



Transportation Electrification Plan (UM 2033)

Aaron Milano, Portfolio Manager – Transportation Electrification

Portland General Electric Company

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Today's agenda

- **Background**
- **TE market insights**
- **TE actions**
 - What it is
 - Needs assessment
 - Current activities
 - Vision
- **Upcoming regulatory activities**

Transportation Electrification Plan

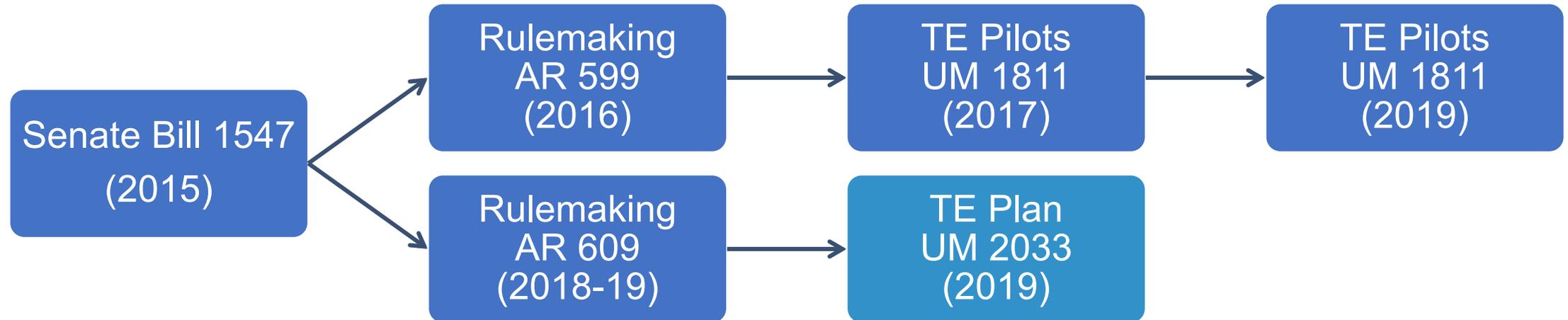
SEPTEMBER 2019



Background

The legislature's vision for transportation electrification is expansive. We expect the planning efforts of the electric companies to take this vision into account. Programing should be developed that seeks to achieve these legislative goals.

–OPUC, Order No. 19-134, in docket AR 609, 4/16/19



Other relevant policies:

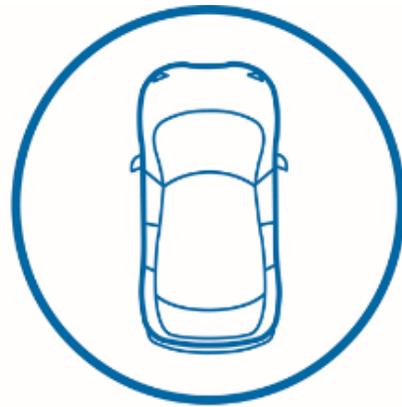
- SB 1044: 250,000 EVs by 2025
- ZEV Mandate
- EV Rebate
- Achieve GHG emission levels that are 75% below 1990 levels by 2050
- Local climate action plans

Electric transportation is a climate imperative



Decarbonize

Reduce GHG emissions by more than 80% by 2050



Electrify

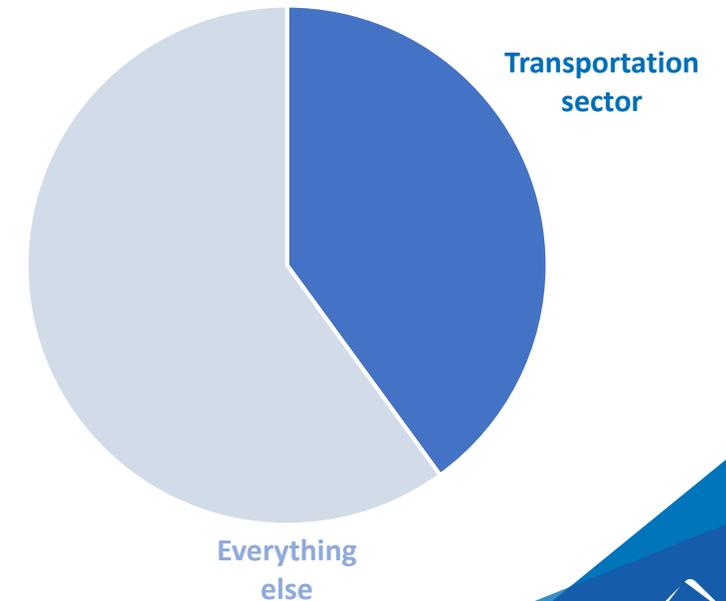
Increase electricity to 50% of energy use by 2050



