansion in this area. Amongst other benefits, these offerings will improve charging adequacy for the multi-family segment.

6.2.3.1 No Demand Charge Rate (Schedule 38)

While not designated solely for TE load, PGE's Schedule 38 tariff is used by owners and operators of EV charging because it does not apply demand charges. Customers may use Schedule 38 for up to 200 kW of load. We have seen fleet customers select Schedule 38 to help mitigate their demand chargers while knowing that their charging can adhere to the time of use rate. Since this rate design predates TE, we will explore how to better structure a Schedule 38-like rate to manage the load for public, workplace, and other charging scenarios, as well as determine other rate options for demand in excess of 200 kW.

6.2.3.2 Business EV Charging Rebates (Sch. 52)[182]

PGE's Business EV Charging Rebates pilot launched in December of 2020. This pilot is available to all non-residential customers who install qualified Level 2 EVSE at their premises. The pilot launched with a standard rebate of $500 per port (increased to $1,000 per port in July 2021) and an income-qualified multi-family rebate of $2,300 per port (extended to all multi-family sites in November 2022). In exchange for the rebate, customers agree to keep the EVSE operational and on a PGE cost-of-service rate for 10 years, as well as release the charger data to PGE for analysis and reporting purposes. Rebates may be paired with programs such as Fleet Partner, Drive Change Fund, and Electric School Bus Fund and are newly reservable in order to offer customer certainty even in the face of uncertain construction timelines.

The pilot launched with three software providers and 10 EVSE hardware models on the qualified product list. PGE continues to add products as we engage vendors and sign data sharing agreements. As of April 2023, the list contains 13 software providers and 39 EVSE hardware models.

The budget for this program was set at $1 million of nominal O&M in an amended stipulation among parties in Docket UM 1811. PGE projects the budget will support the issuance of 500 rebates and will last through the end of 2023, or until funding is exhausted.

As of June 1, 2022 (halfway through the pilot's projected timeline), PGE had issued 58 rebates through this program, or slightly less than 10 percent of the total number of projected rebates. The slow adoption of this program led to PGE proposing the below pilot expansion through MMC 2022 budget filing, which was approved in October 2022.

PGE anticipates program funding will be fully reserved in 2024 with charger installations lasting in 2025. PGE does not propose a further expansion of the program as we transition to supporting infrastructure. In addition, PGE will be studying the load profiles of the installed chargers to

[182] PGE Schedule 52, retrieved from https://assets.ctfassets.net/416ywc1laqmd/4kQwkhxFjQiA3zg1zFbWGI/70b713aa73ffaae5f60127e93d64a0de/Sched_052.pdf.

determine where managed charging or updated rates and tariffs can be used to better manage the load for workplace, public, and multi-family locations.

6.2.3.3 Business EV Charging Rebates Pilot Expansion (Schedule 52)

In 2022, PGE proposed allocating $2 million of the 2022 Monthly Meter Charge to additional business rebate categories in an expansion of Schedule 52. The expanded rebates include:

- Addition of rebates for make-ready infrastructure and EVSE installation: These make-ready rebates would cover 80 percent of the customer's make-ready and installation costs, up to a maximum of $6,000 per L2 port and $36,000 per site. This rebate structure removes additional barriers to adoption, while still incentivizing the customer to be cost-conscious in their site design, as they remain responsible for a portion of the installation costs. The rebates are also designed to be most generous for small sites (six or fewer ports), which are unlikely to be good candidates for other current or envisioned PGE programs that that might offer utility-owned make-ready infrastructure (e.g., Fleet Partner). Customers who enroll in those programs would not be eligible for the make-ready rebates, but would remain eligible for the EVSE rebates, as they are today.
- Removal of income qualification for multi-family rebates: PGE proposed to drop the income qualification requirement for the higher multi-family rebates, and instead offer the higher $2,300 rebate to all multi-family sites located within underserved communities (geographically defined). This both removes a disincentive to participation on the part of multi-family sites, and better aligns the program with HB 2165's definition of underserved communities.
- Addition of DCFC rebates: PGE proposed to add DCFC rebates of $350 per kW (e.g., a $10,500 rebate for a 30 kW DCFC, or a $17,500 rebate for a 50 kW DCFC), up to a maximum of $25,000 per DCFC port. DCFC rebates would have the same requirements as L2 EVSE rebates do today: the customer would select from a Qualified Product List, keep the charger operational and on a PGE cost-of-service rate for 10 years, and authorize the software provided to release charging session data to PGE. DCFC would not be eligible for make-ready rebates unless the customer paired DCFC with L2 chargers.

PGE anticipates the pilot expansion funding will be fully reserved in 2024 with charger installations extending into 2025. The installation rebates have been a helpful addition to the charger rebate and have supported PGE's transition to helping install infrastructure and ensure that line extensions support the various charging scenarios.

In addition, PGE will be studying the load profiles of the installed chargers to determine where managed charging or updated rates and tariffs can be used to better manage the load for DCFC workplace and public charging locations.

6.2.3.4 Affordable Housing EV-Ready Funding

In this program, PGE offers affordable housing projects funding of $2,500 per parking stall that the developer makes "EV-ready," up to 50 percent of the project's parking stalls. This program was implemented in response to the passage of HB 2180, which requires that all new multi-family buildings (five units or more) and new commercial buildings be made EV-ready. EV readiness is defined by the installation of service capacity (or space to provide additional future service capacity) as well as installed conduit for Level 2 EVSE at 20 percent of the building's parking stalls.

Stakeholders alerted PGE to the prospect of affordable housing projects in the pipeline today that may have secured fixed funding, but have not yet submitted permit applications, and will face the need to meet the new building code by the time they do so. This may add costs to the project and impact timelines of deploying this critical community resource.

Funding for this program is on a first-come first-serve basis. Presuming an administrative allocation, this program will provide funding for at least 360 EV-ready parking stalls at affordable housing developments in PGE's service area. This work was budgeted for in PGE's 2022 Monthly Meter Charge Budget, approved in October 2022.

This work was budgeted based on an anticipated policy change in the City of Portland and will thus sunset when funding is reserved. The policy change went into effect in March 2023 and PGE has started receiving requests from affordable housing projects in the pipeline prior to the policy change. PGE will continue to work with CBOs until the need is fulfilled or funding is completely reserved and used.

6.2.3.5 Technical Assistance

Since 2018, PGE has offered technical assistance to commercial customers interested in installing EV charging at their property and/or electrifying their fleet. Services include collateral and information, phone consultations, and on-site visits. In the most recent evaluation of this program (2020), evaluators reported that non-residential customers gave positive feedback about the technical assistance consultations they received, which were characterized as effective and influential, and resulted in 53 percent of surveyed customers installing chargers and 41 percent electrifying some portion of their fleet.

Since the launch of Fleet Partner in 2021, technical assistance for fleet sites has been conducted through that program. Technical assistance for other business sites such as workplaces, multi-family dwellings, and public sites has continued as standalone service, often in coordination with the Business EV Charging Rebates pilot.

6.2.3.6 Clean Fuels Credit Optimization (Schedule 328)

This recently approved offer will be available to business and multi-family customers, but PGE intends to first actively market it to fleet customers; see Section 6.2.4.6 for details.

6.2.4 Fleet Customers

PGE's portfolio of offerings for fleet customers spans rates, infrastructure, and programs. In this TE Plan period, PGE will look to continue this suite of successful programs to meet customer needs. Details on fleet offerings follows:

6.2.4.1 No-Demand Charge Rate (Schedule 38)

PGE's Schedule 38 (discussed in more detail in Section 6.2.3.1) is available to fleet customers.

6.2.4.2 Fleet Partner (Schedule 56)

Approved in June 2021, Fleet Partner is a program that offers non-residential customers no-cost customer planning and technical services, as well as make-ready infrastructure installation with custom cost incentives. Eligible customers include non-residential fleets (commercial, municipal, school, non-profit, and transit) installing 70 kW or more of EV charging. The program's objectives are to enable fleet electrification and reduce adoption barriers (e.g., complexity and cost), create DR-enabled EV charging to support efficient grid integration, identify customer and market barriers, and identify areas for improvement in future evolution of the program.

By participating in the first phase of the program (Fleet Partner Plan), customers receive a Fleet Partner Study where PGE identifies everything a fleet manager might need to know in order to transition their fleet to electric "fuel" including vehicle and charger feasibility assessments, preliminary site designs and costs, and a summary of all potential incentives and grants available to the customer.

Following Fleet Partner Plan, participating customers may commit to the Build phase of the program where they receive final designs, and PGE constructs, operates, and owns the make-ready infrastructure for their EV site. As part of the Build phase, PGE also provides custom cost incentives to pay for some or all of the cost, based on the customer's 10-year energy commitment. The customer then purchases and installs their chargers. Lessons learned thus far include:

- Customer understanding of fleet electrification is extremely variable, and PGE needs to respond to customer needs with appropriate solutions regardless of their level of knowledge
- Customer demand for this program is higher than anticipated, especially among municipalities, but the sales cycle is long (on average 14 months from application to start construction)
- Materials and construction costs have increased significantly since the initial budget was created and supply chain issues are slowing construction timelines
- Fleet sites and designs are not "one size fits all", customer sites are very unique
- Data acquisition is complex and requires dedicated resources

The current approved pilot budget is $9 million. As of April 2023, the program has received 90 site applications from 59 customers. Estimates indicate these sites could enable 1,268 ports and 1,280 fleet vehicles and could deploy $22 million in capital, which exceeds the program's allotted budget. These sites have a load potential of 44 MW.

In order to meet customer demand PGE is proposing to decrease incentives by 50 percent and add an additional $ 9.5 million to cover costs of additional sites, meet the demand, and right-size the incentives. While the original pilot estimated we would complete 24 sites at $9 million; current forecasts indicate 56 additional sites with a budget of $9.5 million. In addition to demand outstripping the approved budget, program costs have also been higher than forecast due to inflation and supply chain issues. Specifically, we have seen rising costs of construction (up to 20 percent), professional services (up to 15 percent), and most significantly, cost of equipment (up to 50 percent). The proposed additional budget and extended timeframe will enable PGE to stretch a similar dollar amount across more sites. PGE is working to find the right balance of utility incentives to augment available state and federal dollars that have since become available since the initial launch of Fleet Partner. These additional funds will increase the overall numbers of light-, medium-, and heavy- duty electric fleet vehicles in PGE territory. This expansion would also allow PGE to find enhanced efficiencies for grid planning to serve TE loads and ultimately reduce GHG and air pollutants in our service territory.

In this TE Plan, PGE proposes a budget increase of $9.5 million to this program to accommodate a total of 56 sites over the next two years. Please see Appendix A.2 for additional detail.

6.2.4.3 Heavy-Duty Charging Demonstration Sites (Schedule 53)

Heavy-Duty Charging Demonstration Sites is an approved program that allows PGE to work with a site host to construct a site to provide Medium and Heavy Duty (MHD) EV charging. The program requires both PGE and the site owner to contribute capital to develop a charging site that meets the specific needs of MHD vehicles. These needs include proximity to MHD corridors, high power charging, and pull-through access (as opposed to head-in) to the chargers.

Each site will also have on-site battery storage to provide DR services back to the grid. The batteries at the MHD charging sites will serve multiple use cases: reducing grid demand during peak events, providing charging resiliency to users when outages occur, and adding additional capacity back into the grid through DR.

The program allows PGE to invest up to $5 million per site for development. To date, PGE has partnered with Daimler Truck North American to construct one site: Electric Island, located on Portland's Swan Island. Electric Island has been operational since late spring 2021. PGE learnings include the unique timing, duration, power usage, and impacts to the feeder and broader grid posed by heavy-duty charging, detailed as follows:

- Heavy-duty vehicle charging load profiles differ greatly from light-duty vehicles. Heavy-duty vehicles have much larger batteries and sustain higher charger rates for much longer periods of time.
- Heavy-duty vehicles require much different public site layouts to allow long-chassis vehicles and semi-trucks to successfully maneuver to charging infrastructure.
- Heavy-duty vehicle charging technology is rapidly evolving to accommodate charging rates of 1 MW or more.[183]
- Information on the integration of storage, controls, and on-site solar.
- More granular details from charging data supplied by Daimler Truck North America.

The addition of megawatt charging and battery storage at Electric Island in 2023 will bring additional lessons regarding DR, grid integration, peak/buffering, and grid services.

Charge management, energy storage, and on-site generation can help to alleviate the impact of heavy-duty charging and may avoid or defer potential distribution feeder upgrades. Proper identification and sizing of these non-wires solutions should be considered early in the planning process for heavy-duty charging sites.

OEMs are beginning to produce electric MHD vehicles at greater scale, and PGE is aware of plans and partnerships for heavy-duty charging sites on major freight corridors. For example, PGE participated in the West Coast Clean Transit Corridor Initiative study with 15 other utilities, which

[183] Details on CharIN's Megawatt Charging System: https://www.charin.global/technology/mcs/.

provided a framework by which to develop heavy-duty EV charging along the I-5 freeway. That study concluded that locating MHD charging sites every 50 miles along I-5 was a requirement to enable EV trucking to be conducted along that corridor.

6.2.4.4 Energy Partner (Schedule 26)

Energy Partner Schedule 26 is a custom flex load program designed to provide customers with significant financial incentives for reducing load without significant impact to their operations. This program is focused on custom load curtailment plans for large customers and provides monthly incentive payments during Winter and Summer seasons, as well as event-based incentives for shifting energy consumption during seasonal peak time events.

Commercial operators of EVSE, including Fleet Partner customers, can enroll in the Energy Partner program and earn incentives by decreasing charging load during peak time events. For the load to be successfully lowered, the EVSE would need to be in operation (i.e., plugged in and charging) at the start of the event. Within Energy Partner, customers have options as to how they stop or decrease charging during peak time events including unplugging chargers, deployment of technical hardware for site control, or use of site management software to manage charging.

6.2.4.5 Fleet Total Cost of Ownership Tool

The Fleet Total Cost of Ownership tool is part of the Fleet Partner program that helps customers calculate the difference in TCO of a fleet of electric-fueled vehicles versus that of a fleet of gasoline-fueled vehicles. The tool also helps customers quantify the environmental impact of electrifying that fleet. One of the barriers to fleet electrification is a lack of understanding of the costs to electrify and operate a fleet, and how these costs differ from that of more typical gas-powered fleets. The primary objective of the tool is to overcome this barrier by helping customers understand these costs, allowing customers to model various inputs for vehicles, chargers, and mileage driven.

PGE customers can use the tool on PGE's website. As of April 2023, PGE has received significant positive feedback from customers, who stated that the tool was extremely useful for education and also for informing business cases for fleet electrification. To date, the tool has seen over 2,200 unique visitors and we anticipate it will continue to be highly utilized, helping fleet owners and operators make the transition to fleet electrification.

6.2.4.6 Clean Fuels Credit Monetization (Schedule 328)

PGE's Clean Fuels Credit Monetization program allows PGE to become an aggregator and seller of Oregon Clean Fuels Credits on behalf of our non-residential customers. To participate, the non-residential customer must be a fleet customer located in PGE's service territory and generate Oregon Clean Fuels Program credits. The objective of the program is for PGE to reduce complexity for customers in the process of fleet electrification, helping them offset the costs of EVs, fueling, administrative burden, and other costs of ownership and operation. Because many customers are not prepared to manage and transact Oregon Clean Fuels credits, this offering removes friction in the overall process of fleet electrification for our customers.

Once a customer is enrolled in the program, PGE registers their chargers with the Oregon DEQ, acquires quarterly charging data, uploads it to DEQ's platform, and tracks the resulting Oregon Clean

Fuels Program credits. PGE then aggregates these credits alongside other customer credits and places them for sale in the credit marketplace. As credit sales occur, PGE allocates the appropriate revenue to each customer and sends payment to the customer on a quarterly or annual basis, less a small administrative fee.

The program is self-funding: participating customers are charged an administrative fee designed to cover—but not exceed—the cost to run the program. As of April 2023, the program has not enrolled any customers but has received interest in the service from Fleet Partner enrollees at the beginning of transitioning their fleets.

6.2.4.7 Electric School Bus Fund

The Electric School Bus Fund (ESB) is focused on promoting public school districts' transition to electric school buses. PGE uses revenue from the sale of residential credits from the Oregon Clean Fuels Program to pay for the incremental cost of an electric school bus and to partially fund charging infrastructure. Public school districts wholly or partially located in PGE's service area are eligible to apply. ESB will cover both the incremental cost of electric school buses and also the cost of charging infrastructure. Since 2020, PGE has awarded over $4.9 million in grant funding to purchase 19 electric school buses. With this TE Plan, PGE proposes to continue the ESB Fund through 2025, with a forecasted annual budget of approximately $3.6 million in 2023, $3.0 million in 2024, and $4.3 million in 2025. For more information on the ESB please see Appendix A.4.

6.2.5 Emerging Opportunities

In addition to programs intended to meet the needs of specific customer segments and address the barriers they face, PGE is also engaged in several TE activities to support customers in capturing emerging opportunities and exploring emerging technologies.

6.2.5.1 Matching External Funds

As part of the 2022 PGE Clean Fuels program budget, PGE reserved up to $400,000 to provide matching funds to public agencies, CBOs, non-profits, educational institutions, and other partners applying for TE grant funding opportunities external to PGE. Many federal grant programs require secured matching funds with timelines that do not align with the annual DCF grant cycle. The need for grant matching was identified from feedback from communities and from the increase in federal funding opportunities for electric transportation. If a project to which PGE awards matching funds does not receive the external funds on which the project depends, these CFP funds will revert to the overall DCF funding pool for that year.

6.2.5.2 Emerging Technology Research and Development

PGE funds research and development work on emerging TE technology through Oregon Clean Fuels Program credits. To date, this work has focused on managed charging and V2G technologies in the residential and fleet spaces. V2G technology, which allows chargers to take power from vehicle batteries and backfeed to the grid, has reached the early stages of commercialization. With several V2G products on the market and many more announced from EVSE vendors and vehicle OEMs, PGE has started deploying this technology in residential and commercial demonstration projects in order to better understand its capabilities and limitations.

PGE deployed two V2G demonstration projects in 2021-22. The first is a +/- 6.2 kW Quasar Wallbox Level 2 charger designed to operate with a passenger vehicle with a CHAdeMO charging connector. PGE energized this charger in October 2021 and successfully demonstrated V2G capabilities by drawing power from the connected Nissan LEAF's battery. Further detail can be found in a whitepaper on V2G regulatory and technology challenges enclosed as Appendix F.

PGE is conducting a second V2G demonstration project with First Student, a school bus transportation contractor. This project uses a +/- 60 kW Nuvve DCFC charging a Bluebird Type C bus with a 155 kWh battery. The charger was first installed at a bus yard in Newberg in March 2022 and V2G capabilities were demonstrated in June 2022. The charger was relocated to Sherwood in September 2022, and PGE is working towards testing V2G communications via the IEEE 2030.5 standard.

PGE will test grid support capabilities, network communication efficiency, system response functionalities, and V2G benefits and impacts on the local distribution system. Testing remains in the early exploration phases, but PGE is excited by the potential of V2G to support community resiliency.

PGE is evaluating the next steps required to better prepare for mass adoption of V2G technology. The Smart Grid Testbed program has available funding for continued managed charging. To date, V2G testing has been funded by CFP and we expect it to foster additional V2G deployments within PGE service territory.

6.2.5.3 Micromobility Approach

In 2023 and 2024, PGE intends to undertake work to better understand the micromobility market. PGE will evaluate customer needs and barriers to adoption in addition to the role a utility has in the micromobility market. We will then work to define a micromobility strategy for the company's activities and potentially develop programs and approaches in accordance with that strategy.

This work is funded by revenue from residential credits from the Oregon Clean Fuels Program.

6.2.6 Other TE Activity

In addition to programs designed to meet customer needs, PGE is engaged in several other activities critical to preparing for the future that TE promises. Since these activities are conducted as part of PGE's base business, their budgets are not included in this TE Plan's budget.

6.2.6.1 PGE Workforce Development

PGE believes the clean energy transition must be equitable and inclusive. PGE has committed to attract and retain employees from underrepresented populations and to increase our purchase of goods and services from small businesses including those that are minority-, women-, and veteran-owned.[184] This commitment is increasingly important with new technologies such as TE since we will

[184] For additional detail on PGE's Workforce Development efforts, see PGE's *Diversity, Equity & Inclusion* webpage: https://portlandgeneral.com/about/who-we-are/diversity-equity-and-inclusion.

want to provide access and opportunities for underrepresented populations to be a part of the workforce supporting this growing industry. PGE has committed to the utilization of union employees and contractors on all TE infrastructure; this includes a focus on providing family wages, healthcare, and apprenticeship opportunities to continue to build the needed workforce pipeline of the future.[185]

To meet the growing demand within the TE space, PGE has begun to establish some TE specialty within our Utility Operations organization. We have worked with IBEW Local 125 and Local 48 to ensure we have the appropriate agreements, training, and safety measures in place to conduct operations and maintenance activities on all PGE-owned and customer (where appropriate) charging infrastructure. Today this team manages approximately 175 public, workplace, and transit charging ports across 38 locations including remote monitoring, testing, inspection, and repair services. PGE expects this team will be critical in ensuring the reliability of charging for customers as deployed programs and infrastructure continue to grow.

To date, lessons learned include:

- Public DC fast charging technology is still evolving and requires a high level of support to provide reliable performance. Technology continues to improve, but robust maintenance strategies and OEM service agreements are required.
- Industry-wide safety practices are continuing to evolve. Some third-party technicians may have varying levels of experience with industrial electrical equipment. In response, PGE is developing our own safety plan and practices specific to charging infrastructure for all internal and third-party staff to follow when servicing PGE-owned equipment.
- An industry-wide shortage of trained service technicians can impact equipment uptime as known issues wait for repair.

6.2.6.2 Statewide Workforce Development

In 2022, PGE convened the Oregon Clean Energy Workforce Coalition, a statewide coalition of a diverse group of stakeholders whose mission is to build equitable and inclusive workforce pathways that adapt to meet the needs of the changing clean energy electric sector. This broad coalition represents utilities, pre-apprenticeship programs, building trades, education, CBOs, renewable energy developers, environmental justice organizations, workforce investment boards, state agencies, environmental organizations, local governments, and policy makers. The coalition includes an Electric Transportation subcommittee to identify the necessary skills and pipelines to ensure a robust workforce to support the deployment of EVs throughout the state. The coalition will seek to secure grants and other funding streams to support the long-term objectives identified in the Oregon Clean Energy Workforce Coalition's strategic plan.

[185] PGE's commitment to utilize union employees and contractors for TE infrastructure is detailed in the *PGE Responsible Contractor Policy: Energy Generation and Storage*, retrieved from: https://assets.ctfassets.net/416ywc1laqmd/2IdhkLbGJkNwtpmNr2GVgf/76b6ca32adfb989565cf95ecd8c1d00c/Responsible_Contractor_Policy.pdf.

6.2.6.3 PGE Fleet Electrification

Though PGE's own fleet electrification is not part of the 2023 TE Plan decision request of the Commission, we share the following:

PGE has set goals to electrify 100 percent of its forklifts and Class 1 light-duty vehicles by 2025, and also a 2030 goal to electrify over 60 percent of its fleet. To help achieve those goals, PGE is deploying EV make-ready infrastructure at its facilities to support the installation of EV chargers as electric fleet vehicles are purchased. Make-ready infrastructure is already complete at five facilities, with five more sites currently being designed. PGE has selected the charging hardware provider (Level 2 and DCFC) for its light-duty fleet chargers. PGE plans to install over 100 Level 2 ports and 8 DC fast charging ports by the end of 2023 to support its fleet electrification efforts. PGE is currently in the process of evaluation and selection for a charging hardware provider (Level 2 and DCFC) for its fleet chargers. PGE estimates approximately 300 Level 2 ports and 50 DC fast charging ports will be needed by the end of 2025 to support its fleet electrification efforts.

Learnings from this project include that it is critical to engage a knowledgeable and experienced technical consultant or engineering firm on make-ready infrastructure design. There are many advantages to a future-proof infrastructure design accounting for future EV demand[186], but it also comes with challenges in creating flexibility and accommodating changing charging technology. Through this process, PGE has found a reasonable balance which has been incorporated into our EV charging programs.

Supply chain delays have affected construction scheduled and cost which have also created logistical challenges (e.g., construction at an active line center). PGE's experience with electrifying our fleet has provided insights which are passed along to our customers electrifying their fleets.

6.3 Portfolio Expansion, 2023 2025

This section describes proposed activities to address needs in the residential, commercial, and fleet sectors, and concludes with an assessment of the impact on the competitive EVSE market.

6.3.1 Residential Customers

6.3.1.1 Residential EV Rate

A residential EV rate is one method to support grid management by using price signals to encourage off-peak charging for customer home charging. charging. PGE is analyzing whether an EV-specific Time of Use rate is warranted, or if our Time of Day rate is the best approach to direct residential customers to charge their EVs during off-peak hours. Customers would need to demonstrate that they own an EV in order to sign up for the Residential EV Rate and would also have the option of enrolling in Residential Smart EV Charging.

PGE is in the early phases of considering a Residential EV Rate and is not proposing a tariff within this TE Plan.

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[186] Examples of future-proofing electrical infrastructure design for future EVs include a standard design for concrete EV pads that can accommodate any type of L2 charger, sizing electrical capacity for future EV power needs, or preparing conduit for later connection in areas where power will be needed for future EVs.

6.3.1.2 Infrastructure Measure: Public Charging - Municipal Charging Collaboration

Public Charging - Municipal Charging Collaboration is an approach wherein PGE designs, owns, operates, and maintains EV chargers in the ROW and on public property. PGE deploys this infrastructure in collaboration with public entities such as municipalities, regional governments, school districts, counties, and state government. The pilot version of this program was approved by the OPUC in October 2022 as part of PGE's 2022 Monthly Meter Charge Budget and included funding for 60 Level 2 Pole Chargers.[187] PGE's 2023 Monthly Meter Charge Budget, approved in April 2023, included funding for an additional 100 Level 2 Pole Chargers.

In the scaled-up version of this approach proposed as part of this TE Plan, PGE will install an additional 80 utility pole-mounted or curbside pedestal Level 2 chargers in its service territory, for a total of 240 L2 Public Charging Ports under this program. PGE will collaborate with public entities and communities in its service territory to identify the best locations to install chargers. Our priority is to install chargers within underserved communities as they are least served by the existing market and would benefit the most from the switch to electric transportation. During the 2023-2025 funding cycle PGE will also attempt to find a market partner interested in owning these chargers or assisting PGE with our charger development as part of this program activity.

The overall budget for this three-year program is $11.5 million, and the infrastructure measure application is found in Appendix C.1.

6.3.2 Commercial Customers

6.3.2.1 Commercial EV Rate

PGE is contemplating a Commercial EV Rate to encourage grid-friendly EV charging among commercial customers including multi-family, public charging sites, and fleet sites. Demand charges are often a deterrent to commercial customer adoption of EV charging due to the low overall utilization of EV chargers combined with the significant power draw when used simultaneously. While customers with loads of less than 200 kW can use PGE's Schedule 38 to avoid demand charges, no comparable rate exists for customers with more than 200 kW of load.

PGE envisions a Commercial EV Rate for non-residential customers with separately metered on-site EV charging greater than 200 kW. These non-residential customers could include fleets, heavy-duty charging stations, retail, multi-family dwellings, and workplaces. The vision is to develop a rate to support TE by lowering TCO and offering lower rates for charging during off-peak hours. PGE will explore options such as TOU Rates, tiered rates, and subscription rates. PGE's intention is to offer this rate on a cost-of-service basis, with no resultant cost shift between customer classes.

PGE is still in the early phases of developing the Commercial EV Rate and does not propose an associated tariff with this TE Plan.

6.3.2.2 Infrastructure Measure: Business and Multi-family Make-ready Solutions

PGE's proposed Business and Multi-family Make-ready Solutions expand charging access for current and future EV drivers by supporting commercial installation of public or "semi-public" EV charging including multi-family locations, workplaces, retail locations, destination centers, schools, and houses

[187] Decision approving 2022 MMC Budget: https://apps.puc.state.or.us/edockets/orders.asp?OrderNumber=23-147. Oregon Public Utility Commission, Order No. 22-381, Oct. 18, 2022. Retrieved from https://apps.puc.state.or.us/orders/2022ords/22-381.pdf

of worship. “Semi-public” EV charging is defined as charging that may be restricted to certain groups as allowable by law (e.g., employees or multi-family residents) but is not intended to support vehicles owned by the business (such as fleet vehicles).

This program intends to address the multi-family property owner and developer barrier: few incentives to install EV charging for residents, and even fewer to install the type of right-sized, future-proofed (assuring the make-ready infrastructure has capacity to meet expansion at the site), networked, and DR-capable EV charging that will be required for widespread EV adoption. This solution extends two major benefits of driving electric not widely available to multi-family residents today: the convenience of home charging and affordability of electricity as a “fuel”. These barriers are exacerbated for low-income customers and other underserved communities, which comprise a significant portion of the multi-family market.

For customers participating in the program, PGE proposes to design, install, own, and maintain electrical infrastructure behind-the-customer-meter to support 200 customer installed, owned, and maintained EV chargers at approximately 35 different locations. This approach leverages PGE’s expertise in service design and installation and relieves customers of the logistical burden of managing these projects. Customers can install EV chargers from a pre-qualified list and receive a rebate for a portion of their costs. For its part, PGE will receive charging session data to better understand the grid impacts of EV charging and plan for more widespread passenger vehicle fleet electrification in the future. The data and experience gathered during the 2023-2025 program activity will be used by PGE to develop rates and tariffs. We will also explore program designs to enable EV adoption in underserved communities in a scalable way.

The overall budget for this three-year program is $7.1 million and the infrastructure measure application is found in Appendix C.1.

6.3.3 Business and Multi-Family Customer Programs: Portfolio View

PGE’s envisioned business and multi-family portfolio of infrastructure measures presents customers with a menu of options, empowering each to select the program design that best meets their needs as they install L2 charging. The following table demonstrates how these programs fit together:

Table 23. Business and Multi-Family Level 2 Infrastructure Portfolio

Infrastructure Measure	2023 Multi-family, Commercial Workplace Make-Ready	2024-2025 Multi-family Make-Ready
Eligibility	Multi-family sites in underserved communities; any commercial or workplace locations. Minimum 8 ports	Multi-family sites in underserved communities. Minimum 4 ports
Ownership and Management	Customer installs, owns, maintains EVSE; PGE manages site design; installs and owns PGE- and customer- side make-ready	Customer installs, owns, maintains EVSE; PGE manages site design; installs and owns PGE- and customer- side make-ready

Infrastructure Measure	2023 Multi-family, Commercial Workplace Make-Ready	2024-2025 Multi-family Make-Ready
Incentives	Make-ready incentive of $17,000 per port Charger incentive for commercial public and workplace: $1,000 per port Charger incentive for multi-family: $2,300 per port	Make-ready incentive of $17,000 per port Charger incentive for multi-family: $2,000 per port

6.3.4 Fleet Customers

6.3.4.1 Fleet Partner Phase 2 Expansion

PGE proposes to expand the Fleet Partner pilot through 2025 to continue support for our fleet customers by reducing the cost and complexity associated with transitioning to electric "fuel". The core of the program will remain the same: we will continue to provide planning and technical assistance for fleet electrification as well as custom cost incentives for the make-ready infrastructure. However, considering the high demand for the program and the entry of state and federal incentives/grants in this space, we propose a reduction in the maximum incentive from $750,000 to $400,000 and also a 50 percent reduction in incentive levels. Likewise, we are reducing coverage of site costs from an average of 74 to 38 percent. The program will continue working towards creating a network of DR-enabled EV charging that can support both efficient grid operations and future renewables integration and collecting data that will help inform a more traditional rate and tariff structure for make-ready in the future. See Appendix A.2 for further details.

6.3.4.2 Fleet Managed Charging

PGE anticipates the need for fleet managed charging solutions to address both fleet and grid management. The proposed solutions are still in a research and development stage. PGE is looking to define flexible load programs that may incorporate a variety of strategies. One path could be time of use rates and/or incentives for customers to charge during certain times. We are also researching Automated Load Management technologies to help customers install more chargers to sites without needing expensive infrastructure upgrades and also connect to energy storage systems and solar. These future flex load programs will also look to integrate V2G and DR with our VPP either through the charger, the vehicle telematics, or both. PGE's primary objectives are to support electrification and create DR-enabled EV charging to support both an efficient grid and the integration of renewables.

6.4 Impact on Competitive EVSE Market

Utilities have an obligation to serve all customers, not just those with the most profitable use cases, and we have designed our TE plan with this in mind. In some cases, this means customer ownership of EVSE, while in others it means utility ownership. The breadth and speed required for the EV transition requires an "all-of-the-above" approach.

Utilities play a central role in advancing TE regardless of who owns the EVSE. Utilities are well-positioned to facilitate charger deployment for both public and business entities by reducing the cost of make-ready infrastructure, providing equipment rebates, and valuing the flexibility that EVs can provide to the grid. PGE's TE Plan seeks to enable businesses, charging networks, governments, and non-profits to deploy EV charging, supporting all customers in the transition to electric "fuel".

In recent years, the Oregon Legislature has provided statutory guidance regarding how electric utilities can assist in the TE transition and play a larger role in enabling deployment of EV charging. In House Bill 2165[188] (2021), the Legislature amended ORS 757.357 and clarified that utilities could invest in and receive a return on infrastructure measures including both investments in the distribution system and investments for behind-the-meter electrical infrastructure. The statute provides that the OPUC must evaluate infrastructure measure investments differently from broader TE programs, which for purposes of the statute, are TE investments and expenditures other than an infrastructure measure. While TE programs are to be evaluated through a six-part list of considerations, including whether a utility program is "reasonably expected to stimulate innovation, competition and customer choice in electric vehicle charging," infrastructure measures have different considerations. The Legislature instead added a much narrower provision focused on allowing customers to choose their charger, subject to equipment prequalified by the utility.

PGE values a robust and competitive market for EVSE amongst both network service providers who provide the back-end software services for networked EVSE and also charger operators in the business of owning and operating EVSE. We also believe there is an important place for utility ownership of EVSE, particularly in areas where the private market has not overcome market barriers such as EV charging that is provided to underserved communities.

The balance of PGE's proposed TE portfolio—both in terms of budget and in terms of ports proposed—is focused on program delivery models where the EVSE is owned by the customer. Examples include make-ready approaches, where PGE proposes to own the make-ready infrastructure but not the EVSE itself, and also grants and rebates, where PGE supports a customer in purchasing an EVSE that meets certain technical standards. Such programs include Fleet Partner, Heavy-Duty Charging Demo Sites, Business and Multi-family Make-ready Solutions, Business EV Charging Rebates, the Drive Change Fund, the Electric School Bus Fund, and Residential Smart EV Charging. These models lower customer barriers to adoption of EVSE, spur the competitive market, and give customers a great deal of choice amongst competing companies to find the hardware and software package that meets their business or personal needs.

When paired with PGE's product qualification process, these program delivery models give customers confidence they are purchasing high-quality products. Additionally, this product qualification process gives stakeholders, regulators, and customers confidence that customer funds are being prudently deployed to support charging infrastructure that is both networked, DR-capable, and appropriately accessible for the use case. PGE intends to keep its existing product qualification process open for the duration of this TE Plan to ensure we continue to support this competitive and evolving market.

In program delivery models where PGE proposes to own EVSE (e.g., Public Charging - Municipal Charging Collaboration and Business and Multi-family Make-ready Solutions) we aim to fill the current gaps in the competitive market that have led to inequitable access to EVs, EV charging, and clean transportation in general. These program delivery models consider and include equity throughout their program design, from choice of collaborator and charging type to siting, accessibility, and driver

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[188] See ORS 757.357: https://oregon.public.law/statutes/ors_757.357.

pricing. Products will be selected through a competitive RFP process to enable PGE to pursue the best commercial terms on behalf of our customers. Further, PGE will seek to develop partnerships for EV charger ownership as well as operations and maintenance.

Importantly, this TE Plan does not include a proposal for PGE to own—or even support through incentives—a majority of the charging ports that will be needed by 2025. The below charts demonstrate how PGE's involvement impacts the market for public and workplace charging. Using ODOT's TEINA methodology and adjusting for PGE's internal EV adoption forecast from AdopDER, PGE's service area will need 6,755 public/workplace L2 ports and 2,008 public DCFC ports by the end of 2025. These charts show how currently installed ports, current and envisioned PGE programs, and other potential funding sources support these needs.

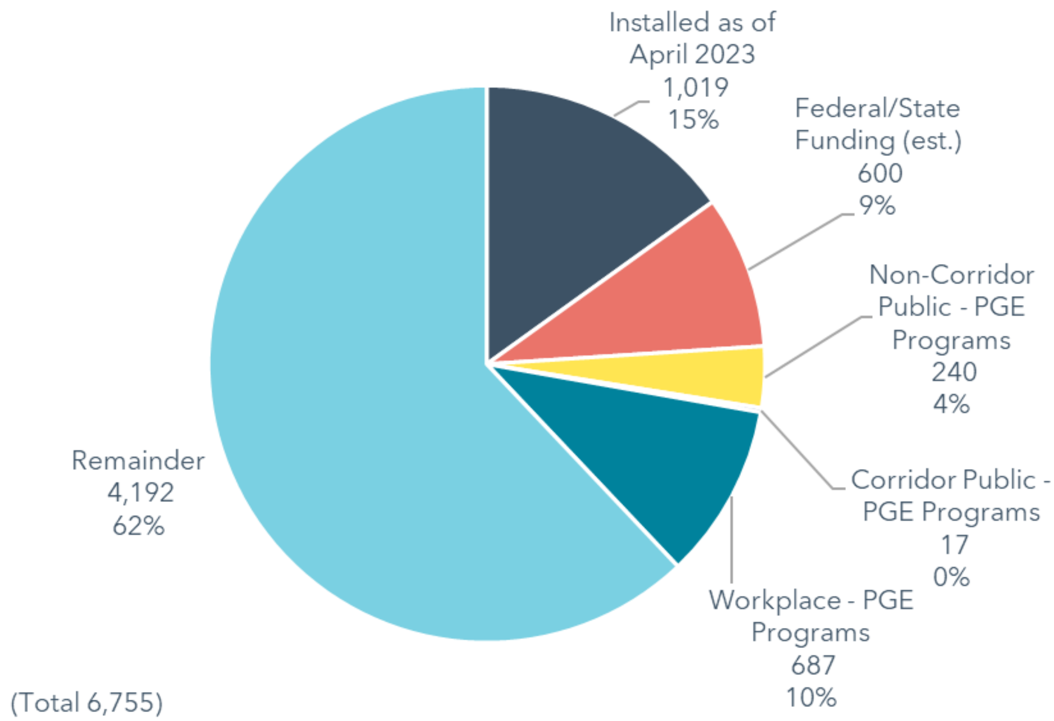

Chart 9. Estimated Public/Workplace L2 Ports Needed in PGE Service Area by 2025

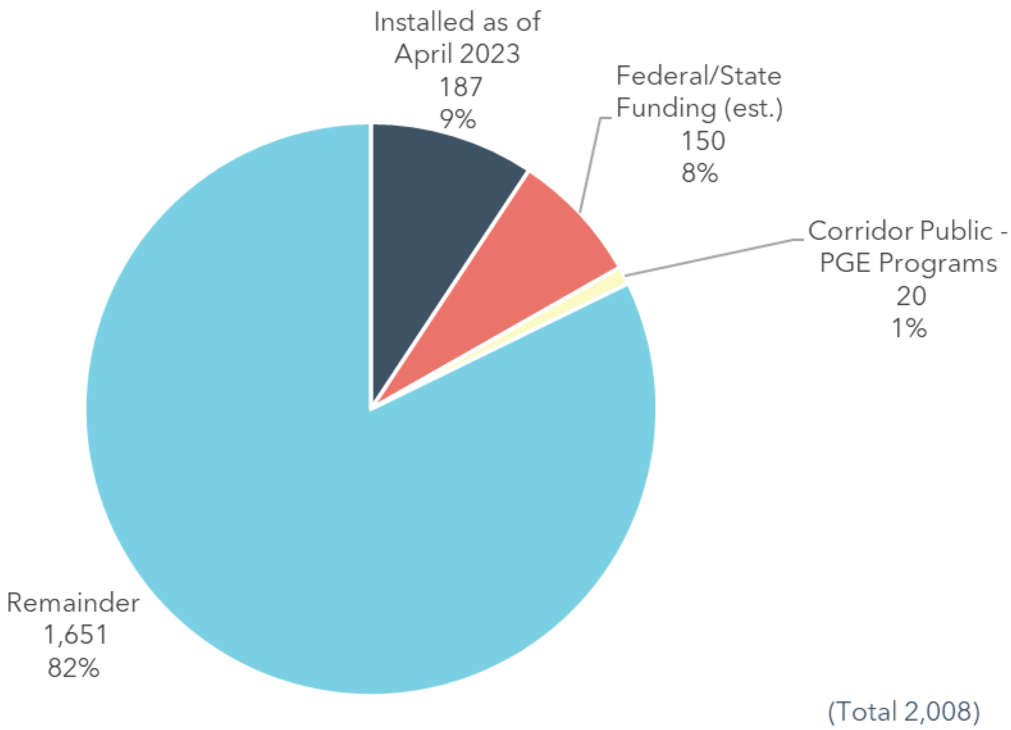

Chart 10. Estimated Public Direct Current Fast Charge Ports Needed in PGE Service Area by 2025

The significant portions of the charts that are not part of PGE's TE Plan, in addition to the areas where customers will own chargers and have choices as to their hardware and software vendor, indicate the depth of competitive choice within the EVSE market supported by this Plan. A similar dynamic is applicable within PGE's residential and fleet programs, where PGE does not propose to own chargers and where we offer customer choice from a Qualified Product List.

Chapter 7. Portfolio Performance Areas

New administrative rules from the OPUC are designed to help the Commission and stakeholders comprehensively review TE Plan outcomes and impacts. PGE is pleased to present the following discussion of how this portfolio of activities holistically advances the portfolio performance area categories below, including tracking and forecasting of specific metrics as required by OAR 860-087-0020. The portfolio performance area categories established in these rules include:

- Environmental Benefits and GHG Emissions Impacts
- EV Adoption
- Underserved Community Inclusion and Engagement
- Equity of Program Offerings
- Distribution System Impacts and Grid Integration Benefits
- Program Participation and Adoption
- Infrastructure Performance including charging adequacy, which considers but is not limited to reliability, affordability, and accessibility

In this chapter, we discuss each portfolio performance area category in turn.

7.1 Environmental Benefits and GHG Emissions Impacts

The transportation sector is responsible for nearly 40 percent of the greenhouse gas emissions in Oregon and is the largest source of such emissions[189]. Transportation is also responsible for significant air pollution including particulate matter (PM2.5), sulfur dioxide (SO_2), and nitrogen oxide (NOx)[190]. The transition to electric transportation reduces both greenhouse gas emissions and air pollution over time, as EVs benefit from the energy efficiency of electric motors over internal combustion engines. Emissions related to electricity are also lower than those from gasoline/diesel because the source of that electricity (power generation plants) employ pollution and other control systems and generate electricity from both lower-emitting fuels such as natural gas as well as non-emitting sources such as hydropower, wind, and solar. PGE's work to support our customers' switch to electric vehicles will reduce both greenhouse gas emissions and non-GHG local air pollutants. Table 24, below, shows the estimated GHG emissions reductions from EVs that are registered in PGE's service area as of year-end 2022, assuming that each of these is replacing a comparable internal combustion engine vehicle that would otherwise be on the road.

[189] Oregon Global Warming Commission (2020). *Biennial Report to the Oregon Legislature*. Retrieved from https://static1.squarespace.com/static/59c554e0f09ca40655ea6eb0/t/5fe137fac70e3835b6e8f58e/1608595458463/2020-OGWC-Biennial-Report-Legislature.pdf.
[190] PGE will present these criteria pollutant reductions in a future filing.

Table 24. Estimated GHG Emission Reductions from EVs Registered in PGE Service Territory in 2022

Vehicle Type	Vehicles in PGE's Service Area	Estimated Annual Miles Driven[191]	Estimated Annual Reduction in CO_2e (metric tons)
Light Duty (LDV)	40,481 EVs	443,995,608 annual miles	117,428 metric tons
Medium Duty (MDV)	247 EVs	5,228,496 annual miles	5,881 metric tons
Heavy Duty (HDV)	15 EVs	941,265 annual miles	357 metric tons
Total	40,743 EVs	450,165,369 annual miles	123,666 metric tons

To estimate the forecasted GHG emissions reductions from EVs registered in PGE's service area, PGE started with the number of EVs in our service area at the end of 2021. For LDVs, we used the residential registration counts provided by DEQ for the calculation of CFP credits. For MDVs and HDVs, we used PGE's analysis of DMV registration data used for our AdopDER forecast model. For each EV, we assumed that it displaced a comparable ICE vehicle. We also assumed that each EV drove the same number of miles that the ICE vehicle would have driven—namely, the average number of residential miles driven per vehicle in Oregon (from Federal Highway Administration data) for LDVs; and the average number of MDV miles driven nationally (from National Transportation Energy Data Book data) for MDVs.

We assumed a 10-year future life of each vehicle, starting in 2021. We applied vehicle energy economy assumptions to determine the number of kWh consumed, and the number of gallons of gasoline displaced (or diesel, for MDVs) based on the number of miles driven. We used constant values for the carbon intensities of gasoline and diesel and assumed a linear reduction in the carbon intensity of PGE's delivered mix from the 2021 value (0.32 MT/Net MWh) to zero in 2040. The annual reduction was calculated by dividing the 10-year benefit by the number of years.

