



2023 Transportation Electrification Plan



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Abbreviations

ACC ... Advanced Clean Cars II Rule	ESB Electric School Bus Fund
ACEEE American Council for an Energy Efficient Economy	EV Electric Vehicle
ACT California's Advanced Clean Trucks	EVSE... Electric Vehicle Service (or Supply) Equipment
ADA ... Americans with Disabilities Act	FTC..... Federal Tax Credit
ATE..... Association for Transportation Electrification	GHG ... Greenhouse Gas
BEV..... Battery Electric Vehicles	HB..... Oregon House Bill
BNEF.. Bloomberg New Energy Finance, or BloombergNEF	HDV.... Heavy-Duty Vehicle
CBO ... Community-Based Organization	I-5..... Interstate 5
CaaS... Charging as a Service	ICE..... Internal Combustion Engine
CCS Combined Charging System	IEC International Electrotechnical Commission
CEP PGE's Clean Energy Plan	IIJA Infrastructure Investment and Jobs Act
CFC Clean Fuels Credit	IRA Inflation Reduction Act
CFP..... Oregon Clean Fuels Program	IRP PGE's Integrated Resource Plan
DAC ... Disadvantaged Community	ISO International Organization of Standards
DCF.... Drive Change Fund	kW Kilowatt
DCFC. Direct Current Fast Charge	kWh Kilowatt-hour
DEQ ... Department of Environmental Quality	L2..... Level 2
DER(S) Distributed Energy Resource(s)	LADWP Los Angeles Department of Water and Power
DLC Direct Load Control	LDV..... Light-Duty Vehicle
DOE ... Department of Energy	LEA Line Extension Allowance
DOT ... Department of Transportation	LMI..... Low and Moderate Income
DR..... Demand Response	MCS ... Megawatt Charging System
DSP PGE's Distribution System Plan	MDHDV ... Medium-Duty/Heavy-Duty Vehicle
ECGD. Electric Car Guest Drive	MDV ... Medium-Duty Vehicle
EEL Edison Electric Institute	MMC .. Monthly Meter Charge (aka TE Charge)
EMV.... Euro Mastercard Visa	MW..... Megawatt
EPA..... Environmental Protection Agency	MWh .. Megawatt-hour
EPRI Electric Power Research Institute	MYP PGE's Flexible Load Multi-Year Plan
EPS Energy Performance Score	NEC.... National Electric Code
EQC ... Environmental Quality Commission	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

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.](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 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.

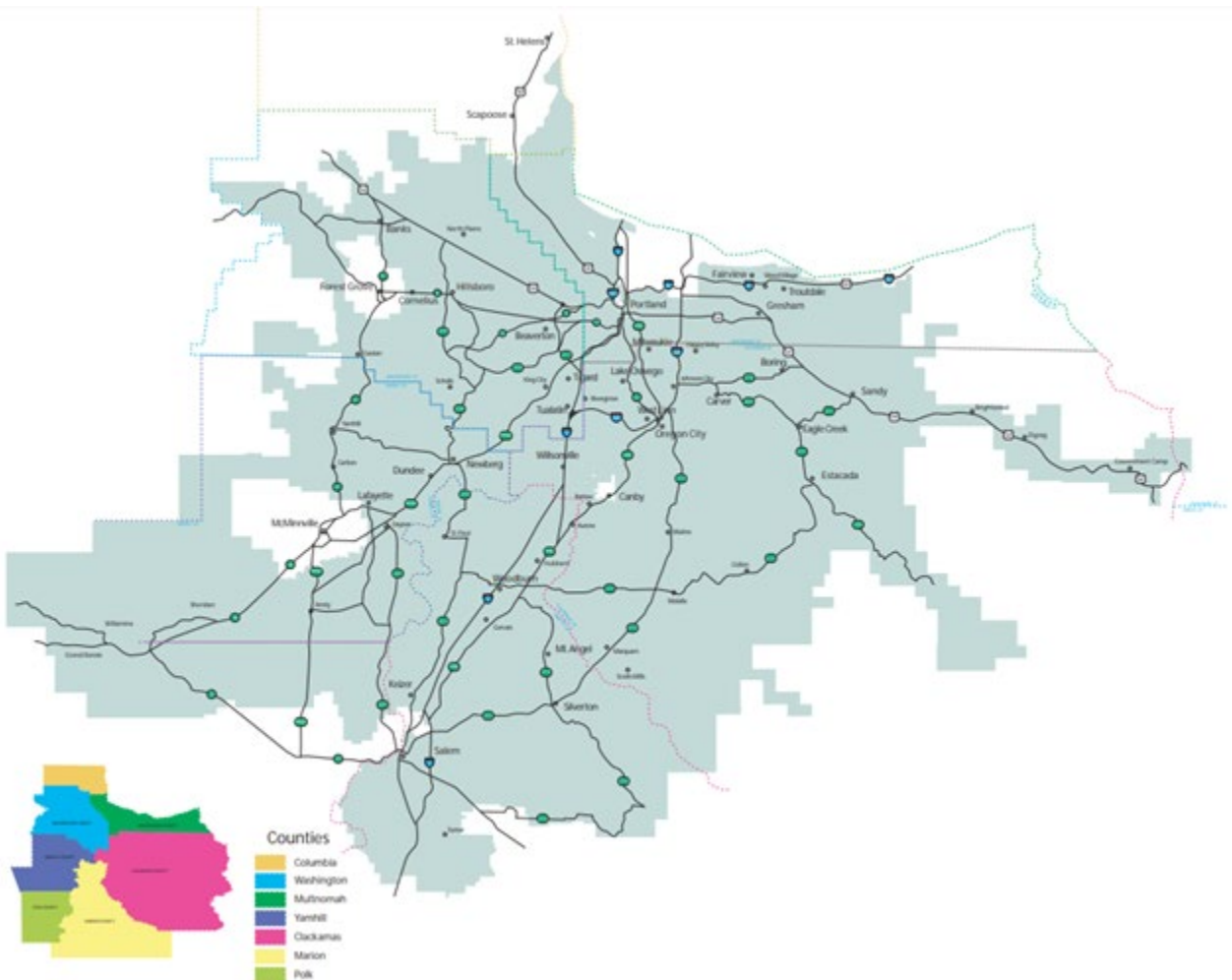


Figure 1. PGE Service Area

Chapter 1. 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 \$96 million into the transportation electrification (TE) market through four sources of funding: the Clean Fuels Program (\$45.3 million), the Monthly Meter Charge (\$23.0 million), existing/approved customer investment (\$17.8 million), and an additional incremental investment requested herein from customers of \$9.9 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.

1.1 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 \$96.0 million into the transportation electrification (TE) market through four sources of funding: the Clean Fuels Program (\$45.3 million), the Monthly Meter Charge (\$23.0 million), existing/approved customer investment (\$17.8 million), and an additional incremental investment requested herein from customers of \$9.9 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.