Reliability

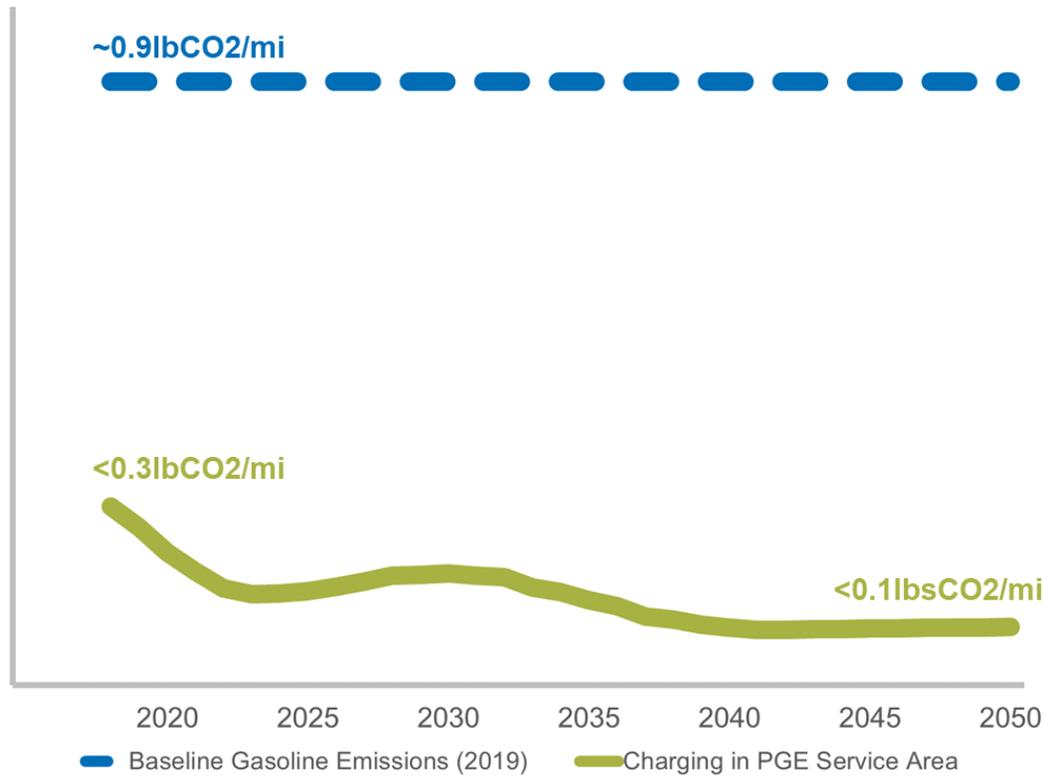
Deliver operational excellence and be sound stewards of energy ecosystem resources

Transportation represents about 40% of the state's GHG emissions, making it a fundamental part of addressing climate change.