7.2 EV Adoption

PGE's TE portfolio is designed to meet the needs of PGE customers across a variety of vehicle sizes, use cases, and charging needs. PGE expects additional investment is needed to meet market needs. The question of who makes these investments and the role of the utility in each use case will be answered by the market over the coming years. At present PGE's position is that the utility must plan for, serve, and manage the load. As discussed in detail in Section 3.6, there remain numerous variables over which PGE lacks control.

[191] Estimated Annual Miles Driven based on 10,968 annual miles driven per LDV (2022 Federal Highway Administration Data); 21,168 annual miles driven per MDV (National Transportation Energy Data Book); 62,751 annual miles driven per HDV (U.S. Department of Energy).

In its 2019 TE Plan, PGE reported the following EV adoption forecast for the period through this TE Plan:

Table 25. PGE Service Area EV Forecast by Vehicle Type (Reference Case), 2019 TEP[192]

Vehicle Type	2020	2025
Light Duty (LDV)	28,000	99,000
Medium Duty (MDV)	20	500
Heavy Duty (HDV)	10	200
Total	28,030	99,700

While not specified in the 2019 TE Plan, the reference case forecast for LDV EVs in PGE's service area by 2021 was 33,637, while the actual number at the end of 2021 was 30,458. As of December 31, 2022 the number of residential LDV EVs in PGE's service area was 40,481.[193]

See Section 3.3.1 for PGE's new adoption forecasts based on updates accounting for the IRA and new state-level policy and market changes.

7.3 Community Engagement

Outreach tends to be short-term for the purpose of informing others. Engagement is long-term and is predicated on trust-building and relationship-development, and reflects the diversity of community members, particularly those impacted by a program project or decision. Potentially affected community groups may not typically participate in regulatory processes or our TE Plan workshops. Given the importance of transportation electrification to our customers, we are focused on longer-term engagement as we recognize the need to go beyond short-term outreach to these underserved communities as defined by HB 2165. Section 4.1.1 details PGE's short-term needs assessment focused on underserved communities.

The following section illustrates PGE's long-term engagement with underserved communities. This engagement will include other forms of electrified transportation such as micromobility and electric-powered public transit. Specifically, PGE's goal is to integrate underserved communities' needs and wants into the implementation and future planning of TE programs. We want to create multiple avenues for stakeholder feedback to address the fact that underserved communities are underrepresented by traditional avenues such as stakeholder workshops. PGE understands that we must engage more purposefully with underserved communities to get their feedback. Additionally, we seek to strengthen relationships with community partners, help improve understanding of TE among communities, listen to feedback, and refine TE development. The long-term engagement

192 Navigant. *Distributed Resource and Flexible Load Study*. Filed as part of PGE's 2019 IRP, page 465. Retrieved from https://downloads.ctfassets.net/416ywc1laqmd/6KTPcOKFlLvXpf18xKNseh/271b9b966c913703a5126b2e7bbbc37a/2019-Integrated-Resource-Plan.pdf.

193 Source: Oregon DEQ.

strategy of underserved communities, discussed in detail below, will build stronger relationships to better serve customers.

In discussions on how best to engage, stakeholders encouraged PGE to include community group capacity-building[194] in our TE planning. In this context, capacity-building means providing long-term support and compensation for their time and contributions, and also building up their understanding of utility regulatory process so they might participate in additional OPUC engagements. We plan to execute this strategy as follows:

- Adopt the best practices co-developed with community-based and community-serving organizations leading up to the recent DSP I and II filings.
- Leverage the PGE Community Engagement Framework[195], the Greenlining Institute's Mobility Equity Framework[196], and the City of Portland's POEM framework[197] (a local guide to equitable mobility) to guide our work.
- Commit to an iterative approach that will lean on the guidance and expertise of a local, minority-owned and -led third-party facilitator which we will hire through the in-progress RFP process for long-term engagement work.
- Convene a TE community working group for sessions 2 or more times per year to delve into programs at various stages. These work group sessions will focus on gaining specific feedback to make program implementation and future planning more accessible and equitable.
- Compensate individuals for their participation using funds from the HB 2165 Monthly Meter Charge and the Oregon Clean Fuels Program.

7.3.1 Long-Term Engagement with Underserved Communities for Transportation Electrification

PGE is in the process of contracting a consulting firm to support long-term engagement with underserved communities for Transportation Electrification. This work builds upon what communities have already provided PGE and seeks to invite a deeper understanding of the TE needs of individuals within underserved communities. It is one of many ways in which PGE can build a stronger understanding of the diverse needs of individuals, and substantial, long-term relationships with these communities.

PGE aims for an initial three year engagement strategy to better understand long-term customer needs within underserved communities when it comes to TE offerings that support EV adoption and charging, as well as other forms of electrified transportation. Specifically, we plan to integrate

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[194] National council of Nonprofits define capacity building as, "an investment in the effectiveness and future sustainability of a nonprofit." https://www.councilofnonprofits.org/tools-resources/what-capacity-building.
[195] PGE Community Engagement Framework used by PGE's DSP team who hosted a multi-year engagement process with stakeholders and community partners https://assets.ctfassets.net/416ywc1laqmd/1wLNK2VjxZdnWiPSf5wvxf/f34e9939bd4cde85bb36d524b6a0177d/PGE_Community_Engagment_Report_7.20.21.pdf.
[196] Greenlining Institute's Mobility Equity Framework elevates values of social equity and community power and addresses structural inequalities through a process for all stakeholders in program and project creation. For additional detail, see: https://greenlining.org/wp-content/uploads/2019/01/MobilityEquityFramework_8.5x11_v_GLI_Print_Endnotes-march-2018.pdf.
[197] More of the City of Portland's POEM work is retrieved from https://www.portland.gov/transportation/planning/pricing-options-equitable-mobility-poem

underserved communities' wants and needs into the design, build, implementation, and modifications of TE programs. We want to create multiple avenues for feedback to address barriers to TE. Additionally, we seek to strengthen relationships with community partners, help improve understanding of TE among communities, listen to feedback, and adjust programming.

This engagement entails one community-centered working group with members representative of the HB 2165 definition of underserved communities. This working group will be provided awareness and knowledge-building opportunities intended to increase understanding of TE and associated energy and utility concepts ahead of and in preparation for PGE eliciting feedback. The working group members will be asked for a 2-year minimum commitment to ensure long-term engagement (3 years total) for this work.

Engagement with underserved communities will be a continuous process that informs the development and implementation of TE programs and will continue to be reflected in our TE Plan and program filings.

7.4 Equity of Program Offerings

PGE has made several adjustments to address equity in our TE program offerings based on short-term outreach findings from underserved communities. For example, the Business and Multi-family Make-ready program will include more targeted outreach to underserved communities, a higher rebate amount for multi-family dwellings, and the ability for customers to reserve rebate funds in advance of charger installation.

One example of PGE's targeted outreach to underserved communities is our TE Community Working Group. This engagement is enabled by CFP funds and facilitated by a local, minority-owned and -led third-party implementer and reflects a strategy to solicit input directly from underserved communities on TE programs and infrastructure measures. While the working group is designed to build capacity with a consistent group of individuals from underserved communities defined by HB 2165, the agreement with the facilitator allows for targeted focus groups for input on specific activities. For example, a focus group of low-income renters could provide specific input on the multi-family and municipal charging. As individuals have intersecting identities, the working and focus groups may have participants who bring the lived experience from one or more of the underserved communities defined by HB 2165. For a more detailed list of changes made to programs due to results from the short-term outreach from underserved communities, please see Section 4.1.3.

PGE is making a concerted effort to ensure that the TE programs presented in this filing reflect our commitment to serving underserved communities. This is demonstrated by the fact that, as illustrated in the below table, the portfolio has allocated over half of the funding to benefit underserved communities:

Table 26. Forecasted Program Funding Allocations that Benefit Underserved Communities

Program	Total Program Funds ($)	Funds to Underserved Communities ($)	Funds to Underserved Communities (%)
Business & Multi-family Make-ready Solutions	$7,130,930	$5,348,198	75%
Business EV Charging Rebates	$2,788,728	$1,059,717	38%
CFP Administration	$3,622,612	$1,811,306	50%

Program	Total Program Funds ($)	Funds to Underserved Communities ($)	Funds to Underserved Communities (%)
CFP Education and Outreach	$4,528,265	$2,264,132	50%
CFP Emerging Tech	$2,264,132	-	0%
CFP Grants and Infrastructure	$30,227,701	$24,182,161	80%
EV Ready Affordable Housing Grants	$1,000,000	$1,000,000	100%
Fleet Partner Pilot	$18,117,273	$3,623,455	20%
Heavy Duty Charging Pilot	$3,620,453	$1,810,226	50%
Portfolio Support	$2,686,500	$1,343,250	75%
Public Charging - Municipal Charging Collaboration and Electric Ave	$11,553,995	$8,665,496	50%
Residential Smart Charging Pilot	$6,492,722	$3,246,361	50%
Total Portfolio, 2023-2025	$94,033,310	$54,354,301	58%

The following table enumerates targeted actions that PGE is undertaking, or will undertake through our TE activities to address key barriers to underserved communities:

Table 27. How TE Activities Will Deliver Benefits to Underserved Communities

Program	Targeted Action	Key Barrier(s) Addressed/Removed	Demographic Addressed
Heavy Duty Charging	After site selection: education about site implications to neighboring communities (air and noise quality)	Education/awareness and air/noise quality	All underserved communities, particularly communities adversely affected by poor air quality
PGE Clean Fuels programs	Education and outreach: long-term engagement to underserved communities funded through PGE Clean Fuels revenues.	Education/awareness/integration of wants and needs of underserved communities	All underserved communities
	Emerging Tech: Funding of e-micromobility program	Financial barriers, program for non-drivers	All underserved communities
	Grants and Infrastructure: outreach to and prioritization of underserved communities in grants evaluation	Education/awareness of grants available and financial barriers	All underserved communities
Public Charging - Municipal Charging Collaboration	Partner with municipalities to communicate effectively with underserved communities	Education/awareness/ integration of wants and needs of underserved communities	Underserved communities where chargers are installed

Program	Targeted Action	Key Barrier(s) Addressed/Removed	Demographic Addressed
	More targeted outreach and education on how to use a pole charger	Education/awareness	Underserved communities where chargers are installed
	More targeted outreach and education on Schedule 50	Education/awareness	Underserved communities where chargers are installed
Fleet Partner	More outreach to transit agencies, school districts, and other fleets in underserved communities: Fleet Electrification and Fleet Partner	Education/awareness of program	Fleets in underserved communities
	Communications and outreach events for general fleet electrification whenever a project is completed	Education/awareness and air/noise quality	Communities where infrastructure is built
	Tracking percentage of infrastructure built in underserved communities	Prioritization of underserved communities to help improve air and noise pollution	All underserved communities, particularly communities adversely affected by poor air quality
Business and Multi-family Make-ready Solutions	Tiered incentives for workplace, public, and multi-family sites	Financial barriers	Multi-family residents and those who rely on public charging
	Committing 70 percent to multi-family sites and 30 percent to public and workplace (half of this is underserved)	Higher accessibility of make-ready for underserved communities	Multi-family residents and those who rely on public charging
	Working with CBOs to conduct outreach to and assist in identifying potential MDF locations. E.g., TE Community Working Group could provide direct input underserved communities to inform this activity	Education/awareness and capacity	Underserved communities: low- and moderate-income communities, residents of multi-family housing.

Program	Targeted Action	Key Barrier(s) Addressed/Removed	Demographic Addressed
	Lowering minimum ports required for underserved multi-family sites	Higher accessibility of make-ready for underserved multi-family sites	Underserved multi-family sites
	Education/awareness directly at multi-family in underserved communities	Education/awareness and capacity	Underserved multi-family sites
Residential Smart EV Charging	More targeted outreach to underserved communities E.g., Using underserved community mapping to focus our outreach to those areas, as well as work with a focus group of underserved community members around the residential smart charging program	Education/awareness of available incentives	Underserved communities
	Exploration of point-of-purchase rebates vs post-purchase rebates	Upfront financial barriers	Underserved communities
	Higher rebate amount for income-eligible customers	Financial barriers	Low- and moderate-income communities
	Increased income eligibility from 80 percent of area median income to 120 percent of state median income	Financial barriers	Low- and moderate-income communities
	Provide support through the installation process	Support/guidance throughout process	Underserved communities

Tracking impacts on underserved communities begins with understanding where these communities are located. At present, PGE is developing a suite of mapping and analytical tools to better understand underserved communities (as defined in HB 2165) within our service area. These tools will provide a set of geographic, demographic, socioeconomic, and environmental data to aid our program planning for these communities.

To begin, PGE has developed a service territory map of underserved communities. To develop the map, PGE reviewed the HB 2165 definitions for underserved populations and analyzed various possible datasets for each category.[198] We developed an estimate of the number of PGE premises within each census tract where residents met at least one of the HB 2165 criteria. We then determined what percentage of premise IDs within each census tract were part of an underserved community based on that minimum threshold. Figure 17, below, shows the results by census tract, with higher proportions of underserved communities in darker blue and lower proportions of underserved communities in lighter blue.

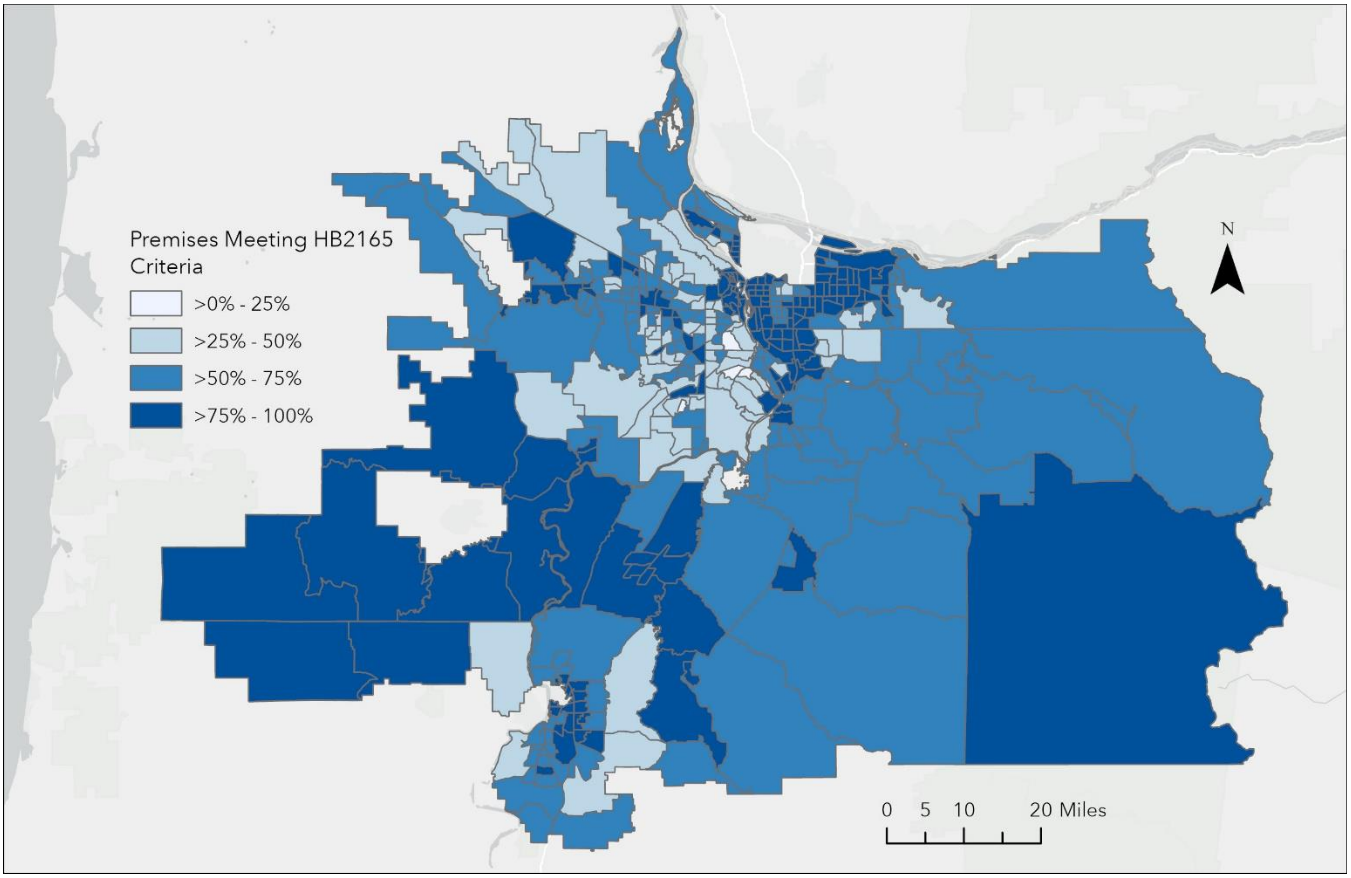

Figure 17. HB 2165 Underserved Communities within PGE's Service Area

This map and the underlying data will enable us to evaluate how many underserved customers each program has served.

Additionally, we assessed the overlapping nature of many of these indicators by developing a composite map, allowing us to identify which census tracts score highly under multiple HB 2165 criteria. This more nuanced view will allow us to better understand where to target certain programs based on the number of community members who may experience even greater barriers to EV adoption and access to charging than looking at each criterion in isolation. For example, the Business and Multi-family Make-ready Solutions program needs to locate communities who have both a large

[198] See DSP Part II Section 3.5.4 and Appendix N for more detail on mapping underserved communities and the variables and data sources PGE reviewed. Retrieved from https://portlandgeneral.com/about/who-we-are/resource-planning/distribution-system-planning/dsp-resources-materials

number of renters, multi-family dwellings and low-income community members in order to serve customers who may face multiple systemic barriers to EV adoption. This will allow us to better engage with community members about needs relating to TE so we can more effectively manage deployment of resources in these communities. Figure 18 shows the composite score map across all HB2165 criteria.

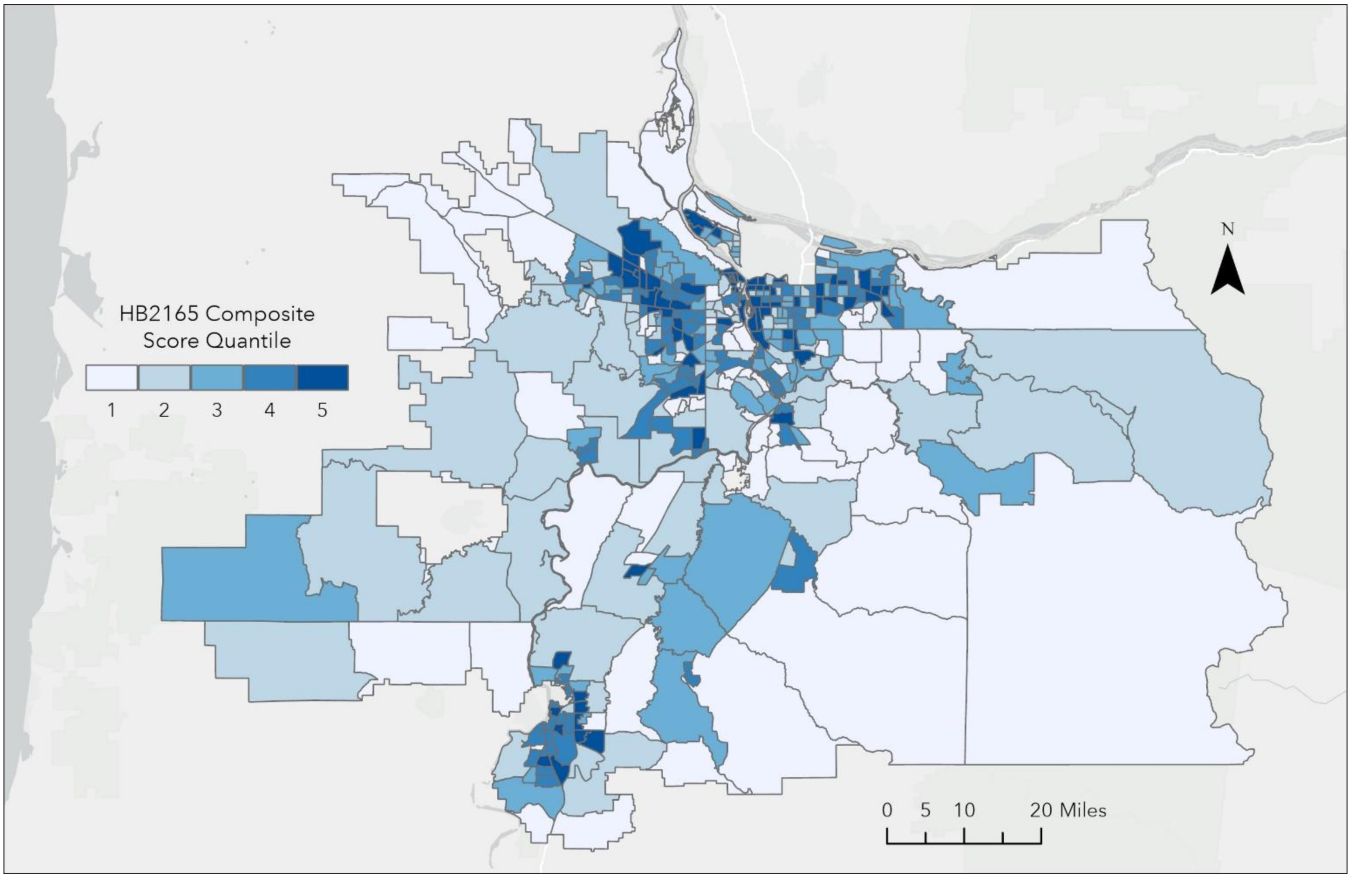

Figure 18. HB 2165 Composite Scoring of Underserved Communities within PGE's Service Area

7.5 Distribution System Impacts and Grid Integration Benefits

PGE's portfolio is designed to manage load by using the right technique for the right customer and charging use case.

Managed charging can take many forms. For example, the Smart Electric Power Alliance describes managed charging as falling into one of two categories: active managed charging or passive managed charging. The following table presents examples of both:

Table 28. Examples of Active and Passive Managed Charging[199]

Passive Managed Charging	Active Managed Charging
EV time-varying rates, including Time of Use and hourly dynamic rates	Direct load control via the charging device
Communication to customer to voluntarily reduce charging load (i.e., Behavioral Demand Response event)	Direct load control via automaker telematics
Incentive programs rewarding off-peak charging	Direct load control via a smart circuit breaker or panel
Good fit for residential, fleet, workplace, and public charging	Good fit for residential, fleet, and workplace charging

In the deployment of this TE Plan, PGE will seek to better understand how to manage EV load in the most efficient ways that benefit the grid, keep integration and program management costs low for all customers, and meet the EV driver's use case for timely charging of their vehicle. To that end, we will begin by tracking the portion of program-enabled charging load that occurs on- and off- peak. Further PGE is currently working with automobile manufacturers and others on vehicle telematics. This pathway is data rich and promises to better manage the vehicle state of charge against grid services needs. This approach is emerging among the OEMs and others. Access to this managed charging pathway is likely by way of a monthly fee imposed on the utility. By assuring deployment of connected chargers capable of participating in DR events while also exploring partnerships for vehicle telematics PGE will be able to assess the capability of both approaches.

Table 29. Forecasted Program-Enabled Charging Load Occurring On- and Off-Peak, by Use Case, 2022-2025[200]

Use Case	On-Peak MWh	Off-Peak MWh	Total MWh
Residential	1,212	2,030	3,242
Multi-Family	553	429	982
Workplace	4	29	32
Corridor Public	305	1,155	1,459
Non-Corridor Public	81	136	217

[199] Adapted from Smart Electric Power Alliance (May 2019). *A Comprehensive Guide to Electric Vehicle Managed Charging*.
[200] For the purposes of TE Portfolio financial analyses, PGE defines on-peak hours as 5 PM-9 PM, Monday through Friday, year-round except for federal holidays.

Use Case	On-Peak MWh	Off-Peak MWh	Total MWh
LDV Fleet	2,702	3,573	6,275
MHD Fleet	2,081	3,588	5,669
Total MWh	6,938	10,939	17,876
Percentage of Total	38.8%	61.2%	100%

7.6 Program Participation and Adoption

PGE's portfolio is designed to deploy charging ports across a variety of use cases and customer segments.

Table 30. Forecasted Number of Program-Enabled Ports, by Use Case (2023-2025)

Use Case	L2 Ports	DCFC Ports	Total Ports	% of Total
Residential	4,088		4,088	67%
Multi-Family	355		355	6%
Workplace	687		687	11%
Corridor Public	17	20	37	1%
Non-Corridor Public	240		240	4%
LDV Fleet	341	74	415	7%
MHD Fleet	192	50	242	4%
Total	5,920	144	6,064	100%

7.7 Infrastructure Performance

As discussed in Section 3.6, the reliability and accessibility of charging infrastructure—specifically public charging infrastructure—remain a serious challenge within the EV charging industry. A successful and easy charging experience requires improved performance, as currently there are far too many chargers either permanently or temporarily inoperable, sited in unsafe or suboptimal locations, too costly, not designed for all users (such as those using wheelchairs), and/or incapable of serving all EV drivers due to differing plug types.

PGE's proposed portfolio endeavors to address these issues for both PGE-owned and customer-owned chargers, to the extent that our role supports it. We will report on both cost-to-charge (in $/kWh) and charger uptime across our portfolio, whether the chargers are owned by customers or

PGE. We have a target uptime of 97 percent for both PGE-owned and customer-owned chargers, which corresponds with the minimum uptime required by the IIJA's NEVI program. To adopt common formulas for calculating uptime, PGE will look to industry standards developed by NEVI and other rulemaking processes, industry experts such as EPRI, or multi-stakeholder standards such as the EV Charging Use Data Specification[201].

In addition to these metrics, elements of our strategy and approach are detailed below.

7.7.1 Reliability

PGE-Owned Chargers: Reliable charging infrastructure is key to ensuring customers feel confident in their transition to electricity as a transportation "fuel". PGE has leveraged the experience from owning, operating, and maintaining fleet, workplace, public, and transit charging infrastructure to develop a three-point charging reliability strategy:

- Procure. Providing reliable charging infrastructure for all customers starts with procuring best-in-class products and service with robust terms and conditions. To achieve this, PGE will continue to use an open and competitive bidding process, leverage commercial terms to ensure equipment is functional upon delivery, enter into service level agreements for maintenance services, develop contracts that allow PGE to self-perform certified repairs, and maintain a robust spare parts inventory for all charging infrastructure.
- Operate. To provide highly reliable charging services, PGE must diligently operate and maintain equipment. PGE or third parties operating on PGE's behalf will remotely monitor equipment during business hours to detect performance issues, create maintenance work orders, and dispatch field technicians; communicate directly with customers regarding issues; routinely inspect and clean charging equipment; perform all routine maintenance at appropriate intervals; and perform emergency repairs.
- Replace. PGE must also replace equipment that cannot meet reliability metrics after multiple field repairs, subject to available budget. Purchasing terms will support the replacement of equipment under warranty and capital fitness dollars will ensure that out-of-warranty equipment is replaced.

Customer-Owned Chargers: PGE maintains qualified product lists for both residential and commercial chargers. While PGE does not endorse or guarantee the performance of products on the list, we do reserve the right to remove any vendor from the list at any point in time and for any reason. For example, if one type of hardware is consistently underperforming in terms of charger uptime, that might merit a removal of that hardware from the qualified product list.

7.7.2 Affordability

PGE-Owned Chargers: The cost-to-charge at PGE-owned public chargers is set by Schedule 50. Schedule 50 offers a flat fee of $3 per L2 session, a flat fee of $5 per DCFC session, or a $25 per month subscription to Electric Avenue sites in lieu of a flat fee. In addition to the flat fee, an on-peak surcharge of $0.19 per kWh is applied during the hours of 3 and 8 PM (excluding weekends and holidays).

[201] *EV Charging Use Data Specification* retrieved from https://evchargingspec.org/#home.

Customer-Owned Chargers: The cost of electric service paid by charger owners is established through PGE's various residential and commercial tariffs. PGE tariffs commonly offer Time of Use cost tiers that enable EV drivers to optimize their charging times for the most beneficial rate.

For public chargers where the owner plans to bill the EV driver for the charging session, PGE requires that the charger offer multiple payment methods and that prices be clearly posted before the charging session begins. PGE staff are available to help owners understand pricing options and advise how to structure pricing for EV drivers. However, PGE does not propose to have requirements regarding the price that charger owners may charge EV drivers, instead letting the competitive market prevail.

7.7.3 Accessibility

PGE-Owned Chargers: PGE is invested in ensuring that all EV drivers are able to charge at PGE-owned chargers. To that end, PGE only installs DCFC that offer both CHAdeMO and Society of Automotive Engineers (SAE) Combined Charging System (CCS) charging ports. PGE will explore the possibility of including Tesla ports on PGE-owned DCFC if and when these are made more widely available commercially (note that Tesla drivers can use an adapter to connect to a CHAdeMO port). For L2 charging, PGE uses the industry-standard J-1772 charging port (again, Tesla drivers can access these ports via an adapter).

Access for customers living with disabilities is also important to PGE. While the State of Oregon lacks specific requirements regarding compliance with the Americans with Disabilities Act (ADA) for EV charging, design recommendations do exist. When installing PGE-owned public charging, PGE will look to the design recommendations of the U.S. Access Board[202] for guidance on how to ensure access for customers living with disabilities. These design recommendations apply to both charging hardware and software, as well as charger siting, site layout, and signage.

It is important to PGE that all customers be able to pay for EV charging using a variety of payment methods. Today, the State of Oregon has no requirements for payment methods at public chargers. Until and unless such requirements exist, PGE proposes to look to the Washington State Department of Agriculture's standards for guidance on payment methods. The current draft of these standards require the following options on public chargers installed on or after January 1, 2024:

- Toll free number or built-in call button that provides the user the option to initiate a charging session and submit payment at any time that EVSE is operational and publicly available
- Credit card reader device that can accept, at a minimum, a Euro Mastercard Visa (EMV) chip
- A mobile payment option

PGE notes that these standards may not be possible to implement in all cases (in particular, on utility pole chargers, where NEC and NESC standards must be applied).

Customer-Owned Chargers: For customer-owned public DCFC enabled through PGE programs, PGE will likewise require that all DCFC offer both CHAdeMO and CCS ports, and that all L2 offer a J-1772 port.

PGE also requires that qualified chargers be compliant with the ADA. PGE will recommend that customers follow the design recommendations of the U.S. Access Board when installing customer-

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[202] U.S. Access Board (August 11, 2022). *Design Recommendations for Accessible Electric Vehicle Charging Stations*. Retrieved from https://www.access-board.gov/tad/ev/.

owned behind-the-meter infrastructure. At sites where PGE owns the make-ready infrastructure and provides the site design, PGE will look to the U.S. Access Board design recommendations for guidance, even if the customer owns the charger.

PGE proposes to likewise require that customer-owned public chargers follow the Washington State Department of Agriculture's standards for payment methods, until and unless an Oregon requirement is in place.

7.8 Clean Fuels Program and the Monthly Meter Charge

Two of the transportation electrification funding sources, Clean Fuels Program (CFP) and Monthly Meter Charge (MMC), were created through legislation and administrative rule. Both include requirements on how the money is allocated and spent as governed by legislation, Oregon Administrative Rules, and/or Commission orders.[203] The following sections outline the requirements for the two funding sources and how the requirements apply to the TE portfolio.

7.8.1 Clean Fuels Program

For a full description of activities and programs funded by CFP please see Appendix A.4.

The CFP is administered by the Oregon DEQ. The DEQ allows PGE to generate credits based on the number of residential EVs registered in the Company's service area (based on DMV vehicle registrations) on a biannual basis. PGE sells these credits to regulated fuel providers throughout the year in the CFP marketplace and plans for the yearly programs based on actual revenue from credit sales. There is a two-year delay between when credits are generated and when programs are implemented (e.g., the 2023 PGE Clean Fuels program budget is based on 2021 EV counts). PGE also generates credits through the charging stations we own, operate, and/or maintain. Revenue from those credits is used to offset the cost of operating and maintaining that infrastructure.

To date, PGE has planned CFP-funded programs through an iterative approach with stakeholders, in consultation with DEQ and OPUC staff, and guided by principles delineated in Commission Order No. 18-376, Docket No. UM 1826. As part of Docket No. UM 2165, Order No. 22-314[5] amended the principles in Order No. 18-376 to allow closer coordination of CFP-funded programs with other TE Portfolio initiatives, and the annual review process for residential CFP funded programs is now incorporated into utility TE Plans.

The six program design principles the Commission established under Order No. 18-376 for CFP-funded programs were:

1. Support the goal of electrifying Oregon's transportation sectors
2. Provide the majority of benefits to residential customers
3. Provide benefits to traditionally underserved communities
4. Programs are designed to be independent from ratepayer support
5. Programs are developed collaboratively and transparently
6. Maximize use of funds for implementation of programs

[203] See Section 3.1.1 for more detail.

Order No. 22-314 eliminated the fourth principle regarding ratepayer support but retained the remaining principles to guide PGE's CFP-funded programming going forward, with continued stakeholder consultation, as part of the company's broader TE portfolio.

7.8.2 Monthly Meter Charge

In May 2021, the Oregon Legislature enacted HB 2165 to support utility investment in EV infrastructure and extend and improve Oregon's EV rebate. Section 2 of the statute requires PGE and Pacific Power to collect a monthly meter charge, set at 0.25 percent of total revenues, from all customers beginning in 2022.[204]

Section 2 also requires funds collected under the MMC be:

- Expended by the utility to support and integrate TE
- Consistent with a budget approved by the Commission
- Expended on elements contained within the utility's TE Plan accepted by the Commission

The bill states that:

- The MMC charge is "a minimum investment in TE and may not limit the amounts that may otherwise be collected" for related utility investments or expenses
- the utility "shall make reasonable efforts to expend not less than one-half of the amount collected [through this charge] on TE in underserved communities.[205]

On January 1, 2022, as directed by HB 2165 and approved by the OPUC in Docket No. ADV 1325[206], PGE began collecting the MMC in supplemental Schedule 150[207]. PGE submitted annual budgets for programs funded by MMC for both 2022 and 2023, which were approved in October 2022[208] and April 2023[209], respectively. This portfolio contains the programs which were approved in those filings which will be implemented 2023 onward. The portfolio also contains programs which will be funded by the forecasted collection of MMC revenues for 2024 and 2025.

MMC are O&M dollars to cover program operations, incentives, O&M maintenance on investments, evaluations, outreach and education, and also costs associated purchasing and installing assets such as pole chargers (under the budget heading "Infrastructure"). Infrastructure includes the capital cost to purchase and install make-ready equipment such as conduit and switchgear, and in some cases, may include the purchase and installation of chargers where there is a market need. PGE views these investments as an extension of traditional capital deployment and as such, expects similar treatment, including the associated authorized rate of return.

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[204] Oregon Laws 2021, Chapter 95, Section 2. Retrieved from https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2021orlaw0095.pdf
[205] Oregon Laws 2021, Chapter 95, Section 2.5 and 2.6. Retrieved from https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2021orlaw0095.pdf
[206] OPUC. *Docket No. ADV 1325.* https://apps.puc.state.or.us/edockets/docket.asp?DocketID=23058
[207] PGE. Schedule 150. Retrieved from https://assets.ctfassets.net/416ywc1laqmd/bAlUAOkBjG2ttYMFzDBzQ/2ac1f49f0029c1d4a16b001def790527/Sched_150.pdf
[208] OPUC Order No. 22-381. Retrieved from https://apps.puc.state.or.us/orders/2022ords/22-381.pdf
[209] OPUC Order No. 23-147. Retrieved from https://apps.puc.state.or.us/orders/2023ords/23-147.pdf

HB 2165 requires utilities make reasonable efforts to spend no less than 50 percent of the MMC to support TE in underserved communities.[210] The legislation specifies that approaches may include, but are not limited to, programs, infrastructure, rebates, or expenses. HB 2165 identifies the following groups as underserved communities:

- Residents of rental or multi-family housing
- Communities of color
- Communities experiencing lower incomes
- Tribal communities
- Rural communities
- Frontier communities
- Coastal communities
- Other communities adversely harmed by environmental and health hazards

PGE outlines the MMC spend by program along with the amount allocated to underserved communities in the Budget section.

7.9 Related Activities

7.9.1 Delivery Platform

PGE is developing a digital platform to support residential customers through the purchase, installation, and program enrollment journeys of qualifying EV chargers. The platform will provide customers education on qualifying grid-enabled chargers and installation considerations to keep costs down. It will connect customers with PGE vetted installers that have been trained on PGE's Residential EV Smart Charging pilot requirements. Should customers choose to enroll in the Residential EV Smart Charging pilot, the platform will give them a streamlined way to do so and will apply the applicable rebates at time of install, reducing the required upfront costs. For customers that need additional financial support to install a grid-enabled EV charger, the platform will connect them to a third-party lender where they can apply for a loan and repay it on a PGE bill. Customers that are able to pay in full at time of purchase, they can do so also via a PGE bill. Potential tax credit information will be provided as well as actions needed to claim those tax credits.

7.9.2 Virtual Power Plant

PGE is preparing for significant growth of distributed resources.[211] PGE assumes that all resource types—including managed charging in the transportation electrification sector—can be integrated into PGE's system and orchestrated to deliver their full potential system value. However, extending this assumption to smaller and/or "behind-the-meter" resources requires advancement of PGE's ability to

[210] Oregon HB 2165, Section 2(6). Retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Downloads/MeasureDocument/HB2165/Enrolled
[211] PGE. *Clean Energy Plan and Integrated Resource Plan 2023*, Sections 6.2, 8.2, 8.3, and Chapter 11. Retrieved from https://downloads.ctfassets.net/416ywc1laqmd/6B6HLox3jBzYLXOBgskor5/db59c8b594a3c380b9d42e90ec9a35aa/2023_PGE_CEP-IRP.pdf.

monitor, schedule, and dispatch resources in an optimized manner. To ensure realization of the full value of these resources, PGE is coordinating resource deployment and operation through a virtual power plant.

PGE's VPP comprises DERs and flexible loads managed through a technology platform to provide grid and power operations services. The VPP will incorporate and optimize the operation of DERs and flexible loads by connecting them through the VPP platform to provide services they would not be able to provide in isolation. The VPP will be an important tool to identify and extend DER and flexible load benefits to customers and communities seeking local clean energy investments.

The development of the VPP will allow PGE to activate the full value of DER capabilities assumed in IRP modeling. Resource orchestration will be managed by a VPP technology platform, which will provide real-time visibility and control of generation, flexible loads, and batteries residing within the distribution network. The VPP will provide essential grid services and serve up to 25 percent of peak demand by coupling customer participation with PGE expertise and resources. PGE recognizes that, in contrast to traditional generation resources, successful operation of the VPP must take into account the customer experience. The ability to orchestrate resources through the technology platform, will provide value during extreme events and essential grid services 24/7/365.

The VPP will also continuously enhance capabilities to increase value during all operating conditions. The number of VPP operations will grow from the 139 events in 2022 to many thousands and eventually millions as we go from discrete event operation to real-time energy management. The progression of the VPP will enable DERs and flexible loads to provide enhanced time- and location-specific benefits. Realization of incremental contingency reserves, frequency response, and peak load reduction services are the foundation of the VPP. These operational services were prioritized for initial capability development due to their high expected value and alignment with other internal initiatives. As the capabilities of the VPP platform are implemented and the size of our DER and flexible load portfolio grows the VPP will increasingly be able to deliver additional services including energy scheduling, voltage regulation, and islanding, which will result in increased reliability (prevention of customer minutes interrupted) and non-wires solutions (locational congestion relief).

Chapter 8. Budget

This chapter details the portfolio budget for this TE Plan. The focus of this Plan is the incremental or "new" activities and proposed budgets (including extensions and expansions of existing activities) and our envisioned portfolio over the 2023-2025 timeframe. Based on OPUC Staff guidance, we also include the budget for currently approved or "existing" activities.[212]

As explained in the Summary for Policy Makers Section, the Plan balances the needs of the market with the incremental funding request of customers. At the same time, the Plan's activities collect the necessary data and experience in areas such as make-ready, rate, and tariff design to transition PGE's TE activity to more sustainable traditional structures beyond program development.

Table 31. Summary of Transportation Electrification Expenditures

	2023	2024	2025	2023-2025 Total
Existing Approved Activities[213]	$20,180,238	$7,187,215	$758,150	$28,125,603
All Clean Fuels Program	$11,758,817	$11,569,165	$17,314,728	$40,642,710
New Activities[214]	-	$10,705,933	$14,559,065	$25,264,998
Total	$31,939,055	$29,462,312	$32,631,943	$94,033,310

The above table provides a high-level summary of PGE's proposed TE expenditures, for both the "new" activities within the three-year (2023-2025) period of the proposed plan as well as the "existing" expenditures in program years (2022-2025) for additional context. Note that the New Activities line item in the above table includes both start-up programs and also incremental expenditures for existing activities. The PGE Clean Fuels Programs line item is based on projected revenues from the sale of Oregon Clean Fuels credits, and thus can be expected to vary depending on wholesale market prices as credits are monetized.

8.1 Context of Long-Term Expenditures (next 10 years)

PGE has carefully weighed an array of inputs, detailed in previous sections of the Plan, to arrive at the TE budget supporting this plan. The budget reflects a measured approach in the developing TE market and balances the need to prepare for the coming growth in TE load with management of the associated risk and cost to customers.

It should, however, be noted that the rapid pace of change in the TE market does present uncertainties which, if left unmanaged, could impact the success of utility TE activities. In this section, we assess these key sensitivities and their potential impact to our long-term (10 year) expenditures, and also lay out our plan to monitor, manage, and adapt to the concomitant risks.

8.1.1 Sensitivity: Supply Chain and Inflation

The TE Portfolio relies on the availability of a variety of EVSE to meet the needs of residential homeowners, renters, underserved communities, fleet expansion, and heavy-duty and public

[212] Per OPUC Staff Memo, Public Meeting May 5, 2022. The 2022 TE Plan should include year 2022 its scope.
[213] Excludes CFP. The figures shown in the "Existing Approved Activities" row of this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.
[214] Includes PGE programs which are funded by forecasted CFP dollars.

charging. PGE has seen extended timeframes for key components of the make-ready infrastructure to the charger equipment (e.g., switchgear and transformers). Materials costs have also dramatically increased over the last several years.[215] PGE will continue to evaluate our implementation and ordering processes to ensure we meet program demand within budget over the next three years and beyond.

Supply chain delays and the inflation risk have the potential to slow down EV adoption across all sectors in the next year.[216] PGE will continue to monitor, manage, and adapt to these risks as well as factor in our ability to meet the anticipated market demand anticipated by the TEINA and in PGE's own forecasts. Material changes will be reflected in future filings. These risks could require PGE to slow some program implementations or, conversely, create new practices and/or supply chain agreements to speed the implementation of other necessary programs.

8.1.2 Sensitivity: Changes in the TE Market

Technology improvements are likely to continue to affect EV adoption and therefore utility TE activities. Automakers are expected to continue their focus on extending vehicle range and capabilities to further EV adoption. It is important to note that the battery is the most expensive component in many EVs and that advances in that technology may increase EV purchase costs. If EV purchase costs increase, customers may purchase EVs with smaller batteries, with reduced range and increased need for charging access. PGE will continue to focus on adequate charging as a means to mitigate this risk. Conversely, technology improvements may reduce the cost of batteries and therefore help address EV purchase costs. Our TE portfolio may require increased focus on public charging if we see technology changes that require a larger investment in underserved communities, or if technology advancements change charging behavior.

The broader economy and EV and EVSE markets also influence the best pace of utility TE activities. During the 2020 economic downturn driven by the COVID-19 pandemic, U.S. EV sales rose 4 percent while U.S. ICE sales fell by 14-15 percent.[217] Future economic downturns may exhibit different characteristics that impact the EV market in unexpected ways, potentially slowing the pace of EV purchases.

Manufacturers are expanding consumer options by increasing the number and type of EVs they offer. The extent and location of investment in EV charging by private EVSE networks and manufacturers also influences charging adequacy in the PGE service area as well as the charging experience of utility customers. PGE will continue to monitor both of these factors as we adjust our TE portfolio.

8.1.3 Sensitivity: Uneven EV Adoption Across Customer Communities

We know that EV adoption will be slower in underserved communities relative to the general population due to less car ownership in underserved communities along with less charging

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[215] See Section 3.6.5.2 for discussion of the impact of supply chain challenges.
[216] Paoli, Gül; International Energy Agency (IEA). *Electric Cars Fend Off Supply Challenges to More Than Double Global Sales*. Retrieved on September 26, 2022 from https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales.
[217] Gorner, Paoli; International Energy Agency (IEA). *How global electric car sales defied Covid-19 in 2020*. Retrieved on September 23, 2022 from https://www.iea.org/commentaries/how-global-electric-car-sales-defied-covid-19-in-2020.

availability as well.[218] These two factors mean that the utilization rate of chargers in these areas may not match that in other growth areas which decreases private market interest in locating charging in underserved communities.

This may occur in more rural areas, communities of color, communities with lower incomes, or multi-family residences. PGE's TE portfolio is designed to serve all our customers with a focus on underserved communities. Our technical assistance services to fleet customers and online cost of ownership tools for all customers may be especially useful to these communities, which may exhibit lower EV adoption. We may see greater uptake of infrastructure measures in some areas, and if we see higher than expected utilization of chargers in underserved communities, we will evaluate the need to further extend public charging programs in those areas.

8.1.4 Sensitivity: Changing Needs for Non-Residential Customers

PGE's Fleet Partner program has received significant interest. We believe fleet electrification will continue to be a priority over the next 10 years for fleet owners in PGE's service area. This could lead to an extension of the Fleet Partner program and provide a high benefit-cost ratio, which could in turn bolster PGE's overall TE portfolio and support our continued efforts to meet the needs of other segments of the non-residential TE market. Economic conditions and unexpected challenges such as the recent COVID-19 pandemic may impact charging patterns across different use cases such as workplace or public charging. PGE will continue to evaluate these activities alongside other public charging programs to ensure they continue to meet the needs of our communities.

8.1.5 Summary of Long-Term Expenditures (next 10 years)

Based on PGE's adjusted TEINA results, we know that this Plan does not, by itself, address the entirety of the charging need anticipated over the next 10 years in our service area. PGE will continue to carefully monitor its TE portfolio and balance the need for adequate preparation for the coming growth in TE load with our commitment to management of associated risks and costs to customers. In doing so, PGE will assess the adequacy of investments in underserved communities, equity, uptake of programs, economic conditions, fleet electrification, availability of electric heavy-duty vehicles, and also changes in EV adoption. While we cannot predict with certainty the impact that the above factors may have upon the specific programs and measures called for in our 2023 TE Plan, we believe they represent a measured approach and are funded at a responsible level to lay the groundwork for continued TE support over the next 10 years and beyond. This plan does not include the distribution grid-level investments required for EV charging as they will be included and addressed in the Distribution System Plan.

[218] See Disadvantaged Communities section, Oregon Department of Transportation TEINA Study, retrieved from https://www.oregon.gov/odot/Programs/Documents/23021%20T031%20TEINA%20Report%20August%202022.pdf.

8.2 Expenditures

The following table presents existing approved budgets combined with a forecast for new programs of proposed operating and capital expenditures (OpEx and CapEx, respectively[219]). For a detailed breakout of existing and proposed budgets by activity, please see Appendices A-C.

Table 32. Program Operating and Capital Expenditures, 2023-2025[220]

Programs	2023	2024	2025	2023-2025 Total
Business and Multi-family Make-ready Solutions[221]	$2,547,130	$2,144,739	$2,439,061	$7,130,930
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Business EV Charging Rebates	$460,000	$2,328,728	-	$2,788,728
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Clean Fuels Program[222]	$11,758,817	$11,569,165	$17,314,728	$40,642,710
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
EV Ready Affordable Housing Grants	$1,000,000	-	-	$1,000,000
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Fleet Partner Pilot	$5,258,760	$6,415,740	$6,442,773	$18,117,273
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]

[219] Operating expenditures are costs recovered in rates each year. Capital expenditures are costs recovered in rates over many years (the period varies with the life of the asset, which reduces impact on customer bills).
[220] Figures shown in this budget include those approved previously by the Commission through docketed proceedings, detailed in Appendix H.
[221] Clean Fuels Program is covering the costs of the Business and Multi-family Make-ready Solutions program in 2024 and 2025.
[222] Clean Fuels Program forecasted totals for 2024 and 2025 do not include the dollars which are allocated to fund Business and Multi-family Make-ready Solutions.

Programs	2023	2024	2025	2023-2025 Total
Heavy Duty Charging Pilot	$1,997,290	$1,186,441	$436,723	$3,620,453
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Public Charging – Municipal Charging Collaborations Pilot	$1,811,500	$587,500	$287,500	$2,686,500
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Portfolio Support	$4,688,559	$3,284,688	$3,580,748	$11,553,995
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Residential Smart EV Charging Pilot	$2,417,000	$1,945,313	$2,130,409	$6,492,722
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Grand Total	$31,939,055	$29,462,312	$32,631,943	$94,033,310
Total CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total OpEx	[redacted]	[redacted]	[redacted]	[redacted]

Table 33. Detail on Program Operating and Capital Expenditures[223]

Programs	2023	2024	2025	2023-2025 Total
Business & Multi-Family Make-Ready Solutions	**$2,547,130**	**$2,144,739**	**$2,439,061**	**$7,130,930**
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Business EV Charging Rebates	**$460,000**	**$2,328,728**	**-**	**$2,788,728**
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Clean Fuels Program[224]	**$11,758,817**	**$11,569,165**	**$17,314,728**	**$40,642,710**
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
EV Ready Affordable Housing Grants	**$1,000,000**	**-**	**-**	**$1,000,000**
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]

[223] For a detailed breakout of existing and proposed budgets by activity, please see Appendices A-C. Figures shown in this budget include those approved previously by the Commission through docketed proceedings, detailed in Appendix H.
[224] Operating expenditures are costs recovered in rates each year. Capital expenditures are costs recovered in rates over many years (the period varies with the life of the asset, which reduces impact on customer bills).

Programs	2023	2024	2025	2023-2025 Total
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Fleet Partner Pilot	$5,258,760	$6,415,740	$6,442,773	$18,117,273
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Heavy Duty Charging Pilot	$1,997,290	$1,186,441	$436,723	$3,620,453
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Portfolio Support	$1,811,500	$587,500	$287,500	$2,686,500
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Public Charging - Municipal Charging Collaboration and Electric Ave	$4,688,559	$3,284,688	$3,580,748	$11,553,995
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments - Electric Avenue	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments - Municipal Charging Collaboration	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services - Electric Avenue	[redacted]	[redacted]	[redacted]	[redacted]

Programs	2023	2024	2025	2023-2025 Total
Evaluation Services - Municipal Charging Collaboration	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Residential Smart Charging Pilot	$2,417,000	$1,945,313	$2,130,409	$6,492,722
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
Grand Total	$31,939,055	$29,462,312	$32,631,943	$94,033,310
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]

8.3 Funding Sources

The following table provides a forecast of all funding sources to be utilized in support of PGE's TE-related activities during the 2023-2025 planning cycle for both existing and new activities, by year. Due to regulatory and other priorities, the proposed values in the table below and throughout this section may be further refined.

Table 34. Summary of Funding Sources for TE-related Activities, Existing and New (2023-2025)[225]

	2023	2024	2025	2023-2025 Total
Existing/Approved	$20,180,238	$7,187,215	$758,150	$28,125,603
Deferral	$2,646,059	$678,162	$305,747	$3,629,968
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GRC/Base Rates	$9,005,180	$4,565,325	$452,403	$14,022,907
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MMC	$8,529,000	$1,943,728	-	$10,472,728

[225] Figures shown in this budget include those approved previously by the Commission through docketed proceedings, detailed in Appendix H.

	2023	2024	2025	2023-2025 Total
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PGE Clean Fuels Programs	$11,758,817	$13,713,904	$19,753,790	$45,226,510
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Incremental	-	$8,561,194	$12,120,003	$20,681,197
GRC/Base Rates	-	$3,336,856	$6,427,093	$9,763,949
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MMC	-	$5,224,338	$5,692,911	$10,917,249
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Grand Total	$31,939,055	$29,462,312	$32,631,943	$94,033,310
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

All forecasts are inherently uncertain, so we reiterate that the dollar projections in the above table are based on the best information available to PGE at the time this plan was prepared. Actual revenue may—and likely will—vary from these estimates. For instance, PGE Clean Fuels program revenues are dependent on EV adoption rates, the rules and policies of the Oregon Department of Environmental Quality in issuing Clean Fuels credits, and market prices for the sale of Clean Fuels credits. Market prices in particular are subject to potential volatility during the three-year period of this plan and can be expected to fall short of or exceed current projections. Likewise, Monthly Meter Charge revenues are based on PGE's current base rates and projected retail power sales during the planning period. Should base rates change in a future General Rate Case or power sales exceed or fall short of projections, Monthly Meter Charge revenues will diverge from these estimates.

The revised Division 87 rules adopted by the Commission on September 6, 2022 require PGE to file an update to its TE Plan and Budget in the event that material changes occur during the period of the plan.[226] Material changes are new TE program or infrastructure measure applications, or program or infrastructure changes that require new incremental customer dollars. PGE will seek to manage within its overall TE budget to address variations in revenue from projections. PGE will file a budget update for Commission approval in the event that we determine significant shortfalls in non-ratepayer funding sources which should be backfilled with additional ratepayer funds to achieve essential TE portfolio objectives.

The two tables below provide additional transparency by listing funding sources for each program by year for both approved and incremental program spend. Note that the spend is a forecast and may extend beyond the year shown depending on customer interest and decision-making timeframes.

[226] OPUC Order No. 22-336, Appendix A, Page 5 of 14, available online at https://apps.puc.state.or.us/orders/2022ords/22-336.pdf.

Table 35. Detail on Program Spend by Funding Source for Incremental Spend

Incremental	2023	2024	2025	2023-2025 Total
Business and Multi-family Make-ready Solutions	**-**	**$2,144,739**	**$2,439,061**	**$4,583,800**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	$2,144,739	$2,439,061	$4,583,800
Business EV Charging Rebates	**-**	**-**	**-**	**-**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Clean Fuels Program[227]	**-**	**$11,569,165**	**$17,314,728**	**$28,883,893**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	$11,569,165	$17,314,728	$28,883,893
EV Ready Affordable Housing Grants	**-**	**-**	**-**	**-**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Fleet Partner Pilot	**-**	**$3,036,856**	**$6,427,093**	**$9,463,949**
GRC/Base Rates	-	$3,036,856	$6,427,093	$9,463,949
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Heavy Duty Charging Pilot	**-**	**-**	**-**	**-**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Portfolio Support	**-**	**$587,500**	**$287,500**	**$875,000**

[227] Clean Fuels Program forecasted totals for 2024 and 2025 do not include the dollars which are allocated to Business and Multi-family Make-ready solutions.

Incremental	2023	2024	2025	2023-2025 Total
GRC/Base Rates	-	300000	-	300000
MMC	-	$287,500	$287,500	$575,000
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Public Charging - Electric Ave	-	-	-	-
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Public Charging - Municipal Charging Collaboration	-	$2,991,526	$3,275,001	$6,266,527
GRC/Base Rates	-	-	-	-
MMC	-	$2,991,526	$3,275,001	$6,266,527
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Residential Smart Charging Pilot	-	$1,945,313	$2,130,409	$4,075,722
GRC/Base Rates	-	-	-	-
MMC	-	$1,945,313	$2,130,409	$4,075,722
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Grand Total	-	$22,275,097	$31,873,793	$54,148,890
GRC/Base Rates	-	$3,336,856	$6,427,093	$9,763,949
MMC	-	$5,224,338	$5,692,911	$10,917,249
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	$13,713,904	$19,753,790	$33,467,693

Table 36. Detail on Program Spend by Funding Source for Approved Spend[228]

Existing and Approved	2023	2024	2025	2023-2025 Total
Business & Multi-Family Make-ready Pilot	$2,547,130	-	-	$2,547,130
GRC/Base Rates	$1,854,630	-	-	$1,854,630
MMC	$692,500	-	-	$692,500
Deferral	-	-	-	-

[228] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

Existing and Approved	2023	2024	2025	2023-2025 Total
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Business EV Charging Rebates	**$460,000**	**$2,328,728**	**-**	**$2,788,728**
GRC/Base Rates	-	-	-	-
MMC	$14,000	$1,943,728	-	$1,957,728
Deferral	$446,000	$385,000	-	$831,000
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Clean Fuels Program	**$11,758,817**	**-**	**-**	**$11,758,817**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	$11,758,817	-	-	$11,758,817
EV Ready Affordable Housing Grants	**$1,000,000**	**-**	**-**	**$1,000,000**
GRC/Base Rates	-	-	-	-
MMC	$1,000,000	-	-	$1,000,000
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Fleet Partner Pilot	**$5,258,760**	**$3,378,884**	**$15,680**	**$8,653,324**
GRC/Base Rates	$4,426,760	$3,378,884	$15,680	$7,821,324
MMC	$832,000	-	-	$832,000
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Heavy Duty Charging Pilot	**$1,997,290**	**$1,186,441**	**$436,723**	**$3,620,453**
GRC/Base Rates	$1,997,290	$1,186,441	$436,723	$3,620,453
MMC	-	-	-	-
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Portfolio Support	**$1,811,500**	**-**	**-**	**$1,811,500**
GRC/Base Rates	$300,000	-	-	$300,000
MMC	$1,511,500	-	-	$1,511,500
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Public Charging - Electric Ave	**$520,059**	**$293,162**	**$305,747**	**$1,118,968**
GRC/Base Rates	-	-	-	-
MMC	-	-	-	-
Deferral	$520,059	$293,162	$305,747	$1,118,968
Grants	-	-	-	-

Existing and Approved	2023	2024	2025	2023-2025 Total
Clean Fuels	-	-	-	-
Public Charging - Municipal Charging Collaboration	**$4,168,500**	**-**	**-**	**$4,168,500**
GRC/Base Rates	$426,500	-	-	$426,500
MMC	$3,742,000	-	-	$3,742,000
Deferral	-	-	-	-
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Residential Smart Charging Pilot	**$2,417,000**	**-**	**-**	**$2,417,000**
GRC/Base Rates	-	-	-	-
MMC	$737,000	-	-	$737,000
Deferral	$1,680,000	-	-	$1,680,000
Grants	-	-	-	-
Clean Fuels	-	-	-	-
Grand Total	**$31,939,055**	**$7,187,215**	**$758,150**	**$39,884,420**
GRC/Base Rates	$9,005,180	$4,565,325	$452,403	$14,022,907
MMC	$8,529,000	$1,943,728	-	$10,472,728
Deferral	$2,646,059	$678,162	$305,747	$3,629,968
Grants	-	-	-	-
Clean Fuels	$11,758,817	-	-	$11,758,817

8.3.1 Monthly Meter Charge Expenditures

HB 2165 requires that utilities make reasonable efforts to expend no less than half of the funds collected to support transportation electrification in underserved communities.[229] PGE allocated the Monthly Meter Charge across its portfolio to support a variety of activities and identified the portion of these allocations that support underserved communities. The following table provides a forecast of the percentage of each activity's Monthly Meter Charge allocations that are expected to provide benefit to underserved communities. Overall, PGE projects spending 63 percent of the 2022-2025 Monthly Meter Charge on activities that meet the needs of underserved communities.

[229] HB 2165 Section 2(6), retrieved from https://olis.oregonlegislature.gov/liz/2021R1/Downloads/MeasureDocument/HB2165/Enrolled.

Table 37. Forecasted Percentage and Amount of Monthly Meter Charge Allocations that Benefit Underserved Communities

Program	Underserved Contribution %	Spending Categories	2023	2024	2025	2023-2025
Business & Multi-family Make-ready Solutions	75%	Underserved Contribution	$519,375	-	-	$519,375
		Not Contributing to Underserved	$173,125	-	-	$173,125
		Total MMC Allocation	$692,500	-	-	$692,500
Business EV Charging Rebates	38%	Underserved Contribution	$5,320	$738,617	-	$743,937
		Not Contributing to Underserved	$8,680	$1,205,111	-	$1,213,791
		Total MMC Allocation	$14,000	$1,943,728	-	$1,957,728
EV Ready Affordable Housing Grants	100%	Underserved Contribution	$1,000,000	-	-	$1,000,000
		Not Contributing to Underserved	-	-	-	-
		Total MMC Allocation	$1,000,000	-	-	$1,000,000
Fleet Partner Pilot	20%	Underserved Contribution	$166,400	-	-	$166,400
		Not Contributing to Underserved	$665,600	-	-	$665,600
		Total MMC Allocation	$832,000	-	-	$832,000
Heavy Duty Charging Pilot	50%	Underserved Contribution	-	-	-	-
		Not Contributing to Underserved	-	-	-	-
		Total MMC Allocation	-	-	-	-
Portfolio Support	50%	Underserved Contribution	$755,750	$143,750	$143,750	$1,043,250
		Not Contributing to Underserved	$755,750	$143,750	$143,750	$1,043,250
		Total MMC Allocation	$1,511,500	$287,500	$287,500	$2,086,500
Public Charging - Municipal	75%	Underserved Contribution	$2,806,500	$2,243,644	$2,456,251	$7,506,395

Program	Underserved Contribution %	Spending Categories	2023	2024	2025	2023-2025
Charging Collaboration						
		Not Contributing to Underserved	$935,500	$747,881	$818,750	$2,502,132
		Total MMC Allocation	$3,742,000	$2,991,526	$3,275,001	$10,008,527
Residential Smart Charging Pilot	50%	**Underserved Contribution**	**$368,500**	**$972,656**	**$1,065,205**	**$2,406,361**
		Not Contributing to Underserved	$368,500	$972,656	$1,065,205	$2,406,361
		Total MMC Allocation	$737,000	$1,945,313	$2,130,409	$4,812,722
Total MMC Allocations	63%	Underserved Contribution	$5,621,845	$4,098,667	$3,665,206	$13,385,717
		Not Contributing to Underserved	$2,907,155	$3,069,399	$2,027,705	$8,004,259
		Total MMC Allocation	$8,529,000	$7,168,066	$5,692,911	$21,389,976

8.3.2 Clean Fuels Program Credits

PGE participates in the Oregon Clean Fuels Program as a credit generator on behalf of residential customers. Revenues are dependent on the number of EVs attributed to PGE's service area by the DEQ, as well as market prices for the sale of Clean Fuels credits. Both of these factors are subject to potential volatility during the three-year period of this plan and may fall short of (or exceed) current projections. The credits-per-vehicle is based on assumptions made by the DEQ on average usage, vehicle efficiency, and the carbon intensity of the fuel.

The DEQ uses the below methodology to calculate residential CFP credits:

$$EV\ Electricity\ Use = \#\ of\ vehicles\ x\ Daily\ Average\ Electricity\ Use\ x\ \#\ of\ Days\ in\ Compliance\ Period$$

- $Credits = (CI\ Standard - Fuel\ CI/EER) * Energy * Energy\ Density * EER$
- Where:
  - Carbon Intensity (CI) Standard is the gasoline or diesel standard for a given compliance period (gCO2e/MJ)
  - Fuel CI is either the statewide CI for electricity or a utility-specific value as requested by the utility (gCO2e/MJ)
  - EER is the energy economy ratio based on the type of vehicle
  - Energy is the amount of electricity used (kWh)
  - Energy Density is the energy density of electricity (MJ/kWh)

Credits are then allocated to individual electric utilities based on the number of EVs registered in their service territories.

Figure 19. Residential CFP Credit Methodology[230]

This portfolio includes the use of CFP revenues to support the broader TE portfolio, possible with the Commission Order No. 22-314[231], which removed the CFP principle requiring programs be independent from ratepayer supported programs. With this shift, PGE proposes to use approximately $4.5 million in CFP revenue to support activities across the TE portfolio supporting infrastructure in underserved residential communities. While the Commission removed the principle from ratepayer supported programs, expenditures must still meet the remaining CFP principles to be funded by CFP revenue:

1. Support the goal of electrifying Oregon's transportation sectors
2. Provide majority of benefits to residential customers
3. Provide benefits to traditionally underserved communities
4. Programs are developed collaboratively and transparently
5. Maximization of funds for implementation of programs

Additionally, this is the first time the company has published a forward-looking estimate of CFP revenue. It is important to note that PGE is a participant in the CFP marketplace, which is subject to market fluctuations. As this forecast is based on multiple forward-looking estimates, readers should assume actual credit revenue will vary. PGE will continue to report actual credit revenue to both the OPUC and DEQ on an annual basis.

[230] Oregon DEQ. *Oregon Clean Fuels Program: Calculating Residential EV Credits*. Retrieved from https://www.oregon.gov/deq/FilterDocs/cfp-resevcredits.pdf.
[231] OPUC Order No. 22-314, retrieved from https://apps.puc.state.or.us/orders/2022ords/22-314.pdf.

The following table details assumptions for the cost estimate of the CFP:

Table 38. Assumptions for the Cost Estimate of the Clean Fuels Program

No.	Assumptions
1	Residential CFP credits are issued to PGE from DEQ based on the number of LDVs registered through the DMV in PGE's service area for the previous year
2	The actual vehicle and credit counts are current through 2021
3	2022-2025 CFP estimation is based on the PGE LDV count forecast from AdopDER, developed as part of the DSP
4	It takes PGE one calendar year to monetize residential CFP credits
5	Each year's forecast is based on the vehicle/CFP count from two years prior (e.g., 2022 is based on 2020 EV count)
6	CFP programs are incorporated into the TE Plan process
7	In the cost estimate, the portfolio percentage approach is applied through 2025
8	We utilize a conservative, stable growth scenario based on the average CFP credit price over the past two years. This scenario forecasts a short term dip in credit prices reflecting decreased demand and increased credit supply, followed by a longer term, steady rise due to increasing credit demand as it becomes more expensive for fuel suppliers/credit buyers to marginally reduce emissions.
9	PGE will leverage renewable energy credits (RECs) to claim all available residential incremental credits
10	REC prices are not forecasted in this estimate; they represent an administrative expenditure
11	The 2022-2025 CFP cost estimate is dependent on three market driven elements: EV counts, CFP credit price, REC prices
12	The CFP market will continue through 2025, and the rules and policies of the Department of Environmental Quality will not materially change credit generation calculations during that period

8.3.3 Deferrals

PGE has three open deferrals supporting transportation electrification work:

- UM 1938, which covers PGE's UM 1811 TE pilots for Electric Avenue expansion, TriMet charging, as well as education and technical assistance
- UM 2003, which covers the original portions of PGE's Business EV Charging Rebates and Residential Smart Charging pilots

- UM 2218, a balancing account for the Monthly Meter Charge

PGE does not propose to open any new deferrals to support the future TE work described in this Plan.

8.4 Spending to Benefit Underserved Communities

PGE has identified the amount of program spend for each program intended to meet the needs of underserved communities. In cases such as Business and Multi-family Make-ready Solutions, the entire customer segment eligible for the program is designated as underserved. In other cases such as Residential Smart EV Charging, PGE has forecasted the portion of the program that will benefit underserved communities. In the latter instance, there is a possibility that enrollment of customers who are either themselves part of an underserved community or serve those communities will exceed the programmatic requirement or forecast. As required, PGE will track actual spend on underserved communities and report this in our annual TE Plan Report.

Table 39, below, presents a forecast of all spending on underserved communities, grouped by program and/or infrastructure measure, and further divided into:

- Expenditures of funds collected through the Monthly Meter Charge, as required by Oregon Laws 2021, Chapter 95, Section 2
- Spending from revenues other than the Monthly Meter Charge, including but not limited to grants, Oregon Clean Fuels Program credits, base rates, and deferrals

Table 39. Program Spending to Benefit Underserved Communities[232]

Program	Funding Source	2023	2024	2025	2023-2025 Total
Business and Multi-family Make-Ready Solutions		**$1,910,347**	**$1,608,554**	**$1,829,296**	**$5,348,198**
	GRC/Base Rates	$1,390,973	-	-	$1,390,973
	MMC	$519,375	-	-	$519,375
	Clean Fuels	-	$1,608,554	$1,829,296	$3,437,850
Business EV Charging Rebates		**$174,800**	**$884,917**	**-**	**$1,059,717**
	MMC	$5,320	$738,617	-	$743,937
	Deferral	$169,480	$146,300	-	-
Clean Fuels Program		**$8,301,725**	**$7,966,180**	**$11,989,694**	**$28,257,599**
	Clean Fuels	$8,301,725	$7,966,180	$11,989,694	$28,257,599
EV Ready Affordable Housing Grants		**$1,000,000**	**-**	**-**	**$1,000,000**
	MMC	$1,000,000	-	-	$1,000,000
Fleet Partner Pilot		**$1,051,752**	**$1,283,148**	**$1,288,555**	**$3,623,455**
	GRC/Base Rates	$885,352	$1,283,148	$1,288,555	$3,457,055
	MMC	$166,400	-	-	$166,400
Heavy Duty Charging Pilot		**$998,645**	**$593,220**	**$218,361**	**$1,810,226**
	GRC/Base Rates	$998,645	$593,220	$218,361	$1,810,226
Portfolio Support		**$905,750**	**$293,750**	**$143,750**	**$1,343,250**
	GRC/Base Rates	$150,000	150000	-	$300,000
	MMC	$755,750	$143,750	$143,750	$1,043,250
Public Charging - Electric Ave		**$390,044**	**$219,872**	**$229,310**	**$839,226**
	Deferral	$390,044	$219,872	$229,310	$839,226
Public Charging - Municipal Charging Collaboration		**$3,126,375**	**$2,243,644**	**$2,456,251**	**$7,826,270**
	GRC/Base Rates	$319,875	-	-	$319,875
	MMC	$2,806,500	$2,243,644	$2,456,251	$7,506,395
Residential Smart EV Charging		**$1,208,500**	**$972,656**	**$1,065,205**	**$3,246,361**
	MMC	$368,500	$972,656	$1,065,205	$2,406,361
	Deferral	$840,000	-	-	$840,000
Grand Total Underserved Spending		$19,067,938	$16,065,941	$19,220,422	$54,354,301

[232] Figures shown in this budget include those approved previously by the Commission through docketed proceedings, detailed in Appendix H.

8.5 Transportation Electrification-Related Costs and Benefits

Generally, the introduction of transportation electrification and other decarbonization goals across the economy are requiring changes to be made to legacy decision-making tools such as cost-effectiveness. OPUC Order 22-314 highlights the importance of transparent cost and benefit analysis to inform discussion and prioritization of utility investments in the TE space, while making clear that budget approvals for this TE Plan are not conditioned upon an investment in TE infrastructure or programs being cost-effective under current tests. Rather, the order notes that this information will be used to inform ongoing efforts to determine any necessary updates preceding subsequent TEP filings.

In developing our assessment of the costs and benefits of TE activity, we first reviewed the literature and engaged expert consultants to understand the range of thinking in this area and seek emerging best practices. We begin this section, then, with an overview and discussion of the general landscape regarding cost effectiveness for TE. Following that, we outline the costs and benefits of TE according to the three perspectives required by the Commission. Finally, we close the section with a discussion of possible trajectories for continued evolution around TE cost effectiveness in Oregon.

8.5.1 Literature Review and Policy Background

California's Standard Practice Manual (SPM) has been used for decades to inform and steer approaches to evaluating utility demand-side management programs, such as energy efficiency and demand response.[233] Although it was primarily developed for demand reduction programs, it was also intended for applications that add load, such as fuel switching or electrification. The main test perspectives of the SPM are:

- Utility Cost Test (UCT), alternatively referred to as the Program Administrator Cost Test (PACT), aims to reflect the perspective of the utility. The UCT includes costs and benefits pertaining to the utility system.
- Total Resource Cost (TRC) Test attempts to broaden the perspective to consider a more holistic view of the resource costs and benefits. Therefore, the TRC includes costs and benefits experienced by the utility system, plus costs and benefits to host customers.
- Societal Cost Test (SCT) takes the broadest view and includes the costs and benefits experienced by society.
- Participant Cost Test (PCT) includes costs and benefits experienced by host customers (i.e., participants).
- Ratepayer Impact Measure (RIM) Test aims to assess potential rate impacts resulting from DER investment applicable to both participants and non-participants.

In 2019, EPRI conducted a review of the California SPM and its various test perspectives to identify major critiques of the traditional tests and their applications, with particular attention to the suitability of applying the SPM to transportation electrification programs.[234] Their research found that the traditional SPM tests were still relevant and applicable to evaluating TE programs, but that "several

[233] See California Standard Practice Manual (2002), retrieved from https://www.calmac.org/events/spm_9_20_02.pdf.
[234] EPRI (2019). *The Total Value Test: A Framework for Evaluating the Cost-Effectiveness of Efficient Electrification*. Retrieved from https://www.epri.com/research/products/000000003002017017

refinements and additions to the SPM methodologies can improve its application to electrification projects."[235] This is especially true, the authors argue, due to the newness and associated uncertainties of TE programs stemming from, for example, long-term customer behavior, rapid technological change, amid other factors. EPRI proposes development of a new test, the "Total Value Test", for beneficial electrification, that seeks to amend the traditional SPM test perspectives for use in evaluating TE investments.

Other recent efforts have similarly sought to modernize or supplement the SPM, most notably the National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources (NSPM for DERs) developed by the National Energy Screening Project.[236] The NSPM for DERS was initially developed in 2017 and focused on energy efficiency program cost effectiveness and was updated in 2020 to broaden the scope to all DERs, including EVs. The 2020 version of the NSPM for DERs contains an entire chapter dedicated to providing guidance on electrification programs and considerations for cost effectiveness.[237] One of the most relevant takeaways from the NSPM for DERS regarding electrification is that the traditional SPM tests do not explicitly contain any treatment of the policy objectives that regulators are inherently aiming to balance in reviewing utility proposals.

Common among these publications is the notion that many perspectives need to be taken into consideration when evaluating the costs and benefits of TE programs, and there are several methods to demonstrate and understand costs and benefits. According to a 2018 report sponsored by the US DOE's Future Electric Utility Regulation series, the significant benefits of TE that lie outside of the typical utility system purview motivate a broadening of the perspectives used to judge TE investments, especially as early pilot programs begin to scale up.[238] These findings are consistent with the ongoing conversations with Staff and stakeholders regarding the appropriate role of cost effectiveness at this juncture in the evolution of TE in Oregon. Per Commission Guidance in Order 22-314, we have calculated values for a RIM, TRC, and SCT, discussed in detail later in this section.

Note that Commission Staff's guidance for implementing the new Division 87 rules, incorporated into Order No. 22-314,[239] indicates that Staff will not use benefit/cost analysis as the basis for recommending Commission approval of TE Budgets in the current planning cycle. Rather, Staff's intent in requiring standard cost tests in the current TE Plan is to enhance ongoing discussion about the role of this analysis in later budget development for subsequent TE Plan cycles. PGE looks forward to actively participating in workshops on this topic as Staff leads development of a jurisdiction-specific cost test for use in developing and evaluating TE Budgets in the future.

8.6 Costs and Benefits Results

This section describes the benefits and costs associated with PGE's TE-related activity. The results are presented along with key methodology considerations for which values are included under each test

[235] Ibid., p. 12.
[236] See https://www.nationalenergyscreeningproject.org/national-standard-practice-manual/
[237] See Chapter 10 of the updated NSPM, which provides key points to consider for assessing cost-effectiveness of electrification, including TE.
[238] Jones et al. (2018). *The Future of Transportation Electrification: Utility, Industry and Consumer Perspectives*. Retrieved from https://escholarship.org/content/qt92m984bs/qt92m984bs.pdf. The authors note that the RIM test may be suitable for early pilots and experiments, but that the broad and significant benefits of TE, coupled with the policy drivers at the federal, state, and local level, point towards more reliance on SCT or other yet-to-be-defined mechanisms.
[239] OPUC Order No. 22-314, Appendix A, Page 8 of 17, https://apps.puc.state.or.us/orders/2022ords/22-314.pdf.

perspective required under Order 22-314. We note here that, although a full expression of costs and benefits related to PGE's TE activity is included in the following sections, this is mainly to support constructive dialogue between Staff and stakeholders as to the overall picture of TE activity. The incremental costs and benefits related solely to the new activity proposed for PGE's TE Portfolio included in this TE Plan, and thus not already approved by the Commission or reflected in rates, will be proportionally lesser. For ease of distinguishing the summary results, at the end of this section we present separate model results for both PGE's overall TE activity, and the more limited 2023-2025 incremental TE Plan Portfolio of activity.

Before performing these tests, it is important to understand the revenue necessary to recover the costs associated with the programs, including an allowed return on capital. This revenue requirement, offset by revenues collected from programs' participants, informs overall rate impacts to customers. These values are shown in the following table:

Table 40. Summary of CapEx, OpEx, and Revenue Requirement All Expenditures, 2023-2025[240, 241]

Year	CAPEX	Capital Carrying Costs	Operating Expense	Total Revenue Requirement
2023	$8,210,904	$562,501	$23,817,948	$24,380,449
2024	$7,217,438	$1,125,400	$22,244,874	$23,370,274
2025	$6,470,407	$2,601,133	$26,161,536	$28,762,669
Totals	$21,898,748	$4,289,033	$72,224,359	$76,513,392

The above revenue requirement, revenues, energy sales, and net customer benefits are foundational for the following benefit-cost tests[242].

8.6.1 Rate Impact Measure Test

The Rate Impact Measure is a standard cost test to evaluate utility programs. It assesses the impact that an activity or set of activities have upon customer rates. The Regulatory Assistance Project (RAP) defines the RIM test as:

> *A test of energy efficiency cost-effectiveness that measures the impact of increased energy efficiency on prices. It is used to determine whether all utility consumers, including non-participants (i.e., the customers not deploying the energy efficiency), will receive lower rates as a result of implementing an efficiency measure.*[243]

[240] Due to regulatory and other priorities the proposed values in Table 40 and throughout this section may be further refined. We note that only new expenditures that may impact rates are included; existing, approved budgets and MMC are considered part of rate baseline and are excluded, as are Clean Fuels Program revenues, which have no rate impact.
[241] Figures shown in this budget include those approved previously by the Commission through docketed proceedings, detailed in Appendix H.
[242] For further detail on how the following benefit-cost tests relate to each other, see Lazar, Jim et al. *The Regulatory Assistance Project. Electricity Regulation In the US: A Guide Second Edition*, Section 17.6 Cost-Benefit Tests (page 125), retrieved from https://www.raponline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf.
[243] Ibid, page 194.

The inputs used to calculate the RIM test are presented in Table 41 below.

Table 41. RIM Test Primary Cost and Benefit Input Variables for TE Programs

Costs	Benefits
• Program delivery costs (admin, outreach and education, incentives, EM&V) • Utility O&M on investments • PGE capital carrying costs • Increased energy supply costs (including energy and capacity)	• Revenue gained from increased sales • Revenue gained from Clean Fuels Credits (where applicable) related to PGE charger ownership or allocated through PGE's Clean Fuels Program

Key assumptions and methods:

- Load shapes based on PGE forecasts
- The RIM cost test is based on the net present value of costs and benefits, assuming annual inflation of 2 percent
- Peak load hours are assumed to be 5 PM to 9 PM, Monday through Friday, year-round except for federal holidays

Interpretation: This test is expressed as a benefit/cost ratio. Any value over 1.0 means that the program is generating surplus benefit compared to cost, driving downward rate pressure on ratepayers. Values less than 1.0 mean that the program is not generating enough revenue to cover costs, putting upward pressure on rates overall.

8.6.2 Total Resource Cost Test

The Total Resource Cost test expands upon the RIM test by adding the net economic benefit to other parties, in this case customers. The RAP defines the TRC as:

> *A measure of energy efficiency cost-effectiveness that considers all resource-related costs and resource-related benefits of the measure. This is a broad test that includes costs paid by utilities, consumers, and third parties, and considers savings in all resource areas, including electricity, other fuels, labor, and comfort.*[244]

The most significant cost-savings factor when it comes to electrifying transportation options for the consumer are O&M savings, notably fuel cost savings and reduced maintenance and repair needs. These are assessed over the lifetime of the vehicle and contribute substantially to the overall benefits of TE.

There have been many studies conducted on the total cost of ownership which have used varying levels of detail and generally have relied on estimates versus actual historical data. This is understandable given the nascency of TE and relative lack of historical data for items like

[244] Lazar, Jim et al. *The Regulatory Assistance Project. Electricity Regulation In the US: A Guide Second Edition*, Section 17.6 Cost-Benefit Tests (page 199), retrieved from https://www.raponline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf.

maintenance and repair, or insurance costs of EVs. For this TE Plan, we rely on PGE's TCO tool, developed by West Monroe consultants.[245] We include TCO savings in the TRC test for the most common vehicle types expected to go through our programs. As an example, Figure 20 shows the lifetime customer benefits for adopting an electric Sedan over a comparable ICE model for the main drivers of the reduced TCO.

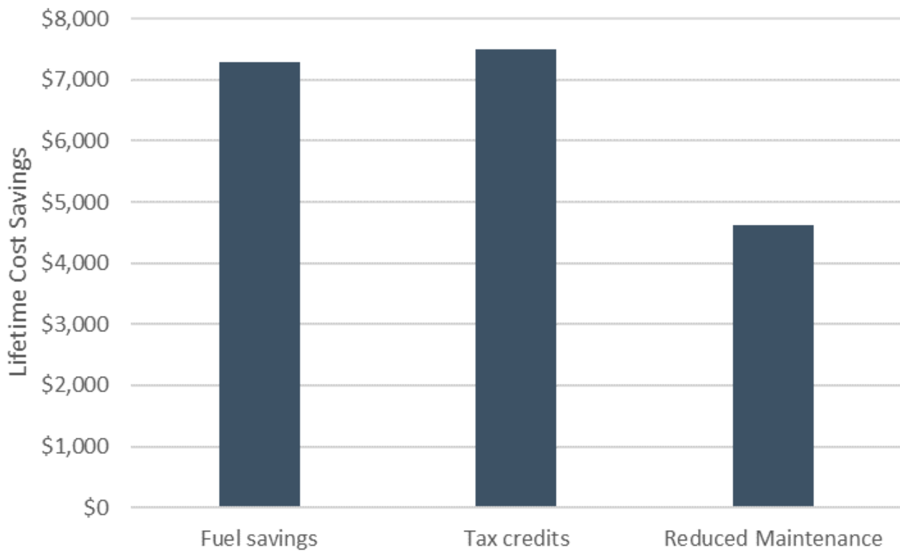

Figure 20. Total Cost of Ownership: Lifetime Dollar Savings from Adopting an EV Sedan compared to ICE-equivalent Vehicle

The inputs used to calculate the TRC test are presented in Table 42 below.

Table 42. TRC Test Primary Cost and Benefit Input Variables for TE Programs

Costs	Benefits
• Program delivery costs (admin, outreach and education, EM&V) • Utility O&M on investments • PGE capital carrying costs • Increased energy supply costs (including energy and capacity)	• Cost savings of an EV compared to an ICE vehicle • Revenue gained from Clean Fuels Credits (where applicable) related to PGE charger ownership or allocated through PGE's Clean Fuels Program

[245] PGE. *Fleet Total Cost of Ownership* Tool. Retrieved from https://portlandgeneral.com/form-fleet-total-cost-of-ownership-tool.

Key assumptions and methods:

- EV and ICE costs include purchase cost, tax credits, fuel cost, and maintenance cost over an assumed 10 year vehicle life. TCO for ICE vehicles and EVs is determined in part from values in PGE's EV Cost and Savings Calculator.
- Assumes equivalent mileage as EVs are substituted for existing ICE vehicles.
- Calculated as cost-per-MWh cost/benefit and applied to program generated load (driven by utilization of program-installed infrastructure).

Interpretation: The TRC test helps identify other non-utility benefits to assess whether the activity has benefits to other stakeholders that outweigh the costs. For this case, PGE added the net economic benefit of EV ownership. Although this helps us better evaluate the monetary benefits of this activity compared to the cost, it is important to note that it does not suggest that the program administrator–in this case the utility–has a positive economic case for the activity; rather, it simply means that benefits (and costs) exist and that the economic impact of the activity is felt by parties other than the administrator.

8.6.3 Societal Cost Test

The Societal Cost Test adds to the TRC a factor for benefits that impact society as a whole, rather than just explicitly the utility or EV drivers. The RAP defines the SCT as:

> *A measure of energy efficiency cost-effectiveness that considers all costs and all benefits of a measure, regardless of who pays or who benefits. This is the broadest cost test, and includes utility, customer, and third-party payments, energy benefits, non-energy economic benefits, plus societal benefits such as public health, economic development, and energy security.*[246]

PGE worked with consultants at Cadmus to review the literature surrounding non-energy impacts, including the societal impacts identified in the NSPM, and determined which of these were applicable to TE. The review determined that the following impacts were applicable to TE:

- Economic and jobs impacts
- GHG reductions
- Public health
- Energy security
- Other environmental impacts
- Resilience

For quantifying values for this test, PGE has included two interim values representing reduced carbon emissions and energy security impacts. Our approach to account for the cost of carbon in the SCT is to use the Social Cost of Carbon (SCC) and a reduced discount rate, consistent with the recommendations to the Oregon Global Warming Commission by the Oregon DOE.[247] The SCC is a

[246] Lazar, Jim et al. *The Regulatory Assistance Project. Electricity Regulation In the US: A Guide Second Edition*, Section 17.6 Cost-Benefit Tests (page 198), retrieved from https://www.raponline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf.
[247] Oregon Department of Energy. *Primer on the Social Cost of Carbon*. May 2020. Retrieved from https://www.oregon.gov/energy/energy-oregon/Documents/2020-Social-Cost-of-Carbon-Primer.pdf.

widely used metric and a popular method to quantify externalities associated with carbon release or sequestration.

For energy security impacts, we rely on recommendations provided by our consultants, E3, regarding use of EPA macroeconomic oil security premiums.[248] These values reflect energy security benefits based on avoiding sudden increases in oil prices that can lead to macroeconomic disruption. The EPA calculates these benefits based on a forward-looking expectation of marginal change in expected import costs and related changes to gross domestic product, which is a measure of macroeconomic activity. The values can be applied to reductions in crude oil imports resulting from TE. The energy security impact ranges from $3.15 (in 2018$/barrel) to $4.21/barrel in 2040.[249]

Note that these metrics are expected to evolve as PGE, Staff, and stakeholders continue to develop and align on an accepted methodology for future filings.[250]

Table 43, below, shows the cost and benefit inputs used to calculate the TRC test.

Table 43. SCT Primary Cost and Benefit Input Variables for TE Programs

Costs	Benefits
• Program delivery costs (admin, outreach and education, incentives, EM&V) • Utility O&M on investments • PGE capital carrying costs • Increased energy supply costs (including energy and capacity)	• Cost savings of an EV compared to an ICE vehicle • Revenue gained from Clean Fuels Credits (where applicable) related to PGE charger ownership or allocated through PGE's Clean Fuels Program • Benefit of reduced carbon emissions (using SCC), see key assumptions below

Key assumptions and methods:

- Compared carbon emissions from ICE vehicles compared to EVs for equivalent usage per vehicle assuming a one-for-one substitution.
- Carbon intensity for electricity is PGE's system value (0.32 mt/MWh in 2023), which is declining as PGE moves toward CEP goals.

[248] U.S. Environmental Protection Agency. (December 2021). *Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis.* Retrieved from https://www.federalregister.gov/documents/2021/12/30/2021-27854/revised-2023-and-later-model-year-light-duty-vehicle-greenhouse-gas-emissions-standards.
[249] These values in $/barrel are converted to lifetime $/vehicle based on the methodology followed by Malmgren, I. (2016). "Quantifying the Societal Benefits of Electric Vehicles" *World Electric Vehicle Journal,* vol 8. There are roughly 19 gallons of gasoline per barrel of oil produced, translating to $0.17 to $0.22 per gallon. We then apply these to the lifetime gallons of gasoline saved by EVs as determined by the PGE's TCO calculator referenced above.
[250] Importantly, the public health benefits of TE are undoubtedly large, and yet are not explicitly included here. However, by leveraging an SCC value, a portion of the external damages (including health impacts) associated with vehicle emissions are implicitly captured. Given the difficulties associated with disentangling individual components of the SCC and comparing to alternative methods, we believe this is a suitable proxy for the time being.

- Valued carbon using values from the Primer on the Social Cost of Carbon. The central estimate was used, incorporating a 3 percent social discount rate.
- Calculated as cost-per-MWh cost/benefit and applied to program generated load (driven by utilization of program-installed infrastructure).

Interpretation: The SCT takes the TRC one step further in that it includes impacts to parties not directly involved in the activity. By including the net benefit of carbon reduction, PGE has factored in benefits to society that we can estimate from the TE activity. Since this benefit is non-economic, it does not imply headroom for the administrator to spend to achieve these benefits, but it does enumerate their value.

Table 44, below, presents the overall benefit-cost ratios for each of the three test perspectives.

Table 44. Cost Effectiveness Tests, New Incremental Expenditures

Cost Effectiveness Results (Benefit Cost Ratio)[251]	All Years	2023-2032
Rate Impact Measure Test	0.67	0.67
Total Resource Cost Test	1.47	1.51
Societal Cost Test	1.71	1.73

8.7 Ratepayer Impact

8.7.1 Analysis of Ratepayer Impact for New Expenditures Not Already in Rates (2023-2025)

In proposing this Transportation Electrification budget, the Company has considered the need to prepare for significant new electric load within a challenging macroeconomic environment.[252] We do not propose to attempt to fulfill the entire need for TE infrastructure development in our service area with this Plan, but instead to advance toward that goal at a level that considers the range of utility activities that impact customer prices and establishes an appropriate, ongoing utility role in this effort. In proposing this budget, we also engage directly in load management use cases and lay the groundwork for future managed charging scenarios. We believe this Plan reflects an investment that will benefit all customers.

[251] Costs associated with the incremental capacity need from EV charging are based off of electric load carrying capability data derived from the 2019 IRP. As soon as we have completed an updated analysis for TE activity from the recent IRP, we will update these calculations accordingly.
[252] PGE's 2022 DSP forecasts a load increase range of 12-40 MWa from 2022-2025.
See Chapter 3. DSP Chapter 3. Load and DER forecasting, Table 18. Transportation electrification potential forecasts. Retrieved from https://assets.ctfassets.net/416ywc1laqmd/46I2n65SyTv3TUMMdq1l55/a993aebb7b7a84ebd3209d798454a33a/DSP_Part_2_-_Chapter03.pdf.

Table 45. Estimated Rate Impact, New Expenditures (2023-2025)

Category	Schedule	2023 Rate Impact	2024 Rate Impact	2025 Rate Impact
Residential	7	0.13%	0.20%	0.22%
Small Non-residential	32	0.11%	0.18%	0.20%
Large Non-residential Time of Day	38	0.17%	0.27%	0.30%
Large Non-residential Capacity Tier	83	0.01%	0.02%	0.02%
Large Non-residential Capacity Tier	85	0.02%	0.03%	0.03%
Large Non- residential Capacity Tier	89	0.02%	0.04%	0.04%
Large Non- residential Capacity Tier	90	0.01%	0.02%	0.02%
Total Impact, All Schedules		0.08%	0.13%	0.15%

The above table represents the total rate impact by year and schedule. Total rate impact is the total percentage increase in revenues from rates in all schedules compared with a 2022 base year.