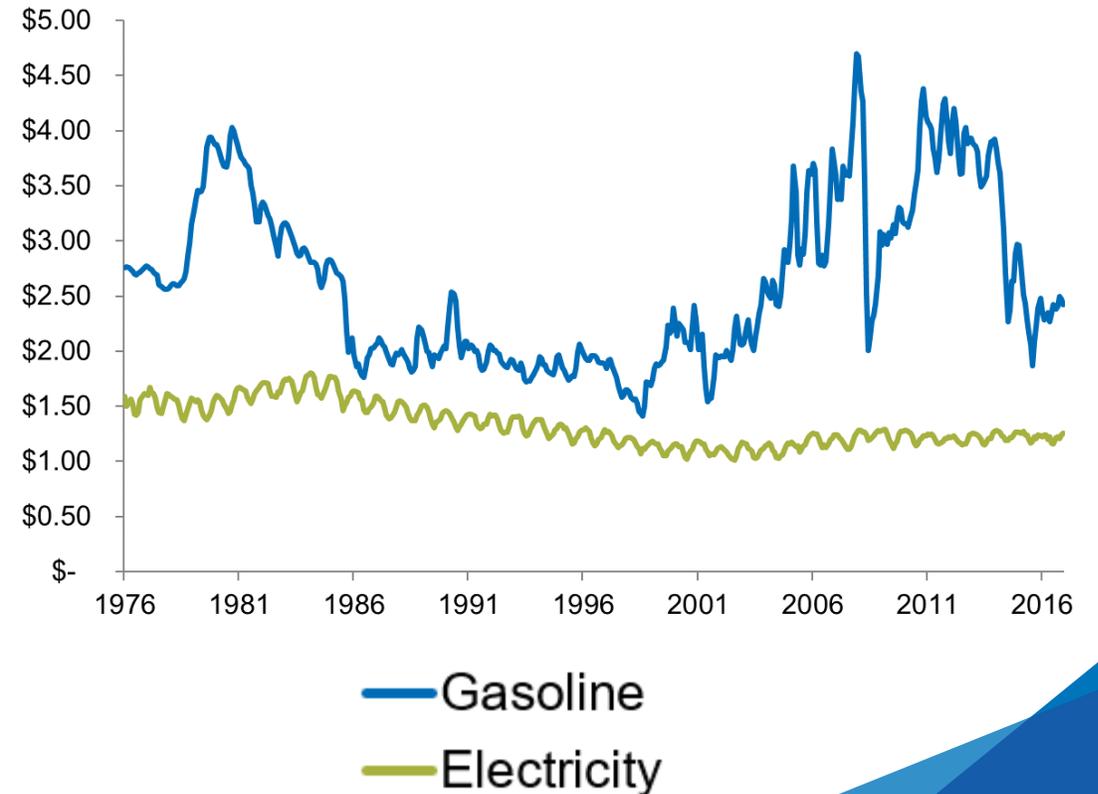


Electricity is clean, affordable, local

Carbon Intensity of new gas vehicle vs. EV



Monthly motor gasoline retail prices vs. Electricity prices in \$/gal-equivalent

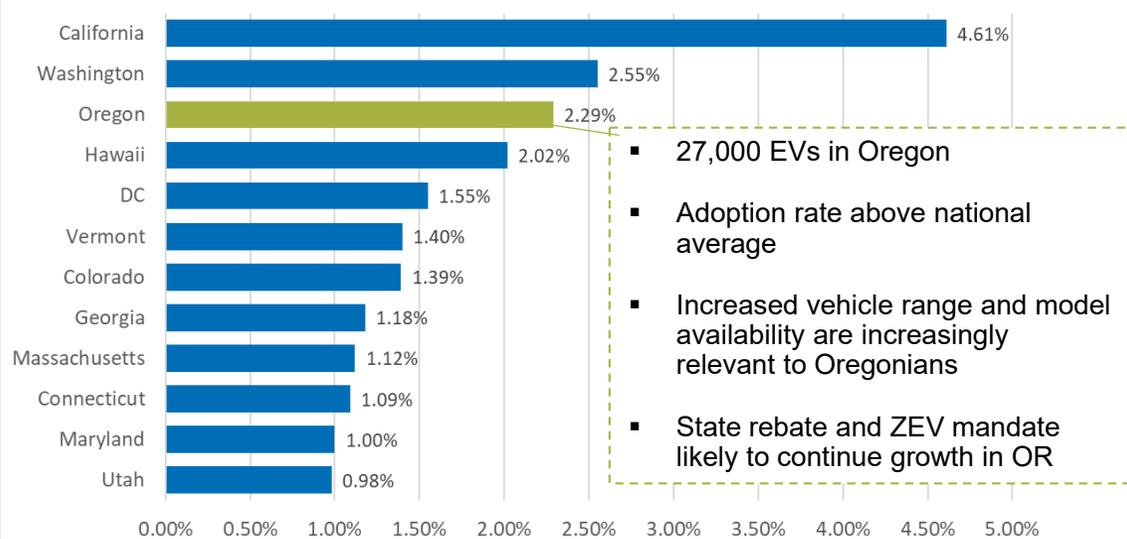


EV market at a glance

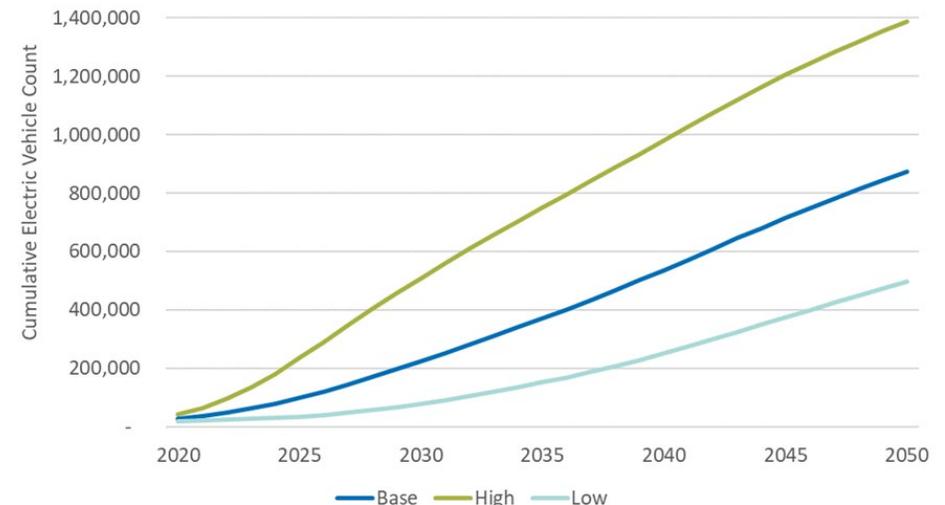
- 100M EVs projected in USA by 2040
- Auto manufacturers have committed >\$250B global investment in new EV models
- 400 EV models globally by 2025
- Transportation companies have committed more than \$5B to electrify more than 100,000 delivery trucks and vans



% of new vehicle Sales that are Electric

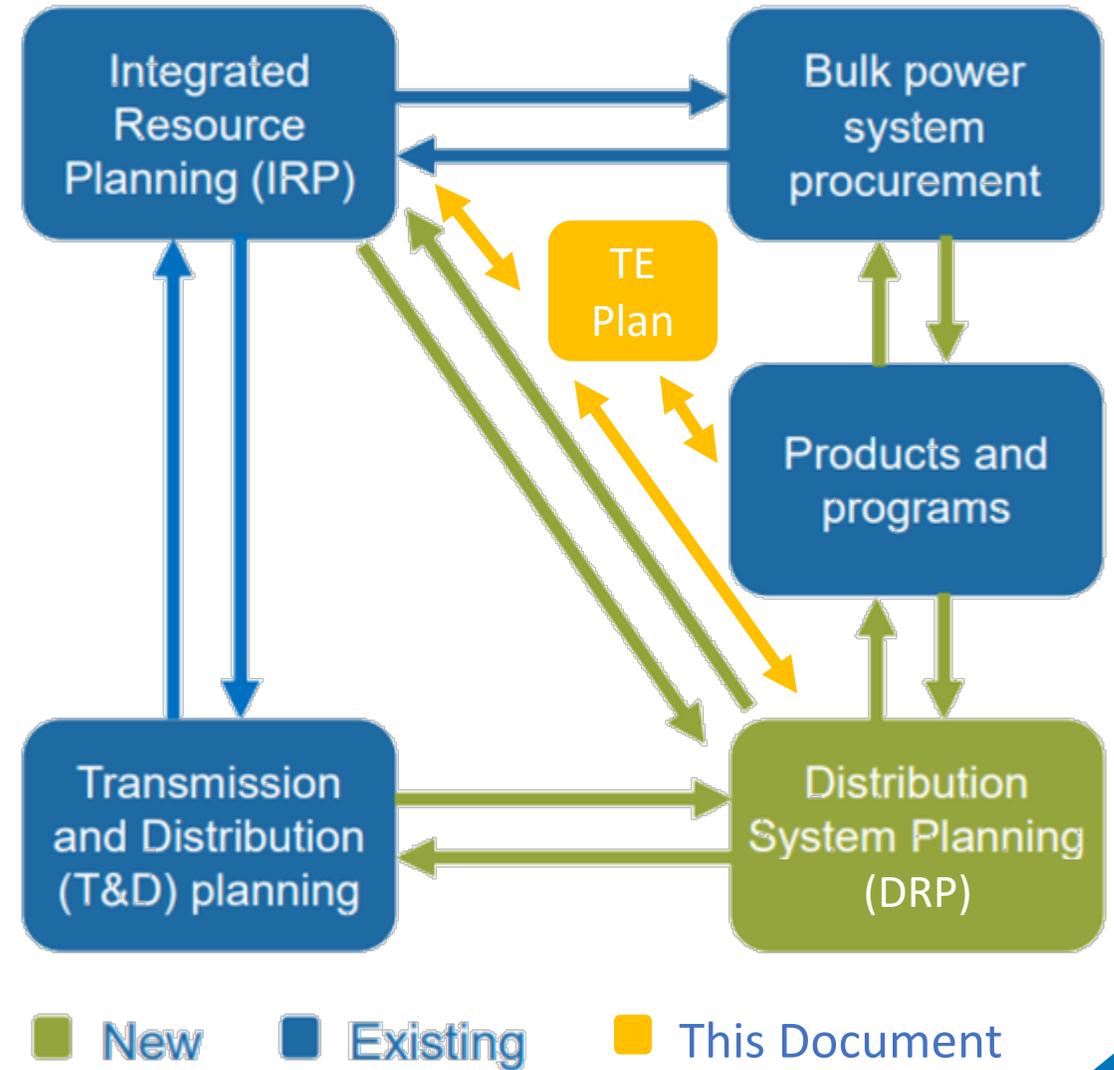


EV Forecast, PGE Service Area



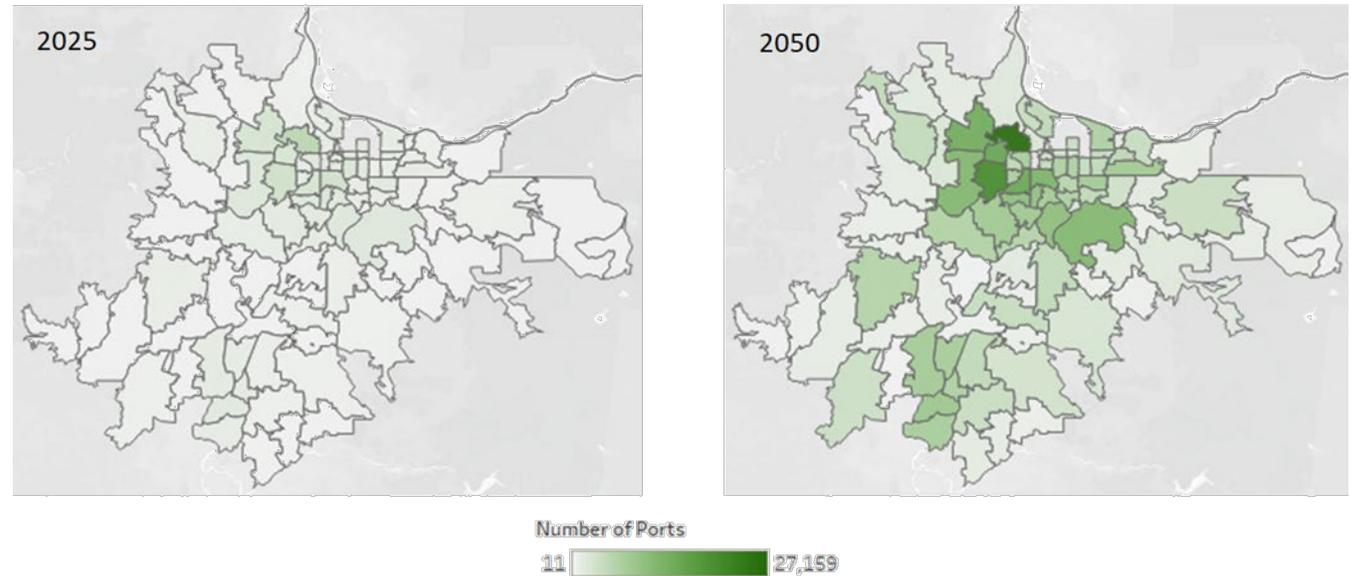
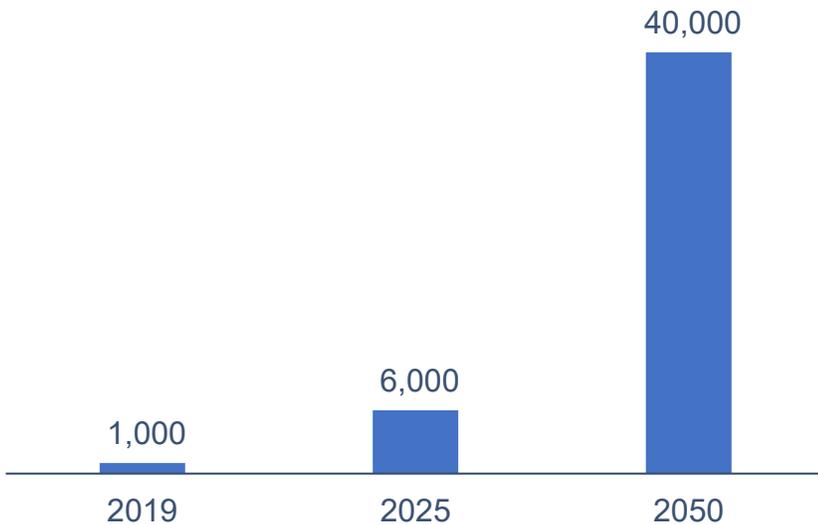
TE Plan

	TE plan informs:	TE informed by:
IRP	<ul style="list-style-type: none"> Market changes Charging needs 	<ul style="list-style-type: none"> System needs Forecasts Supply costs
DRP	<ul style="list-style-type: none"> Locational forecasts Program opportunities 	<ul style="list-style-type: none"> Locational system needs
Programs	<ul style="list-style-type: none"> Product roadmap 	<ul style="list-style-type: none"> Customer insights