Chapter 9. Conclusion

PGE's 2023 TE Plan employs a strategy to plan, serve, and manage load through rates, programs, and infrastructure investments within the context of the current market and regulatory environment. The TE Plan also balances the proposed expenditure within the context of the clean energy transition investments forecasted within PGE's IRP and CEP. TE Plan activities are connected to the broader planning context at PGE, basing its planning analysis on the same modeling that informs PGE's IRP, CEP, DSP, and MYP activities. Further, this Plan balances costs with policy considerations such as meeting the needs of underserved communities. The Plan meets the needs of residential, multi-family, business, and fleet customers with only a 0.15 percent impact to rates and a positive total resource cost benefit score.

PGE recognizes the dynamic nature of the electric vehicle market in Oregon and the nation. Adoption is accelerating with vehicle manufacturer investment in new models and battery technology. Federal investment in consumer tax credits, charging infrastructure, and grants are also accelerating electric vehicle adoption. The private market continues to invest in new charging infrastructure, though PGE recognizes that these investments may fall behind in markets such as underserved communities. To address this investment gap, 58 percent of PGE's 2023 TE Plan portfolio of activity is directed in the service of underserved community needs. PGE's 2023 TE Plan utilizes Clean Fuels Program credit revenue ($45.2 million) and, to the greatest extent possible, previously-approved Monthly Meter Charge funding ($10.5 million) and existing/approved customer investment ($17.6 million). These funds are used in concert with additional Monthly Meter Charge funding ($10.9 million) and a requested additional ratepayer funding of $9.8 million. The 2023 TE Plan requests approval of these incremental funds ($10.9 million of MMC and $9.8 million in additional ratepayer dollars) to conduct the activities proposed.

The 2023 TE Plan requests approval of these incremental funds to conduct the activities proposed herein. PGE designed these activities to inform an evolution from program structure and expenditures to utility base business, which we seek to accomplish through new rate and tariff designs tailored to the needs and requirements of unique TE loads. Programs will continue to meet emerging needs, address policy considerations such as serving underserved communities, and explore managed charging technologies.

The 2023 TE Plan balances PGE's TE market presence and role. Our programs support private investment in charging infrastructure. Further, the portfolio of program activity attempts to attract private investment or demonstrate to the private market that a need is not being met, as well as how to meet that need or that a need could be met through partnership with PGE. Our investment in infrastructure requires managed charging investment and data sharing. These requirements and investments will further the benefits of transportation electrification and customers through resource development and lowered overall cost to serve and lower total cost of ownership.

Appendices

Appendix A. Summary of Current Activities

This appendix includes a summary of activities that are already approved, for which PGE seeks to allocate additional funding to expand or extend our approach.

A.1 Residential Smart EV Charging

Table 46. Residential Smart EV Charging Reference

Docket Number(s)	ADV 1151[253]
Docket Name(s)	PGE SCHEDULE 8, ADV. NO. 20-18, RESIDENTIAL ELECTRIC VEHICLE CHARGING PILOT
Filing Date	February 15, 2019
Effective Date	October 23, 2020
Allowed (Approved) Utility Filing Date	October 20, 2020
Allowed (Approved) Utility Filing Name	Advice No. 20-18[254]
Governing Tariff	Schedule 8[255]
Deferral Number(s)	UM 2003[256]
Deferral Date(s)	February 11, 2021[257], February 22, 2022[258]

PGE's Residential EV Smart Charging Pilot launched in 2020. The current pilot is available to up to 5,000 eligible residential customers. PGE is proposing to extend the pilot through the end of 2025, reduce the charger rebate amount from $500 to $300 and eliminate the enrollment cap. PGE is proposing this pilot extension to continue to learn more from the current pilot and to take the learnings from the Smart Grid Testbed EV Charging Study to work towards creating a managed charging program. The Residential Smart Charging pilot rewards participants for shifting or reducing

[253] OPUC Docket ADV 1151 available here: https://apps.puc.state.or.us/edockets/DocketNoLayout.asp?DocketID=22516.
[254] OPUC Advice No. 20-18 available here: https://apps.puc.state.or.us/edockets/DocketNoLayout.asp?DocketID=22516.
[255] PGE Schedule 8 available here: https://assets.ctfassets.net/416ywc1laqmd/2CrkwfPNPaDoM1tiVX68k0/2be53eec9b97dd32c72b72bc79daa940/Sched_008.pdf.
[256] OPUC UM 2003 available here: https://apps.puc.state.or.us/edockets/docket.asp?DocketID=21817.
[257] February 2021 deferral available here: https://edocs.puc.state.or.us/efdocs/HAQ/um2003haq91312.pdf.
[258] February 2022 deferral reauthorization available here: https://edocs.puc.state.or.us/efdocs/HAQ/um2003haq145445.pdf.

their home EV charging at peak times. Enrolled customers are eligible for a $25 seasonal reward by participating in flex load events. During these events, PGE sends a signal to automatically pause customers' charging for the duration of the event, either through their qualified charger or through cloud-based vehicle telematics. This pilot is intended to explore how PGE can use flex load from residential EV charging.

Customers have three ways to enroll in the pilot:

- Customers receive a $500 rebate ($1,000 for income-eligible customers) for the purchase and installation of a qualified Level 2 charger at their home. PGE is proposing to reduce the charger rebate amount from $500 down to $300.
- Customers receive a $50 rebate if they purchased and installed a qualifying Level 2 charger prior to it being added to the Qualified Products List.
- Customers that drive a qualified vehicle (i.e., Teslas) but have a non-qualified EV charger can enroll through vehicle telematics (evPulse) and receive a $50 rebate. These customers are then enrolled in the Residential EV Smart Charging Pilot and, like those that receive the charger rebate, have demand response events called.

This pilot has also included dealership incentives to help enroll prospective EV buyers in the Residential EV Smart Charging Pilot. These dealerships have Chargeway Beacons, which are kiosks that provide customers with information on EVSE locations, trip-planning, and also details on how to enroll in the pilot. Based on learnings from the past two years, we are re-assessing the dealership referral program.

In 2022, PGE allocated $738K of the 2022 Monthly Meter Charge[259] to enhance this pilot. There were no 2023 Monthly Meter Charge dollars allocated to the Residential EV Smart Charge Pilot. The 2022 enhancements provide an additional rebate for customers who require an electric panel upgrade when installing a Level 2 charger in their home. Customers who apply for the Residential EV Smart Charging Pilot can also qualify for the electric panel upgrade rebate. Those customers who apply for the standard rebate can receive up to $1,000 towards the cost of the panel upgrade. Income-eligible customers can apply to receive up to $5,000 towards the cost of their panel upgrade. This enhancement was added to break down financial barriers to help support EV adoption and make it easier for income-eligible customers to install a Level 2 charger in their home. The panel upgrade rebate will continue at the same incentive level until 2022 MMC funds are exhausted.

After the first demand response season ended on April 30, 2022, PGE found that over 80 percent of evPulse customers participated in the Smart Charge events and about 70 percent of other customers participated. As of April 28, 2023, there were a total of 2,981 customers enrolled in the pilot: 1,601 in the Standard/Income-eligible/Bring-Your-Own-Charger portion of the pilot, and another 1,297 enrolled via WeaveGrid's evPulse[260]. This brings a potential of about 0.56 MW of flex load. The forecasted MW impact is as follows:

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[259] PGE's 2022 Monthly Meter Charge filing, retrieved from https://edocs.puc.state.or.us/efdocs/HAH/um2033hah1673.pdf.

[260] WeaveGrid is a vehicle telematics software company that allows utilities to connect directly to an EV, rather than via the charger. This allows PGE to add Tesla chargers to the pilot, which would otherwise not be accessible to PGE for DR purposes.

Table 47. Load Forecast for Residential EV Smart Charging Pilot

Year	Participants Added	Total Participants	Load Forecast (MW)
2022	1,757	2,396	0.66
2023	1,804	4,200	1.39
2024	3,300[261]	7,500	2.39
2025	2,399	9,899	3.49

By the end of the current pilot, PGE anticipates 2.14 MW of enrolled flexible load capacity across 5,000 connected vehicles. PGE anticipates an evaluation memo of the first two demand response seasons of the pilot in July 2023 to analyze the capacity and results.

With this TE Plan, PGE proposes extending the timeframe of the pilot and changing the funding from the approved deferral funding source to the monthly meter charge starting with enrollments beyond the 2023 forecast. These two changes are recommended to reduce future customer ratepayer impact from the deferral as well as to incorporate learnings from the Smart Grid Testbed's managed charging demonstration into a future managed charging program. The changes equate to a budget of $4.08 million: an increase of $1.53 million to increase the number of allowed enrollments and the associated incentives and a change in funding for customers enrolled prior to 2024 and the extension of the pilot for those customers through the end of 2025 (approximately $2.55 million) from deferral funding to MMC funding. The $4.08 million budget will allow the integration of 4,399 additional vehicles (9,399 total vehicles) and 1.35 MW additional flexible load capacity (for a program total of 4.22 MW).

A.1.1 Program/Measure Details

A.1.1.1 Elements, Objectives, Timeline, Expected Outcomes

Program Objectives

This program aims to:

- Enhance PGE's understanding of how to effectively manage residential EV load by gathering data from the current and proposed activities to inform future rate design for a managed charging program and the need for an EV-specific time of day rate/tariff
- Gain insight into how to best serve underserved communities

Program Elements

To participate, customers visit PGE's website to learn which chargers and vehicles qualify for the program. Enrollment in the managed charging program through vehicle telematics requires customers to have a Level 2 charger and a qualified vehicle. Customers purchase a qualified charger, show proof that the charger is qualified, and connect with an EV charger installer. Customers then enroll on the Residential EV website and receive their rebate check approximately 4-6 weeks after

[261] Enrollment numbers are dependent on when cap removal is implemented. If this program is approved, Tariff update will be submitted shortly thereafter. Including lower participant amount based on lower upfront rebate.

acceptance. To participate in an event, customers must start charging their vehicle prior to an event, not opt out, and resume charging after the event. Requirements include participating in Smart Charge events, charging at home, and keeping chargers connected to the internet. evPulse customers do not need to have a qualified charger as charge events are called through vehicle telematics. Customers receive a $25 seasonal incentive based on a six-month season (October – March; April – September) for allowing PGE to pause EV charging during peak loads. The current pilot does not call emergency demand response.

Customers learn about the program through PGE's website, direct outreach and education, from the EV Costs & Savings calculator, the dealership referral program, and word of mouth. To join the program, customers go to PGE's website and complete the application. This includes submitting information about their EV, the number of people in the household, and other pertinent details. Customers must also include invoices and other documents relevant to their application.

Customer Journey

- Customer wants to install an at-home Level 2 charger
- Learns of the pilot through targeted outreach and education
- Purchases a qualified Level 2 charger (Tesla drivers apply through telematics (evPulse) and join the Smart Charge Pilot)
- Gets an installation quote through the trade ally network
- Gets their charger installed
- Goes to PortlandGeneral.com and applies for the pilot
- Once enrolled, receives their charger rebate ($300) within 4-6 weeks
- Participates in Smart Charge events and receives $25 on-bill credit at the end of the six-month season

Education and Outreach

Given the different elements of the program, education and outreach will be vital for customers to understand how the program works and its benefits. PGE has assessed the current effectiveness of our outreach and education dollars compared to other outreach and education strategies (e.g., dealership incentives) to determine whether the amount of education, outreach, and outreach and education dollars is appropriate. PGE's outreach and education has proven to be 10 times more effective than dealerships in getting enrollments.

Relative to the overall cost of the measure, education and outreach dollars represents approximately 5 percent of the overall measure cost. This ratio has decreased as the program has gained enrollments, as EV adoption is effectively occurring without the need to promote the program, resulting in a relatively low ratio.

Program Timeline

PGE plans to revise the rebate by Q4 2023, following the approach proposed in this application. PGE also intends to move to a managed charging program by Q4 2026.

Expected Outcomes

- 4.22 MW of flexible load by the end of 2025

- 9,399 participants in Residential EV Smart Charge Pilot
- Established learnings from pilot evaluation and managed charging demonstration

A.1.1.2 Market Baseline Assumptions

According to the Oregon Department of Environmental Quality, using vehicle registrations from the Oregon Department of Motor Vehicles, as of June 2022, there were 40,426 light duty EVs registered to residential customers in PGE's service area.[262] Using PGE's AdopDER forecasting model, PGE forecasts EV adoption to grow to 146,000 vehicles (including commercial) by the end of 2025 and potentially half a million EVs in PGE's service area by 2030. PGE's vehicle forecast is derived as part of the Company's DSP process.

A.1.1.3 Major Performance Milestones

Milestones are as follows:

- July 2023 Pilot evaluation memo
- November 2023 Pilot annual evaluation
- 5,000 customers enrolled in Pilot by end of 2023
- November 2024 Pilot annual evaluation
- 7,000 customers enrolled in Pilot by end of 2024
- Smart Grid Testbed EV charging study concludes December 31, 2024
- 9,399 customers enrolled in Pilot by end of 2025

PGE will monitor the impact that the rebate amount will have on customer participation and adjust accordingly relative to projected enrollment. PGE will also provide education and outreach to ensure customers understand the benefit of flexible load events and monitor customer participation in seasonal DR events. If customer participation decreases, PGE will assess the incentive structure to determine its impact on customer participation.

A.1.1.4 Program/Measure Phases

For the long-term evolution of the program, PGE seeks to utilize findings from the Smart Grid Testbed EV Charging Study to better understand vehicle telematics capabilities, including measuring the effectiveness of telematics managed charging compared to the current smart charging activity. PGE will determine changes needed from the Smart Grid Testbed EV Charging Study to scale managed charging from the demonstration and pilot into a program.

Developing a managed charging program that leverages vehicle telematics to communicate various charging and curtailment events will provide benefits to both the grid and customers. With an effective managed charging program, the customer will be able to get the desired charge when they need it and PGE can use the flexible load to help manage the grid. Managed charging goes beyond stopping the charge of the car during high peak times. It would also allow PGE to determine the right time to charge the car when is beneficial for the customer and the grid.

[262] Oregon DEQ (March 2023). *Oregon Clean Fuels Program: Residential EV Credits for the Second Half of 2023*. Retrieved from https://www.oregon.gov/deq/ghgp/Documents/cfpResCredits2021p1.pdf.

A.1.1.5 Utilization, Eligibility, Incentive Structures

This program will continue to be offered to residential customers in PGE's service area. PGE uses a mixture of rebates and incentives to help customers overcome the financial burden to EV adoption and home charging installation.

The installation rebate lowers the total costs involved in installing a qualifying connected EVSE and can increase depending on the participating customer's income level. Customers are eligible to receive an installation rebate of up to $300 towards the installation of a qualified EV charger installed at the customer's home. Income-eligible customers are eligible to receive an installation rebate of up to $1,000 toward the installation of a qualified EV charger installed at the customer's premise. During the application process, customers will have the opportunity to opt-into PGE's Schedule 7 TOD rate.

PGE will automatically enroll all applicants into the Smart Charging Program. PGE will utilize the smart charging incentive to encourage customers to keep their EVSE connected to PGE's Demand Response Management System (DRMS), charging their vehicles at home, and participating in flexible load events. Qualifying customers will receive this incentive either annually or at intervals PGE determines is appropriate to incent and maintain customer participation. PGE will pay customers up to $50 for their successful participation in the Smart Charging Program.

A.1.1.6 Market and Implementation Barriers Addressed

Section 3.6 details the market barriers to EV adoption. The Residential EV Smart Charging Pilot addresses the specific barriers to EV deployment, including education and awareness, cost, fueling infrastructure and availability, channel/sales processing, incentives and policies, equitable access, and infrastructure reliability.

A.1.1.7 Performance Area Categories

PGE's proposed design addresses relevant Division 87 performance area categories in the following ways:

- Environmental benefits including greenhouse gas emissions impacts.
- Increased access to electricity as a transportation "fuel" will reduce greenhouse gas emissions across PGE's service area.
- Electric vehicle adoption: Enhances the customer value proposition for going electric.
- Equity of program offerings to meet underserved communities: The enhanced incentives for income-qualified customers aims to break down financial barriers to help support EV adoption and make it easier for income-eligible customers to install a Level 2 charger in their home
- Distribution system impacts and grid integration benefits: PGE does not anticipate significant distribution system impacts stemming from this program. Grid integration benefits are largely represented by the networked and DR-capable requirements in the technical standards that PGE sets.
- Program participation and adoption: PGE anticipates a total of 9,399 participants.
- Infrastructure performance including charging adequacy which considers, but is not limited to reliability, affordability, and accessibility: PGE tracks charger uptime and utilization rates.

A.1.1.8 PGE's Role in the Program

PGE's role in the program is to support EV adoption and influence the role of EVs as a flexible load resource in the future. With the additional electric load coming onto the grid from customer's fueling their electric vehicles, PGE must engage with and educate customers on the new fueling paradigm and how to benefit customers and the grid.

A.1.1.9 Resulting Distribution Upgrades

PGE does not expect the program to trigger any significant distribution system upgrades. However, as part of our data gathering work, the Company will monitor transformers and substations to proactively identify any needed upgrades.

A.1.1.10 Ownership Structure

PGE will own the make-ready infrastructure and the EVSE. PGE will procure, install, operate, and maintain any EVSE installed under this program.

In discussions with municipalities, many have expressed the need of public charging to help in the transition to electric vehicles. Municipalities also believe that many underserved communities could be left behind that without a program such as this or without PGE's help. In additional discussions, PGE has learned that, while many municipalities want to provide public charging for their constituents, they don't believe they are well suited to own and operate the equipment and look for PGE to help fill this role and their guidance.

This approach addresses the barriers which municipalities without the resources or inclination to own and operate EVSE face when considering public EV charging. ROW charging is particularly well suited to this purpose, as EV charging can be deployed on assets already located in the public right of way. The program also allows PGE to offer local and visiting customers in its service area a consistent user experience with equitable, affordable, and easy-to-understand pricing. PGE ownership, operation, and maintenance of EVSE in the ROW in collaboration with municipalities helps ensure that chargers are located strategically, with an eye toward an equitable transition to electric vehicles.

PGE will also explore potential private partnerships around ownership and maintenance of all chargers installed in the program. Potential private partnerships would have to comply with Schedule 50 or another tariff that is specifically tailored for this purpose. There is the risk of a lack of wiling market actors to agree to private partnerships and adhere to PGE's Schedule 50. If PGE is unable to create a private partnership, PGE will continue to own, operate, and maintain the chargers unless and until the private market is meeting the needs of underserved communities.

A.1.1.11 EVSE Requirements (Equipment Interoperability and National Standards)

PGE utilizes a single Qualified Products List (QPL) to determine eligible EVSEs for all of PGE's non-residential EV programs. EVSE vendors must submit a Request for Qualification (RFQ) if they want their products added to the QPL. PGE engineers review each RFQ for completeness and against the predefined qualification requirements, listed below. If the vendor receives technical approval, they must also execute a Data Sharing Agreement with PGE before their products will be added to the QPL.

Hardware requirements (Level 2 and DCFC):

- National Electrical Manufacturers Association (NEMA) Type 3R or 4, which certifies that equipment is weatherproof and certified for either indoor or outdoor use.
- Compliant with Federal Communications Commission Part 15, which sets limits on the amount of electromagnetic interference allowed.
- Compliant with National Electric Code, National Fire Protection Association (NFPA) article 625, which covers wires and equipment used to supply electricity for EV charging.

- Compliant with the Americans with Disabilities Act (ADA), which ensures that the EVSE is ADA accessible, if installed according to the manufacturer's instructions.
- EVSE model must have a cellular connectivity option, either 4G LTE or 5G.
- Compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of network service providers. It also must be remotely upgradable to support future versions of OCPP.
- Must include a standard warranty of 1 year or greater
- Must have an operating range of at least -22F to 122F, ensuring it can withstand extreme environments

Level 2-specific requirements:

- Compliant with Society of Automotive Engineering (SAE) J1772, the standard Level 2 connector that is compatible with all road-legal EVs for sale in the United States, including plug-in hybrids (PHEVs), battery electric vehicles (BEVs), and Tesla vehicles using an adaptor.
- Listed by a nationally recognized test lab to the requirements of UL 2251 and 2594, demonstrating that products are tested to UL's recognized safety standards.

DCFC-specific requirements:

- If the EVSE includes a Combined Charging System (CCS) connector, it must be compliant with SAE J1772.
- Listed by a nationally recognized test lab to the requirements of UL 2202, demonstrating that products are tested to UL's recognized safety standards.
- Equipment compliant with recommended practice SAE J2894/1_201112 or later (power quality requirements for EVSE).
- If the EVSE includes an automated conductive charging mechanism (pantograph), it must meet SAE J3105.
- DCFC EVSE efficiency must be greater than 92 percent

Software requirements:

- Software platform must be responsive to grid services, modifying charger power output levels, using either one of the following methods
  - Certified OpenADR 2.0b Virtual End Node (VEN)
  - Application Programming Interface (API)
  - IEEE 2030.5 (SEP 2.0)
- Software must also be compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of EVSE hardware.

Through the RFQ process, PGE collects additional technical information from vendors that aren't requirements but help inform PGE programs and potential future requirements. This includes items such as:

- Compliance with ISO/IEC 15118

- Payment methods and pricing options
- Compliance with OCPI v2.2 or later
- EVSE metering accuracy
- Bi-directional charging capability
- Lead time and indicative pricing
- Installation manuals
- The vendor's sales point of contact to post on PGE's QPL webpage so customers know who to contact when interested in a specific product

As of 4/28/2023, PGE has qualified 137 EVSE models from 18 different EVSE vendors.

A.1.1.12 Equipment Interoperability

PGE maintains a list of qualified residential EVSEs to ease the charger selection process, as well as to ensure customer and pilot success. The Qualified Product List (QPL) includes only the Level 2 EVSEs that qualify for the pilot's rebates. PGE makes the list available on the Company's website, and to dealers, trade allies, and community organizations. Selection criteria for PGE's QPL includes:

- EVSE must be a UL-listed, Level 2 EVSE and capable of operating with an input voltage of 208/240VAC, an output amperage of a least 20 amps, and designed for residential use.
- EVSE must be capable of connecting to a customer's local area network via wired or wireless protocols.
- EVSE must be capable of participating in demand response events by reducing the power output of, stopping, and starting active charging sessions.
- EVSE must be capable of integration with a third-party distributed energy resource management platform of PGE's choosing.
- EVSE must provide a satisfactory user experience, including unboxing, installation, set-up, and control via mobile and web-based applications
  - Mobile app must allow user to opt out of demand response events

A.1.2 Program/infrastructure coordination

A.1.2.1 Stakeholder involvement in development

For the 2023 TEP, PGE held one stakeholder workshop to discuss the evolution of this pilot. Please refer to Chapter 4 for details on PGE's stakeholder engagement on this and other TE proposals.

A.1.2.2 Coordination with State Programs

PGE recognizes EV ownership is expensive. There are several federal and state rebates available to help assist with the upfront cost of owning or leasing an EV. PGE offers rebates towards the purchase and installation of Level 2 chargers, along with a panel upgrade rebate that helps bring down the cost of installing an at-home charger.

A.1.2.3 Coordination with Market Actors and Activities

Prior to the first demand response season, PGE conducted a soft launch with about 20 participants in August 2021. In that soft launch, we tested different event times, communication strategies and overall customer satisfaction with the experience. This launch informed the timing of demand response events and the communications associated with the events.

PGE consistently scans the utility market to determine program shifts and technology updates to calling flex load events on EVs. PGE tested vehicle telematics technology in PGE's Testbed and achieved positive results that it was introduced into the Residential EV Smart Charging Pilot. We included these vehicle telematics customers into the program in November 2021 and hit the 500 customer cap in February 2022. In Quarter 3 2022, PGE updated the Tariff to add the incentive for vehicle telematics and it remains a pathway into the Pilot.

A.1.3 Fit with Long Term TE Strategy

The expansion of the current pilot directly aligns with PGE's strategic goal to plan for, serve, and manage residential EV charging load. Expanding and extending the current pilot program provides an opportunity to evaluate the impact of electric vehicle charging on the grid and increasing the number of vehicles enrolled in the Residential EV Smart Charge program can provide also greater flexibility for load management that contributes to PGE's VPP. Flexible load capabilities also benefit non-EV drivers by keeping costs down for all ratepayers, as PGE is less reliant on the wholesale market to buy energy. Furthermore, flex load capability will help PGE manage the grid while still allowing EV drivers to charge their EVs when needed.

In addition, the expansion of the pilot will help PGE better understand rate design, panel capacity, and the electrification process, in addition to understanding where customers are charging their EV's in PGE's service territory.

With an effective managed charging program, customers will be able to get the desired charge when they need it, and PGE can use the flexible load to help manage the grid. Managed charging goes beyond stopping the charge of the car during high peak times. It would also allow PGE to determine the optimal time to charge the car when it is beneficial for the customer and the grid.

Through the Smart Grid Testbed Managed Charging Demonstration, PGE aims to determine whether a managed charging program can help identify optimal times to start charging and when to curtail charging.

A.1.4 Learning Objectives, Evaluation of Effectiveness, and Data Collection Methods

Evaluation on the current Residential EV Pilot is scheduled to have an interim memo completed by June 2023, and an annual report in November 2023 and November 2024. These reports will be used to determine the success of the current pilot and whether the EVSE portion of the pilot will continue into program, along with a managed charging program. PGE will also assess the amount of flexible load delivered by the pilot. The July evaluation memo will evaluate the first two demand response seasons and the annual report in November will provide further evaluation on flexible load deliverables. PGE seeks to measure the best flexible load capabilities while minimizing customer price impacts.

The Testbed EV Charging Study will also have more conclusive data Q3/Q4 2023 that can be drawn upon when creating a managed charging program, including data on usage and load profiles to determine the impact of this load on the grid.

In addition to informing PGE's approach for a managed charging program, the pilot's expansion will evaluate the effectiveness of the incentive and rebate structure by measuring enrollment and customer satisfaction and retention, along with its cost effectiveness.

Through expansion of this pilot, PGE aims to better serve underserved communities based on the findings from the evaluation survey. The evaluation will inform PGE's understanding of the following learning objectives:

- Can the incentive offered bridge the gap and encourage community electrification?
- Do underserved customers exhibit the same charging behavior as other participants?
- Is there anything unique about the way underserved customers participate in the program?

Additionally, the pilot will investigate:

- Which type of chargers are being purchased and if the proposed rebate amount is sufficient to incentivize customers to purchase a qualified charger.
- Where customers are charging their electric vehicles in the territory, supporting PGE's efforts to plan effectively for increased TE load.

A.1.5 Program and Infrastructure Costs

A.1.5.1 Estimated total costs, including incentives, program delivery, evaluation, marketing, and program operations costs

Table 48. Residential Smart EV Charging Budget: Forecasted Operating and Capital Expenditures[263]

Approved	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Ops	[redacted]	[redacted]	[redacted]	[redacted]
O&M	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation	[redacted]	[redacted]	[redacted]	[redacted]
Marketing	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$2,417,000	$1,945,313	$2,130,409	$6,492,722

A.1.1.13 Estimated participant costs

Residential customers are billed on Schedule 7.

[263] Budget is based on forecasted enrollment numbers in Table 45. The forecasted enrollment numbers are higher than UM2003 deferral filing in February 2023 due to increased market interest shown since the end of 2022.

A.1.6 How Infrastructure Measure Addresses Oregon Administrative Rule and Oregon Law

Table 49. Residential EV Charging Concordance with OAR 860-087-0020(4)

OAR 860-087-0020(4)	Section of Application Addressing the Rule
A description of the infrastructure measure;	A.1.1
Data used to support the description;	A.1.1
A description of infrastructure measure coordination;	A.1.1.5 - A.1.1.11 A.1.2 - A.1.5
A description of how the proposed infrastructure measure fits within the electric company's long-term strategy to support TE;	A.1.3
A description of costs;	A.1.5
A description of learning objectives and how the electric company will evaluate the infrastructure measure; and	A.1.4
For infrastructure measures, a description of how the measure addresses the considerations of ORS 757.357	Table 78

Table 50. Residential EV Charging Solutions Concordance with ORS 757.357

ORS 757.357	How Application Addresses the Law
(1) (b) (A) "Infrastructure measures" includes, but is not limited to, investments in, expenses related to or rebates for: (i) Distribution system infrastructure that supports transportation electrification; (ii) Communication and control technologies that support transportation electrification; and (iii) Behind-the-meter infrastructure that supports transportation electrification and is owned by an electric company or by a customer.	The investments proposed in this application meet the description of infrastructure measures in (iii), as they are issued for behind-the-meter infrastructure that supports transportation electrification
(b) (B) "Infrastructure measures" does not include investments in or expenses related to education and outreach activities related to transportation electrification, or other	While this infrastructure measure has an associated outreach and education budget, it is for enrollment only, rather than general

ORS 757.357	How Application Addresses the Law
transportation electrification-related activities determined by the Public Utility Commission to be separate and distinct from the development of infrastructure.	education and outreach to advance transportation electrification
(5) If undertaken by an electric company, an infrastructure measure to support transportation electrification is a utility service and a benefit to utility customers if the infrastructure measure can be reasonably anticipated to:	
(a) Support reductions of transportation sector greenhouse gas emissions over time; and	A.1.1.7
(b) Benefit the electric company's customers in ways that may include, but need not be limited to: (A) Distribution or transmission management benefits; (B) Revenues to utilities from electric vehicle charging to offset utilities' fixed costs that may otherwise be charged to customers; (C) System efficiencies or other economic values inuring to the benefit of customers over the long term; or (D) Increased customer choice through greater transportation electrification infrastructure deployment to increase the availability of and access to public and private electric vehicle charging stations.	A.1.1.7 A.1.2.3

A.2 Fleet Partner

Table 51. Fleet Partner Reference

Docket Number(s)	ADV No. 21-09
Docket Name(s)	NEW SCHEDULE 56, Fleet Electrification Make-Ready Pilot
Filing Date	April 20, 2021
Effective Date	July 1, 2021
Allowed (Approved) Utility Filing Date	June 1, 2021
Allowed (Approved) Utility Filing Name	https://edocs.puc.state.or.us/efdocs/UAA/adv1261uaa15156.pdf
Governing Tariff	Tariff PUC No. 18
Deferral Number(s)	N/A
Deferral Date(s)	N/A

Approved in June 2021, Fleet Partner is a program that offers non-residential customers no-cost customer planning and technical services The program also offers make-ready infrastructure installation with custom cost incentives. Eligible customers include non-residential fleets (commercial, municipal, school, non-profit, and transit), that are installing 70kW or more of EV charging. The program objectives are to enable fleet electrification and reduce adoption barriers (e.g., complexity and cost), create demand response-enabled EV charging to support efficient grid integration, identify customer and market barriers, and identify areas for improvement in future evolution of the program.

By participating in the first phase of the program (Fleet Partner Plan), customers receive a Fleet Partner Study where PGE identifies everything a fleet manager might need to know in order to transition their fleet to electricity including vehicle and charger feasibility assessments, preliminary site designs and costs, and a summary of all potential incentives and grants available to the customer.

Following Fleet Partner Plan, participating customers may commit to the Build phase of the program where they receive final designs, and PGE constructs, operates, and owns the make-ready infrastructure for their EV site. As part of the Build phase, PGE also provides custom cost incentives to pay for some or all of the cost, based on the customer's 10-year energy commitment. The customer then purchases and installs their chargers. Lessons learned include:

- Customer understanding of fleet electrification is extremely variable, and PGE needs to respond to customer needs with appropriate solutions regardless of their level of knowledge.
- Customer demand for this program is higher than anticipated, especially among municipalities, but the sales cycle is long (on average 14 months from application to start construction).

- Materials and construction costs have increased significantly since the initial budget was created and supply chain issues are slowing construction timelines.
- Fleet sites and designs are not a one-size-fits all, customer sites are very unique.
- Data acquisition is complex and requires dedicated resources.

The current approved pilot budget is $9 million. As of April 2023, the program has received 90 site applications from 59 customers. Estimates indicate these sites could enable 1,268 ports and 1,280 fleet vehicles and could deploy $22 million in capital (exceeding the program's allotted budget). These sites have a load potential of 44 MW.

In order to meet customer demand PGE is proposing to decrease incentives by 50 percent and add an additional $9.5 million to cover costs of additional sites, meet the demand, and right-size the incentives. While the original pilot estimates we will complete 24 sites at $9 million, current forecasts point to completing 56 additional sites with a budget of $9.5 million. In addition to demand outstripping the approved budget, program costs have also been higher than forecast due to inflation and supply chain issues. Specifically, we have seen rising costs of construction (up to 20 percent), professional services (up to 15 percent), and most significantly, cost of equipment (up to 50 percent). The proposed additional budget and extended timeframe will enable PGE to stretch a similar dollar amount across more sites. We are trying to find the right balance of utility incentives to augment available state and federal dollars that have since become available since the launch of Fleet Partner Phase 1. The additional funds for Fleet Partner Phase 2 will increase the overall numbers of light, medium, and heavy-duty electric fleet vehicles in PGE territory. This expansion would also allow PGE to find enhanced efficiencies for grid planning to serve TE loads and ultimately reduce greenhouse gas emissions and air pollutants in our service territory.

In this TE Plan, PGE proposes a budget increase of $9.5 million to this program to accommodate a total of 56 sites over the next two years.

A.2.1 Program/Measure Details

A.2.1.1 Elements, objectives, timeline, and expected outcomes

Program Objectives

The Fleet Partner pilot aims to:

- Support fleet customers by reducing the cost and complexity associated with transitioning to electric "fuel"
- Create a network of DR-enabled EV charging that can support both efficient grid operations and future renewables integration
- Better understand the customer and market barriers and opportunities in the fleet electrification space, including the best ways to engage and increase participation of customers in underserved communities
- Identify areas for utility process improvement with respect to fleet electrification
- Generate an empirical data set for electric fleets that:
  - Supports PGE and fleet customers in managing electric fleet load, thereby increasing grid utilization and mitigating increases to system peak loads
  - Informs existing utility analyses and helps PGE develop future products and programs

Additionally, the pilot will investigate:

- How to implement fleet electrification for companies where employees take their vehicles home overnight
- Software charging optimization for managed charging, fleet management, and grid management
- Commercial EV Rates, including customer options such as TOU, Tiered Rates, and Subscription Rates
- Managed Charging, including options to bundle Fleet Partner Customers in Energy Partner (Sch. 26) to manage load
- The benefits of this work are not limited to Fleet Partner; the pilot complements other TE work by providing information, lessons learned, and data for other PGE make-ready infrastructure programs.

Program Elements

Customers apply for Fleet Partner by submitting an application through our website. This kicks off the Planning Phase of the program, and the customer provides data on their fleets such as number of vehicles, hours of operation, and miles driven. PGE then provides the customer with a Fleet Partner study that provides all the information needed for a customer to electrify their fleet. Next, the customer approves preliminary designs, and officially enrolls in the program by signing the Participation Agreement that includes their 10-year energy commitment. Next, construction is completed, and the customer installs at least one charger within 6 months of construction completion. The customer then has flexibility in installing their subsequent chargers as long as they meet their 10-year energy commitment. Throughout the 10-year term, the customers are required to keep their chargers operational, and all charging session data is shared with PGE. PGE is aware of the risk that participants are unable to fulfill their 10-year energy commitment, leading to the need to repay PGE for a portion of the installed make-ready infrastructure. To mitigate this risk, PGE collaborates with customers during the planning phase to ensure a reasonable and achievable energy commitment. Annual reports are also sent to each customer on their energy consumption and goal status. Lastly, there is risk that a participating fleet goes out of business or that customers abandon chargers, resulting in stranded assets. To mitigate this risk, during the enrolment process, PGE assesses the credit worthiness of the customer to try to ensure that the customer is of sound financial standing. Additionally, we have built some of this risk into our financial modeling and forecast.

Customer Journey

The customer journey is as follows:

- Customer is interested in fleet electrification and learns of program through PGE's Business Outreach, emails, LinkedIn, or web search
- Customer applies via website application
- PGE sets up kick-off meeting, gives customers a thorough program overview
- Customer confirms number of vehicles and chargers they are interested in
- PGE provides free Fleet Partner Study that includes all the information a customer needs to electrify their fleet
- Customer commits to Build phase of program and submits Reservation Form
- PGE completes final design
- Customer approves final designs, signs Enrollment Package, includes 10-year energy commitment
- PGE completes construction of make-ready infrastructure

- Customer installs charger(s), EV drivers take service
- PGE receives charging session data that will help inform future grid planning

Education and Outreach

The transition from gasoline to electric "fuel" can be a complex and challenging process for fleet managers. Thus, effective education and outreach are crucial to achieve success with fleet electrification. PGE recognizes the importance of educating fleet managers about how fleet electrification can support their sustainability goals and while providing cost savings to encourage enrollment. This outreach supports PGE establishing our role in the market and clarifies the roles and scopes of both PGE and the customer.

Primary outreach strategies include direct customer outreach by PGE's Key Customer Managers and the Business Outreach Team, targeted LinkedIn ads, and presence at various events. PGE measures the success of its education and outreach efforts by the number of interested customers in the pipeline, quick allocation of incentive dollars, and overall adoption of fleet electrification. PGE anticipates low outreach costs due to the significant number of customers in the pipeline waiting to participate. Thus, PGE has allocated 1.2 percent of the Phase 2 budget towards outreach and education.

Program Timeline

PGE expects the Fleet Partner pilot to continue through to the 2025 TE Plan. We have seen very high demand, as well as higher than anticipated costs and incentives in the first year of the program. This growth is expected through 2025.

Table 52. Fleet Partner Historical and Forecasted Site Applications and Sites Completed

Year	2021	2022	2023	2024	2025	Total
Est. Site Applications	24	56	25	50	55	210
Est. Sites Completed	–	1	19	21	39	80

Table 53. Fleet Partner Historical and Forecasted Incentives

Year	2021	2022	2023	2024	2025	Total
Est. CapEx Incentives	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Expected Outcomes

- Better enable PGE to plan for, serve, and effectively manage fleet load to create grid benefits. As of April 2023, the program has received 90 site applications from 59 customers. Estimates indicate these sites could have a load potential of 44 MW

- Increased numbers of electric light-, medium-, and heavy-duty fleet vehicles in PGE's service territory
- Increased levels of EV awareness among both fleet and residential customers, by providing and excellent customer experience, gaining understanding about the right types of education and levels of planning support
- Support for future adoption of EV rates or flexible load programs, creating positive grid impacts
- Enhanced efficiency of existing planning, engineering, and operations services to serve new TE loads
- Enhanced workforce readiness in TE infrastructure design, engineering, construction, operation, and maintenance
- Reduced greenhouse gas emissions, criteria air pollutant emissions, and water pollution in PGE's service territory and beyond
- Increased equitable access to electric mobility through electric transit, shuttle, and/or school buses
- Better understanding of the right incentive level for customers and the right investment in ownership from PGE
- Enhanced program implementation efficiencies, documenting more streamlined processes and procedures

A.2.1.2 Market Baseline Assumptions

The fleet market is poised to electrify—and quickly—as evidenced by the public commitments of players such as FedEx, UPS, PepsiCo and Amazon to electrify their fleets. PGE anticipates that several dozen plug-in medium- and heavy-duty vehicle models will arrive in the market over the next decade. PGE projects that by 2030, over 415,000 EVs will be located in its service territory. This includes nearly 6,000 heavy-duty vehicles and over 8,500 medium-duty vehicles—both presumed to be operated by fleets)—as well as a portion of the remaining roughly 400,000 light-duty vehicles. See Section 3.4 for additional details.

A.2.1.3 Major Performance Milestones

The expansion of this pilot allows PGE to test different incentive levels and analyze the similarities and differences to Phase 1 when it comes to timelines, customer uptake, successes, and lessons learned.

Performance milestones are as follows:

- Phase 1 Successful outreach & education: 50 applications received in year 1
- Phase 1 Customer education and demand: all incentive funding reserved; (18 months, 24 customer sites)
- Phase 1 First site complete September 2022
- Phase 1 All original pilot funding was reserved by 24 sites, enabling 366 L2 charging ports and 82 DCFC ports (~448 ports) December 2022
- Phase 1 Half of sites complete 12 sites expected by Sept 2023
- Phase 1 All sites complete 24 total sites expected complete by August 2024
- Phase 2 Successful relaunch of outreach and education upon TEP approval
- Phase 2 Customer education and demand: all incentive funding reserved
- Phase 2 Half of sites complete
- Phase 2 All sites complete, stellar customer satisfaction and feedback
- Phase 2 Pilot complete December 2025

These milestones are contingent on achieving projected enrollment. Low enrollment creates risk for PGE's ability to influence charger procurement or installation, leading to consequences for future interconnection, flexible load goals, and data necessary for planning. If PGE experiences low enrollment due to inadequate incentives, PGE intends to adjust incentives to market needs as it gathers data on the number of applications and enrollment timelines, uptake and withdrawal trends, and direct customer feedback.

A.2.1.4 Program/Measure Phases

The Fleet Partner (Phase 1) Pilot experienced high uptake by customers. Given such, PGE may be able to lower incentives to reach a higher number of customers. PGE is proposing to lower incentives by 50 percent and reduce the maximum incentives per customer to $400,000 in Phase 2. PGE will then proceed to a more typical utility tariff and/or rate, and also implement a flex load/managed charging pilot or program after determining the proper level of utility investment In Phase 2.

The long-term evolution of the Fleet Partner (Phase 2) Pilot will inform the development of a future rate of tariff by providing data to inform the development of future rate structures. The first phase of the pilot built out foundational components for customers to electrify their fleets, including education, an online TCO tool, planning, right sizing, and construction fleet depots. Over time, PGE anticipates this pilot to continue to evolve into a flex load program and a more traditional tariff and rate for make-ready infrastructure. The gradual and phased long-term evolution of the Fleet Partner pilot will involve the implementation of time-of-use rates or payment of incentives to encourage customers to charge during off-peak times as the likely first step. In addition, Automated Load Management is expected to become a key aspect of the pilot, enabling customers to add chargers to sites without incurring additional expensive infrastructure upgrades. Future flexible load programs will aim to integrate demand response with our VPP, utilizing either the charger, the vehicle's telematics, or both. Research and development are currently underway to gain a better understanding of how this load modification will be visible and dispatchable. Ultimately, PGE's goal is to achieve a future stable make-ready approach through a more traditional utility mechanism to meet the loads of fleet electrification.

A.2.1.5 Utilization, Eligibility, Incentive Structures

Eligible customers are non-residential customers that use or operate fleets (including, but not limited to, commercial, non-profit, public, school, or transit fleets) in PGE's service area and also plan to install a minimum of 70kW (total) of EV charging. Eligible rate schedules include 32, 38, 83, 85, and 89; note that this list may be expanded to include new rates, including EV rates, in the future.

Customers may participate in the Pilot along with other PGE products and programs as appropriate. Major product dependencies include the standard Line Extension Allowance (LEA) and the Schedule 52 Business EV Charging Rebate Pilot. Customers may participate in the Pilot and take the standard LEA. Likewise, Pilot customers may also participate in the Business EV Charging Rebate Pilot.

PGE applies a custom incentive calculation to offset the costs customers would otherwise bear to install make-ready infrastructure to support EV charging. The incentive is designed to help cover the following Make-Ready Costs:

- Customer share of Line Extension Costs following the application of the LEA (as defined in Schedule 300) and Rule I7)
- Permitting, trenching, and pathway on the utility side of the meter
- All work—including design, engineering, permitting, construction, and installation—on the customer side of the meter up to, but not including, the EVSE

- Project management for site construction

On average, the Fleet Partner Pilot (Phase 1) covered 74 percent of the costs of make-ready infrastructure. The substantial number of applicants and the rapid depletion of Phase 1 incentives suggests that the original pilot incentive may be lowered to meet the current market demand. Current data also shows that fleet electrification is increasing at a faster rate than originally forecasted in the 2019 TE Plan. Additionally, PGE anticipates that fleet electrification will only accelerate further with the passage of ACT and ACF. Given these factors, the Fleet Partner Pilot (Phase 2) expansion proposes to cover an average of 38 percent of the cost of the make-ready infrastructure. In this expansion, PGE seeks to learn the right incentive cost and ownership coverage that will meet market demand and incent fleet owners to partner with PGE.

A.2.1.1 Market and Implementation Barriers Addressed

Section 6.7 (Market Barriers) details the market barriers to EV adoption. By combining fleet planning and technical services with cost offsets for charging infrastructure—and ensuring that charging sites are primed to take advantage of future EV rates or flexible load offerings, thereby lowering TCO—this Pilot will effectively address each of these barriers. Reducing the cost and complexity of fleet electrification through the proposed Pilot lowers the barriers to fleet electrification and provides long term environmental and local business benefits to PGE customers and the State. The Pilot will lower the fueling infrastructure cost to the customer and allow PGE to play an integral, upfront role in the integration of new electric fleets with the grid.

Implementation Barriers

PGE anticipates several implementation barriers for this program and has applied lessons learned from Fleet Partner (Phase 1), along with lessons from similar utility programs, in considering how to mitigate these. Key barriers and mitigation plans include:

Table 54. Fleet Partner Implementation Barriers and Mitigants

Barrier	How Addressed
Rising costs resulting from macroeconomic conditions, including the COVID-19 pandemic, supply chain constraints, and rising interest rates	PGE will keep continue to assess and evaluate these changing factors, as well as the availability of infrastructure and charging equipment, and commercial lending rates. Our goal is to ensure that our incentives are not overcompensating for the costs and perceived benefits of adding EV charging to these properties. PGE will monitor the situation to ensure we are making informed decisions.
Long sales cycle inherent to projects of this scale.	PGE expects—and PGE staff will be prepared to support—a six-month cycle time from customer application to commissioning of the charger.