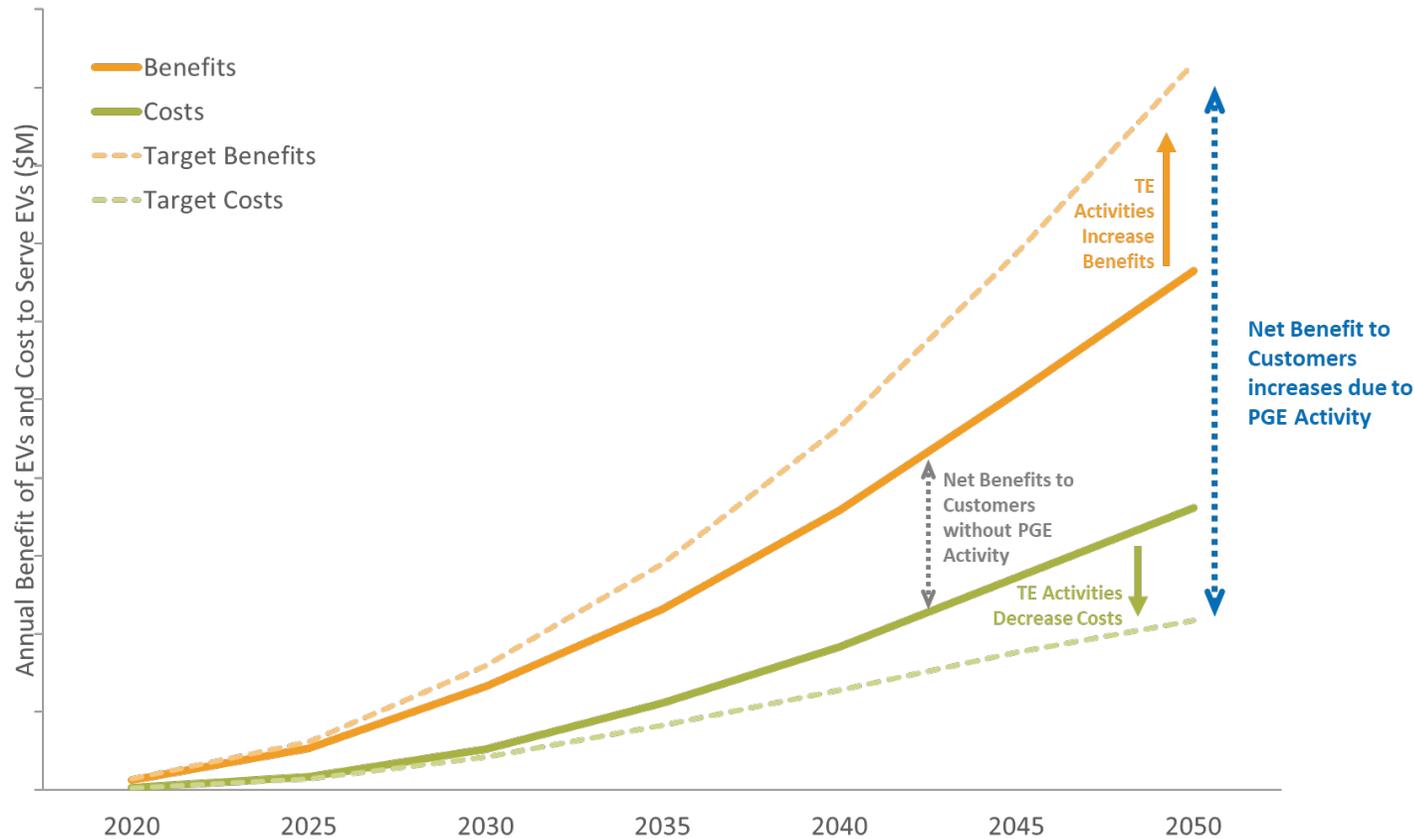
Charging infrastructure investment must continue to meet future EV fueling demands

Number of public EV ports required
PGE Service Area



Source: PGE 2019 TE Plan, Charging Needs Assessment

Transportation electrification creates value for all customers



- Downward rate pressure: Fixed costs spread over additional kWh sales
- \$10M benefits in 2020
- > \$500M/year by 2050

Partnership is driving change



Transit electrification

- TriMet: 5 e-bus operational
- SMART: 2 e-bus operational
- Planning for 10-20 buses in 2020
- PGE plan to own/operate chargers



Expanding charging access

- 6 new Electric Avenue sites
- Charging make-ready offering
- Residential smart charging rebates



Fleet electrification

- Daimler demonstration partnership
- Technical assistance and training
- Fleet electrification studies for PGE and our customers



R&D and innovation

- Test Bed smart charging
- V2G demonstration
- Shared circuit: distribution deferral
- I-5 Heavy Duty Trucking



Clean Fuels Program

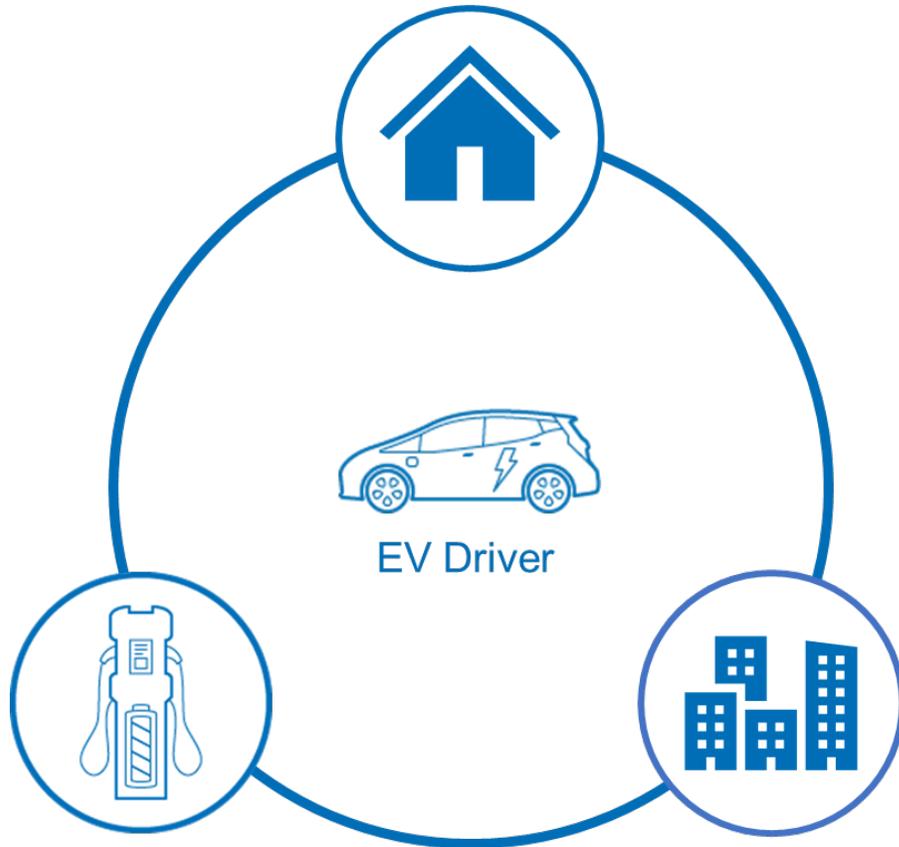
- Drive Change Fund
- 4 electric school buses
- Community awareness campaign
- Innovative e-mobility hub