A.2.1.2 Performance Area Categories

PGE's proposed design addresses relevant Division 87 performance area categories in the following ways:

- Environmental benefits including greenhouse gas emissions impacts
- Increased access to electricity as a transportation "fuel" will reduce greenhouse gas emissions across PGE's service area
- Electric vehicle adoption: Supporting fleet customers by reducing the cost and complexity associated with transitioning to electric "fuel" will support EV fleet adoption across PGE's service area.
- Equity of program offerings to meet underserved communities: PGE is tracking and gathering how many fleet make-ready ports are being installed in underserved communities to understand their correlation.
- Distribution system impacts and grid integration benefits: As noted, PGE does not anticipate distribution system impacts stemming from this program. Grid integration benefits are largely represented by the networked and DR-capable requirements in the technical standards that PGE sets.
- Program participation and adoption: PGE anticipates completing an additional 56 sites.
- Infrastructure performance including charging adequacy which considers, but is not limited to reliability, affordability, and accessibility: PGE tracks charger uptime and cost-to-charge across its fleet of utility-supported chargers and will include this data in future TE Plan Reports.

A.2.1.3 PGE's Role in the Program

- Supporting fleet customers with fleet planning services
- Qualification of EVSE products for inclusion in the pilot
- Ownership, operation, and maintenance of make-ready assets behind-the-meter up to, but not including, the EVSE
- Design and installation of electrical infrastructure from the existing distribution grid through the meter to the charger pad(s)
- Calculation of custom cost offsets (i.e., applying the incentive to the customer costs)
- Other technical assistance, as appropriate

A.2.1.4 Resulting Distribution Upgrades

All 24 sites with initial pilot funding have not triggered any significant distribution system upgrades to date. In the unlikely case that a future site would require significant distribution system upgrades, these costs would be part of the make-ready costs and would fall to the customer, less the incentive. PGE will work closely with customers to ensure that all options including right-sized EVSE, managed charging, and planful siting are considered in order to control distribution system costs and minimize potential impacts, including cost impacts, on participating and non-participating customers.

A.2.1.5 Ownership Structure

PGE owns the make-ready infrastructure behind-the-meter up to, but not including the EVSE on behalf of the customer.

A.2.1.6 EVSE Requirements (Equipment Interoperability and National Standards)

PGE utilizes a single Qualified Products List (QPL) to determine eligible EVSEs for all of PGE's non-residential EV programs. EVSE vendors must submit a Request for Qualification (RFQ) if they want their products added to the QPL. PGE engineers review each RFQ for completeness and against the predefined qualification requirements, listed below. If the vendor receives technical approval, they must also execute a Data Sharing Agreement with PGE before their products will be added to the QPL.

Hardware requirements (Level 2 and DCFC):

- National Electrical Manufacturers Association (NEMA) Type 3R or 4, which certifies that equipment is weatherproof and certified for either indoor or outdoor use.
- Compliant with Federal Communications Commission Part 15, which sets limits on the amount of electromagnetic interference allowed.
- Compliant with National Electric Code, National Fire Protection Association (NFPA) article 625, which covers wires and equipment used to supply electricity for EV charging.
- Compliant with the Americans with Disabilities Act (ADA), which ensures that the EVSE is ADA accessible, if installed according to the manufacturer's instructions.
- EVSE model must have a cellular connectivity option, either 4G LTE or 5G.
- Compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of network service providers. It also must be remotely upgradable to support future versions of OCPP.
- Must include a standard warranty of 1 year or greater
  - Must have an operating range of at least -22F to 122F, ensuring it can withstand extreme environments

Level 2-specific requirements:

- Compliant with Society of Automotive Engineering (SAE) J1772, the standard Level 2 connector that is compatible with all road-legal EVs for sale in the United States, including plug-in hybrids (PHEVs), battery electric vehicles (BEVs), and Tesla vehicles using an adaptor.
- Listed by a nationally recognized test lab to the requirements of UL 2251 and 2594, demonstrating that products are tested to UL's recognized safety standards.
- DCFC-specific requirements:
- If the EVSE includes a Combined Charging System (CCS) connector, it must be compliant with SAE J1772.
- Listed by a nationally recognized test lab to the requirements of UL 2202, demonstrating that products are tested to UL's recognized safety standards.
- Equipment compliant with recommended practice SAE J2894/1_201112 or later (power quality requirements for EVSE).
- If the EVSE includes an automated conductive charging mechanism (pantograph), it must meet SAE J3105.
  - DCFC EVSE efficiency must be greater than 92 percent

Software requirements:

- Software platform must be responsive to grid services, modifying charger power output levels, using either one of the following methods
  - Certified OpenADR 2.0b Virtual End Node (VEN)
  - Application Programming Interface (API)
  - IEEE 2030.5 (SEP 2.0)
- Software must also be compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of EVSE hardware.

Through the RFQ process, PGE collects additional technical information from vendors that aren't requirements but help inform PGE programs and potential future requirements. This includes items such as:

- Compliance with ISO/IEC 15118
- Payment methods and pricing options
- Compliance with OCPI v2.2 or later
- EVSE metering accuracy
- Bi-directional charging capability
- Lead time and indicative pricing
- Installation manuals
- The vendor's sales point of contact to post on PGE's QPL webpage so customers know who to contact when interested in a specific product

As of 4/28/2023, PGE has qualified 137 EVSE models from 18 different EVSE vendors.

A.2.2 Program/infrastructure coordination

A.2.2.1 Stakeholder involvement in development

PGE has engaged stakeholders in discussion about this Pilot in a series of workshops under the UE 368 and has consulted with several stakeholders offline as well. Workshops were held on February 3, 24, and March 22, 2021.

A.2.2.2 Coordination with State Programs

PGE seeks to determine the ideal balance between federal and state grant dollars and utility incentives. Based on the number of applicants and speed at which the incentives were reserved, PGE is interested to identify the proper level of utility incentives to support transportation electrification while leveraging available federal or state dollars. PGE will stay abreast of incoming and changing legislature to promote awareness of the different types of incentives available.

PGE will make customers aware of, and support customers in relaying information regarding, the Oregon Clean Vehicle Rebate, the Diesel Emissions Reduction Grants Program, the Oregon Clean Fuels Program, and other relevant state programs, as appropriate.

PGE anticipates that some customers may elect to stack this program with ODOT's deployment of federal, state and/or local funding sources such as grants. PGE welcomes this type of coordination and will work as necessary with federal, state, and/or local entities to ensure a smooth incentive delivery for customers.

A.2.2.3 Coordination with Market Actors and Activities

For the initial pilot, PGE issued an RFI seeking to better understand the market for Level 2 and Direct Current Quick Charging (DCQC) hardware and software for fleet charging. While PGE does not plan to issue a qualified product list for this pilot, we will share fleet EVSE options with customers and work directly with customers' selected vendors to qualify the EVSE to ensure that PGE and the vendor are able to provide the most efficient customer experience. PGE will also coordinate with vehicle original equipment manufacturers, dealers, trade groups—as well as energy storage system, energy generation, and other vendors—as appropriate to best serve the customer.

A.2.3 Fit with Long Term TE Strategy

This pilot allows PGE to plan for, serve, and manage TE load. PGE affirms its position as the optimal market player to provide make-ready infrastructure for EV expansion, allowing for faster and easier EV expansion at separately metered sites by engaging customers early in the planning process to plan for future load ramping. PGE's involvement ensures that chargers meet qualifications, are capable of demand response, are ready for an EV rate, and that PGE has access to charging session data with a 10-year committed cost of service energy use to better plan for TE load, as well as effectively manage TE load by informing the development of TE rates/tariffs to incent beneficial charging behavior. Specifically, the data collected from the pilots will provide direct feedback on load curves, the willingness of fleets to drop load, dwell time at chargers, the types of vehicles, battery size, charger size, as well as the costs and timelines for construction. This information is crucial for optimizing electric fleet charging and planning for future growth in a way that is efficient, cost-effective, and sustainable.

PGE's involvement also gives customers peace of mind that they have a trustworthy partner managing the design, construction, and maintenance of EVSEs, while also providing cost-sharing to enable more fleets to justify electrification. Furthermore, PGE assists customers in optimizing the charger size and educates them on grid-friendly charging practices, thereby avoiding the need for distribution system upgrades. Thus, this pilot provides broader benefits to the PGE grid system and limits non-participating customer costs by influencing the size and charging behaviors of the additional fleet load, thus mitigating additional infrastructure upgrade costs.

In summary, the Fleet Partner pilots' understanding of managing electric fleet loads is beneficial in influencing charger type and model choices, promoting efficient charging, creating future flex load programs, and providing insights into fleet characteristics. The insights gained through the pilots will enable more efficient and sustainable growth of electric fleets.

A.2.4 Learning Objectives, Evaluation of Effectiveness and Data Collection Methods

The expansion of the Fleet Partner Pilot (Phase 2) will provide learnings on how to construct electric fleet sites long-term and how these sites will participate in managed load programs. This will inform PGE's approach to further drive the efficiency of internal processes and procedures to serve both customer and grid needs.

PGE also anticipates that the expansion of the pilot will benefit our understanding of underserved communities' transportation electrification needs. PGE is tracking how many fleet make-ready ports are being installed in underserved communities to understand their correlation. Greener fleets improve air and noise quality in these areas.

The following high-level metrics have been identified as indicators of success:

- Total make-ready ports installed & successful transfer of session data from EVSE to PGE
- Relationships with customers, as measured by customer engagement, satisfaction, and experience
- Analysis of incentive level data

To assess these indicators, PGE plans to engage third-party evaluators to evaluate and report on the pilots in 2023, 2025, and 2026. The results of these reports will assist PGE in better understanding and meeting the needs of customers and establishing optimal processes for building and maintaining make-ready infrastructure. Data on charging sessions will also help PGE assess fleet loads, peak loads, and the impacts on the grid to inform future rate designs and flexible load programs. PGE anticipates acquiring and utilizing charging session data for evaluation on a monthly basis. This data will be used to understand fleet loads and impacts to the grid, peak loads, future TOU, rates, and flex load programs, and make-ready infrastructure longevity and performance.

A.2.5 Program and Infrastructure Costs

A.2.5.1 Estimated total costs, including incentives, program delivery, evaluation, marketing, and program operational costs

PGE is on track to spend all capital funds for Phase 1 sites by mid-2024 and plans to continue to track and report on budgets and spend via annual reports. All Phase 1 funds have been reserved and will be disbursed gradually until site construction is complete by mid-2024. The rate of spend in Phase 2 is likely to mirror those in Phase 1, with inflationary costs potentially raising costs for equipment and construction in both 2024 and 2025. PGE plans to provide annual reports and acknowledges the potential for further adjustments. The following table reflects to costs for both Phase 1 and Phase 2:

Table 55. Fleet Partner Budget: Forecast of Operating and Capital Expenditures (2023-2025)

Total	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Marketing Services	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$5,258,760	$6,415,740	$6,442,773	$18,117,273

A.2.5.2 Estimated participant costs

Estimated participation costs vary significantly across customer segments and site configurations. PGE proposes to recover the cost of these activities through subsequent general rate cases.

A.2.6 How Infrastructure Measure Addresses Oregon Administrative Rule and Oregon Law

Table 56. Fleet Partner Concordance with OAR 860-087-0020(4)

OAR 860-087-0020(4)	Section of Application Addressing the Rule
A description of the infrastructure measure;	A.2.1
Data used to support the description;	A.2.1
A description of infrastructure measure coordination;	A.2.2
A description of how the proposed infrastructure measure fits within the electric company's long-term strategy to support TE;	A.2.3
A description of costs;	A.2.5
A description of learning objectives and how the electric company will evaluate the infrastructure measure; and	A.2.4
For infrastructure measures, a description of how the measure addresses the considerations of ORS 757.357	Table 57

Table 57. Fleet Partner Concordance with ORS 757.357

ORS 757.357	How Application Addresses the Law
(1) (b) (A) "Infrastructure measures" includes, but is not limited to, investments in, expenses related to or rebates for: (i) Distribution system infrastructure that supports transportation electrification; (ii) Communication and control technologies that support transportation electrification; and (iii) Behind-the-meter infrastructure that supports transportation electrification and is owned by an electric company or by a customer.	The investments proposed in this application meet the description of infrastructure measures in (iii), as they are issued for behind-the-meter infrastructure that supports transportation electrification.
(b) (B) "Infrastructure measures" does not include investments in or expenses related to education and outreach activities related to	While this infrastructure measure has an associated education and outreach budget, it is for enrollment only, not more general education

ORS 757.357	How Application Addresses the Law
transportation electrification, or other transportation electrification-related activities determined by the Public Utility Commission to be separate and distinct from the development of infrastructure.	and outreach to advance transportation electrification.
(5) If undertaken by an electric company, an infrastructure measure to support transportation electrification is a utility service and a benefit to utility customers if the infrastructure measure can be reasonably anticipated to:	
(a) Support reductions of transportation sector greenhouse gas emissions over time; and	A.2.1.2
(b) Benefit the electric company's customers in ways that may include, but need not be limited to: (A) Distribution or transmission management benefits; (B) Revenues to utilities from electric vehicle charging to offset utilities' fixed costs that may otherwise be charged to customers; (C) System efficiencies or other economic values inuring to the benefit of customers over the long term; or (D) Increased customer choice through greater transportation electrification infrastructure deployment to increase the availability of and access to public and private electric vehicle charging stations.	A.2.1.2 A.2.2.3

A.3 Heavy Duty Charging

Table 58. Heavy Duty Charging Reference

Docket Number(s)	UE 389[264]
Docket Name(s)	PGE ADVICE NO. 21-03 SCHEDULE 53
Filing Date	February 10, 2021
Effective Date	June 16, 2021
Allowed (Approved) Utility Filing Date	June 15, 2021
Allowed (Approved) Utility Filing Name	New Schedule 53 Heavy-Duty Electric Vehicle Charging Program, Advice No. 21-03[265]
Governing Tariff	Schedule 53[266]
Deferral Number(s)	n/a
Deferral Date(s)	n/a

A.3.1 Overview

A.3.1.1 Description of Program Activity

The goal of this program is to plan, design, and build out heavy-duty charging site(s) that allows PGE and a partner to test and gather learnings for the feasibility of non-wires solutions, gather fleet load data for future forecasting, and to test and understand battery solutions, solar solutions, and megawatt charging. PGE seeks to learn how to proactively engage on the siting of these projects to manage potential grid impact, which, if unplanned, could prove expensive for projects of this magnitude.

Each site will have on-site battery storage to provide demand response services back to the grid. The batteries at the MHD charging sites will serve multiple use cases: reducing grid demand during peak events, providing charging resiliency to users when outages occur, and adding additional capacity back into the grid through demand response. Charge management, energy storage, and on-site generation will help to alleviate the impact of heavy duty charging and prevent or defer potential distribution feeder upgrades.

Schedule 53 is an existing tariff under which PGE built the Electric Island site with Daimler Truck North America. It was originally funded at $10 million, with approximately $5 million forecasted costs over

[264] Oregon Public Utility Commission Docket UE 389, retrieved from https://apps.puc.state.or.us/edockets/DocketNoLayout.asp?DocketID=22782.
[265] Oregon Public Utility Commission Advice No. 21-03 under protective order.
[266] PGE Schedule 53, retrieved from https://assets.ctfassets.net/416ywc1laqmd/43HMjSSNNhOCBEiSpedGmV/61301b872ca75a6f5971413a55cb317a/Sched_053.pdf.

the ten-year period. That leaves the remaining $5 million available for possible future projects. Under this model, PGE works with a site partner who matches PGE's share of spending on a MHD charging project. The goal is a partnership structure with the site owner/operator. PGE may own the infrastructure (both sides of the meter) and the EVSE hardware and will manage and maintain the EVSE for the site operator. Currently, Electric Island is available for MHD and LDV charging. PGE and Daimler are forecasting to have one battery installed in 2023, and another second-life truck battery installed in 2024. Planning is also underway for installing megawatt charging and solar.

Schedule 53 pairs well with the vision of the West Coast Clean Transit Corridor WCCTC)[1]. The WCCTC is a consortium of 16 utilities that are working towards enabling freight mobility & electric charging needs along the I-5 freeway from San Diego to Vancouver BC. This model recommends a charging site every 50 miles and calls for three possible sites in PGE service area. As part of this effort, and to ensure heavy duty charging is available in our service areas as the fleet electrify, PGE is reviewing a site in the Salem area in addition to the Electric Island site near Interstate 5.

The planned MHD charging locations will benefit communities adversely affected by environmental and health hazards by reducing their exposure to environmental pollutants such as diesel particulate matter (DPM). Health effects from DPM include "cardiovascular and respiratory hospitalizations, and premature death."[267] Since most DPM "derives from combustion, such as use of gasoline and diesel fuels by motor vehicles"[268], and traditional ICE trucking has been specifically identified as a major source of DPM[269], it follows that providing MHD EV infrastructure to support the transition from ICE trucking in these locations will reduce these communities' exposure to these harmful pollutants. Figure 21, below, shows the overlap of the current/planned MHD Charging locations and the public's exposure to DPM. Figure 22, below, shows the overlap of current/planned MHD Charging locations and a demographic index of low-income and minority populations[270].

[267] California Air Resources Board. *Overview: Diesel Exhaust & Health*. Retrieved from https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health.
[268] Ibid.
[269] Ibid.
[270] Figure 21 and Figure 22 generated on September 20, 2022 using the Environmental Protection Agency's *Environmental Justice Screening and Mapping Tool (Version 2.0)*, retrieved from https://ejscreen.epa.gov/mapper/.

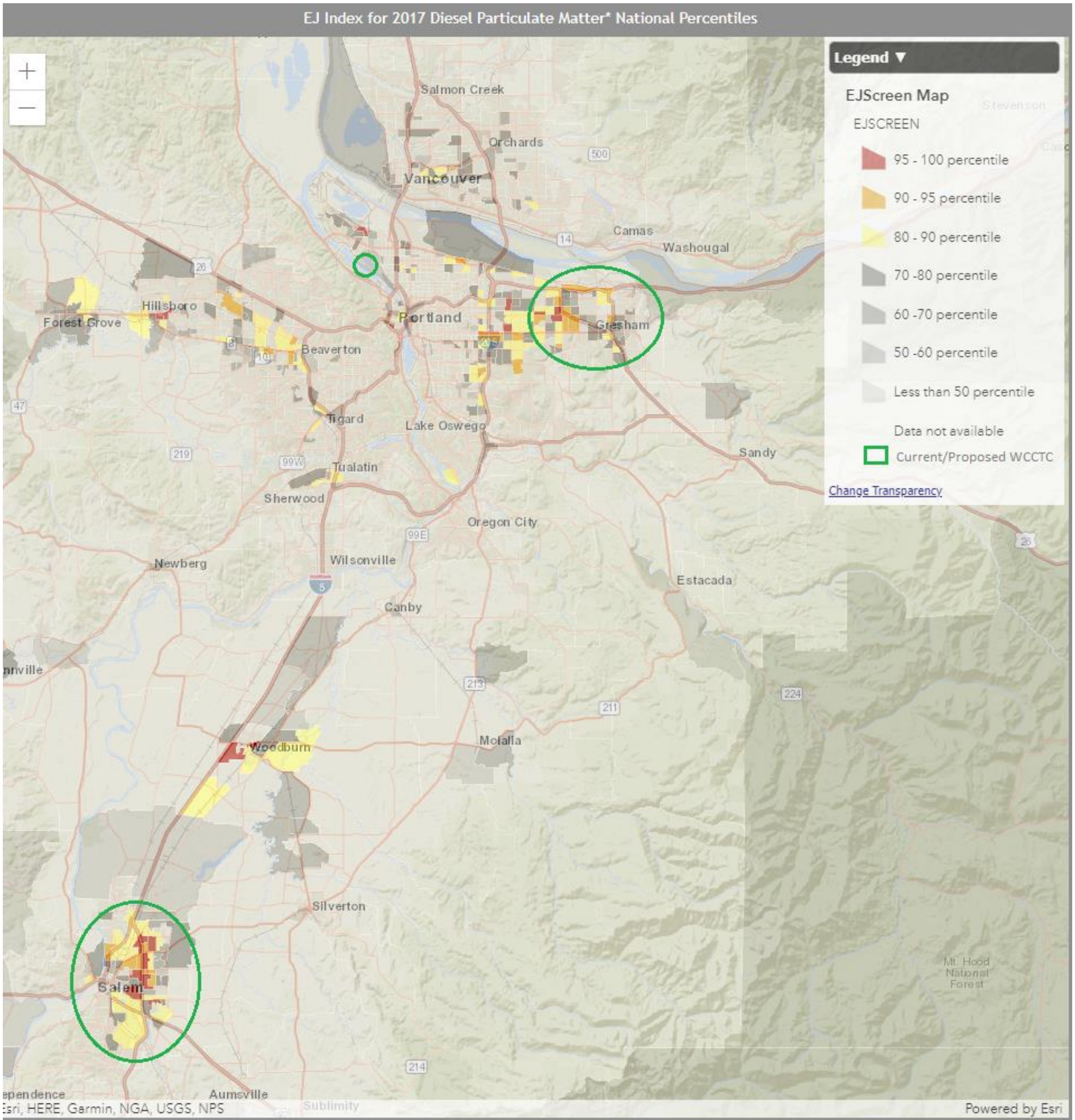

Figure 21. Heavy Duty Charging Locations and Diesel Particulate Matter

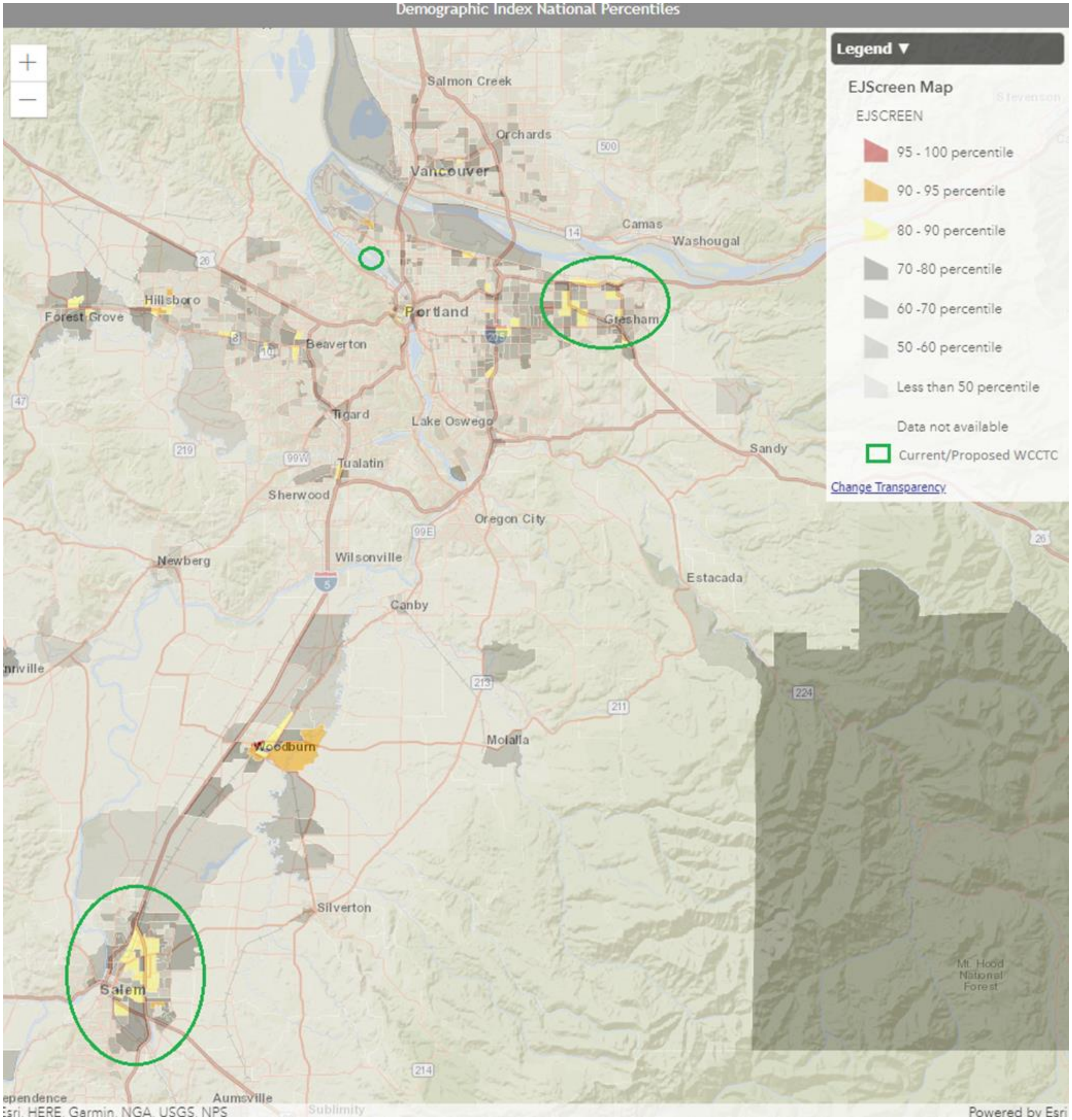

Figure 22. Heavy Duty Charging Locations and Low-Income and Minority Populations

As illustrated in the above figures, the proposed MHD charging locations in Gresham/Troutdale and Salem are situated where low-income and minority populations reside and where populations are exposed to relatively high DPM. Providing infrastructure that supports HD EV charging is expected to help reduce pollution in these areas and therefore benefit the underserved communities residing there.

Truck manufacturers are beginning to roll out production models of EV MHD trucks. The early adopters for this technology are short trip operations like drayage (delivering shipping containers from the docks to train depots) and local delivery, which can be depot charged nightly and operated during the day. Use cases are evolving where vehicle range is a limiting factor, for which enroute charging is needed.

Building MHD charging sites is heavily dependent on a site location/operator/partner. With the complexity of an appropriate geographic location, these projects have a narrow set of ideal parameters that need to line up for a site to move forward. PGE began this project by determining potential locations and then entered into conversations with potential site partners in those areas. PGE is now engaging with multiple site operators to begin working through these challenges. It is important to note that not every potential site partners approaches investments in MHD charging in the same way. An MHD EV manufacturer or transit agency may be more inclined to invest in MHD infrastructure as it supports their existing priorities (e.g., selling MHD EVs or electrifying their fleet). Conversely, a truck stop operator may be more reticent to invest in MHD infrastructure regardless of co-investment by the utility as they focus on existing fuel sales.

Any construction of MHD truck charging sites will likely require upgrades to the PGE distribution network. Power requirements for each site are estimated to begin at 1.5 MW, with five-year growth to 20 MW. This may require feeder upgrades or a transformer replacement, and in some locations, a new substation. If PGE prepares for this demand appropriately, we can construct these sites in areas with better distribution available, and better manage the process and costs as well as reduce the potential for further, significant distribution system upgrades. Conversely, if an independent operator brings these projects to PGE, the Company would not be able to manage the grid impact as well because we would have less control over project location or timing, which could result in unplanned, more expensive distribution upgrades.

A.3.1.2 Strategic Context

The Heavy-Duty Charging program aligns with the following components of PGE's 2024-2025 TE strategy:

1. Lead through Planning and Siting. This program will enable efficient deployment of MHD charging sites within PGE's service territory and help build future rates and tariffs which influence the siting of larger loads at feeders and substations with available capacity.
2. State, Local, and Regional Planning. This program will enable efficient deployment of MHD charging sites within PGE's service territory, and with the broader WCCTC, enable electric trucks to operate seamlessly along the West Coast.
3. Build Distribution and Grid Infrastructure to Serve Customers. PGE will leverage grid and customer insights to deploy HD charging in the locations and in such a manner that they can be integrated into our system as efficiently as possible. PGE make-ready requires DR capable charger installation to help manage the future load and PGE will also explore the use of battery and solar installations within future rate designs to help serve the load at a distribution level.

A.3.1.3 Timeline

The first and largest hurdle is to find site owners/operators to collaborate with PGE. Once a site can be secured, evaluation of the grid requirements to supply the necessary power needs to be completed (1.5 MW to begin, growth to 20 MW in five years). Construction of the grid upgrades (line extension) can run parallel to the site make-ready construction for the behind-the-meter work required for the power supply to the chargers. Estimated overall delivery timelines for these sites range from two to five years.

A.3.2 Budget

The Heavy-Duty overall spend was approved in 2021 and below shows the continued spend of this program within 2023-2025 for the first site. There may be a future site identified which would require an update to the plan of the forecasted spend depending on the site, site agreement reached, and timeline of implementation.

Table 59. Heavy Duty Charging Budget: Existing/Approved Operating and Capital Expenditures (2023-2025)[271]

Costs	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$1,997,290	$1,186,441	$436,723	$3,620,453

A.3.3 Additional Scope/Scale

PGE's first foray into MHD charging was a partnership with Daimler Truck North America. PGE operates the site and manages the power billings for this project. PGE has learned many lessons around charging patterns, power usage, and site layouts. Key learnings follow:

- Grid Impacts: MHD vehicles can impart substantial electrical loading at a charging site. Over the four-month sample period, there were 28 charging session with a recorded energy delivery greater than 100 kWh. These instances made up only 1.5 percent of the total number of sessions but accounted for 18.4 percent of the total energy delivered to the site during this time period.

[271] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

- Significant Customer Site Usage: There were 1,812 separate charging sessions recorded during the four-month data sample.
- General Public Charging Applications: While the site is envisioned as a location for heavy-duty charging customers, it also hosts residential customers simply looking to charge their vehicles. Conversations with these customers have revealed a paucity of available chargers in the Swan Island area and appreciation for the Electric Island facility. The DCFC are equipped with both CCS1 and CHAdeMO ports, which allows all non-Tesla passenger vehicles to charge.

This partnership has been beneficial to both companies and their customers, and PGE is scanning the outreach and education market for other partners like this to continue under our approved Schedule 53 program. Unfortunately, not all our potential partners have similar economic drivers as the commercial and research and development operations of a truck manufacturer. The economics and rationale are different for a site like a truck stop. In these instances, PGE will need to take a more active role in the development of these locations. PGE would manage the project during all construction phases (line extension and make-ready). Under the current language of Schedule 53, participants are required to match PGE funds dollar-for-dollar. This may not be a model within which all participants are willing to work. This program works best with a partner that has an economic interest in the development of the site. PGE's goal will be to engage site owners who have that economic interest, or work to help develop it.

MHD vehicles draw a large amount of load. The timing of that demand, the length of time of the charging session, and the impact on the specific feeder are all relative unknowns at this point. It is challenging to plan and model these demand spikes on load without actual historical data. Additionally, as PGE adds onsite storage, we want to learn about the demand mitigation approaches and how to shape these loads. PGE's planning for storage is underway at our Electric Island site to inform future deployments of MHD sites.

The following figure provides an overview of Daimler Truck North America telematics showing where their trucks drive and depot. Daimler supplies more than 30 percent of the trucking market, and we therefore assume their traffic patterns are valid across other manufacturers.

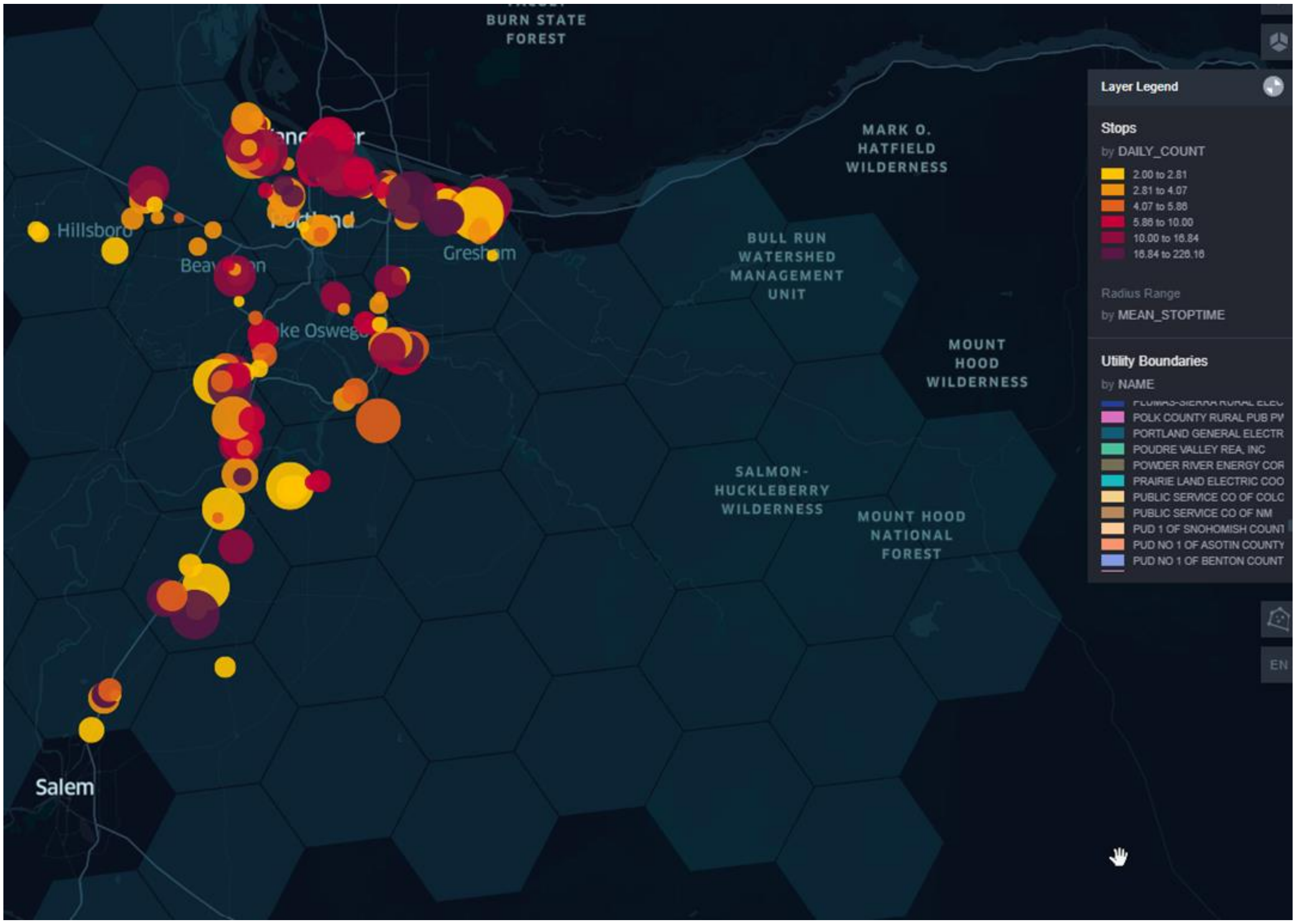

Figure 23. Daimler Truck Telematics

PGE has worked closely with Daimler and TriMet to develop and deploy MHD charging infrastructure (Electric Island and HD transit charging infrastructure, respectively). TriMet is also considering other PGE programs to extend charging into other areas such as maintenance and traffic monitoring vehicles.

PGE is relatively agnostic on EVSE hardware and will coordinate with other market actors as we select charging equipment for the Heavy-Duty Charging program. The goal of the program is to deliver MHD charging in locations identified as necessary to the overall network for a specific use case (WCCTC for example). PGE will also coordinate with existing trucking site operators, as we do not plan to build charging sites from the ground up.

A.3.4 Original Proposal

To maintain readability of this document, the original product proposal is linked here rather than embedded in its entirety: https://assets.ctfassets.net/416ywc1laqmd/43HMjSSNNhOCBEiSpedGmV/4bcaf51ba30634fc114c18c63d99d2cc/Sched_053.pdf.

A.4 Clean Fuels

Table 60. Clean Fuels Reference

Docket Number(s)	UM 1826
Docket Name(s)	STAFF INVESTIGATION INTO ELECTRIC UTILITY PARTICIPATION IN CLEAN FUEL PROGRAMS
Filing Date (s)	March 29, 2019, July 29, 2019, November 22, 2019, August 7, 2020, November 20, 2020, December 1, 2021, April 22, 2022
Effective Date	October 10, 2018
Allowed (Approved) Utility Filing Date	Order No. 18-376[272]
Allowed (Approved) Utility Filing Name	Revised principles and process for utility use of revenue from Clean Fuels Program
Governing Tariff	The Orders that govern utility participation relating to the Clean Fuels Program are: • Order No. 17-250 Directing PGE and PacifiCorp to register as Credit Generators in the CFP[273] • Order No. 17-512 Credit Monetization Principles for utility monetization of residential CFP credits[274] • Order No. 18- 376 Revised principles and process for utility use of revenue from the Clean Fuels Program[275]
Deferral Number(s)	n/a
Deferral Date(s)	n/a

A.4.1 Overview

A.4.1.1 Description of Program Activity

PGE's residential Clean Fuels Program supports equitable deployment of transportation electrification in Oregon to benefit residential customers. The program is funded through the sale of residential credits generated by PGE through the Oregon Clean Fuels Program and is therefore not included in this TE Plan's funding request or cost effectiveness tests. PGE is a registered credit

[272] Oregon Public Utility Commission Order No. 18-376, retrieved from https://apps.puc.state.or.us/orders/2018ords/18-376.pdf.
[273] Oregon Public Utility Commission Order No. 17-250, retrieved from https://apps.puc.state.or.us/orders/2017ords/17-250.pdf.
[274] Oregon Public Utility Commission Order No. 17-512, retrieved from https://apps.puc.state.or.us/orders/2017ords/17-512.pdf.
[275] See footnote 272, above.

generator for credits generated by residential EVs registered in the Company's service area. The Oregon Clean Fuels Program is administered by the Oregon DEQ. The DEQ assigns credits to PGE for the number of residential EVs registered in the Company's service area (based on DMV vehicle registrations) on a biannual basis. PGE monetizes these credits throughout the year in the Oregon Clean Fuels Program marketplace and plans for the yearly programs based on actual revenue from credit sales. There is a two-year delay between when credits are generated and when programs are implemented (e.g., the 2023 PGE Clean Fuels program budget is based on 2021 EV counts).

PGE also generates credits through the charging stations we own, operate, and/or maintain. Revenue from those credits is used to offset the cost of operating and maintaining that infrastructure. This section covers PGE activities funded by those residential CFP credits.

To date, PGE has planned CFP-funded programs through an iterative approach with stakeholders, in consultation with DEQ and OPUC staff, and guided by principles delineated in Commission Order No. 18-376, Docket No. UM 1826. As part of Docket No. UM 2165, Order No. 22-314[276] amended the principles in Order No. 18-376 to allow closer coordination of CFP-funded programs with other TE Portfolio initiatives, and the annual review process for residential CFP funded programs is now incorporated into utility TE Plans.

The six program design principles the Commission established under Order No. 18-376 for CFP-funded programs were:

- Support the goal of electrifying Oregon's transportation sectors
- Provide the majority of benefits to residential customers
- Provide benefits to traditionally underserved communities
- Programs are designed to be independent from ratepayer support277
- Programs are developed collaboratively and transparently
- Maximize use of funds for implementation of programs

Order No. 22-314 eliminated the fourth principle regarding ratepayer support but retained the remaining principles to guide PGE's CFP-funded programming going forward, with continued stakeholder consultation, as part of the company's broader TE portfolio.

Starting with the 2021 CFP program portfolio, PGE worked with stakeholders to design a portfolio approach to the spending of proceeds from the sale of residential Clean Fuels credits, including what types of programs to support through this approach. Based on that input, market research, and CFP participation, PGE developed a portfolio method to plan for the CFP. These resulting programs are organized in the following categories:

- **Infrastructure and grants** to enable deployment of vehicles and charging across Oregon.
- **Education and outreach** to increase awareness of and dispel existing misconceptions regarding TE and also help create an ecosystem of support roles (e.g., EV/Charger

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[276] Oregon Public Utility Commission Order No. 22-314, retrieved from https://apps.puc.state.or.us/edockets/orders.asp?OrderNumber=22-314.
[277] In 2022, the Commission amended Order No. 18-376 to remove the fourth principle: "Programs are designed to be independent from ratepayer support" as part of Order No. 22-336, retrieved from https://apps.puc.state.or.us/edockets/orders.asp?OrderNumber=22-336.

maintenance job training and EV service re-training) that promote a dependable customer experience.

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

Additionally, administrative costs are tracked and expected to remain below 10 percent of total annual expenditures. While funding amounts vary from year-to-year based on residential CFP Revenue, PGE estimates the following approximate budget breakdown and percentages for programs funded by residential CFP credit revenue:

Table 61. Categories of Clean Fuels Program Funding

Category	*% Portfolio per Year*
Infrastructure and Grants	70%–80%
Education and Outreach	5%–15%
Emerging Technology	5%–15%
Estimated Administrative Costs	5%–10%

Table 62. Clean Fuels Program Forecasts by Spending Category[278]

Category	2023	2024	2025	2023-2025
Infrastructure and Grants	$9,054,289	$10,242,669	$15,253,276	$34,550,234
Education and Outreach	$1,175,882	$1,371,438	$1,980,945	$4,528,265
Emerging Technology	$587,941	$685,719	$990,472	$2,264,132
Administration Total	$940,705	$1,097,150	$1,584,756	$3,622,612
Total Funds Forecasted	$11,758,817	$13,396,977	$19,809,449	$44,965,243

[278] Includes forecasted funds that could be applied to the TE portfolio while meeting the requirements of Order No. 18-376, amended by Order No. 22-314.

The Clean Fuels Program's areas of focus are enumerated below:

Table 63. Areas of Focus for the PGE Clean Fuels programs

Area of Focus	Programs to date	Major milestones and progress to date
Grants and Infrastructure Programs that increase access to transportation electrification	Drive Change Fund Electric School Bus fund External matching funds Public infrastructure updates	Drive Change Fund awarded 52 organizations $8.92 million to fund 110+ new EVs and 155+ ports Electric School Bus fund awarded 19 school buses in 11 school districts
Education and Outreach Increase awareness of transportation electrification options across the state	Oregoin' Electric Statewide campaign EV Costs and Savings Calculator Ride-and-Drives Workforce development	Oregoin' Electric had 10 million or more views in 2021 Oregoin' Electric had a 15 percent engagement rate Ride-and-Drives EV Costs and Savings Calculator launch
Emerging Technology Test and demonstrate emerging technologies that have an EV nexus and could scale to larger utility programs	V2G charging Pole charging Residential smart charging	First V2G charging in Oregon
Portfolio Administration	Credit sales REC purchases for incremental credits Portfolio administration	2022 and on includes REC purchases for incremental credits

GRANTS AND INFRASTRUCTURE

These funds support programs that increase access to electric transportation. Funding awards grants for programs that apply a strong equity lens, like the Drive Change Fund and Electric School Bus Fund, which both prioritize traditionally underserved communities. Starting in 2022, PGE set aside matching funds for grants from other sources that support CFP goals. This effort will utilize PGE Clean Fuels funding in an effort to bring external grant opportunities to Oregon. Infrastructure investments will include support for initiatives like charging site upgrades that improve user experience, give customers' peace of mind, and make EV ownership easier for Oregonians. In all cases, funding will target underserved communities and efforts that provide access to infrastructure in those communities. Details on these efforts follows:

- **Drive Change Fund** is a competitive grant fund available to non-residential customers for TE projects that prioritize underserved communities, advance transportation electrification, and benefit residential customers. Since 2019, DCF has awarded $8.9 million in grant funding to 52 organizations. PGE ran the fourth cycle of DCF in 2022, awarding $2.25 million to community TE projects. PGE is in the review cycle for 2023 DCF applications.

Table 64. 2022 Drive Change Awardees

Organization Name	Org Type	Project Type	# of Vehicles	# of Ports	Total Awarded
Working Theory Farm	Nonprofit	EV	1	-	$40,125.00
APANO Communities United Fund	Nonprofit	Chargers	-	12	$168,376.00
Chemeketa Community College	Community College	Chargers, EV, Education	2	2	$183,458.00
Volunteers of America Oregon	Nonprofit	Chargers, EV	6	6	$251,384.00
Tualatin Hills Parks & Rec	Government	EV	2	-	$126,378.00
Raphael House	Nonprofit	Chargers, EV	2	2	$88,910.00
NW Pilot Project	Nonprofit	EV	1	-	$76,957.00
Immigrant and Refugee Community Organization	Nonprofit	Chargers, EV	3	3	$482,770.00
Outgrowing Hunger	Nonprofit	EV	1	-	$43,664.00
City of Tigard	Government	EV, Education	-[279]	-	$105,800.00
Ecumenical Ministries of Oregon	Nonprofit	Chargers, EV	3	3	$431,425.00
Hacienda CDC	Nonprofit	EV	1	-	$66,000.00
Central City Concern	Nonprofit	Chargers	-	11	$84,478.00
Linfield University	Nonprofit	Chargers	-	4	$57,845.56
Community Cycling Center	Nonprofit	EV	1	-	$65,000.00
TOTAL			23	43	$2,272,570.56

[279] The City of Tigard's projects fund six electric cargo bikes.

- **Electric School Bus Fund** is a competitive grant that help school districts and/or school bus fleet operators acquire electric buses and supporting charging infrastructure. Grant evaluation and selection prioritizes school districts serving underserved communities. Since 2020, ESB has awarded 19 school buses to 11 school districts. To date, 10 of these buses are currently on the road. PGE ran the third cycle of ESB in 2022, awarding five districts the purchase of six buses and charging infrastructure. The fourth cycle of ESB opened in April 2023.

Table 65. 2022 Electric School Bus Fund Awardees

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

- **Matching External Funds** Starting in 2022, PGE reserved up to $400,000 to provide matching funds to public agencies, community-based organizations, nonprofits, educational institutions, and other partnerships applying to external funding opportunities. PGE identified the need for reserving matching external funds through receipt of community feedback and from the increased federal funding opportunities for electric transportation. When matching funds are not awarded they revert to the DCF funding pool for that year.
- **Public Charging Infrastructure:** The project of upgrading outdated public charging infrastructure continued as part of the Infrastructure and Grant portfolio in 2022. To date, this project focused on updating legacy charging equipment that had been previously installed and operated by other entities dating back to 2012 often referred to as the Oregon Electric Byway (OEB). Upgrading and updating these sites has proven to be a greater challenge than originally anticipated.

  After a year of engagement with site hosts, signed site host agreements were not progressing by mid-2022 which was impacting the ability to upgrade and update the sites. PGE evaluated what locations were most likely to result in improved EV driver experience and updated infrastructure. PGE provided a deadline to site hosts and offered the option for site hosts to either sign new agreements and easements with PGE to update the sites or take over ownership

[280] Final total award amount varies based on actual infrastructure costs.

of the existing make-ready without further PGE engagement. Due to the potential for poor driver experience, PGE did not want to leave unreliable or non-functional equipment in place.

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

EDUCATION AND OUTREACH

Education and outreach funds support programs that help dispel TE myths and educate all Oregonians that TE is here today and works for everyone. This effort will encourage and support an equitable transformation of the transportation sector. Details on these efforts follows:

- Statewide Campaign, Oregoin' Electric: Based on research conducted in 2019, PGE determined additional awareness was needed around TE to equitably transform Oregon's transportation sector for all Oregonians. Once people are aware of the savings, incentives, and benefits of electric transportation, they are significantly more likely to consider purchasing an EV. Through research and focus groups with customers, PGE learned that there are significant barriers to EV adoption for underserved communities, including misconceptions around product availability, EV infrastructure, and the association of EVs with privilege.

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

- Long-Term Engagement with Underserved Communities: PGE is implementing a long-term engagement strategy to directly engage underserved communities as defined by HB 2165. These parties have historically lacked the resources to intervene in the regulatory process. This work will allow PGE to better understand the specific needs of these demographics. PGE's goal is to integrate underserved community wants and needs into the design, build, implementation, and modifications of TE programs. Funds will be used for participant compensation, facilitation services, among other expenses related to long-term community engagement and capacity building. These stakeholder engagement efforts are detailed in Section 4.1, above.

- Ride and Drives: In 2022 PGE hosted the company's first ride and drive event since 2019. Held at Portland Community College Sylvania campus August 12 and 13, the event was successful in increasing awareness of the wide variety of EVs currently available and addressing barriers to EV adoption. In addition to driving, attendees were able to ask questions of EV owners and ask PGE subject matter experts about charging at home or on the go.

  Highlights and learnings from the ride and drive included:

  – The most popular cars to test drive were Ford Mustang Mach-E and Kia EV-6.

  - 12 attendees already drove an EV.
  - 100 of the 117 attendees asked said they are "very likely" to purchase an EV for their next car and 14 said they are "probably likely". 281
  - Respondents attended the event primarily to test drive EVs. Many attendees reported being at least somewhat knowledgeable about EVs, with some having experience driving EVs or already owning an EV of their own.
  - Attendees reported high satisfaction with all aspects of the Ride-and-Drive, although some would have liked to see more vehicles available to test drive. Most indicated that the event increased their likelihood to buy or lease an EV.282
  - The primary concern of attendees for purchasing or leasing an EV is the vehicle cost.
- EV Costs and Savings Calculator: PGE published an EV Costs & Savings Calculator in June 2022 on the Company's website[283] which uses data from PGE's rates and available state and federal financial incentives to help inform a customer on what owning an EV could look like for their budget and charging accessibility. This interactive tool has a comprehensive, updated inventory of all currently available electric vehicles, and their respective available financial incentives. The search page allows users to filter for their vehicle needs, including vehicle type, minimum range, price, etc. After a user selects their vehicle, they see all the vehicle details on one page. Users can change settings based on their vehicle usage, including average miles driven, years of ownership, eligibility for financial incentives, and charging strategy. After toggling to their usage, users can see their estimated total net savings, fuel savings, and greenhouse gas emissions reduced. The tool also includes details such as: electric vehicle specifications, cost by category, home charging options, EV dealerships, and a public charging map.

EMERGING TECHNOLOGY

Emerging Technology funds support small scale testing of new TE technologies with the potential to provide customer and grid benefits. To-date these funds have been used to test and demonstrate emerging TE technologies that could scale to larger programs.

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

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

  PGE is conducting the second V2G demonstration project in partnership with First Student, a school bus transportation contractor. The project uses a +/- 60 kW Nuvve DCFC unit installed

[281] Electric Car Insider (2022). *Electric Car Guest Drive After-Action Report*.
[282] Opinion Dynamics (2022). *PGE Transportation Electrification Pilot Program – 2022 Electric Car Guest Drive and EV Charger Exhibit Intercept Survey Results*.
[283] PGE. *Electric Vehicle Costs and Savings Calculator*. Retrieved from https://portlandgeneral.com/energy-choices/electric-vehicles-charging/ready-to-buy-an-ev/electric-vehicle-costs-and-savings-calculator.

at the First Student bus yard. This unit charges a Bluebird Type-C bus with a 155 kWh battery. The charger was energized in March 2022 and V2G capabilities were demonstrated in June 2022 before the charger was relocated. In 2022 Q3 the original school district selected a new transportation contractor who declined to continue testing at the original site.

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

- Pole Charging: In 2022, PGE evolved the initial CFP-funded pole charging demonstration to a broader utility pilot. Funding for this emerging technology enabled critical learnings that will result in more equitable charging infrastructure available across the region. These learnings include:
  - Following a new method of mounting chargers to poles to satisfy National Electric Code (NEC) and National Electric Safety Code (NESC) safety guidelines. The new mounting method puts chargers higher on the pole, with a QR code down below to activate a charging session. By mounting chargers higher up on the pole, PGE has been able to reduce safety concerns around climbing hazards and cable management that were brought up with the original demonstration chargers.
  - Developing an engineering standard design for the new chargers influenced by the original pole mounted chargers.
  - Efficiently deploying equitable charging accessibility. PGE's experience with pole-mounted chargers and their lower relative cost when compared to pedestal chargers informed PGE's planning for a larger scale program.

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

- Smart Charging: Launched in late 2020, this three-year smart charging pilot program used vehicle telematics tools to track EV driver habits in the PGE Smart Grid Testbed areas to understand the impacts of EV charging behavior on overall grid load.[284] All participants received a $150 enrollment incentive, and a $25 seasonal participation bonus twice a year. The pilot was scoped for up to 500 EVs but due to geographical restriction of the Testbed only 177 vehicles could participate. PGE collected driving and charging data (e.g., charging time,

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

location, consumption and travel distances and times) through integration between the vehicle and telematics software.

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

- Driving and Charging
  - Longer-range EVs (battery capacity greater than 50kWh) tend to drive longer distances and have a higher energy demand than short range EVs and plug-in hybrid vehicles
  - EV Drivers typically start charging with a state of charge (SOC) of ~65 percent and end with an SOC of 90 percent. Longer range EV drivers end with a lower SOC of ~80 percent
  - Most charging sessions took place using a Level 2 charger and there is some dependency on fast charging with approximately 2 percent of charges occurring at this charging level. Most charging sessions took place using a Level 2 charger and there is some dependency on fast charging with approximately 2 percent of charges occurring at this charging level
  - Summer and winter charging demand was similar but weekend charging was more sporadic than weekday charging
- Charging Incentives learnings
  - The Testbed groups exhibited different behavior from the control group and demonstrate willingness to charge off-peak, particularly where incentives were offered.
  - Daytime off-peak times were not highly utilized by EV drivers.
  - The small sample sizes of the groups may allow for individual vehicles to become overly influential when analyzing load curves.

- Electric Micromobility: Feedback from underserved communities has indicated that EVs are too costly to be viable for low-income individuals and that EVs are not an option for those who are non-drivers. Using a minimal amount of CFP funding PGE will explore an electric micromobility program as a potential solution to these barriers. There are many different incentive types for electric micromobility, including rebates, free e-bikes, lending libraries, and charging hubs. These will be explored more using market insights.

PORTFOLIO ADMINISTRATION

PGE tracks the cost to report, monetize credits, purchase RECs, transact in the market, and administer the CFP portfolio.

A.4.1.2 Strategic Context

PGE plans to continue the portfolio administration and program categories agreed to with stakeholders. The portfolio approach with percentage targets for programs allows spending to flex up or down based on actual revenues from CFP sales. With the removal of the requirement to keep CFP funds and ratepayer programs separate, PGE will coordinate CFP funds within the overall TE portfolio of programs where appropriate.

Within the 2023-2025 period, PGE will continue to fund current CFP programs like the Drive Change Fund and Electric School Bus grants at the current percentage levels (~30 and 20 percent, respectfully), leveraging additional revenue beyond today's programmatic levels to bring down the cost of TE programing to ratepayers. Using CFP dollars within the broader portfolio will need to be aligned with the remaining program principles:

- Support the goal of electrifying Oregon's transportation sectors
- Provide the majority of benefits to residential customers
- Provide benefits to traditionally underserved communities
- Programs are developed collaboratively and transparently
- Maximize use of funds for implementation of programs

A.4.1.3 Timeline

PGE plans to continue participating in the Oregon Clean Fuels Program through 2035 as required by Order No. 18-376.

A.4.2 Budget

The program is funded via revenue from the sale of residential CFP credits and is therefore not included in either the Transportation Electrification Plan's funding request or its cost effectiveness tests.

This is the first time the company has published a forward-looking estimate of CFP revenue. It is important to note that PGE is a participant in the CFP marketplace, and that marketplace is subject to market fluctuations. As this forecast is based on multiple forward-looking estimates, readers should assume actual credit revenue will vary. PGE will continue to report actual credit revenue to both the PUC and DEQ on an annual basis.

Using the assumptions for the cost estimate of the CFP (Table 38, page 156), PGE developed estimated program expenditures through 2025 illustrated in Table 66, below. Note that actual expenditures will vary based on CFP revenue.

Table 66. Forecasted Clean Fuels Funds (2023-2025)[285]

Category	2023	2024	2025	2023-2025
Infrastructure and Grants[286]	**$9,054,289**	**$10,560,073**	**$15,253,276**	**$34,867,638**
DCF	$4,527,145	$3,484,824	$5,643,712	$13,655,681
ESB	$3,621,716	$2,956,820	$4,270,917	$10,849,453
Matching funds	$543,257	$528,004	$762,664	$1,833,925
TE portfolio	-	$2,323,216	$3,965,852	$6,289,068
Outreach	$90,543	$105,000	$152,533	$348,076
Program Management	$271,629	$316,802	$457,598	$1,046,029
Education and Outreach	**$1,175,882**	**$1,371,438**	**$1,980,945**	**$4,528,265**
Statewide campaign	$446,835	$521,146	$752,759	$1,720,741
Ride-and-Drives	$176,382	$205,716	$297,142	$679,240
Long term US engagement	$211,659	$246,859	$356,570	$815,088
PGE Education and Awareness	$235,176	$274,288	$396,189	$905,653
Program Management	**$105,829**	**$123,429**	**$178,285**	**$407,544**
Emerging Technology	$587,941	$685,719	$990,472	$2,264,132
Micromobility	$264,573	$308,574	$445,713	$1,018,860
Vehicle-to-Grid	$146,985	$171,430	$247,618	$566,033
Program Management	**$58,794**	**$68,572**	**$99,047**	**$226,413**
Administration Total	$940,705	$1,097,150	$1,584,756	$3,622,612
Staff time	$352,765	$411,431	$594,283	$1,358,479
REC Purchases	$470,353	$548,575	$792,378	$1,811,306
Evaluation	$117,588	$137,144	$198,094	$452,826
Subtotal Infrastructure and Grants[287]	$9,054,289	$10,560,073	$15,253,276	$34,867,638
Subtotal Education and Outreach	$1,175,882	$1,371,438	$1,980,945	$4,528,265
Subtotal Emerging Technology	$587,941	$685,719	$990,472	$2,264,132
Administration Total	$940,705	$1,097,150	$1,584,756	$3,622,612
Total Funds Forecasted[288]	**$11,758,817**	**$13,714,381**	**$19,809,449**	**$45,282,647**

[285] Includes all forecasted CFP revenue, including planned funding for use.
[286] Includes forecasted funds that could be applied to the TE portfolio while meeting the requirements of Order No. 18-376, amended by Order No. 22-314.
[287] Ibid.
[288] Ibid.

A.4.3 Additional Scope/Scale

PGE plans to continue the portfolio administration and program categories agreed to with stakeholders. The agreed upon portfolio approach–with percentage targets for programs–allows for spending to flex up or down with actual revenues from CFP sales. PGE will coordinate CFP funds within the overall TE portfolio of programs where appropriate.

Table 67. Breakdown of Cost Categories Across the Portfolio

Category	% Portfolio per Year
Infrastructure and Grants	70%–80%
Education and Outreach	5%–15%
Emerging Technology	5%–15%
Estimated Administrative Costs	5%–10%

A.4.3.1 Incremental Credits

DEQ's 2021 CFP rulemaking introduced the concept of base and incremental credits. Base credits are generated through use of a fuel with carbon intensity lower than that of gasoline or diesel. Incremental credits are generated when a registered entity claims a lower carbon intensity of electricity by retiring RECs alongside EV charging. Incremental credits are otherwise functionally the same, as there is no distinction in selling or trading either type of credit.

Incremental credits were first available in 2021. Since there is a two-year delay between when credits are earned and when they are used to fund a program (e.g., CFP credits from the EV count in 2020 funded 2022 CFP program year) the first year incremental credits will fund program activity is 2023. Once incremental credits are claimed and deposited into a utility account by DEQ, they appear as credits in the account balance and there is no way to distinguish them from a base credit. In order to track the revenue earned via base versus incremental credits, PGE applies the yearly average CFP credit price to the percentage of base versus incremental credits. Incremental credit revenue expenditures will need to meet the same standards as base CFP revenue, with a particular focus on the underserved communities, as defined in HB 2165.

A.4.4 Original Proposal

To maintain readability of this document, the original CFP proposals are linked here rather than embedded in their entirety:

- PGE's 2022 Clean Fuels Program Report to DEQ: https://www.oregon.gov/deq/ghgp/cfp/Pages/utility.aspx
- PGE's 2023 Clean Fuels Program Plan: https://edocs.puc.state.or.us/efdocs/HAH/um2033hah162744.pdf
- PGE's 2022 Clean Fuels Program Plan: https://apps.puc.state.or.us/edockets/edocs.asp?FileType=HAH&FileName=um1826hah112934.pdf&DocketID=20725&numSequence=74 .

- Prior plans can be found under OPUC Docket UM 1826: https://apps.puc.state.or.us/edockets/docket.asp?DocketID=20725.

Appendix B. Sunsetting Activities

B.1 Business EV Charging Rebates

Table 68. Business EV Charging Rebates Reference

Docket Number(s)	ADV 1155
Docket Name(s)	PGE SCHEDULE 52, NONRESIDENTIAL ELECTRIC VEHICLE CHARGING REBATE PILOT
Filing Date	July 17, 2020
Effective Date	December 18, 2020[289]
Allowed (Approved) Utility Filing Date	December 15, 2020
Allowed (Approved) Utility Filing Name	Advice No. 20-19[290], Advice No. 21-15[291]
Governing Tariff	Schedule 52[292]
Deferral Number(s)	UM 2003[293]
Deferral Date(s)	February 11, 2021[294], February 22, 2022[295]

B.1.1 Overview

B.1.1.1 Description of Program Activity

PGE's Business EV Charging Rebates program is available to non-residential customers in PGE's service area, excepting those participating in PGE's proposed Business Make-Ready Solutions program. Once the existing rebate budgets are exhausted, this program will sunset. Section B.1.1.2, below, provides detail on the rationale for PGE's sunset of this program.

The program comprises the following rebate options:

- **Standard EVSE Rebate:** up to $1,000 per qualified L2 port installed at non-residential settings

289 Additional Docket No. ADV 1273, filed 5/27/2021 and effective 7/1/2021, Advice No. 21-15, increased the standard rebate from $500 to $1,000 per qualifying L2 port.
290 OPUC Advice No. 20-19, retrieved from https://edocs.puc.state.or.us/efdocs/UAA/uaa15947.pdf.
291 OPUC Advice No. 21-15, retrieved from https://edocs.puc.state.or.us/efdocs/UAA/uaa115634.pdf.
292 PGE Schedule 52, retrieved from https://assets.ctfassets.net/416ywc1laqmd/4kQwkhxFjQiA3zg1zFbWGI/70b713aa73ffaae5f60127e93d64a0de/Sched_052.pdf.
293 OPUC UM 2003, retrieved from https://apps.puc.state.or.us/edockets/docket.asp?DocketID=21817.
294 February 2021 deferral, retrieved from https://edocs.puc.state.or.us/efdocs/HAQ/um2003haq91312.pdf.
295 February 2022 deferral, reauthorization retrieved from https://edocs.puc.state.or.us/efdocs/HAQ/um2003haq145445.pdf.

- **Multi-Family EVSE Rebate:** up to $2,300 per qualified L2 port installed at multi-family dwellings
- **L2 Make-Ready Rebate:** 80 percent of the customer's make-ready and installation costs, up to $6,000 per qualified L2 port, and $36,000 per site (note that this rebate is not compatible with the Fleet Partner)
- **DCFC Rebate:** up to $350 per kW for qualified DCFC, up to a maximum of $25,000 per port

Participating customers are responsible for procuring and installing the EVSE. Customers commit to keeping the chargers operational and on an eligible PGE rate for 10 years, and also sign a release to allow PGE to collect charging session data from the qualified vendor.

B.1.1.2 Strategic Context

PGE's goal with this program was to support EV adoption by ensuring the availability of charging infrastructure to meet customers' charging needs. The program was designed to reduce the cost and complexity of installing EV Supply Equipment, which can preclude customers from deploying charging infrastructure. Finally, it created a network of demand-side resources to reduce the costs of serving EV loads by supporting efficient grid operations and future renewables integration.

The Business EV Charging Rebates program was designed to meet the needs of underserved communities–including renters, multi-family residents, and others who lack access to charging at home–by expanding access to public and semi-public charging. In addition, the rebate reservation system offers cost certainty and the ability to coordinate with other PGE programs (such as Fleet Partner) in a way that benefits capital-constrained organizations, including those that may serve underserved communities.

Despite the above, as of June 1, 2022 (halfway through the pilot's projected timeline), PGE had only issued 58 rebates through this program, or slightly less than 10 percent of the total number of projected rebates. The slow adoption of this program led to PGE proposing the Business EV Charging Rebates pilot expansion (see Section 6.2.3.3) through MMC 2022 budget filing, which was approved in October 2022.

PGE anticipates program funding will be fully reserved in 2024 with charger installations lasting in 2025. PGE does not propose a further expansion of the program as we transition to supporting infrastructure. In addition, PGE will be studying the load profiles of the installed chargers to determine where managed charging or updated rates and tariffs can be used to better manage the load for workplace, public, and multi-family locations.

B.1.1.3 Timeline

The current program is projected to extend through the end of 2023, or as long as the allocated budget lasts. Over this time period, this program will fund 500 Level 2 ports, 250 Level 2 make-ready installations, and 20 DCFC ports.

B.1.2 Budget

Table 69. Business EV Charging Rebates Budget: Existing/Approved Operating and Capital Expenditures (2022-2025)[296]

Programs	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$460,000	$2,328,728	-	$2,788,728

B.1.3 Additional Scope/Scale

Once the existing rebate budgets are exhausted, this program will sunset.

[296] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

B.2 Affordable Housing EV-Ready Funding

Table 70. Affordable Housing EV-Ready Funding Reference

Docket Number(s)	UM 2033
Docket Name(s)	PGE TRANSPORTATION ELECTRIFICATION PLAN
Filing Date	July 29, 2022[297]
Allowed (Approved) Utility Filing Date	October 18, 2022[298]
Governing Tariff	N/A

B.2.1 Overview

B.2.1.1 Description of Program Activity

PGE's Affordable Housing EV-Ready Funding program provides limited-term funding to support affordable housing projects in PGE's service territory meet the requirements of HB 2180, which requires that all new multi-family buildings be made EV-ready. EV readiness is defined as the installation of service capacity (or space to provide additional future service capacity) as well as the installation of conduit for Level 2 EVSE at 20 percent of the building's parking stalls. The bill allows local governments to require a greater percentage of parking spots be made EV-ready, and the Oregon Land Conservation and Development Commission adopted a temporary rule in June 2022 that requires this of cities within metropolitan areas.

PGE allocated $1 million of its 2022 Monthly Meter Charge funds be made available for affordable housing developers to meet these state and local jurisdictional requirements. PGE will fund $2,500 per parking stall the developer makes EV-ready, up to 50 percent of the project's parking stalls. Funding is on a first-come, first-served basis. This program will provide funding for approximately 360 EV-ready parking stalls at affordable housing developments in PGE's service area.

B.2.1.2 Strategic Context

This program supports a more-equitable deployment of EV resources for residents of affordable housing. It does so by covering the cost of meeting the above code requirements for those affordable housing developers who have already secured fixed funding, but have not yet submitted permit applications. This allows affordable housing projects to proceed with the development process without seeking additional funding. The approach is a stop gap to assist developers as they adapt to these new code requirements.

[297] See PGE's 2022 Monthly Meter Charge Budget, at https://edocs.puc.state.or.us/efdocs/HAH/um2033hah1673.pdf
[298] Order No. 22-381, retrieved from https://apps.puc.state.or.us/edockets/orders.asp?OrderNumber=22-381

B.2.1.3 Timeline

The program will launch in 2022 and is projected to extend as long as the allocated budget lasts. Over that timeframe, we project that the program will fund 360 EV-ready parking stalls at affordable housing developments in PGE's service area.

B.2.2 Budget

Table 71. Affordable Housing EV-Ready Funding Budget: Existing/Approved Operating and Capital Expenditures (2022-2025)[299]

Programs	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Outreach and Education Services	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments	[redacted]	[redacted]	[redacted]	[redacted]
Program Operations	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$1,000,000	-	-	$1,000,000

B.2.3 Additional Scope/Scale

Once the existing budget is exhausted, this program will sunset.

[299] The figures shown in this budget have been approved previously by the Commission through docketed proceedings, detailed in Appendix H.

Appendix C. New Activity Applications

This section details infrastructure measure applications for new approaches.

C.1 Public Charging – Municipal Charging Collaboration and Electric Avenue

PGE is combining Electric Avenue and our new proposed program the Municipal Charging Collaboration into a new activity portfolio called Public Charging. Several reasons exist for this new categorization. First, PGE continues to have a role in public charging whether as the current owners and operators of Electric Avenue or as the provider of public charging solutions for underserved communities through the Municipal Charging Collaboration. Second, PGE will have a long-lasting role in serving public charging load. Third, PGE intends through customer collaboration, programs, rates and tariffs to serve as a partner in the design and build of public charging sites. Electric Avenue is not new work but a continuation of an investment which originated in 2016. PGE is not proposing to expand Electric Avenue, simply to continue operating through this Plan period. Further, to limit risks associated with maintenance and operation of these site PGE is assessing whether to open a dialogue to explore partnerships or passing ownership of these sites to other entities. Electric Avenue continues to provide insights and to be utilized and relied upon by electric vehicle drivers. The data and lessons learned from owning Electric Avenue has informed the development of many of the activities proposed in this TE Plan. This work was prior approved and is well known to the Commission and stakeholders, therefore, this section of the appendix is dedicated to detailing the Municipal Charging Collaboration.

The Municipal Charging Collaboration is an approach wherein PGE designs, owns, operates, and maintains EV chargers in the ROW and on public property. PGE deploys this infrastructure in collaboration with public entities such as municipalities, regional governments, school districts, counties, and state government. The pilot version of this program was approved by the OPUC in October 2022 as part of PGE's 2022 Monthly Meter Charge Budget and included funding for 60 Level 2 Pole Chargers. PGE's 2023 Monthly Meter Charge Budget, which was approved in April 2023, included funding for an additional 100 Level 2 Pole Chargers.

In the scaled-up version of this approach, which PGE proposes as part of this TE Plan, PGE will install 80 utility pole-mounted or curbside pedestal Level 2 chargers in its service territory, for a total of 240 L2 Public Charging Ports under this program.[300] Chargers under this program will utilize Schedule 50. PGE will collaborate with public entities and communities in its service territory to identify the best locations to install chargers. Our priority is to install chargers within underserved communities as they are least served by the existing market and would benefit the most from the switch to electric transportation. During the 2023-2025 funding cycle PGE will also attempt to find a market partner interested in owning these chargers or assisting PGE with our charger development as part of this program activity.

[300] The following factors used to identify potential pole locations, include, but are not limited to: Proximity of the pole in the ROW to the parking spot, proximity to an ADA ramp (corner or a driveway), proximity to the curb (far enough for car doors to not hit), age of the pole (preference for poles installed after 1980), size and height of the utility pole, transformer location on the pole, climbing space and presence of other devices on the pole to ensure crews can safely work on the pole, and parking availability near the pole. Census data will also influence potential pole locations, including median household income in the area, percentage of BIPOC communities, and environmental justice tract ID from EJScreen.

The overall budget for this three-year program is $11.5 million. In this TE Plan, PGE is requesting an incremental $6.3 million (which is included in the three-year program cost of $11.5 million).

C.1.1 Program/Measure Details

C.1.1.1 Elements, objectives, timeline, and expected outcomes

Program Objectives

This program aims to:

- Improve charging adequacy for PGE's customers and identify how pole and curbside chargers create access for those particularly in underserved communities by targeting areas of high density of rentals, multi-family housing, low-income families, BIPOC communities, and other traditionally underserved communities, as defined by HB 2165
- Demonstrate the demand for EVSE in underserved communities and identify how the private market can meet these communities' needs
- Validate whether Schedule 50 is appropriate to address the needs of underserved communities or requires further revision
- Help municipalities reach their climate action and sustainability goals
- Design, own, operate, and maintain EVSE for municipalities unable to fund this work
- Use existing franchise agreements and ROW ordinances to fairly compensate municipalities for the use of their property
- Install appropriate charging infrastructure based on ODOT's TEINA estimates
- Collect Clean Fuels Credits to help offset costs
- Explore private partnership opportunities for ownership of chargers

Program Elements

From the municipal customer's perspective, key features of the program include:

- Close partnership to determine the best locations to help underserved communities
- PGE ownership and maintenance of EVSE and make-ready equipment
- Affordable and equitable pricing for all customers
- Knowledge of where to find public charging infrastructure
- PGE will offer Schedule 50 rates on all public charging infrastructure installed under this program

PGE will ask municipalities commit to:

- Provide written approval for PGE to install EVSE on identified public property
- Correct and expedited permits for different applications of installations
- Mutually agreed upon terms between PGE and municipality
- Outreach to communities regarding upcoming EVSE installations
- Notification of vandalism, questions, or concerns they receive around EVSE installed under this program

PGE will commit to:

- Site Selection: PGE will work with internal and external stakeholders to select locations that best provide charging to underserved communities at the lowest cost.
- Equipment Selection: PGE will seek equipment designs and specifications that meet the unique combination of requirements for utility pole-mounted applications, as put forth by the

National Electrical Code and National Electrical Safety Code. PGE will ensure proposed designs are supported by internal and external stakeholders, including OPUC safety staff.
- Design and Engineering: PGE will design and engineer sites to ensure conformance with all applicable codes, regulations, and standards.
- Permitting and Installation: PGE will permit and install all chargers to meet all applicable codes, regulations, and standards set forth by the authority having jurisdiction.
- Operations and Maintenance: PGE will operate and maintain all make-ready and charging infrastructure for the duration of the program. Operations and maintenance tasks include remote monitoring, testing and inspection, routine, maintenance, and emergency repair.

PGE will track the uptime and first pass charge rate of each individual charger. PGE will target 98 percent uptime and 93 percent first pass charge rate. PGE will consider replacement of individual units if they are found to consistently underperform these targets.

Customer Journey

For municipal customers:

- PGE reaches out to municipality about the PGE program
- Municipality expresses interest in program
- Municipality provides target neighborhoods or areas
- PGE conducts preliminary assessment of viable locations
- Municipality signs agreement
- PGE shares viable locations with municipality
- Municipality conducts community outreach with PGE support
- Municipality and PGE agree upon final locations
- Project proceeds through building and enablement
- Municipality marks off an "EV parking only" space and appropriate signage at each location
- Chargers online, EV drivers take service
- PGE maintains pole charging, exploring options for pedestal charging

For customers, outreach and education materials, such as mailers and emails, will be sent to customers in the immediate area of the chargers. Additionally, charger locations will be available on PGE's website, Plugshare, and Chargeway. Customers must utilize the appropriate charging vendor's app and sign up for an account and have a payment card available.

For customers:

- EV Driver finds a neighborhood charger near them via PGE's website, Plugshare, or Chargeway
- EV Driver reviews instructions on the pole or charger
- EV Driver scans the QR code to initiate session
- EV Driver plugs in their vehicle to start their charging session
- EV Driver is charged the Schedule 50 rate for their session
- EV Charger can monitor charging progress via vendor app
- EV Driver unplugs their vehicle when the charging session is finished
- EV Driver leaves the charger and parking spot so others may utilize the charger

Education and Outreach

Supporting the successful adoption of EVs requires PGE to educate the public on how to use chargers and where to find them. Outreach and education activities, such as advertising and informational materials, are an essential component of outreach efforts. These activities can help customers understand how to use the chargers and identify where the chargers are located. Proper signage and instructions on the chargers can help drivers understand how to use them and who to contact if they are not operational. Without proper outreach and education activities, customers may not be aware of the location of chargers or how to operate them. This can lead to lower utilization rates and dissatisfaction with PGE's charging infrastructure. By implementing education and outreach programs, we can ensure higher satisfaction with chargers. Education, outreach, and outreach and education represent roughly 5 percent of the total program budget.

Program Timeline

PGE plans to launch the program in Q2 2024, with additional signed agreements and EVSE installations occurring as early as the end of Q3/early Q4 2024. PGE will reassess public infrastructure needs and conduct surveys of municipalities and neighborhoods where chargers have been deployed on an annual basis. PGE plans to make this information available to all municipalities (cities, counties) and managers of public property (i.e., Metro, school districts).

Expected Outcomes

- Enable adoption and equitable access of transportation electrification in underserved communities and support fueling and availability of transportation electrification.
- Reduction in greenhouse gas emissions and criteria air pollutant emissions as well as improvement in water quality in PGE's service territory and beyond
- Beneficial partnership that helps both PGE and municipalities achieve their climate goals
- Streamlined data collection from EVSE to better understand customer charging
- Promote the use of public facilities such as library and parks

C.1.1.2 Market Baseline Assumptions

The State of Oregon has a goal of growing ZEV adoption to 250,000 registered vehicles by 2025.[301] The Company forecasts that approximately 115,000 of those light duty vehicles will be registered in PGE's service territory (up from 31,000 in 2021). EV drivers who own their homes and have access to off-street parking are likely to perform the majority of their vehicle charging at home overnight. However, many potential EV drivers—such as those who rent their home or live in multi-unit dwellings (MUD)—lack dedicated off-street parking at their current residence and cite this as a main barrier to their EV adoption. A recent PGE survey found that, within the population of renters, 44 percent of MUD residents and 32 percent of single family housing residents responded that they were more likely to consider an EV or Plug-in Hybrid Electric Vehicle (PHEV) if they had access to a utility-pole mounted charger in their neighborhood. Furthermore, within the population of customers without access to off-street parking, 55 percent of MUD residents and 48 percent of single family housing residents noted that they would be much more likely to consider an EV if they had access to utility-pole mounted EV charging in their neighborhood.

Forty-nine percent of residents in the PGE's service territory currently live in renter-occupied dwellings. BIPOC communities and/or traditionally underserved communities disproportionately rent

[301] Oregon Revised Statutes, Volume 7, Title 26, Chapter 283 (ORS 283.401), https://oregon.public.law/statutes/ors_283.401.

their residence[302]. ODOT's TEINA mentions that overnight home charging is the highest importance for widespread and equitable adoption of EVs. TEINA shows that by 2025, a four-fold increase in the total number of charging ports (over 2020 levels) will be needed to support urban LDV requirements, particularly in areas of high populations of rentals and MUDs. TEINA goes on to show that vehicle registrations are 11 percent lower in underserved communities, and these customers currently have no way to charge an EV near their home and therefore are unlikely to consider acquiring one.[303] These customers may be unable to enjoy the benefits of owning an EV, which include decreased maintenance costs, better air quality, and the convenience and cost savings of electric "fuel". To ensure that all residents may enjoy these benefits, customers need:

- Reliable access to public charging infrastructure close to their residence
- Charging locations where their vehicles are likely to be parked for long periods of time
- Charging available at a price comparable to what they might pay to charge at home

PGE recognizes that to increase EV adoption, there needs to be an emphasis on installing charging equipment where the vehicles currently park for long periods of time. This program will focus on underserved communities, where the private sector is least likely to invest. PGE expects that the installation of EVSE in these areas will help underserved communities gain access to the benefits EV ownership.

Table 72, below, illustrates how the usage of PGE's two pole chargers compares to that of PGE's Electric Avenue L2 public chargers. PGE acknowledges that not all pole chargers will demonstrate these relatively high usage levels.

Table 72. PGE Public L2 Usage Data (2022)

Station Name	Total Usage (kWh)
Pole Chargers	
Pole Charger 29th Ave.	10,439
Pole Charger 35th Ave.	19,951
Electric Avenue L2 Public Chargers	
Electric Avenue World Trade Center	18,162
Electric Avenue Hillsboro	590
Electric Avenue Eastport Plaza	6,451
Electric Avenue Wilsonville	2,319

[302] Portland Housing Bureau (2020). *State of Housing Report.* Retrieved from https://www.portland.gov/phb/state-of-housing-report.
[303] Oregon DOT. *TENIA Study*, retrieved from https://www.oregon.gov/odot/Programs/Pages/TEINA.aspx.

Station Name	Total Usage (kWh)
Electric Avenue Beaverton	7,031
Electric Avenue Milwaukie	3,726

To determine total port need, PGE reviewed total residential charging demand and estimated the portion of unmet charging demand that requires additional public charging infrastructure to serve EV load. PGE then reduced the total port needed to reflect various important factors to the design of the Municipal Charging Program, including a preference for serving unmet needs of multi-family renters, providing infrastructure in low-income census areas, and serving unmet charging need due to a lack of on-site parking.

Based on the methodology above, the following port needs were estimated for the 2024-2025 program:

Table 73. Public Charging - Municipal Charging Collaboration Ports

Metric	2024 Ports	2025 Ports
Total unmet residential charging need	19,583	21,677
Total in MF renters	1,000	1,220
Total in MF renters due to the lack of garage	784	960
Total in MF renters due to the lack of garage, in <120 percent state median income census blocks	695	859
Percentage market reach	5%	5%
Final port counts	34.75	42.95
Final port count (rounded)	35	43

C.1.1.3 Major Performance Milestones

- New Schedule 50 rate implemented by Q1 2024
- Third party partnership agreement explored by Q2 2024
  - If applicable, signed by Q4 2024
- 20 Pole Charging Locations identified by mid-Q3 2024
- Agreements with municipalities signed in Q4 2024
- Engineering and Safety Design Standards for curbside charging by Q1 2024
- 30 Curbside Locations (each charger will have 2 ports) identified by Q4 2024

- Pole Charging Locations Finish Installation by Q2 2025
- Begin Curbside Charging Installation by Q1 2025
- Curbside Charging Finish Installation by Q4 2025

C.1.1.4 Program/Measure Phases

PGE seeks to leverage utilization and evaluation data to determine if the current selection criteria for charger location is appropriate and to assess the efficacy of ROW and curbside charging. Evaluation data will also be used to determine if Schedule 50 is the correct rate for a program like this, or if a new one should be introduced. Lastly, PGE plans to conduct an RFP with third-party entities to determine ownership model of ROW charging.

PGE has planned to complete the installation of all chargers under this program by 2025. These chargers are expected to have a life expectancy of 10 years. However, PGE may explore the option of a pole charging ownership partnership before the end of the 10-year period. In addition, PGE is currently exploring potential partnerships for curbside ownership, which can be implemented in the near future. Following the installation of these chargers, we anticipate developing a rate structure that will better align to our evolving role to support, rather than accelerate, EV charging expansion.

Over the duration of the program, PGE will evaluate utilization of and general awareness of the chargers in areas where they are located. While low utilization is expected at the start, if chargers continue to show low utilization overtime, PGE will increase education and outreach activities in those areas. Continued low charger utilization overtime and long-term evaluation in low utilization areas can help determine if PGE's location selection criteria needs to be re-evaluated.

The long-term evolution of this program is to inform appropriate rate design for this program, along with a potential public charging rate, ownership model of chargers in the ROW, inform a long-term approach for serving underserved communities (especially those who lack off-street parking), and exploration of flex load opportunities with municipal chargers.

C.1.1.5 Utilization, Eligibility, Incentive Structures

Municipalities and public entities that manage or own public property (including cities, counties, school districts, state agencies, and regional agencies) are eligible to partner with PGE to offer this product. PGE encourages any municipality in its territory to apply. PGE will use geospatial analysis to highlight those historically underserved communities most in need of EV charging infrastructure. Public property managed by the municipality will be overlaid on this map and PGE's program team will evaluate key areas to determine the best locations to place EVSE.

Chargers installed under the Municipal Charging Collaboration will utilize Schedule 50. Learnings from the program will help PGE understand if the current Schedule 50 rate is appropriate or requires tariff revision. PGE will also attempt to find a market partner interested in owning these chargers or assisting PGE with our charger development as part of this activity. The rate is currently being revised to better reflect a rate closer to residential rates to promote parity between customers who can charge their vehicles at home and those who must rely on the availability of public charging infrastructure. PGE recognizes the importance of affordability and equitable access to charging infrastructure, particularly for underserved communities, and is committed to developing a rate structure that supports these objectives.

C.1.1.6 Market and Implementation Barriers Addressed

PGE found that current EV owners have a higher level of home ownership (94 percent) compared to that of all respondents (67 percent).[304] Only 3 percent of current EV owners surveyed lived in multi-family housing, compared to 22 percent of all respondents.[305] These data points indicate an issue with equitable access for non-homeowners, as 63 percent of vehicle purchasers surveyed reported the ability to charge at home as a major barrier.

Additionally, we found that current EV owners reported higher household incomes, with 59 percent of reporting household income of over $100,000, compared to 25 percent of all respondents.[306]

ODOT's TEINA study identifies the following as additional barriers to light-duty vehicle charging:

Table 74. Municipal Charging Collaboration Market Barriers and Mitigants

Barrier	How Addressed
Cost of electric power upgrades and charging port installation	Utility covers costs for electric upgrades for public charging
Inconsistent fees and/or rates for public charging	Chargers installed under this program will be subject to PGE's Schedule 50 pricing, which is meant to be easy to understand, equitable, and grid friendly
Limited multi-unit dwelling and workplace charging	The site selection process which PGE will undertake with municipalities and communities will include a prospective site's proximity to MUDs and rentals
Limited EV focused government planning, programs, policies, and resources	PGE will leverage its expertise in charger ownership and management, and also use existing assets to reduce the complexity of these projects for municipalities
Limited government planning, guidance, or resources for EV infrastructure needs	PGE already assesses and plans for EV infrastructure needs and can provide this information with municipalities
Limited venues capable of providing power, safety, and amenities	Placing charges on utility poles will provide charging at/or near residences, where it most benefits customers
Further Barriers for Underserved Communities:	
Need for DCFC charging in areas of high transportation network company use or near drivers' homes	Future phases of this pilot will take into consideration the placement of utility-owned DCFC on public property

[304] Opinion Dynamics (May 19, 2022). *Evaluation of Portland General Electric's Transportation Electrification Pilot Programs:* Figure 31, retrieved from https://edocs.puc.state.or.us/efdocs/HAD/um1938had165623.pdf.
[305] Ibid, Figure 32.
[306] Ibid, Figure 34.

Barrier	How Addressed
Economics of installing and operating charging ports (upfront, demand charge costs)	PGE will own, install, maintain, and operate these chargers, leveraging existing assets to keep costs low and capturing economies of scale

The above barriers can result in a lack of charging infrastructure (colloquially referred to as a "charging desert") and is a particular issue in BIPOC communities.[307] PGE's 2022 TE Evaluation found that the same lack of infrastructure was cited by 45 percent of survey respondents as a reason for not considering an EV/PHEV.[308] This program seeks to address this barrier with:

- Focus on deployment in underserved communities
- Access to public property for charger placement
- Skilled owner/operator (the utility)
- Help for local governments to plan for and deploy chargers in their communities

Implementation Barriers

PGE anticipates several implementation barriers for this program and has applied lessons learned from its Fleet Partner program, along with lessons from similar utility programs, in considering how to mitigate these. Key barriers and mitigation plans include:

Table 75. Public Charging - Municipal Charging Collaboration Implementation Barriers and Mitigants

Barrier	How Addressed
Rising costs resulting from macroeconomic conditions, including the COVID-19 pandemic, supply chain constraints, and rising interest rates	PGE will keep continue to assess and evaluate these changing factors, as well as the availability of infrastructure and charging equipment, and commercial lending rates. Our goal is to ensure that our incentives are not overcompensating for the costs and perceived benefits of adding EV charging to these properties. PGE will monitor the situation to ensure we are making informed decisions.
Long equipment lead times leading to installation delays	Ordering equipment ahead of time alleviates any delays that may pop up or make us aware of potential delays in installation due to long equipment lead times

[307] Englund, Will (December 2021). Washington Post. *Without access to charging stations, Black and Hispanic communities may be left behind in the era of electric vehicles*. Retrieved from http://www.washingtonpost.com/business/2021/12/09/charging-deserts-evs/.
[308] See footnote 304.

Barrier	How Addressed
Low applicant success rate due to lack of experience installing electric charging infrastructure and underestimation of process and costs.	PGE will manage this risk by pre-qualifying sites. Up front engagement, and assistance with site design and business case development. Long-term site engagement for the collection information and data will inform PGE of the success and hurdles these early adopter experience thus informing PGE role an activity.

C.1.1.7 Performance Area Categories

PGE's proposed design addresses relevant Division 87 performance area categories in the following ways:

- Environmental benefits including greenhouse gas emissions impacts.
- Increased access to electricity as a transportation "fuel" will reduce greenhouse gas emissions across PGE's service area.
- Electric vehicle adoption: Increased charging adequacy, including chargers that are visible and available at the retail, workplace, multi-family, and other destinations residential customers frequent, may help potential EV drivers feel more confident in their ability to successfully transition to electric "fuel", thus boosting EV adoption across PGE's service area.
- Equity of program offerings to meet underserved communities: The expansion of public and semi-public charging that is anticipated to take place as a result of this program will better meet the needs of underserved communities, including BIPOC communities, renters, multi-family residents, and others who lack access to charging at home.
- Distribution system impacts and grid integration benefits: PGE does not anticipate distribution system impacts stemming from this program at present size. Grid integration benefits are largely represented by the networked and DR-capable requirements in the technical standards that PGE sets.
- Program participation and adoption: PGE anticipates that approximately 240 L2 ports will be constructed under this program. The plurality of ports (75 percent) will be installed near underserved communities as defined by HB 2165. All ports installed under this program will be publicly available.
- Infrastructure performance including charging adequacy which considers, but is not limited to reliability, affordability, and accessibility: PGE tracks charger uptime and cost-to-charge across its fleet of utility-supported chargers and will report on this information in future TE Plan Reports. If the site host elects to bill EV drivers, PGE requires multiple forms of payment be available. This requirement increases accessibility of chargers to all types of residential customers.

C.1.1.8 PGE's Role in the Program

Utilities play a central and critical role in advancing transportation electrification. PGE owns infrastructure in public rights of way that can serve as the location for public charging or home charging for those without off-street parking. Utilities have an obligation to serve all customers, not just the most profitable use cases, and we apply an equity lens to all of our customer programs, including our TE programs.

The Oregon Legislature has found that "widespread transportation electrification requires that electric companies increase access to the use of electricity as a transportation "fuel" in low and moderate income communities" (ORS 757.357). Utilities are well positioned to provide public charging based on where communities will need it, rather than where usage will be maximized. Private charging business models may depend on high utilization and may therefore leave behind underserved communities, where EV adoption is expected to be slower and later. EV adoption in these communities is still dependent on charging availability as a key part of the decision to drive electric. To choose charger locations, PGE will use in-house mapping of underserved communities and work with municipalities and their communities, who are also the customers we serve.

PGE's role in the program includes supporting municipalities in:

- Planning for public charging infrastructure
- Public outreach to neighborhoods identified through mapping
- Designing, owning, and maintaining EVSE in service to local climate and transportation electrification goals
- Other technical services

While utilities play a central role in transportation electrification, the breadth and speed required for the EV transition requires an "all-of-the-above" approach. Partnerships, investments, and coordination amongst utilities, charging networks, businesses, local governments, states, fleets, and communities are essential. This proposal is an example of such collaboration.

C.1.1.9 Resulting Distribution Upgrades

PGE does not expect the program to trigger any significant distribution system upgrades. However, as part of our data gathering work, the Company will monitor transformers and substations to proactively identify any needed upgrades.

C.1.1.10 Ownership Structure

PGE will own the make-ready infrastructure and the EVSE. PGE will procure, install, operate, and maintain any EVSE installed under this program.

In discussions with municipalities, many have expressed the need of public charging to help in the transition to electric vehicles. Municipalities also believe that many underserved communities could be left behind that without a program such as this or without PGE's help. In additional discussions, PGE has learned that, while many municipalities want to provide public charging for their constituents, they don't believe they are well suited to own and operate the equipment. They look for PGE to help fill this role and their guidance.

This approach addresses the barriers which municipalities without the resources or inclination to own and operate EVSE face when considering public EV charging. ROW charging is particularly well suited to this purpose, as EV charging can be deployed on assets already located in the public right of way. The program also allows PGE to offer local and visiting customers in its service area a consistent user experience with equitable, affordable, and easy-to-understand pricing. PGE ownership, operation, and maintenance of EVSE in the ROW in collaboration with municipalities helps ensure that chargers are located strategically, with an eye toward an equitable transition to electric vehicles.