EVS33 event & ecosystem

- Position Oregon as a leader in decarbonization
- Elevate profile of TE across the state

Creating a charging ecosystem



Support growth

Ensure charging adequacy to support EV adoption goals

Customer experience

Simple, standard experience across service area

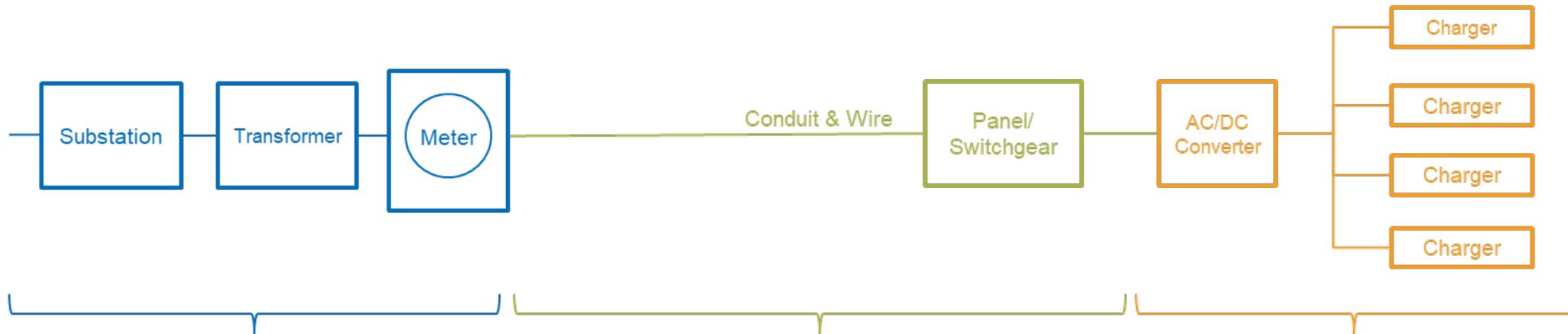
Data & insights

Charging behavior across ecosystem

Optimize charging behavior

Encourage charging at the right time, place, and speed

Utility investment is critical to meeting Oregon's decarbonization goals



Traditional Distribution Infrastructure:

Typically, PGE builds & owns infrastructure up to the meter and charges each customer for this work. The customer receives a discount on that work in the form of a “line extension allowance” based on their projected energy use.

Make-ready Infrastructure:

Typically, new infrastructure that is behind the meter, even for new service is considered the customers' responsibility. PGE will make investments in make-ready assets, to support the rapid deployment of EV charging.

Charging Infrastructure:

Typically, new infrastructure that is behind the meter, even for new service is considered the customers' responsibility. In certain applications (e.g. transit) PGE will install, own, operate, and maintain behind the meter, charging assets, to support the rapid deployment of EV charging.

Fleet electrification

Customer fleet planning

Collaborative customer/grid planning

Proactive investments

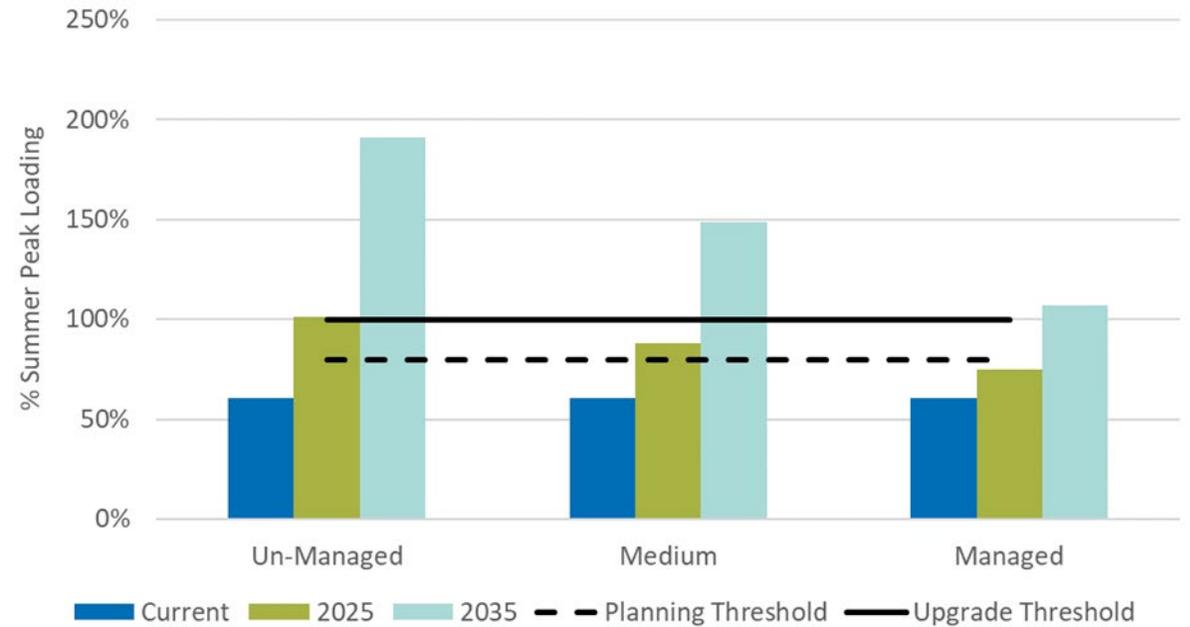
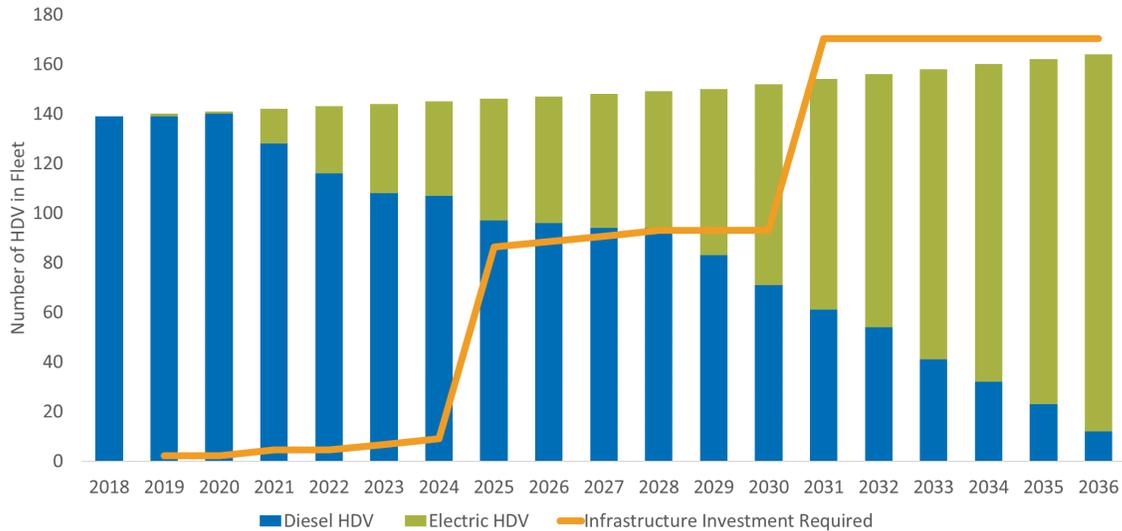
Distribution system and charging grid-connected charging infrastructure to support fleet electrification