PGE will also explore potential private partnerships around ownership and maintenance of all chargers installed in the program. Potential private partnerships would have to comply with Schedule 50 or another tariff that is specifically tailored for this purpose. There is the risk of a lack of willing market actors to agree to private partnerships and adhere to PGE's Schedule 50. If PGE is unable to create a private partnership, PGE will continue to own, operate, and maintain the chargers unless and until the private market is meeting the needs of underserved communities.

C.1.1.11 EVSE Requirements (Equipment Interoperability and National Standards)

PGE utilizes a single Qualified Products List (QPL) to determine eligible EVSEs for all of PGE's non-residential EV programs. EVSE vendors must submit a Request for Qualification (RFQ) if they want their products added to the QPL. PGE engineers review each RFQ for completeness and against the predefined qualification requirements, listed below. If the vendor receives technical approval, they must also execute a Data Sharing Agreement with PGE before their products will be added to the QPL.

Hardware requirements (Level 2 and DCFC):

- National Electrical Manufacturers Association (NEMA) Type 3R or 4, which certifies that equipment is weatherproof and certified for either indoor or outdoor use.
- Compliant with Federal Communications Commission Part 15, which sets limits on the amount of electromagnetic interference allowed.
- Compliant with National Electric Code, National Fire Protection Association (NFPA) article 625, which covers wires and equipment used to supply electricity for EV charging.
- Compliant with the Americans with Disabilities Act (ADA), which ensures that the EVSE is ADA accessible, if installed according to the manufacturer's instructions.
- EVSE model must have a cellular connectivity option, either 4G LTE or 5G.
- Compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of network service providers. It also must be remotely upgradable to support future versions of OCPP.
- Must include a standard warranty of 1 year or greater
- Must have an operating range of at least -22F to 122F, ensuring it can withstand extreme environments

Level 2-specific requirements:

- Compliant with Society of Automotive Engineering (SAE) J1772, the standard Level 2 connector that is compatible with all road-legal EVs for sale in the United States, including plug-in hybrids (PHEVs), battery electric vehicles (BEVs), and Tesla vehicles using an adaptor.
- Listed by a nationally recognized test lab to the requirements of UL 2251 and 2594, demonstrating that products are tested to UL's recognized safety standards.

DCFC-specific requirements:

- If the EVSE includes a Combined Charging System (CCS) connector, it must be compliant with SAE J1772.

- Listed by a nationally recognized test lab to the requirements of UL 2202, demonstrating that products are tested to UL's recognized safety standards.
- Equipment compliant with recommended practice SAE J2894/1_201112 or later (power quality requirements for EVSE).
- If the EVSE includes an automated conductive charging mechanism (pantograph), it must meet SAE J3105.
- DCFC EVSE efficiency must be greater than 92 percent

Software requirements:

- Software platform must be responsive to grid services, modifying charger power output levels, using either one of the following methods
  - Certified OpenADR 2.0b Virtual End Node (VEN)
  - Application Programming Interface (API)
  - IEEE 2030.5 (SEP 2.0)
- Software must also be compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of EVSE hardware.

Through the RFQ process, PGE collects additional technical information from vendors that aren't requirements but help inform PGE programs and potential future requirements. This includes items such as:

- Compliance with ISO/IEC 15118
- Payment methods and pricing options
- Compliance with OCPI v2.2 or later
- EVSE metering accuracy
- Bi-directional charging capability
- Lead time and indicative pricing
- Installation manuals
- The vendor's sales point of contact to post on PGE's QPL webpage so customers know who to contact when interested in a specific product

As of 4/28/2023, PGE has qualified 137 EVSE models from 18 different EVSE vendors.

C.1.2 Program/infrastructure coordination

C.1.2.1 Stakeholder involvement in development

PGE will design, own, operate, and maintain charging infrastructure installed under the program. Both PGE and municipalities recognize the importance of gaining constituent support for the siting and location of chargers. PGE is coordinating with municipalities to streamline site host agreements, determine the best location for chargers, and conduct public engagement and outreach. Municipalities will take the lead on public engagement, with PGE support as needed.

Given that both PGE and municipalities share a focus on equitable deployment to underserved communities, PGE will assist with engagement strategies to reach those constituents. To that end, PGE will share community input from our ongoing underserved engagement (see Section X.X) with municipalities so that they can more effectively communicate with underserved communities. PGE will also help with targeted outreach and education regarding how to use different charging equipment, including the utility pole mounted charger, as well as additional outreach and education on PGE's Retail Electric Charging Rate. Additionally, PGE is actively partnering with municipalities to mitigate concerns (e.g., regarding loss of parking spots) with this program and intends to send proactive communication to alert residents in the area.

C.1.2.2 Coordination with State Programs

PBOT has applied for a Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy grant to leverage utility pole-mounted chargers for overnight EV charging. This will help PBOT with the permitting, engagement, and related processes. PGE joined the City of Portland as a partner in this grant application. PGE will plan to move forward with placing chargers in Portland, regardless of whether PBOT receives the DOE grant.

C.1.2.3 Coordination with Market Actors and Activities

PGE has coordinated closely with a variety of market actors including network service providers, EVSE manufacturers, and other utilities to better understand the most promising technology and strategies used in ROW charging. Conversations have helped inform PGE's requirements for EVSE technology and program designs. Currently, only one manufacturer has brought a charger to market that is both ADA-compliant and capable of meeting NEC and NESC requirements for mounting on an electric utility pole.

Both the Los Angeles Department of Water and Power (LADWP) and National Grid have piloted EVSE on their utility-owned poles in the right of way. LADWP has deployed over 400 of these chargers on light poles throughout their city. National Grid has deployed 16 chargers on utility poles in Melrose, Massachusetts. Both utilities shared engineering standards which helped inform how chargers were mounted on PGE utility poles. PGE has also been part of the World Research Institute's working group on pole mounted charging, where we shared program design and strategies with other utilities.

Since 2020, PGE has operated a pole charging demonstration project on two utility poles in the SE Clinton neighborhood in Portland, Oregon. PGE has been in discussion with two well-established network service providers (and also one start-up) to discuss how to improve the technology and user experience for this program.

PGE also intends to explore opportunities for a market actor to agree to a private partnership and adhere to Schedule 50. If PGE is unable to create a private partnership, PGE will continue to own, operate, and maintain the chargers unless and until the private market is meeting the needs of underserved communities.

C.1.3 Learning Objectives, Evaluation of Effectiveness, and Data Collection Methods

PGE intends to evaluate the effectiveness of this program and determine whether Schedule 50, which governs public charging infrastructure, is the appropriate rate for these installations. If necessary, PGE may revise Schedule 50 or introduce a new tariff that specifically addresses municipal chargers or all public charging.

As part of our commitment to providing affordable and equitable access to transportation electrification, PGE will utilize utilization data to determine the appropriateness of our public charging rate (Schedule 50) for the chargers installed under this program. Specifically, we will analyze usage data, load profile information, dwell time, maintenance costs, and electricity costs to inform any necessary updates or revisions to the rate structure. This analysis will ensure the provision of fair and affordable access to charging infrastructure for all customers, particularly those in underserved communities. This data will help PGE understand how to serve this load, which can create benefits for the whole system.

The following high-level metrics have been identified as indicators of success:

- Increased awareness of chargers, as measured via customer surveys
- Increased EV consideration in neighborhoods where chargers are deployed, as measured via customer surveys
- Unique customers leveraging our charging portfolio via analysis of charger data
- Increased utilization of chargers via analysis of charger data

To assess these indicators, PGE will be drawing data on charger utilization monthly and status reports on where chargers are in the build process. Evaluations will be conducted on an ongoing, annual basis. The first evaluation will begin in 2024 and run until 2026.

C.1.4 Program and Infrastructure Costs

C.1.4.1 Estimated total costs, including incentives, program delivery, evaluation, marketing, and program operations costs

PGE's Pole Charging Demonstration and Municipal Charging Pilot informs the proposed costs. Costs are also reflective of current market costs of charging and electric supply infrastructure (e.g., meter base, meters, and conduit), and anticipated inflation. As the activity continues through 2024 and 2025, PGE will work to bring costs down, including through exploration of partnerships for chargers to mitigate ongoing O&M costs. If costs are lower than anticipated, PGE will install additional chargers as the budget allows.

PGE is seeking an additional $6.27 million for the program. The decision to request additional funding without evaluation is due to the program's initial delays, causing PGE to begin the work as soon as possible in smaller segments. Pole charging installation is the most cost-efficient way to deploy charging infrastructure in underserved communities. However, PGE has included curbside charging for underserved community areas where viable poles are not readily available. To date, $5.2 million has been approved and $0.49 million has already been spent. PGE has initiated the process of identifying a suitable number of pole locations, ordering the first batch of chargers and meter bases, and working with municipalities. The first chargers are expected to be ready for installation in late Q2 2023.

Table 76. Municipal Charging Collaboration 2023 TEP Budget: Forecast of Operating and Capital Expenditures (2023-2025)

Programs	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Ops	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments - Electric Avenue	[redacted]	[redacted]	[redacted]	[redacted]
O&M on Investments - Municipal Charging Collaboration	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services - Electric Avenue	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation Services - Municipal Charging Collaboration	[redacted]	[redacted]	[redacted]	[redacted]
Marketing	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$4,688,559	$3,284,688	$3,580,748	$11,553,995

C.1.4.2 Estimated participant costs

PGE will design, own, operate and maintain charging infrastructure installed under this program. Residential customers will pay a Schedule 50 rate, priced as follows:

- Flat fee (all hours): $3 for 4 hours
- An additional peak-time fee of $0.19 per kWh will be assessed on weekdays between 3 PM and 8 PM.

Should PGE find a private market partner, we would expect the private market partner to use a Schedule 50 rate (or a new tariff introduced for this program).

C.1.5 Fit with Long-Term TE Strategy

As a public utility, PGE is obligated to ensure equitable and affordable access to electricity for all customers. PGE is further guided by legislation in HB 2165 to serve underserved communities. PGE is committed to meeting this obligation by ensuring that all communities have access to reliable and affordable charging infrastructure.

Through the Public Charging – Municipal Charging Collaboration program, PGE will determine if owning and operating chargers based on policy (HB 2165) is the right approach or if a potential private partnership would make more sense. PGE also intends to gain insights into the appropriate tariff rate for these chargers and whether Schedule 50, its current public charging rate, needs to be revised or if a new tariff rate needs to be introduced. We also hope that the program will help inform the private market of the viability of installing infrastructure in traditionally underserved communities.

The Public Charging – Municipal Charging Collaboration program fits into PGE's overall retail charging strategy to support EV adoption by increasing access to charging infrastructure for customers. To achieve this, we recognize there need to emphasize the installation of charging equipment where customers park today, particularly those parked for an extended period of time (e.g., in residential areas without off-street parking). PGE plans to focus the program on underserved communities, where the private sector is least likely to direct their investments. Installation of EV charging in these areas with a high density of MUDs and rentals will help residents in underserved communities gain access to the benefits that owning an EV offers.

C.1.6 How Infrastructure Measure Addresses Oregon Administrative Rule and Oregon Law

Table 77. Public Charging – Municipal Charging Collaboration with OAR 860-087-0020(4)

OAR 860-087-0020(4)	Section of Application Addressing the Rule
A description of the infrastructure measure;	C.1.1
Data used to support the description;	C.1.1
A description of infrastructure measure coordination;	C.1.1.5 - C.1.1.11 C.1.2 - C.1.5
A description of how the proposed infrastructure measure fits within the electric company's long-term strategy to support TE;	C.1.5
A description of costs;	C.1.4
A description of learning objectives and how the electric company will evaluate the infrastructure measure; and	C.1.3
For infrastructure measures, a description of how the measure addresses the considerations of ORS 757.357	Table 78

Table 78. Public Charging – Municipal Charging Collaboration Concordance with ORS 757.357

ORS 757.357	How Application Addresses the Law
(1) (b) (A) "Infrastructure measures" includes, but is not limited to, investments in, expenses related to or rebates for: (i) Distribution system infrastructure that supports transportation electrification;	The investments proposed in this application meet the description of infrastructure measures in (iii), as they are issued for behind-the-meter infrastructure that supports transportation electrification

ORS 757.357	How Application Addresses the Law
(ii) Communication and control technologies that support transportation electrification; and (iii) Behind-the-meter infrastructure that supports transportation electrification and is owned by an electric company or by a customer.	
(b) (B) "Infrastructure measures" does not include investments in or expenses related to education and outreach activities related to transportation electrification, or other transportation electrification-related activities determined by the Public Utility Commission to be separate and distinct from the development of infrastructure.	While this infrastructure measure has an associated outreach and education budget, it is for enrollment only, rather than general education and outreach to advance transportation electrification
(5) If undertaken by an electric company, an infrastructure measure to support transportation electrification is a utility service and a benefit to utility customers if the infrastructure measure can be reasonably anticipated to:	
(a) Support reductions of transportation sector greenhouse gas emissions over time; and	C.1.1.7
(b) Benefit the electric company's customers in ways that may include, but need not be limited to: (A) Distribution or transmission management benefits; (B) Revenues to utilities from electric vehicle charging to offset utilities' fixed costs that may otherwise be charged to customers; (C) System efficiencies or other economic values inuring to the benefit of customers over the long term; or (D) Increased customer choice through greater transportation electrification infrastructure deployment to increase the availability of and access to public and private electric vehicle charging stations.	C.1.1.7 C.1.2.3

C.2 Business and Multi-family Make-ready Solutions

PGE's proposed Business and Multi-family Make-ready Solutions program will expand charging access for current and future EV drivers by supporting commercial installation of public or "semi-public" EV charging including multi-family locations, workplaces, retail locations, destination centers, schools, and houses of worship. "Semi-public" EV charging is defined as charging that may be restricted to certain groups as allowable by law (e.g., employees or multi-family residents) but is not intended to support vehicles owned by the business (such as fleet vehicles).

This program intends to address the barrier that multi-family property owners and developers have few incentives to install EV charging for residents, and even fewer incentives to install the type of right-sized, future-proofed, networked, and demand response-capable EV charging that will be required for widespread EV adoption. This solution will extend two major benefits of driving electric not widely available to multi-family residents today: the convenience of home charging and the affordability of electricity as a "fuel". These barriers are exacerbated for low-income customers and other underserved communities, who comprise a significant portion of the multi-family market.

For customers participating in the program, PGE proposes to design, install, own, and maintain electrical infrastructure behind the customer meter to support 200 customer installed, owned, and maintained EV chargers at approximately 35 different locations. This approach leverages PGE's expertise in service design and installation and relieves customers of the logistical burden of managing these projects. Customers can install EV chargers from a pre-qualified list and receive a rebate for a portion of their costs. For its part, PGE will receive charging session data to better understand the grid impacts of EV charging and plan for more widespread passenger vehicle fleet electrification in the future. The data and experience gathered during the 2023-2025 program activity will be used by PGE to develop rates and tariffs. We will also explore program designs to enable EV adoption in underserved communities in a scalable way.

The overall budget for this three-year program is $7.3 million. In this TE Plan, PGE is requesting an incremental $4.5 million utilizing credits from the Clean Fuels program.

C.2.1 Program/Measure Details

C.2.1.1 Elements, objectives, timeline, and expected outcomes

Program Objectives

This program aims to:

- Expand charging access and adequacy for current and future EV drivers in multi-family, commercial, and workplace locations
- Support business customers by reducing the cost and complexity associated with installing EV charging
- Create a network of DR-enabled EV charging that can support efficient grid operations and future renewables integration
- Better understand the customer and market barriers and opportunities in the EV charging space
- Identify areas for utility process improvement with respect to EV charging
- Generate an empirical data set for EV charging that:

- Supports PGE in managing electric vehicle load, thereby increasing grid utilization and mitigating increases to system peak loads
- Informs existing utility analyses and helps PGE develop future products and programs.

Program Elements

From the customer's perspective, key features of the offering include:

- Site planning services
- Product qualification of Level 2 EVSE
- Vendor qualification of electric vehicle service providers
- PGE ownership of make-ready assets located behind-the-meter
- Turnkey design and installation of electrical infrastructure up to, but not including, the EVSE
- Custom PGE capital contribution based on the type of charging offered (public, multi-family, or workplace charging)
- Rebates for the purchase of L2 EVSE based on the type of charging offered (multi-family or other)
- Other technical services, as appropriate

PGE's proposed design is intended to future-proof sites: the EVSE will be metered separately from existing site load, and also networked and DR-ready. This will facilitate adoption of follow-on products such as EV rates or flex load programs.

PGE has designed the terms and conditions for participation to extend benefits to all customers and reduce the risk of stranded utility assets. To this end PGE will require that participants:

- (Multi-Family Housing only) have a minimum of 10 percent affordable units and be in a census tract with greater than 50 percent of the premises meeting the underserved criteria as defined by HB 2165.
- Submit a refundable deposit to cover final site design, should extensive engineering be required
- Install qualified, networked, DR-enabled EVSE upon PGE's completion of make-ready infrastructure
- Keep EVSE operational and on a cost-of-service rate for 10 years
- Release charging data to PGE
- Reimburse PGE for pro-rata capital and rebate costs, should the participant breach any of the above commitments

For customers participating in the program, PGE proposes to design, install, own, and maintain electrical infrastructure in front of and behind the customer meter to support customer-installed EV chargers. This approach leverages PGE's expertise in service design and installation and relieves the customer of the logistical burden of managing such projects. Customers will select their EV chargers from a pre-qualified product list and receive a rebate to offset their charger costs. For its part, PGE will receive charging session data, which it will use to better understand the grid impacts of EV charging and to plan for more widespread passenger fleet electrification in the future.

Customer Journey

- PGE partners with CBOs, housing bureaus, and local non-profits to identify potential sites

- PGE's Technical Outreach team engages property owners to determine interest and feasibility
- Customer (building owner) submits application
- PGE constructs preliminary engineering assessment and site walk to develop engineering scope and cost estimate
  - Preliminary design approval; fund reservation
  - Final design approval
  - Make-ready installation
  - EVSE installation and commissioning
  - Chargers online, EV drivers take service
- Customers responsible for data transmission, pricing, associated data fees, and ongoing maintenance

Education and Outreach

The success of this program relies on the participation of low/medium income multi-family properties in the adoption of Electric Vehicle charging infrastructure. However, as the target demographic of this program may be unfamiliar with EVs and EV charging, PGE must provide focused outreach and education and communications to inform them. The communications will primarily focus on the benefits of Electric Vehicle ownership, financial assistance for EV purchases through State and Federal offerings, and the differences between charging behavior versus fueling behavior. PGE will also explain the benefits of charging at home and the opportunities related to managed charging and incentive offerings available through PGE. Additionally, PGE will communicate the benefits of EV charging at MF locations and the benefits of EVs to MF tenants and underserved community members. Overall, communication and education efforts will be necessary to ensure the success of this program.

Guidelines and information on program participation will be available on a dedicated program webpage. This page will include information on how to apply including a high-level program overview, application, terms and conditions, Qualified Product List, incentive and rebate information, customer cost estimates and summary, and timeline. Customers will learn about the program through outbound recruitment coordinated in partnership with CBO's, Local Housing Bureaus, Local Non-Profits, PGE Key Customers and Commercial Energy Outreach Team.

Program Timeline

- Q3 2023: Phase I of program launched. Funding will be available on a first-come, first-served basis until the funding for the program is fully reserved.
- Q4 2023: Completion of first site
- Q1 2024: Commencement of charging data collection
- Q3 2024: 50 percent of funding reserved
- Q3 2025: 100 percent of funding reserved
- Q2 2024/25/26: Status updates within TE Plan Report
- Q4 2024: Anticipated date for all sites to finish construction

- Q1 2026: Evaluation report

PGE intends to launch Phase I of the program in mid-2023. Funding will be available on a first-come, first-served basis. until the funding dedicated to this program is fully reserved. Customers reserve funding during the Preliminary Design Approval stage of the program. During this stage the customer approves a final design and thereby reserves funding in accordance with the agreed upon site need. Construction will necessarily lag the enrollment window. PGE anticipates all sites will finish construction by the end of 2024.

Phase II of the program will be effective for three years (2023-2025). Participating sites will be required to install all charging infrastructure within five years of construction of make-ready, which means there could be additional charging incentive funds being disbursed as late as 2030.

Expected Outcomes

PGE expects this pilot to support adoption of light-duty EVs by providing convenient charging where current and future EV drivers work, learn, live, shop, play, and worship. Specific outcomes include:

- Increasing the number of EVs at locations with EV chargers
- Furthering the development of rates and tariffs to promote efficient charging behavior
- Enhancing efficiency of existing planning, engineering, and operations services to serve new TE loads
- Reducing greenhouse gas emissions, criterial air pollutant emissions, and water pollution in PGE's service area and beyond
- Increasing equitable access to electric mobility through the provision of EV charging ports in underserved communities

C.2.1.2 Market Baseline Assumptions

Using the EV charging infrastructure needs forecasts from TEINA, adapted for PGE's service area and internal EV adoption forecasts, PGE forecasts the need for 6,015 L2 ports in public and workplace settings by 2025 to support the electric vehicles that will be adopted over that timeframe. Today, only 991 L2 ports exist in public and workplace settings within PGE's service area. This leaves a gap of over 5,000 L2 ports at public and workplace settings as the required investment to support new vehicles.

PGE has sized this program to partially fill this gap (550 of the proposed ports will be at public or workplace settings) in a way that leverages economies of scale. It is assumed that the private market and/or other PGE programs will contribute to the charging infrastructure needed by 2025.

C.2.1.3 Major Performance Milestones

- In 2023, installation of 100 L2 charging ports at 10 different workplace, commercial, and multi-family locations throughout PGE's service territory
- In 2024, installation of 100 ports at multi-family locations only, specifically targeting muti-family properties impacted by the criteria outlined in HB 2165.
- By the end of 2025, installation of 200 L2 charging ports in PGE's service territory

PGE forecasts that approximately 107 sites may enroll in the program. The specific number of sites for the program will depend heavily on how many ports customers decide to install.

Table 79. Business and Multi-Family Make-ready Solutions Forecasted Port Counts by Site Type

	Small (4 ports)	Medium (6 ports)	Large (8 ports)	Extra Large (10 ports)	Total Ports
Multi-family	48	36	16	40	**140**
Public				30	**30**
Workplace				30	**30**
Total	48	36	16	100	200

C.2.1.4 Program/Measure Phases

For 2023, PGE is proposing to fund 100 ports at 10 different workplace, business, and multi-family locations throughout our service territory. For 2024-2025, PGE is proposing to fund 100 ports at multi-family locations only, specifically targeting multi-family properties serving underserved communities as defined by HB 2165, or within specific underserved census tracts.

This pilot is not anticipated to develop into a full program following 2025. Following the pilot, PGE anticipates developing a rate structure that is better aligned to our evolving role to support, rather than accelerate, EV charging expansion. This approach will enable PGE to have a more streamlined solution which can serve Fleet, Commercial, and Multi-family make-ready needs.

Recognizing that there are systemic, economic, and societal factors that limit adoption of EVs for low to medium-income customers, PGE may explore development of an Underserved EV Charging Program based on the learnings from this pilot. Data captured through the pilot expansion will be used to evaluate programmatic solutions that facilitate charging equity for customers.

C.2.1.5 Utilization, Eligibility, Incentive Structures

The program will be offered to non-residential customers in PGE's service area including, but not limited to, workplaces, retail locations, destination centers, schools, houses of worship, and multi-family locations. PGE's present understanding of L2 charger load shapes, utilization rates, uptime, and make-ready costs informs the following participation requirements for the program:

- PGE will require having a separate meter for each site to gather granular usage data and use this information to assess the performance of managed charging.
- Chargers must remain on an eligible rate schedule for the duration of the 10-year term (currently eligible rates include Schedules 32, 38, 83, 85, and 89[309]).
- Customers may also participate in other PGE offerings such as EV-Ready Affordable Housing or the Drive Change Fund as appropriate. Customers may not cross-enroll the same site in Business EV Charging Rebates (as EVSE rebates are already provided within the program

[309] The list of eligible rate schedules may be expanded at a later date to include new rates, including EV rates.

design), or Fleet Partner and the Electric School Bus Fund (which are for fleet charging, which is not semi-public).

PGE's contribution to make-ready will be capped at $17,000 per L2 port. To qualify for incentive, customers must install compatible charging as defined by PGE's Commercial Qualified Product List (QPL). PGE will offer the following incentive for each port installed:

- Standard rebate: $1,000 per L2 port
- Multi-family rebate: $2,300 per L2 port for the first 50 ports, $2,000 per L2 port for the next 100 ports

The incentive is structured in a manner to:

- Encourage participating sites to install EVSE that are compatible with PGE's DRMS platforms and pricing programs
- Promote a greater number of EVSEs than historically experienced in underserved communities

PGE will revisit the incentive level in the event of significant costs above or below estimation of make-ready construction costs and/or underestimation of demand for chargers per location.

C.2.1.6 Market and Implementation Barriers Addressed

Market Barriers

This program design addresses several market barriers identified by TEINA, including:

Table 80. Business and Multi-family Make-ready Solutions Market Barriers and Mitigants

Barrier	How Addressed
Cost of electric power upgrades and charging port installation (conduit, trenching)	Contributions from PGE towards charging infrastructure
Limited multi-unit dwelling and workplace charging	60 percent of program resources to be allocated for charging at multi-unit dwellings and workplaces
Economics of installing and operating charging ports (upfront, demand charge costs)	PGE will own, operate, and maintain make-ready infrastructure, providing cost relief for participants while leveraging existing assets and resources to keep overall costs low
Confusing and inconsistent user charging experience	PGE to provide incentives on prequalified chargers which are compatible with A) commonly available charging standards, and B) have the ability to participate in future PGE EV pricing/DR offerings PGE is providing a charger incentive intended to encourage participating sites to increase

Barrier	How Addressed
	EVSE installation that is compatible with PGE's DRMS platform and pricing program

Implementation Barriers

PGE anticipates several implementation barriers for this program and has applied lessons learned from its Fleet Partner program, along with lessons from similar utility programs, in considering how to mitigate these. Key barriers and mitigation plans include:

Table 81. Business and Multi-family Make-ready Solutions Implementation Barriers and Mitigants

Barrier	How Addressed
Rising costs resulting from macroeconomic conditions, including the COVID-19 pandemic, supply chain constraints, and rising interest rates	PGE will continue to assess and evaluate these changing factors, as well as the availability of infrastructure and charging equipment and commercial lending rates. Our goal is to ensure that our incentives are not overcompensating for the costs and perceived benefits of adding EV charging to these properties. PGE will monitor customer participation relative to the proposed incentive levels.
Long sales cycle inherent to projects of this scale.	PGE expects—and PGE staff will be prepared to support—a six-month cycle time from customer application to commissioning of the charger.
Low applicant success rate due to lack of experience installing electric charging infrastructure and underestimation of process and costs.	PGE will manage this risk by pre-qualifying sites. Up front engagement, and assistance with site design and business case development. Long-term site engagement for the collection information and data will inform PGE of the success and hurdles these early adopter experience thus informing PGE role an activity.

C.2.1.7 Performance Area Categories

PGE's proposed design addresses relevant Division 87 performance area categories in the following ways:

- Environmental benefits including greenhouse gas emissions impacts: As the site is utilized PGE will be able to calculate illustrative emission reductions. The data can be used to draw correlations between the investment made and the driving and charging habits of those who utilize these chargers. The data may help us better understand how these investments affect the community where they are sited.

- Electric vehicle adoption: Increased charging adequacy, including visible and available chargers at the retail, workplace, multi-family, and other destinations frequented by residential customers. PGE expects this to help meet the needs of increased EV adoption across PGE's service area.
- Equity of program offerings to meet underserved communities: The program will target and prioritize public and semi-public charging for underserved communities including renters, multi-family residents, and others lacking access to charging at home.
- Distribution system impacts and grid integration benefits: PGE does not anticipate distribution system impacts stemming from this program. Grid integration benefits are largely represented by the networked and DR-capable requirements in the technical standards PGE sets. Data acquired will inform how growth of business and multi-family charging could affect the design and operation of the distribution system. Being DR capable these chargers will also inform how smart and managed charging can mitigate distribution system operation disruptions, support local grid and system reliability.
- Program participation and adoption: PGE anticipates that approximately 107 sites will be constructed under this program, representing 1,000 L2 ports. The plurality of ports (45 percent) will be installed at multi-family dwellings, with a further 25 percent installed at public sites. Half of those public ports (12.5 percent of all ports) will be located in geographically designated underserved communities.
- Infrastructure performance including charging adequacy which considers, but is not limited to reliability, affordability, and accessibility: PGE tracks charger uptime and the cost-to-charge across its fleet of utility-supported chargers and will report on this information in future TE Plan Reports. If the site host elects to bill EV drivers, PGE requires multiple forms of payment be available. This requirement increases accessibility of chargers to all types of residential customers.

C.2.1.8 PGE's Role in the Program

PGE's role in the program includes:

- Support for customers with site planning services and advising on charger deployment
- Qualification of EVSE products for inclusion in the program
- Ownership, operation, and maintenance of make-ready assets behind-the-meter up to, but not including, the EVSE
- Design and installation of electrical infrastructure from the existing distribution grid through the meter to the charger pad(s)
- Calculation of custom capital contributions and rebate amounts
- Issuance of rebates
- Other technical assistance, as appropriate
- Program administration

The customer's role in the program includes:

- Selection of qualified equipment from PGE's qualified product list
- Review and approval of preliminary and final site designs in a timely way

- Engaging a vendor to procure and install the EVSE
- Submission of invoices and other supporting documentation to PGE as requested
- Release of charger session data to PGE
- Maintaining an ongoing relationship with a qualified vendor for data and software services
- Maintaining the chargers in good working condition, and on a cost of service rate, for 10 years
- Paying the retail energy rate at the meter
- Determining charger access and pricing for EV drivers, if any

C.2.1.9 Resulting Distribution Upgrades

The maximum site size that PGE has modeled for this program is under 150 kW of load. Aside from new or upgraded distribution-level transformers, both of which are accounted for in the budget in the Program Costs section below, PGE does not expect the program to trigger significant distribution system upgrades. PGE will work closely with customers to ensure that right-sized EVSE, managed charging, and planful siting are considered, which will help control distribution system costs and minimize potential impacts (including cost impacts) on both participating and nonparticipating customers.

C.2.1.10 Ownership Structure

To meet program objectives, PGE proposes to install and own the PGE and customer-side make-ready infrastructure, while the customer installs, owns, and maintains the EVSE. This approach allows PGE to reduce complexity for the customer by assuming the burden of designing, installing, and maintaining the make-ready infrastructure. It allows customers to focus on the aspects most important to their business objectives (e.g., chargers and driver experience). This approach is warranted because TE is changing how customers use energy, prompting a rethinking of the infrastructure necessary to provide customers flexible access to the grid. PGE successfully piloted this approach with its Fleet Partner pilot, where we found customers receptive to and enthusiastic about the approach.

PGE's market research indicates that multiple third parties (typically EVSE vendors) are engaged in the "Charging as a Service" (CaaS) space. Under this model, the vendor owns the EVSE at the customer site and the customer pays for charging service over time as an "off-balance-sheet" operating expense. In traditional CaaS, the vendor does not own or operate the make-ready infrastructure. Importantly, chargers installed under third-party CaaS contracts will also be eligible for rebates. In this case, the rebates will still be issued to the PGE customer (site host).

Third parties are beginning to explore and offer financing for turnkey make-ready infrastructure, acknowledging the market gap and significant cost outlay to design, install, and maintain such infrastructure. However, to PGE's knowledge, entrants in this space are either start-ups or are working with financing partners that are themselves new to this type of model. Furthermore, our market research suggests that this approach is more common in the fleet space than in the charging-as-an-amenity space. PGE continues to view this as an immature market and sees the need for trusted customer solutions today.

PGE will leverage this program to test the efficacy, customer value proposition, and cost-effectiveness of this approach to ownership of make-ready infrastructure in the public and semi-public charging space.

C.2.1.11 EVSE Requirements (Equipment Interoperability and National Standards)

PGE utilizes a single Qualified Products List (QPL) to determine eligible EVSEs for all of PGE's non-residential EV programs. EVSE vendors must submit a Request for Qualification (RFQ) if they want their products added to the QPL. PGE engineers review each RFQ for completeness and against the predefined qualification requirements, listed below. If the vendor receives technical approval, they must also execute a Data Sharing Agreement with PGE before their products will be added to the QPL.

Hardware requirements (Level 2 and DCFC):

- National Electrical Manufacturers Association (NEMA) Type 3R or 4, which certifies that equipment is weatherproof and certified for either indoor or outdoor use.
- Compliant with Federal Communications Commission Part 15, which sets limits on the amount of electromagnetic interference allowed.
- Compliant with National Electric Code, National Fire Protection Association (NFPA) article 625, which covers wires and equipment used to supply electricity for EV charging.
- Compliant with the Americans with Disabilities Act (ADA), which ensures that the EVSE is ADA accessible, if installed according to the manufacturer's instructions.
- EVSE model must have a cellular connectivity option, either 4G LTE or 5G.
- Compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of network service providers. It also must be remotely upgradable to support future versions of OCPP.
- Must include a standard warranty of 1 year or greater
- Must have an operating range of at least -22F to 122F, ensuring it can withstand extreme environments

Level 2-specific requirements:

- Compliant with Society of Automotive Engineering (SAE) J1772, the standard Level 2 connector that is compatible with all road-legal EVs for sale in the United States, including plug-in hybrids (PHEVs), battery electric vehicles (BEVs), and Tesla vehicles using an adaptor.
- Listed by a nationally recognized test lab to the requirements of UL 2251 and 2594, demonstrating that products are tested to UL's recognized safety standards.

DCFC-specific requirements:

- If the EVSE includes a Combined Charging System (CCS) connector, it must be compliant with SAE J1772.
- Listed by a nationally recognized test lab to the requirements of UL 2202, demonstrating that products are tested to UL's recognized safety standards.
- Equipment compliant with recommended practice SAE J2894/1_201112 or later (power quality requirements for EVSE).
- If the EVSE includes an automated conductive charging mechanism (pantograph), it must meet SAE J3105.

- DCFC EVSE efficiency must be greater than 92 percent

Software requirements:

- Software platform must be responsive to grid services, modifying charger power output levels, using either one of the following methods
  - Certified OpenADR 2.0b Virtual End Node (VEN)
  - Application Programming Interface (API)
  - IEEE 2030.5 (SEP 2.0)
- Software must also be compliant with Open Charge Point Protocol (OCPP) v1.6 or later, enabling the flexibility to operate with a variety of EVSE hardware.

Through the RFQ process, PGE collects additional technical information from vendors that aren't requirements but help inform PGE programs and potential future requirements. This includes items such as:

- Compliance with ISO/IEC 15118
- Payment methods and pricing options
- Compliance with OCPI v2.2 or later
- EVSE metering accuracy
- Bi-directional charging capability
- Lead time and indicative pricing
- Installation manuals
- The vendor's sales point of contact to post on PGE's QPL webpage so customers know who to contact when interested in a specific product

As of 4/28/2023, PGE has qualified 137 EVSE models from 18 different EVSE vendors.

C.2.2 Program/infrastructure coordination

C.2.2.1 Stakeholder involvement in development

PGE discussed this concept with stakeholders in workshops we held on April 28, June 14, July 12, and October 6, 2022. We specifically discussed the concept of make-ready ownership at business charging sites in our February 2019 UM 1811 compliance filing, our July 2020 Transportation Line Extension Allowance filing, and also in early 2021 discussions with stakeholders regarding PGE's Fleet Partner pilot.

At the urging of stakeholders, PGE has reduced the overall cost and scale of the program; introduced cost sharing for customers; tiered cost sharing to deliver higher benefits to underserved communities; and made commitments regarding the total number of ports installed at each site type to ensure that underserved communities are included.

C.2.2.2 Coordination with State Programs

PGE will make customers aware of, and support customers in relaying information regarding, the Oregon Clean Vehicle Rebate, the Oregon Clean Fuels Program, and other relevant state programs, as appropriate.

PGE anticipates that some customers may elect to stack this program with ODOT's deployment of NEVI funding, or other federal, state and/or local funding sources such as grants. PGE welcomes this type of coordination and will work as necessary with federal, state, and/or local entities to ensure a smooth incentive delivery for customers.

C.2.2.3 Coordination with Market Actors and Activities

PGE is pleased to support increased customer choice and increase the availability of and access to public and semi-public EV charging by working with EVSE hardware and software vendors in the execution of this program. Some of the ways we will work together include:

- PGE manages a qualification process for hardware and software for EV charging. PGE collects details and specifications about each of the hardware options on the qualified list and reviews this information to ensure the EVSE and software meet the technical requirements specified above.
- PGE has executed data sharing agreements with each of the vendors on the qualified list and will obtain charging session data directly from the vendors (customers will sign a data release as part of the enrollment process). This ensures that customers do not have to provide data directly to PGE on an ongoing basis.
- PGE also works regularly with the vendors on the qualified list to ensure that they are informed about PGE's various TE programs and have outreach and education and other collateral on hand to share with their customers. In this way, vendors play an integral role in raising customer awareness of PGE's programs. For its part, PGE shares EVSE options and details with customers, and will work directly with their selected vendors to ensure that PGE and the vendor are able to provide the most efficient customer experience.
- PGE will also coordinate with installers, dealers, and trade groups as appropriate to best serve the customer.

C.2.3 Learning Objectives, Evaluation of Effectiveness, and Data Collection Methods

Learnings from this program will further enhance PGE's understanding of how to manage this type of TE load. PGE is collecting data to determine the feasibility of managing commercial, multi-family, and workplace load, including data on load shape and utilization of charging. This data will inform hardware and software requirements that most effectively and efficiently communicate charging status and potential for load management. Additionally, this program will provide insight into EV usage for drivers who are using vehicles for more than personal transportation, but for income generation through Transportation Network Companies, meal delivery, and other jobs of convenience enabled by having access to transportation. This along with the usage and subscription data from our Electric Avenue charging network, will provide a more comprehensive profile of EV drivers using their vehicles to make a living.

PGE will utilize customer interviews, customer surveys, property ownership and management interviews, charging data, infrastructure and charger installation costs, and O&M costs to inform future program opportunities. These opportunities include, but are not limited to Make-ready Infrastructure rebates, Commercial Charger Rebates, and New Construction EV Infrastructure Rebates. PGE will design the pilot evaluation to measure the program's effectiveness in meeting its objectives, identify areas for continuous improvement, and also assess energy impacts on PGE's system. Data will be used to determine direction for a future rate/tariff design for make-ready programs beyond 2025.

High-level learning objectives include:

- Identifying specific programmatic opportunities that can positively influence accelerating EV adoption for low to medium-income multi-family residents who have historically been overlooked in the efforts to electrify multi-family residences due to lower EV adoption
- Gathering insight into the usage of EV charging in various commercial settings, with a focus on usage in multi-family housing, looking at metrics including:
  - kWh charged and corresponding revenue generated from charging activities
  - Charge time, including the length of typical charging sessions, which days charging occurs most frequently, and times of day with most frequent charging
  - Retail cost per charge
  - Dwell/idle time
  - Service levels, reliability, and maintenance costs will also be assessed to provide a comprehensive understanding of the program's effectiveness.

PGE will collect charging data daily and monthly and issue a final report at the end of the demonstration period in 2024-2025. PGE will also conduct an overall program/site evaluation in 2024-2025, depending on install rate/uptake at this time. These reports will provide customer feedback on process, costs, and experience with charging installation. These will also help us understand make-ready needs at MF sites, how to engage property owners and managers, and when to engage property owners.

C.2.4 Fit with Long-Term TE Strategy

This program directly supports PGE's role to serve load and informs PGE on how to better serve TE customers and how to incorporate TE load and TE customer needs into current business practices and tools. This program is designed to address two pillars of PGE's long-term vision for TE:

- Charging is equitable, affordable, reliable, and accessible
- Electric vehicles are efficiently integrated into the grid

Make-ready programs offer an opportunity for utilities to efficiently support the deployment of EV charging. They leverage a favorable capital model while also allowing for significant customer choice and control over EVSE and shaping of the driver experience.

While this program does not have a formal flex load component at launch, it sets the stage for managed charging by building a network of grid-connected resources, supporting the efficient long-term grid integration of EVs. In the future, PGE anticipates introducing optional demand response programs for program participants. Meanwhile, both workplace and multi-family charging load shapes are generally favorable for the grid, with workplace charging predominantly during morning hours and multi-family charging predominantly overnight, both times of excess grid capacity.

C.2.5 Program and Infrastructure Costs

C.2.5.1 Estimated total costs, including incentives, program delivery, evaluation, marketing, and program operational costs

PGE is requesting an incremental $4.5 million in our 2023 TEP utilizing credits from the Clean Fuels program.

If construction, material, or EVSE costs end up being higher than expected, PGE may consider increasing the costs for either the make-ready or equipment incentives. However, if PGE overestimates the required incentives, we will keep an eye on macro-economic conditions to determine if additional incentives are necessary to justify the capital requirement for both PGE and customers to add EV charging. If there is a significant difference in the required incentive compared to the costs, PGE may need to revisit the commission mid-cycle to adjust the incentives accordingly.

If there is significant deviation between anticipated costs, actual costs, and incentive amount PGE would request a mid-cycle allowance to adjust based on market conditions.

We may find that the port count, customer contribution, and overall demand is not compatible with the needs of the underserved Low/Medium Income MF market, in which case PGE would request a mid-cycle allowance to different demographics to get the desired learnings for program period.

Table 82. Business and Multi-family Make-ready: Forecast of Operating and Capital Expenditures (2023-2025)

Programs	2023	2024	2025	2023-2025 Total
OpEx	[redacted]	[redacted]	[redacted]	[redacted]
Incentives	[redacted]	[redacted]	[redacted]	[redacted]
Program Ops	[redacted]	[redacted]	[redacted]	[redacted]
O&M	[redacted]	[redacted]	[redacted]	[redacted]
Evaluation	[redacted]	[redacted]	[redacted]	[redacted]
Marketing	[redacted]	[redacted]	[redacted]	[redacted]
CapEx	[redacted]	[redacted]	[redacted]	[redacted]
Total	$2,547,130	$2,144,739	$2,439,061	$7,130,930

C.2.5.2 Estimated participant costs

Final costs to program participants are unknown and will vary by customer. Participants will be responsible for the costs associated with the following:

- Make-ready and line extension costs beyond that covered by PGE's Line Extension Allowance and the custom PGE capital contribution for this program
- Acquisition of EVSE, less rebate amount
- Installation and commissioning of EVSE
- Maintenance of EVSE, including data/software fees
- Energy and other costs via the PGE bill, for the meters serving the EVSE

In order to help offset their out-of-pocket costs, participants will be required to claim and monetize CFP credits generated at the EVSE, either directly or through a brokerage.

PGE acknowledges the risk for participants to commit to a larger number of charging ports than needed for the site in the near-term. To manage this risk, PGE may allow for variance on the number of EVSEs installed initially while maintaining the requirement that all make-ready needs to add ports must occur no later than five years after Make-ready infrastructure is installed.

C.2.6 How Infrastructure Measure Addresses Oregon Administrative Rule and Oregon Law

Table 83. Business and Multi-family Make-ready Solutions Concordance with OAR 860-087-0020(4)

OAR 860-087-0020(4)	Section of Application Addressing the Rule
A description of the infrastructure measure;	C.2.1
Data used to support the description;	C.2.1
A description of infrastructure measure coordination;	C.2.2
A description of how the proposed infrastructure measure fits within the electric company's long-term strategy to support TE;	C.2.4
A description of costs;	C.2.5
A description of learning objectives and how the electric company will evaluate the infrastructure measure; and	C.2.3
For infrastructure measures, a description of how the measure addresses the considerations of ORS 757.357	Table 57

Table 84. Business and Multi-family Make-ready Solutions Concordance with ORS 757.357

ORS 757.357	How Application Addresses the Law
(1) (b) (A) “Infrastructure measures” includes, but is not limited to, investments in, expenses related to or rebates for: (i) Distribution system infrastructure that supports transportation electrification; (ii) Communication and control technologies that support transportation electrification; and (iii) Behind-the-meter infrastructure that supports transportation electrification	The investments proposed in this application meet the description of infrastructure measures in (iii), as they are issued for behind-the-meter infrastructure that supports transportation electrification.

ORS 757.357	How Application Addresses the Law
and is owned by an electric company or by a customer.	
(b) (B) "Infrastructure measures" does not include investments in or expenses related to education and outreach activities related to transportation electrification, or other transportation electrification-related activities determined by the Public Utility Commission to be separate and distinct from the development of infrastructure.	While this infrastructure measure has an associated outreach and education budget, it is for enrollment only, not more general education and outreach to advance transportation electrification.
(5) If undertaken by an electric company, an infrastructure measure to support transportation electrification is a utility service and a benefit to utility customers if the infrastructure measure can be reasonably anticipated to:	
(a) Support reductions of transportation sector greenhouse gas emissions over time; and	C.2.1.7
(b) Benefit the electric company's customers in ways that may include, but need not be limited to: (A) Distribution or transmission management benefits; (B) Revenues to utilities from electric vehicle charging to offset utilities' fixed costs that may otherwise be charged to customers; (C) System efficiencies or other economic values inuring to the benefit of customers over the long term; or (D) Increased customer choice through greater transportation electrification infrastructure deployment to increase the availability of and access to public and private electric vehicle charging stations.	C.2.1.7 C.2.2.3

Appendix D. Stakeholder Comments

The following table provides a detailed summary of the feedback received from stakeholders and how PGE has considered the feedback. As part of this draft, PGE invites stakeholders to identify any key feedback PGE has inadvertently omitted from this summary.