Rates

Innovative rate structures that help customers transition, save money, and manage their business



Planning and customer partnerships will increase pace and minimize cost



Upcoming activities

UM 1826

- 11/22:
2020 CFP
Program Plan

UM 1811

- 12/31:
Tariffs and revised
proposals for
residential and
business charging

UM 2033

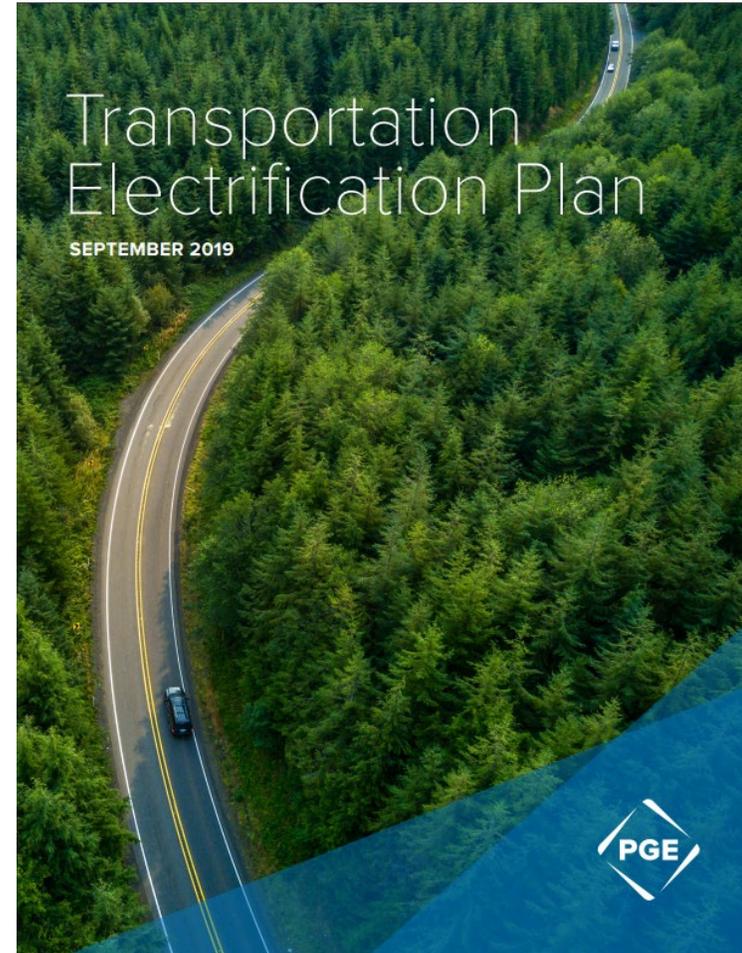
- 2/13 Public
Meeting on TE
Plan

Thank you!

Aaron Milano

Aaron.Milano@pgn.com

503-464-7547



<https://www.portlandgeneral.com/-/media/public/our-company/documents/pge-2019-transportation-electrification-plan>

Appendices

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Customer needs

Lower Cost

- First cost
- Total cost of ownership (e.g. fuel and infrastructure costs)

Better Product

- Model availability
- Functionality (e.g. range)
- Dealer sales process
- Standardization (e.g. charging ports)

Awareness

- Familiarity with technology
- Consideration in buying process
- Equitable access
- Anxiety of the unknown

Infrastructure

- Fueling infrastructure availability
- Fueling capacity
- Network interoperability/customer experience

Ongoing activities

UM 1811

- TriMet
- Electric Avenue
- Technical Assistance
- Future:
 - Residential smart charging
 - Business charging rebates

UM 1826

- Drive Change
- School Bus
- Test bed smart charging demo
- Community awareness campaign
- e-mobility hub