Table 85. Summary of Stakeholder Feedback

Topic	Summary of Comment	PGE Response
Alternative mobility options	Support policies to expand multi-modal and alternative transportation infrastructure.	PGE has supported e-bike projects through the Drive Change Fund and expects to continue to do so.
Business Programs	When there is significant utility investment, the site host should be limited from making charging only available to selected public employees, their customers.	PGE understands this perspective, but notes that the host must maintain control over property, and requirements that overly interfere with customer needs may reduce participation in utility programs. Instead of setting requirements for each participant, PGE has set customer segment minimums for multi-family and public charging within the program design of the Business Make-Ready Solutions program.
Charger Reliability	Any enforcement of charger reliability standards should attach to the person who received the utility funds. For small businesses, PGE could require that site host/funding recipient has a service level agreement with charger provider to transfer MX responsibility.	Given the significant challenges of charger reliability and monitoring (including basic requirements for enforcement such as a common formula for calculating uptime), PGE does not propose to enforce charger uptime for customer-owned chargers. Instead, PGE will continue to rely on requirements that customers keep chargers operational or risk forfeiting the utility-provided incentives. PGE also reserves the right to remove any vendor from the qualified product list, at any time and for any reason.
Charger Reliability	Can PGE require/incentivize private suppliers to provide a consistent customer experience at different charging stations (including its own)?	As part of listing on the qualified product list, vendors must demonstrate a satisfactory customer experience. PGE reserves the right to remove a vendor from the qualified product list if they fail to meet customer experience requirements.

Topic	Summary of Comment	PGE Response
Charger Reliability	Appreciate uptime reporting requirement proposals but concerned about placing the enforcement on the customer rather than the charging provider.	As part of listing on the qualified product list, vendors must provide charging session data to ensure that chargers incentivized through utility programs demonstrate satisfactory performance. PGE reserves the right to remove a vendor from the qualified product list if they fail to meet this requirement.
Charger Reliability	We encourage PGE to require 97 percent or greater uptime for customer owned chargers for a minimum of five years and add "internet service provider outages" to the list of eligible uptime exclusions. Publish standardized reliability data.	PGE will provide annual reporting on reliability of EVSE, with a target uptime of 97 percent.
Charger Reliability	Ultimate responsibility for meeting charger reliability requirements should rest with owner and operator for reporting and compliance.	As part of listing on qualified product list, vendors must demonstrate satisfactory customer experience. PGE reserves the right to remove a vendor from the qualified product list if they fail to meet customer experience requirements.
Charger Reliability	Support reliability requirements for utility owned and supported public charging stations.	This draft TE Plan reflects this feedback. See Sections 7.7.1, C.1.1.7, and C.2.1.7 for details.
Charger Reliability	Enforcement mechanisms to ensure compliance with the uptime standard for non-utility owned chargers are not necessary at this time. Encourage PGE to consider additional tools that can increase compliance with any reliability standard, such as requiring service level agreements between site hosts and charging providers to ensure the charging provider adequately services the charger.	PGE will first look to the development of a national formula for calculating uptime in a standardized way. Applying enforcement mechanisms for uptime without an agreed-upon calculation method would be premature at this point in the EV charging market.

Topic	Summary of Comment	PGE Response
Cost to Charge at Customer-Owned Chargers	Utility should take a role in setting rates for utility assisted public charging. PGE should consider Puget Sound Energy's recently filed TE tariffs, Schedule 552 and Schedule 555, which ensure site hosts, who make EV charging available for a cost, set the price per kWh no more than the average Electric Charges per kWh of their Electric Service from the Company.	PGE recognizes that there are many non-energy charges that owners of EVSE incur (e.g., data and software fees, maintenance costs, and demand charges), and the complexity of applying these across per-kWh charges for EV drivers. These costs and complexities can already create a deterrent to third-party installation of EVSE for public use. PGE also acknowledges that customers have different use cases and business models, which may impact the prices they set for EV charging. For these reasons, PGE does not expect to take a role in setting rates for program-enabled ports, except to offer advice to charger owners as we are able, and let the competitive market prevail. We will continue to monitor industry practices in this area.
Cost to Charge at Customer-Owned Chargers	Support PGE's approach to let site host set price to charge for the EVSE they own	See above.
EVSE and Infrastructure Requirements	Location, equipment standardization, and user experience need to be well coordinated across utilities, governments, and private actors.	This draft TE Plan reflects this feedback. See Sections 1.8, 2.8.1, 3.8, 6.1.2, A.1.2, A.2.2, A.4.1.1, C.1.1.8, C.1.2, and C.2.2 for details.
EVSE and Infrastructure Requirements	Utility ownership appropriate in circumstances that support, not compete with private market. PGE's proposed Muni program should allow customers to choose from multiple vendors using rolling RFP. Public Charging – Municipal Charging Collaboration Program may have a disproportionately negative influence on the competitive charging market in Oregon.	PGE will support a competitive private charging market through an open RFP process for the Public Charging – Municipal Charging Collaboration program.

Topic	Summary of Comment	PGE Response
EVSE and Infrastructure Requirements	Please ensure there are clear explanation materials on equipment (payment etc.). PGE should also ensure that there are no requirements to use chargers that require membership or subscription.	PGE-owned chargers will have clear instructions on how to use equipment, including multiple-modes of payment.
EVSE and Infrastructure Requirements	PGE should consider ADA needs for EVSE accessibility and make clear to stakeholders what it will require and on what basis.	PGE proposes to look to the recommendations of the U.S. Access Board with respect to accessible EV charging and to recommend these standards to customers as well.
EVSE and Infrastructure Requirements	50 kW is appropriate for DCFC depending on circumstances. PGE should allow lower charger power levels depending on site needs, even for PGE-owned chargers.	PGE does not require a minimum power level for customer-owned DCFC (including public DCFC). As a provider of EV charging, PGE will apply an internal minimum of 150 kW for public DCFC, starting with this TE Plan.
EVSE and Infrastructure Requirements	PGE's plan feels light on DCFC ports needed. Anticipate more EVs adopting 800v battery technologies.	PGE's plan focuses more heavily on L2 than DCFC charging because the former is more affordable for the utility, the site host, and the EV driver; has less impact on the grid; and is slated to receive less support from the private market and state/federal funding than DCFC. As evidenced by our past, current, and proposed support for DCFC, we do see a role for both types of charging. Meanwhile, we plan to track charging deployments through our TE Plan Reports and adjust our portfolio accordingly. This approach is supported by the Division 87 TE Plan process.
EVSE and Infrastructure Requirements	Open Charge Point Interface (OCPI) version 2.1.1 should be required for all publicly available chargers.	PGE is considering implementing additional requirements for publicly available chargers, including OCPI.
Managed Charging	Include robust demand-side management including rate design and DLC.	This draft TE Plan reflects this feedback. See Sections A.1 and A.2 details.

Topic	Summary of Comment	PGE Response
Medium/Heavy EV Charging	PGE should consider applying to DEQ's new Medium and Heavy-duty infrastructure pilot program for additional funding for charging	PGE is open to considering state and federal grant opportunities and applicant partners.
Medium/Heavy EV Charging	Retail rate to charge at utility supported heavy duty charging sites should not be set lower than market price for this charging class	PGE appreciates this feedback and will consider it in our program design.
Payment Methods	National EV Infrastructure Formula program's proposed standards require contactless card reader as a minimum, PGE should consider using NEVI standards for payment method.	PGE proposes to require that all public PGE-owned and customer-owned charging adhere to the payment methods requirements that are being established in the State of Washington. The present draft of those requirements stipulates that public L2 and DCFC chargers installed after January 1, 2024 contain an EMV chip reader.
Cost to Charge at PGE-Owned Chargers	Schedule 50 or similar undercuts private market providers. Below market rates will not promote public charging development, so PGE should ensure utility-owned stations are priced consistently with private market.	PGE's Schedule 50 pricing tariff was set through a public process and is designed to meet the EV charging needs of customers who lack access to charging at home, with rates designed to approximate home charging rates.
Cost to Charge at PGE-Owned Chargers	Will equitable pricing include lower rates for PGE customers who are in PGE's low-income program?	Due to software integration limitations, PGE does not currently have the ability to offer lower retail EV charging rates to customers enrolled in our Income-Qualified Bill Discount program. However, we are working to understand what it would take to offer something like this in the future.
Cost to Charge at PGE-Owned Chargers	Provide price parity so residential customers charging at public stations don't pay more than residential customers charging at home.	This TE Plan reflects this feedback through use of Schedule 50 for utility-owned chargers. See Section C.1.1.5 for details.

Topic	Summary of Comment	PGE Response
Cost to Charge	What peak pricing does PGE offer for Transportation Electrification? Is PGE considering revising these rates?	Pricing at PGE's public chargers is detailed in PGE Schedule 50 Retail Electric Vehicle (EV) Charging.[310] PGE is exploring revised pricing in Schedule 50. Customers charging at their residence may enroll in PGE's Time-of-Use pricing, detailed in PGE Schedule 7 Residential Service.[311]
Pole/Public Charging	PGE should follow the draft rule in Washington that requires an EMV chip card reader. Contactless is that it is not fully accessible, CARB Technical Review found 43 percent of low-income drivers don't have contactless card or smart phone. Veteran benefits and SSI benefits are paid through direct express Mastercard debit cards, which is EMV only.	PGE proposes to require that all public PGE-owned and customer-owned charging adhere to the State of Washington's payment methods requirements[312]. Washington requires that public L2 and DCFC chargers installed after January 1, 2024 contain an Euro Mastercard Visa (EMV) chip reader. The sole exception is for pole chargers, where EMV chip readers pose National Electric Code (NEC) and National Electric Safety Code (NESC) violations around climbing space. As a result, PGE will continue to utilize payment through a charging vendor app for pole chargers.
Pole/Public Charging	Muni program: Engage community members/neighborhood delegates from the beginning in site selection and project design to address community needs.	PGE is leveraging Geographic Information System (a/k/a GIS) mapping to identify utility poles within underserved communities which are strong candidates for charger placement. We will also work directly with municipalities to conduct thorough outreach within the communities where chargers are proposed.
Pole/Public Charging	Where affordable housing has no parking, work with developers to site pole chargers?	With the Public Charging – Municipal Charging Collaborations pilot, PGE will examine the possibility of partnering with municipalities

[310] PGE Schedule 50, retrieved from https://assets.ctfassets.net/416ywc1laqmd/2hNjMQ203TEcCmZttyKCTt/60e36b07499f89b45856a4576d4107ec/Sched_050.pdf.
[311] PGE Schedule 7, retrieved from https://assets.ctfassets.net/416ywc1laqmd/6RgTNk5RU1bldl0LdPpIY9/39c0b84c532cd899cccccjgijernbrctunikrtltteeegtndeduetvgvjnjf2715adf7e32bbca/Sched_007.pdf.
[312] Washington State Standards can be found here: https://cms.agr.wa.gov/WSDAKentico/Documents/AdminRegs/Rule%20Making/WAC16-662_EVSE_CR103_121622.pdf.

Topic	Summary of Comment	PGE Response
		with high rates of affordable housing lacking dedicated parking to install pole or curbside chargers in those neighborhoods.
Pole/Public Charging	Make languages other than English available at utility owned and supported public charging stations.	PGE plans to do so for utility-owned chargers.
Pole/Public Charging	How will PGE address situations where charger access is blocked by cars that are not actively charging?	PGE is exploring options to address this issue by modifying Schedule 50.
Pole/Public Charging	For the proposed Public Charging – Municipal Charging Collaboration program, who will own the chargers?	PGE will own, operate, and maintain pole chargers installed as part of the Public Charging – Municipal Charging Collaboration. We are exploring partnerships for pedestal charging to shift ownership and maintenance and manage costs.
Program Design	PGE needs to explain how the utility considered customer cost sharing in program design, and the extent of utility assistance.	PGE has added customer cost sharing where appropriate, such as in the proposed Business Make-ready Solutions offering.
Program Design	The north star for PGE's EVSE and program requirements should be the driver need, regardless of ownership. The focus needs to be on moving the market.	PGE appreciates and agrees with the value for a broader perspective on the transition to electric transportation.
Program Design	Multi-family options should be mix and match so customer can choose level of utility assistance. East coast utility multi-family incentives weren't effective until utility full own/operate offering was available.	This draft TE Plan reflects this feedback
Program Design	Consider use case where public charging is the only meaningful option for low-income EV ownership. Locate and operate charging accessible to these neighborhoods neighborhood parks, store parking lots, other	This draft TE Plan reflects this feedback

Topic	Summary of Comment	PGE Response
	sites of necessary or likely trips. Focus on DCFC, Level 2 okay for overnight residency.	
Program Design	Rebates should be agnostic of power levels allow site host to choose. Suggest rebates in tiered structure for DCFC from 50 kW to 350 kW.	This draft TE Plan reflects this feedback for customer owned chargers.
Program Design	Supportive of DCFC rebates, especially if paired with make-ready rebate. Hope DCFC rebates for public charging complement NEVI funds.	PGE expects that some DCFC rebates will be available for NEVI sites that otherwise meet PGE criteria.
Program Design	Support public charging stations for MHD that are not necessarily tied to a fleet.	This draft TE Plan reflects this feedback
Program Design	Do PGE's proposed programs include Direct Current Fast Charging (DCFC)?	Fleet Partner focuses on make-ready sites for both L2 and DCFC charging. The Public Charging – Municipal Charging Collaboration will not include DCFC charging. PGE is reassessing our role in the evolving EV market with a focus on planning, serving, and managing the load. We see third parties supporting the DCFC market and will participate in grant proposals supporting the build of third-party DCFC installations. The transition to an electric future in transportation will require engagement by all market participants. In that context, our public charging goal in our TE portfolio is to ensure we deliver the most impact to underserved communities with pole-charging and curbside make-ready, which serve needs least likely to be met by other market actors.
TE Plan Scope/Cost	Be prepared for EV uptake/fleet penetration to move faster than projected, especially later in the decade.	PGE will continue to monitor the pace of EV adoption in our service area.

Topic	Summary of Comment	PGE Response
TE Plan Scope/Cost	PGE must consider not only affordability relating to charging itself but also the base rates impacts on all PGE ratepayers.	This draft TE Plan reflects this feedback. See Section 8.7 for detail.
TE Plan Scope/Cost	It is regrettable to take too small or short term a view of transportation of the scope of TE investments by PGE.	PGE appreciates the need to enable transportation electrification to meet the GHG reduction goals of the State of Oregon and many of the municipalities we serve.
TE Plan Scope/Cost	Advocates on climate want you to lean into deploying EV charging. Please use new thinking to get beyond historical judgements of what's cost-effective.	PGE appreciates the need to enable transportation electrification to meet the GHG reduction goals of the State of Oregon and many of the municipalities we serve.
TE Plan Scope/Cost	PGE needs to demonstrate how its TE Plan compares in cost and scope to other utilities active in supporting transportation electrification.	PGE has presented this information in workshops and has made slides and recordings publicly available.
TE Plan Scope/Cost	How much of the PGE's previously approved transportation electrification budget has been spent?	The TE plan shows what will be spent in Heavy-Duty charging during 2023-2025 for the current identified site in 2023-2025. The TE Plan will contain the spend through 2022 in each program. The spend for Heavy-Duty charging through the end of 2022 is approximately $2.3M.
TE Plan Scope/Cost	Is it premature for PGE to pivot from accelerating to supporting transportation electrification?	In the three years since PGE's last TE Plan, the TE market has rapidly matured, with accelerated EV adoption, automaker investment, and state/federal investment and policy action. In the United States, electric car sales increased 55 percent in 2022 over 2021, a particularly stark increase given the 8 percent drop in total car sales nationally over the same period[313]. The transition to electric vehicles (EVs) is underway in Oregon, with the state surpassing 62,000

313 International Energy Agency (2023). *Global EV Outlook*, retrieved from https://www.iea.org/reports/global-ev-outlook-2023.

Topic	Summary of Comment	PGE Response
		registered EVs in 2023[314] and more than seven percent of new vehicles registered in Oregon in 2021 being EVs, the fourth-highest percentage nationally. Given this momentum, PGE is bringing forward a TE plan with sharper focus on the right role for the utility to play in transportation electrification and with consideration of customer price pressures across utility activities. Even as we work to right-size our TE portfolio, we will continue to work with our customers, communities, and industry partners on grant applications and partnerships to advance the significant investment required to achieve a reliable, equitable transition to electric vehicles.
TE Plan Scope/Cost	What portion of Clean Fuels Program (CFP) funds support PGE's transportation electrification programs?	PGE proposes to spend 10 percent of CFP funds to support transportation electrification programs in 2024-2025. PGE has not allocated CFP spending beyond 2025 since that extends beyond the budget period of the 2023 TE Plan. Note that the CFP budget is a forecast, which will be updated annually with the actual figures as we sell credits for the prior year.
Underserved Communities	There is limited knowledge about EVs and charging, but there is overall interest in acquiring an EV.	Some products will add more targeted outreach and education for underserved communities relating to their products. PGE's long-term engagement strategy with underserved communities will also continue to address increasing education and outreach. More specific details on the engagement with underserved communities can be found each program can be found in the program details.
Underserved Communities	Most do not have an understanding of financial assistance available for EVs, and many also feel that these resources do not go	Some products will add more targeted outreach and education to underserved communities relating to their products, and long-term engagement strategy will also continue to address increasing education and outreach. More specific details on engagement with

[314] State of Oregon. *Oregon Electric Vehicle Dashboard*. Retrieved from https://www.oregon.gov/energy/Data-and-Reports/Pages/Oregon-Electric-Vehicle-Dashboard.aspx.

Topic	Summary of Comment	PGE Response
	far enough. Costs associated with EVs and their use are consistently cited as concerns	underserved communities can be found in Section 4.1.3 and Section 7.3, as well as in the program details found in Appendix A, Appendix B, and Appendix C.
Underserved Communities	Access to charging stations was a common concern for many reasons including the connection with gentrification and potential displacement and conflict, as well as less parking spaces for non-EVs	PGE will help municipalities participating in the Public Charging – Municipal Charging Collaboration to effectively communicate with underserved communities and gather input from the same.
Underserved Communities	The majority of people would be more likely to drive EVs with greater public access to charging	PGE's portfolio is designed to address this gap.

Appendix E. Division 87 Concordance

Table 86, below, provides a reference as to how this filing addresses Division 87 rules applicable to the portfolio of activities. Appendix C.1 Public Charging - Municipal Charging Collaboration and Appendix C.2 Business and Multi-family Make-ready Solutions address how new activities proposed within this filing meet the rules applicable thereto.

Table 86. Division 87 Concordance (Rules 1-3, for the Transportation Electrification portfolio)

Division 87 Rule	Section(s) that Address the Rule
(1) This rule prescribes the required elements of an electric company's Transportation Electrification Plan (TE Plan). The objective of the TE Plan is to:	
(a) Integrate the electric company's transportation electrification actions into one document. The Plan shall include, but is not limited to, the electric company's portfolio of near-term and long-term transportation electrification actions, including applications for program(s), and infrastructure measure(s), planning and expenditure of the Monthly Meter Charge, and other transportation electrification actions such as PGE Clean Fuels programs.	Chapter 6, Appendix A, Appendix C
(b) Act as a summary of the electric company's investments and activities, which may include investments and infrastructure for electric vehicles of various sizes, rate design, programs, and services, reasonably expected to achieve the objectives of Oregon Laws 2021, chapter 95. The TE Plan shall seek to address areas most affected by market barriers in the electric company's service territory, prioritize load management, and to provide benefits for underserved communities.	Chapter 8
(2) An electric company must file for Commission acceptance of a TE Plan.	The full filing will meet this requirement
(a) As used in this rule, "acceptance" means the Commission finds that the TE Plan meets the criteria and requirements of this rule and does not constitute a determination on the prudence of the individual actions discussed in the TE Plan. The Commission may accept the TE Plan subject to conditions. Acceptance, or acceptance subject to conditions, shall constitute approval of the electric company's program applications and TE Budget as filed in the TE Plan and its appendices. Non-acceptance means that the TE Plan does not meet the criteria or requirements of this rule.	
(b) An electric company must present a draft TE Plan to Commission staff and stakeholders for review and comment on or before May 1, every three years starting in the year 2025, or as otherwise directed by the Commission. The TE Plan shall include the three calendar years after the year the TE Plan is presented.	This filing is consistent with this requirement and direction given utilities in

Division 87 Rule	Section(s) that Address the Rule
	Commission Order No. 21-484[315].
(c) The electric companies will work with Commission staff to propose a schedule to parties for draft TE Plan review, comment, and workshops.	PGE will work with Commission staff and stakeholders to propose an appropriate review process and schedule.
(d) After public review of the draft TE Plan, the electric company must file a final TE Plan with the Commission, noting how the electric company responded to parties' comments.	PGE will comply, continuing the stakeholder engagement laid out in Chapter 4, as well as additional responses as laid. out in Appendix D.
(e) Commission staff will present its recommendation on the electric company's TE plan at a public meeting. The Commission shall also consider party and electric company comments and recommendations on a TE Plan at the public meeting before issuing an order of acceptance. The Commission may provide direction to an electric company regarding any additional analyses or actions that the electric company should undertake in its next TE Plan.	n/a
(f) An electric company may propose TE Plan updates at any time between scheduled TE Plan filings. An electric company is required to file a TE Plan update for material changes to its TE Plan. Material changes are new TE program or infrastructure measure applications, or program or infrastructure measure changes that require new incremental ratepayer dollars. Commission staff will work with parties to propose a schedule for public review of TE Plan updates.	PGE will comply in the event an update to the TE Plan or Budget is necessary during the 2023-2025 cycle.
(3) The TE Plan must include	
(a) The current condition of the transportation electrification market in the electric company's Oregon service territory, including, but not limited to:	Chapter 3
(A) A discussion of new state policies and programs since the last TE Plan filing;	Section 3.1.1
(B) Market barriers that the electric company can address and other barriers that are beyond the electric company's control, including any identified	Section 3.6

[315] OPUC Order No. 21-484, retrieved from https://apps.puc.state.or.us/orders/2021ords/21-484.pdf.

Division 87 Rule	Section(s) that Address the Rule
emerging challenges to transportation electrification, charging, and vehicle technology updates;	
(C) Existing data reasonably accessible to the electric company on the availability, reliability, and usage patterns of charging stations;	Section 3.7
(D) Number of electric vehicles of various sizes in the utility service territory and projected number of vehicles in the next ten years;	Section 3.3.1
(E) Other transportation electrification infrastructure, if applicable; and	Section 3.5
(F) A forecast of public and private charging infrastructure needed in the company's service territory to support transportation electrification. The forecast should utilize a Commission-approved tool to estimate needed public charging infrastructure over the next ten years and include type, location and timing of needed infrastructure.	Section 3.4
(b) A summary of the electric company's transportation electrification portfolio of program(s) and future transportation electrification concepts and actions in its Oregon service territory for the next three years. The summary should include the company's long-term vision for its TE portfolio and strategy to support transportation electrification in its service territory. The TE Plan must incorporate project lessons learned and any other relevant information gathered from other transportation electrification infrastructure investments, programs, and actions to ensure that lessons learned are carried forward to the next TE Plan;	Chapter 6
(c) A discussion of how programs and infrastructure measures in the TE Plan holistically advance performance area categories that include, but are not limited to:	Chapter 7
(A) Environmental benefits including greenhouse gas emissions impacts;	Section 7.1
(B) Electric vehicle adoption;	Section 7.2
(C) Underserved community inclusion and engagement;	Chapter 4, Section 7.3
(D) Equity of program offerings to meet underserved communities;	Section 7.4
(E) Distribution system impacts and grid integration benefits;	Section 7.5
(F) Program participation and adoption;	Section 7.6
(G) Infrastructure performance including charging adequacy which considers, but is not limited to reliability, affordability, and accessibility;	Section 7.7

Division 87 Rule	Section(s) that Address the Rule
(d) Supporting data and analysis used to develop the TE Plan, which may be derived from elements such as review of costs and benefits, rate design, energy use and consumption, overlap with other electric company programs, and customer and electric vehicle user engagement;	Chapter 8
(e) A discussion of the electric company's potential impact on the competitive electric vehicle supply equipment market, including consideration of alternative infrastructure ownership and business models, and identification of a sustainable role for the electric company in the transportation electrification market;	Section 6.4
(f) Analysis of the estimated ratepayer impact of the TE Plan over the next three calendar years; and	Section 8.7
(g) The electric company's TE Budget. The TE Budget must include: (A) Annual budgets for the TE Plan for the three calendar years after the year the TE Plan is presented to Commission Staff and stakeholders. The annual budgets should include a discussion of the context of anticipated long-term expenditures for the next ten years, including but not limited to benefit-cost analysis "cost tests;"	Chapter 8
(A) A forecast of all expenditures to support transportation electrification grouped by program and/or infrastructure measure, and further divided into:	Section 8.2
(i) Capital expenditures; and	Section 8.2
(ii) Expenses, separating administrative costs, O&M on investments, incentives paid to program participants, and any other unique category as relevant;	Section 8.2
(B) A forecast of all funding sources to be utilized, including but not limited to, the Monthly Meter Charge, grants, Oregon Clean Fuels Program credits, base rates, and deferrals based on a reasonable estimate, including a discussion of how actual revenue might vary from the estimate;	Section 8.3
(C) A forecast of all spending on underserved communities, grouped by program and/or infrastructure measure and further divided into:	Section 8.4
(i) Expenditures of funds collected through the Monthly Meter Charge as required by Oregon Laws 2021, chapter 95 Section 2;	Section 8.3.1
(ii) Spending from revenues other than the Monthly Meter Charge, including but not limited to grants, Oregon Clean Fuels Program credits, base rates, and deferrals;	Section 8.3
(D) The Commission's acceptance of the electric company's TE Plan will constitute approval of the TE Budget, which includes the Monthly Meter Charge budget as required by Oregon Laws 2021, chapter 95 Section 2.	n/a

Appendix F. PGE Whitepaper on V2G

Utility Experience with Vehicle-to-Grid Regulatory and Technology Challenges, and the Final Hurdles to Large-Scale V2G Deployment

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***Abstract*—Advancements in electric vehicle charging equipment, vehicle battery improvements, and technical standards updates have led to a recent proliferation of vehicle-to-grid (V2G) demonstration projects that presages a dramatic increase in V2G deployments worldwide. This paper discusses one utility's initial experiences in developing a regulatory framework for customer participation in V2G. It also covers the technical barriers encountered when implementing several V2G demonstration projects, and considers the final barriers that remain before V2G chargers are widely installed across the power system.**

***Index Terms*—Electric Vehicles, Vehicle-to-Grid, Distributed Energy Resources**

I. Introduction

Motivated by carbon reduction goals and improved product performance, consumers and businesses are adopting electric vehicles (EVs) at a rapid pace. The exponential growth of EVs and their accompanying electrical infrastructure requirements has compelled system planners to think deeply about how these resources will be integrated into the power grid in a way that is convenient to the user, avoids malignant impacts to the electric provider, and is cost effective for all parties involved. One avenue that has the potential to reduce costs for consumers and provide flexibility to the utility is vehicle-to-grid (V2G) technology, in which the EV's on-board energy storage can be utilized to send power back to the grid through the EV's associated Electric Vehicle Supply Equipment (EVSE).

While V2G technology has existed since the early 2000's [1], it has taken many years for EVSE vendors to commercialize products that offer bi-directional charging. There are a number of reasons for this - initial technology limitations, firming up standards to include V2G capability, and a lack of obvious revenue streams - that will be discussed throughout the paper. Nonetheless, breakthroughs in these areas have led to recent V2G demonstration projects, and the time is ripe for much wider deployments of V2G-capable EVSE in a number of applications.

This paper briefly discusses some of the early efforts involving V2G charging and more recent commercial deployments. It then pivots to discuss some of the last hurdles that must be overcome before wide-scale V2G adoption, including regulatory and policy considerations as well as technological challenges. Finally, it covers the experiences that Portland General Electric (PGE) has had installing two separate V2G chargers - one a passenger vehicle charger located at a PGE facility, and the second a larger V2G-capable electric bus charger located at a customer's school bus depot.

Portions of this work were funded through the Oregon Clean Fuels Program

II. Past V2G Efforts

The possibility of using EVs to provide V2G services has existed since Kempton and Tomić [1] first proposed and patented the technology in the early 2000's. Since then, considerable research has gone into understanding how V2G resources could be integrated into the grid, including discussions of the possible transmission impacts of large fleets of V2G vehicles [2], considerations of the required communication and control infrastructure [3], as well as analysis of both the technical and social barriers preventing early adoptions [4]. A recently published textbook [5] provides a comprehensive overview of many of these issues.

The economics of V2G have also gained considerable attention. Previous research analyzing how V2G revenue could affect vehicle purchase economics [6, 7] indicates that the technology can pencil out provided that the correct compensatory structures are put in place. Using V2G to provide ancillary services [8], participate in energy markets [9], and offer reactive power support [10] has also been considered, and these options are likely to become more viable in the United States as FERC Order 2222 is fully integrated across ISO/RTO environments.

Managed charging of electric vehicle fleets employing V2G has also been studied extensively, both to provide energy to the grid at times of peak system demand [2, 4, 11] and to relieve more local distribution system bottlenecks [12, 13]. These analyses indicate that V2G could provide substantial benefits over uni-directional charging by offering increased system flexibility. Indeed, a review of past EV research [3] indicates that the total amount of energy stored in V2G-capable EVs could match or even exceed the amount of stationary battery energy storage deployed on many power systems in the near future. If managed in a coordinated fashion, the potential for V2G as a dispatchable resources is quite large.

Given these insights into the potential benefits of bi-directional EV charging, a number of V2G demonstrations have been conducted over the years. In the US, this includes early efforts to integrate a V2G-capable vehicle into the California ISO [14] and at an Air Force base [15]. There are also several incidents where V2G chargers were incorporated into microgrid environments [16, 17]. While all notable efforts, these tended to contain one-off prototype technology that was not yet fit for large-scale commercialization. Of particular interest to this paper are the more recent deployments of V2G technology, all within the last two years, and all utilizing commercial off-the-shelf EVSE chargers. These include an electric school bus and charger deployed at Pekin, Illinois [18], a five bus V2G testing site deployed in White Plains, New York [19], and a larger-scale project involving both passenger vehicles and electric buses employing V2G technology within Southern California Edison service territory [20]. Together, these projects seem to represent the start of a much larger push for V2G adoption within the US.

PGE has also recently deployed a pair of V2G projects within its service territory, which are discussed in Section V. First though, Sections III and IV discuss some of the barriers that were encountered during project execution. The lessons learned during these endeavors may be of use to other industry participants as they navigate their own V2G deployments.

III. Regulatory and Policy Barriers to V2G Adoption

The potential for V2G - or "batteries on wheels" - presents a challenge for regulatory and policy analysts. Should these resources be treated the same as stationary energy storage assets? Can they deliver the same level of reliability? And what are the implications of a utility or third-party aggregator directly controlling both charging and discharging of a customer's vehicle?

A. Tariffs and Rate Design

As of publication, there were few, if any, widescale V2G electricity tariffs available within the US. Several pilot tariffs have been or are in development for the projects mentioned above, but these tend to be available to only a select few participants. As previously mentioned, without the ability to compensate vehicle owners that provide power back to the grid, it is difficult to justify the added project costs of V2G-equipped EVSEs.

General considerations for designing a V2G electric rate structure include:

- **Lack of Precedents** - While V2G tariffs do exist in EU and UK markets, there is a paucity of existing examples in the United States. This puts increased pressure and visibility on any initial V2G tariffs from a US electricity provider.
- **Comparison to Stationary Storage** - There are tariffs available for instances where US utilities directly control and dispatch stationary battery energy storage assets. Of course, since a V2G battery can drive off at any moment, it begs the question of how these resources should be compensated compared to an asset that is generally available 24/7.
- **General Rate Design** Special consideration must be given to the implications that a rate structure will have on V2G operations at scale. Particular approaches could include net-metering, time-of-use rates, or more dynamic pricing structures. Poor rate design could have the unintended effect of causing vehicles to dispatch at off-peak times rather than aligning V2G discharge to the grid at peak times when the energy is most valuable.
- **Demand Charges** An EVSE that can charge and discharge at a high rate may be more valuable to the power system than a lower-powered model; however, demand charges could inadvertently punish an EV customer that is providing this higher degree of flexibility by charging a flat rate for the peak energy used during a billing cycle. For instance, a customer providing ± 50 kW of bi-directional charging is more useful than a customer providing ± 25 kW, but the former customer could potentially see much higher demand charges, therefore disincentivizing them from providing the full range of their EVSE power capability to the grid. Care must be taken to avoid this type of misaligned incentive.
- **Equity Considerations** Policy makers and electricity providers have a duty to design rates in a way that promotes equity among ratepayers. For instance, the Oregon Public Utility Commission (PUC) has stated [21] that distribution system planning must "identifying grid needs, implemented in partnership with communities and community-based organizations" that "create value-adding investments for communities, and align the energy system with community priorities." Discussions around V2G rate structures must consider how they will impact low-income customers and those for whom EV adoption may be more difficult to attain. Early research in this space [22] indicates that additional studies and consideration are warranted to better understand the social dimension of V2G charging.
- **Control of Customer Assets** Any form of managed charging, whether uni-directional or V2G, must contemplate the implications of a utility or third-party aggregator gaining control over a customers asset, especially one as critical to daily life as an automobile.

All of these consideration make designing V2G tariffs a challenging process. It is anticipated that the ongoing discourse between electricity providers and PUCs across the country on this subject will lead to more widely-available V2G rates in the very near horizon.

B. Interconnection Agreements

Typically in the US, any resource that backfeeds onto the distribution system is required to file an Interconnection Request and eventually sign an Interconnection Agreement that specifies how the asset can operate. These agreements legally bind the customer's resource to provide features such as anti-islanding control during outages, and may specify compliance with standards such as IEEE 1547-2018.

The Interconnection Agreement process tends to be highly regimented and specific to each state. The necessary adjustments to this process to include V2G-capable resources are not considered particularly onerous. Nonetheless, it does require coordination between electricity providers, state regulators, and relevant stakeholders to make the changes necessary to allow V2G resources to file such Interconnection Requests.

C. *Market Participation of V2G Resources*

Besides direct payment from the utility to a customer providing V2G services, there is also the possibility of an EVSE or aggregation of EVSEs to engage in an energy or ancillary services market in order to receive compensation. In the US, this process is currently being overhauled to comply with FERC Order 2222, which will impact the value proposition of V2G resources in ISO/RTO environments. In more vertically-integrated environments such as the West's Energy Imbalance Market outside of California, it remains to be seen how V2G-capable chargers and related distributed energy resources will be engaged with market operations.

IV. Technological Barriers to V2G Adoption

The past twenty years have seen considerable advancements in both EV charging equipment and battery technology that has made V2G a more viable economic proposition.

A. *Battery Degradation*

The earliest and most daunting issue facing V2G operation was the prospect of increased battery degradation over time. All chemical batteries experience a waning of their power and energy capacity as they experience charge/discharge cycles. For the lithium-ion batteries installed in most EVs, the implication used to be that battery life did not extend past the 7-10 year range (under uni-directional charging and normal driving patterns). V2G charging inherently increases the number of charge/discharge cycles that a battery endures, and thus may shorten its life and decrease the value proposition of V2G participation. Indeed, early research indicated that V2G charging would require multiple battery replacements over the life of an EV [23].

More recent studies, however, suggests that these concerns may be overstated (for a review, see [24]). While V2G operation does have a measurable impact on battery life, at least one empirical study [25] has demonstrated that the effect on battery capacity is not much more impactful than standard uni-directional charging. There is evidence [26] that keeping the battery within a 30-90% state-of-charge, for instance while providing frequency regulation services, tends to minimize degradation under V2G charge/discharge cycles.

Adding to these observations is the increasing prevalence of V2G-capable vehicles on the commercial market. Anecdotely, several electric bus manufacturers now offer V2G capability standard. This is indicative of reduced concerns over V2G-induced battery degradation that manufacturers now have.

Fig. 1. A Nissan LEAF undergoing V2G testing at PGE's Portland Service Center with a Quasar Wallbox charger. The 240 V, 32 A bi-directional charger can provide up to 7.2 kW of power from the vehicle battery to the grid. Successful testing of the charger's V2G capability was conducted in October 2021, with ongoing efforts underway to study the efficiency and reliability of the charge/discharge process.

B. *Ongoing ISO 15118 Standard Update*

One issue that, as of publication, is still being resolved is the ongoing revision process of the ISO-15118 standard. This standard specifies how vehicles and EVSEs communicate under V2G conditions. While several V2G charger manufacturers have been able to find near-term workarounds for this issue, once the revisions are officially in place, they will prevent the need for these type of "bootstrapped" solutions and make it easier for EVSE vendors to manufacture V2G-capable equipment.

C. *Integration with Utility Control Infrastructure*

Another ongoing integration challenge revolves around how electricity providers and third parties interact with distributed energy resources on the grid. This will require coordination with both utility-owned advanced distribution management systems and third-party operated distributed energy resource management systems.

The IEEE 2030.5 standard is anticipated to aid in the communication between EVs and other entities. Increased deployment of IEEE 2030.5-compatible equipment, both by the customer and the electricity provider, should aid this transition and enable managed charging of both uni-directional and V2G resources.

V. Experience with V2G Demonstrations at PGE

PGE installed and operated two separate examples of V2G technology in the 2021 timeframe - one a passenger vehicle charger, the other an electric school bus charger. Both are discussed below.

A. *Utility-owned passenger vehicle charger*

In an effort to gain access to early V2G technology, PGE purchased a European model residential charger, the Quasar

Fig. 2. The (very shiny) display of the V2G-equipped passenger vehicle charger. The negative sign convention on the -6.1 kW reading indicates that the vehicle is engaged in V2G discharging to the grid. The display also shows the vehicle's current state-of-charge (71%).

Wallbox, in 2021. The charger was installed at a PGE-owned facility, obviating the need for an Interconnection Agreement and related complexities. Installing the charger came with a few key challenges:

1) The charger uses the ChadeMO connection, and thus a Nissan LEAF is the only compatible US vehicle that can be used to test it. PGE had several LEAFs in its fleet and was able to assign one for testing. It also required a trip to the dealership to have the vehicle configured to allow for V2G operation (this functionality is typically disabled for customers).
2) As a European model, the charger expected a 240 V connection via one hot and one neutral wire. Since the US distribution system configuration requires two hots to provide 240 V service, a specialized ground fault current interrupting circuit breaker was required for the installation. Testing by the electrical contractor ensured that the breaker correctly operated during faulted system conditions.
3) In order to avoid additional service upgrades to the distribution equipment at the site, the charger had to be installed at a location where there was significant background load to prevent net backfeed to the grid. PGE's Portland Service Center was chosen as the hosting site, given its higher ambient loading and its general accessibility for fleet vehicles.

The Wallbox model was successfully installed in October 2021, and initial testing demonstrated the ability of the EVSE to discharge power back to the grid as well as charge the vehicle. The listed bi-direction power capacity of the model is ±7.68 kW (at 240V, 32 A), and these levels were achieved in both directions. During initial trials, the battery of the vehicle has been successfully discharged from 90% state-of-charge down to 65% and back to 90%.

Additional testing is underway at the site. The research plan for the charger includes assessment of its round-trip efficiency during a discharge/charge cycle and its ability to perform several charge/discharge events back-to-back. Efforts are also underway to tie the resource to existing PGE control systems and allow for remote dispatch. If achieved, this would allow the parked vehicle to discharge power back to the grid during peak loading conditions, thus integrating it into a nascent virtual power plant.

B. Electric School Bus V2G Charger

The PGE Electric School Bus initiative, with funding provided through Oregon Clean Fuels Program, give school districts access to capital that can be used to purchase electric school buses and associated charging infrastructure. One local customer, the Newberg School District, in conjunction with their transportation provider First Student, applied for and received funding for a V2G-capable vehicle and charger to be installed in 2021. This project featured a 155 kWh Blue Bird bus and a 60 kW bi-directional Nuvve charger.

As a customer-owned endeavor, this project presented additional challenges during implementation compared to the PGE-owned charger. For instance, this was the first V2G resource to go through PGE's Interconnection Agreement process, and required some adjustments to the pro forma language included in the attendant documents.

It was also necessary to determine the required electrical infrastructure for the V2G charger. Eventually, the PGE Electrical Service Requirements for PV generation were utilized by the distribution engineers studying the project. These include stipulations that a utility-accessible manual disconnect switch be located adjacent to the customer-owned switchgear. The EVSE was also required to comply with the IEEE 1547-2018 standard and have gained full UL-certification.

The charger will also be integrated into PGE control systems via an IEEE 2030.5-compatible server. Similar to the passenger vehicle charger, this integration will allow the electric school bus to be dispatched as part of a larger virtual power plant operation.

There is ongoing dialogue in the state of Oregon with a number of stakeholders around potential V2G tariffs, and PGE looks forward to being able to offer compensation to customers who provide this valuable service.

VI. Conclusion

While vehicle-to-grid (V2G) technology was original developed decades ago, it seems poised to finally reach a level of large-scale commercial success in the near future. As discussed throughout this paper, the barriers to mass adoption include regulatory and legal hurdles such as updates to interconnection processes, questions about appropriate electricity rate structures, and considerations for how a customer's vehicles can and should be controlled. There are also a few technical bottlenecks related to standards updates and integration with utility and third-party control systems that need to be resolved.

Still, the big picture outlook is bright. Two recent demonstration projects by PGE are discussed in this paper, which together may foster larger-scale tests and help to visibly promote the technology. Ongoing cooperation by electricity providers, equipment manufactures, and a range of customers will be required to make broad V2G deployments a reality.

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Appendix G. Brattle Economic Variables

Table 87. Brattle Economic Variables

Variable Name	Variable Type	Description
Dependent Variable: EV sales per capita	Continuous	Defined as the total incremental sales of EV (BEV or PHEV) per million residents
State incentives	Continuous	The maximum incentive (rebate, tax credit or tax exemption) offered by a state upon purchase of a BEV or PHEV, in $/vehicle
Clean Vehicle Credit	Continuous	A federal tax credit (FTC) offered by the federal government upon purchase of a BEV or PHEV, in $/vehicle
Total Incentive	Continuous	Sum of the state incentives and FTC
Battery price	Continuous	Lithium-ion battery cost index in $/kWh, as a proxy of electric vehicle cost (BNEF)
Vehicle miles travelled (VMT)	Continuous	Average vehicles miles travelled annually, per capita
EV-ICE fuel cost ratio	Continuous	Ratio of operating costs of an EV ($/100 miles) to that of an ICEV ($/100 miles)
Tesla Cap dummy	Binary	A dummy variable to indicate a period of spike in EV sales after Tesla hit the cap for the FTC Q3'18 and Jan'19
Model availability	Continuous	Number of EV models available across a state by year
Green views score	Continuous (0-100)	Average environmental voting score of state House and Senate reps (League of Conservation Voters Annual Environmental Scorecard)
High Occupancy Vehicle (HOV) lane exemption	Binary	Indicates the presence of an HOV lane exemption for EVs
Traffic density	Continuous	Weighted average daily traffic per lane for all principal arterials
Zero Emission Vehicle (ZEV) mandate	Binary	Indicates the presence of a ZEV mandate enacted by the government
EV charging rate	Binary	Indicates whether or not at least one utility offers an EV rate for charging in a given state

Appendix H. Commission Dockets Which Approved Funding of TE Activities

Table 88. Commission Dockets Which Approved Funding of TE Activities

	Funding Source	Approval Action	Year(s) Approved	Detail
Business & Multi-Family Make-Ready Solutions	Customer Ratepayer	UM 2033; Order No. 23-147	2023	Capital spend referenced in 2023 MMC budget
	MMC	UM 2033; Order No. 23-147	2023	2023 MMC Budget expansion of ratepayer program
Fleet Partner Pilot	Customer Ratepayer	Approval letter 6/1/21; Adv. No. 21-09	2021	Program application approved with tariff
	MMC	UM 2033: Order No. 23-147	2023	2023 MMC Budget expansion of ratepayer program
Heavy Duty Charging Pilot	Customer Ratepayer	Order No. 21-195; Adv. No. 21-03	2021	Approved 6/15/2021
Public Charging – Electric Avenue and Municipal Charging Collaboration	Customer Ratepayer	UM 2033: Order Nos. 22-381 and 23-147	2022 and 2023	Capital spend referenced in 2022 and 2023 MMC budgets
	MMC	UM 2033: Order Nos. 22-381 and 23-147	2022 and 2023	2022 and 2023 MMC Budgets
	Deferral	UM 1938; Order No. 21-475	2021	Electric Avenue
Business EV Charging Rebates	MMC	UM 2033; Order No. 22-381	2022	2022 MMC Budget expansion of deferral program
	Deferral	UM 2003; Order No. 22-263; Adv. Nos. 20-19 and 21-15	2020 and 2021	Deferral program (expanded with 2022 MMC)
EV Ready Affordable Housing Grants	MMC	UM 2033; Order No. 22-381	2022	2022 MMC Budget only
Residential Smart Charging Pilot	MMC	UM 2033: Order No. 22-381	2022	2022 MMC Budget expansion of deferral program

	Funding Source	Approval Action	Year(s) Approved	Detail
	Deferral	UM 2003; Order No. 22-263; Adv. No. 20-18	2020	Deferral program (expanded with 2022 MMC)
Portfolio Support	Customer Ratepayer	N/A		Utility CapEx
	MMC	UM 2033: Order Nos. 22-381 and 23-147	2022 and 2023	2022 and 2023 MMC Budgets

CERTIFICATE OF SERVICE

I hereby certify that I have this day caused the **Portland General Electric Company's 2023 Transportation Electrification Plan** to be served by electronic mail to those parties whose email addresses appear on the attached service list for OPUC Dockets UM 2033, UM 2165 and AR 654.

Dated this 1st day of June, 2023.

/s/ Riley Peck

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