UM 2033

- TE Plan
- Charging Needs assessment

Emerging activities and R&D

- Make-ready
- Transit & School Charging
- Daimler
- Pole Charging
- Shared Circuit/distribution deferral

Customers are committing to change

Company	U.S. EV Fleet commitments
	Ordered 100,000 electric delivery vans from Rivian (by 2024)
	Acquired 1,000 EV delivery vehicles in 2019. Committed to buy 20 e-HDVs
	Committed to buy 125 e-HDVs & developing a proprietary EV delivery truck
	Purchased 63 EV cargo vans. Committed to zero fleet emissions by 2050
	Committed to convert 20% of their fleet to alternative fuels by 2025
	Committed to buy 10 e-HDVs
	Committed to buy 40 e-HDVs; goal: convert entire fleet to renewables by 2025
	Committed to buy 100 e-HDVs
	Plan to add 60 EVs to sedan fleet by the end of 2020 Goal to meet 100 percent of energy needs with renewable energy by 2050
	By 2025, Lyft's shared platform will provide at least 1 billion rides per year using electric autonomous vehicles.



Auto manufacturers are investing big in electrification

OEM	Committed EV Investments (\$Billion)	Planned No. of EV Models by 2025
	\$ 91	80
DAIMLER 	\$ 42	130
	\$ 20	23
	\$ 11	28
 FIAT CHRYSLER AUTOMOBILES	\$ 10	32
Other OEMs	\$74	114
TOTAL	\$ 248	407



- Daimler Trucks CEO, declaring the “future is electric”
- Daimler to convert Swan island facility to produce electric trucks



- Ford announced their electric F150 to come to market in early 2020s
- Towing capacity >1M lbs.
- Competition expected (Tesla and Rivian)



- Most new models will have 250+ mi range
- Variety of vehicle types and form factors to meet customers’ transportation needs

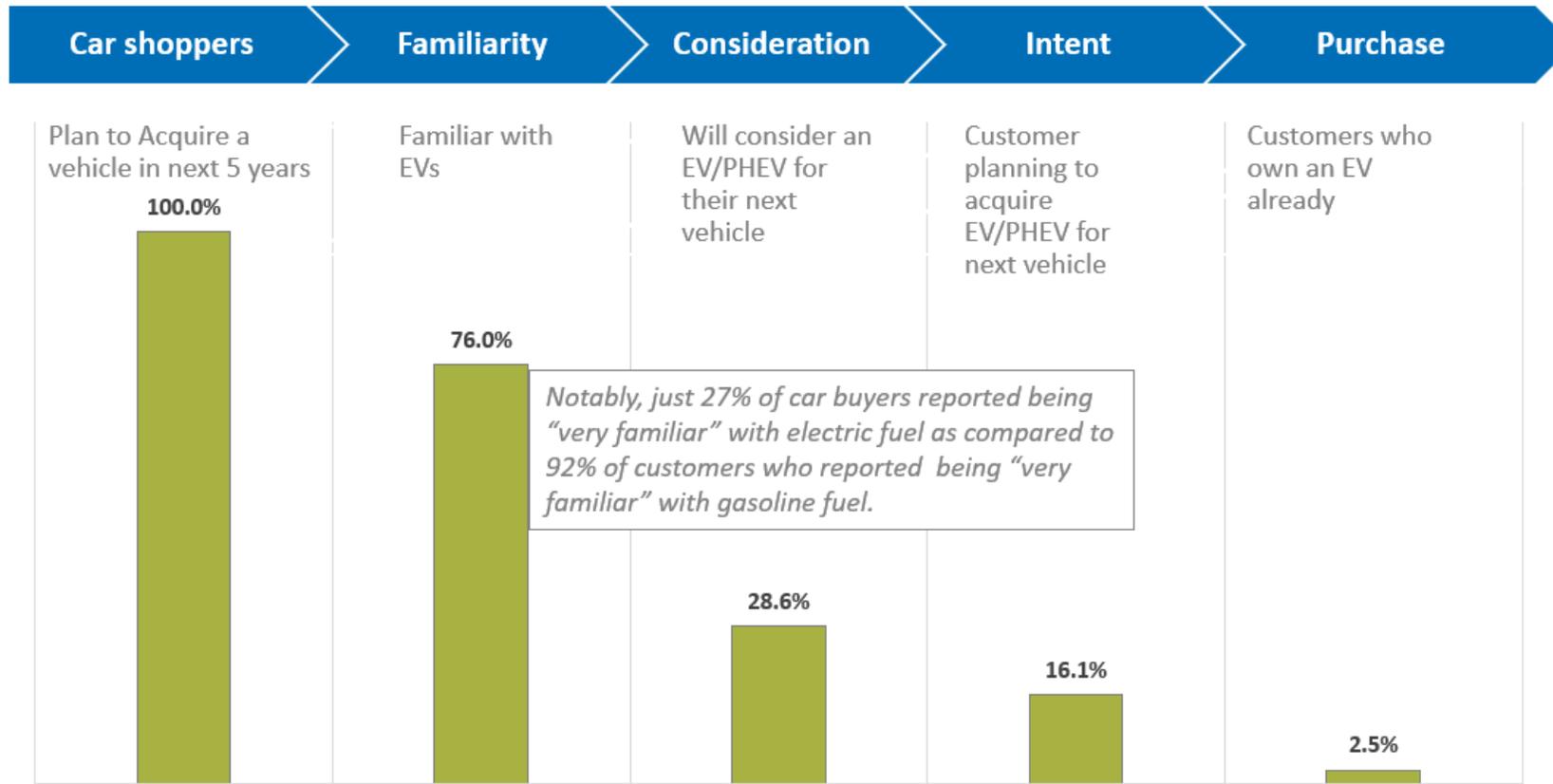
Infrastructure is coming but must keep pace



Over a 10-year period ending in 2027, Electrify America will invest \$2B in ZEV infrastructure

EV purchase funnel

Car buyers in PGE service area



Source: PGE EV Survey Among Residential Customers (October, 2018)