

# Transportation Electrification

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Portland General Electric Company

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# Electric transportation is a climate imperative



## Decarbonize

Reduce GHG emissions by more than 80% by 2050



## Electrify

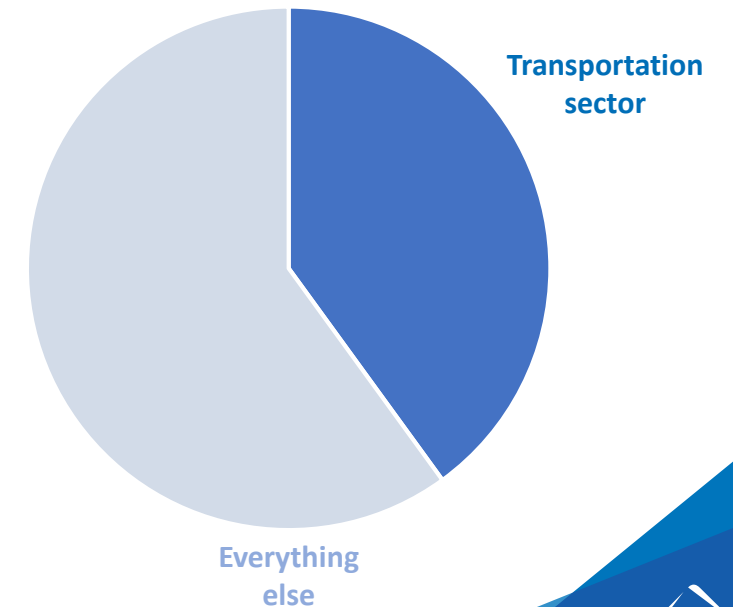
Increase electricity to 50% of energy use by 2050



## 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.*



# Customer needs

## 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

## Lower Cost

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

## Fueling infrastructure availability

- Fueling capacity
- Network interoperability/customer experience



# EVs are Better



- More Powerful
- Cheaper to Operate
- Can Charge Anywhere
- Cleaner

# Long-term savings are not accessible due to up-front costs

Class	ICE		Electric	
Truck	Ford F150	\$24k	Cybertruck*	\$39k
Crossover/SUV	Rogue	\$22k	Chevy Bolt	\$30k
Sedan	Toyota Camry	\$21k	Nissan Leaf	\$27k

*\*Not commercially available.*



ICE Vehicle Lease		Electric Vehicle Lease	
Lease	\$199/mo.	Lease	\$249/mo.
Fuel	\$150/mo.	Fuel	\$50/mo.
<b>Total</b>	<b>\$349/mo.</b>	<b>Total</b>	<b>\$299/mo.</b>



# Lower costs will accelerate fleet electrification

## Lyft adds 200 electric vehicles to its fleet in Denver

It's the company's largest EV deployment to date.



Mariella Moon, @mariella\_moon  
11.15.19 in Transportation

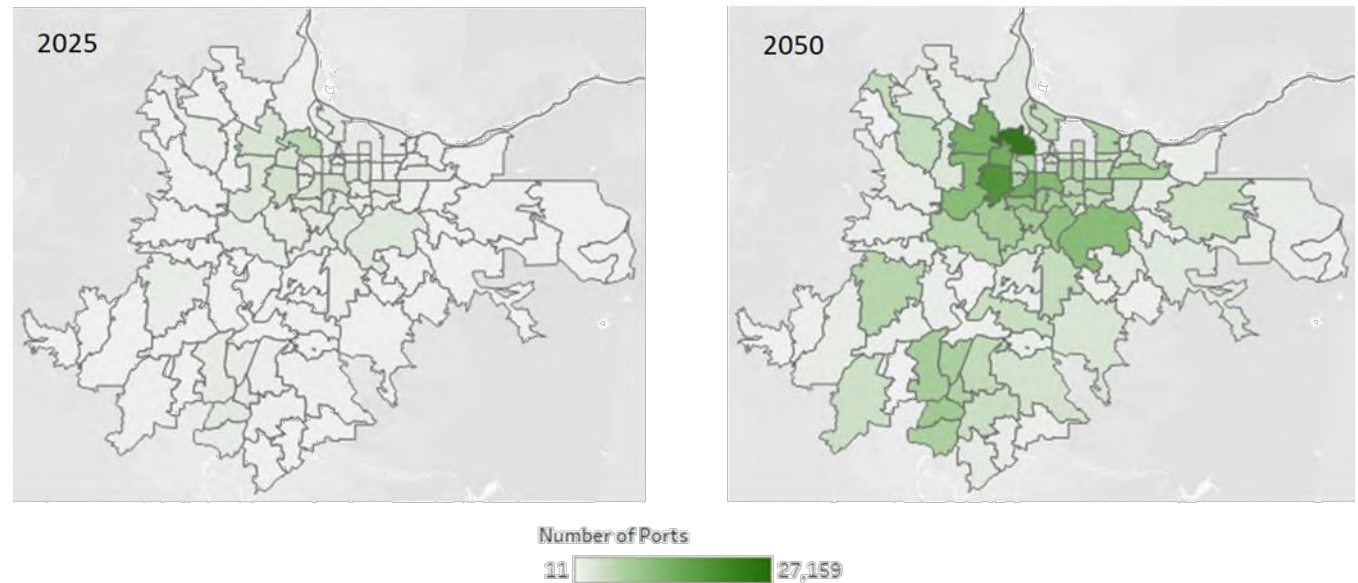
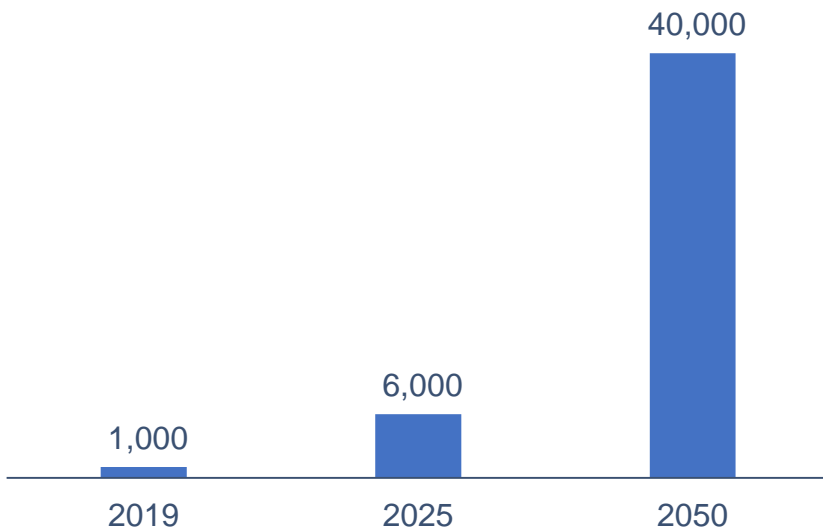
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# Charging infrastructure investment must continue to meet future EV fueling demands

Number of public EV ports required  
PGE Service Area

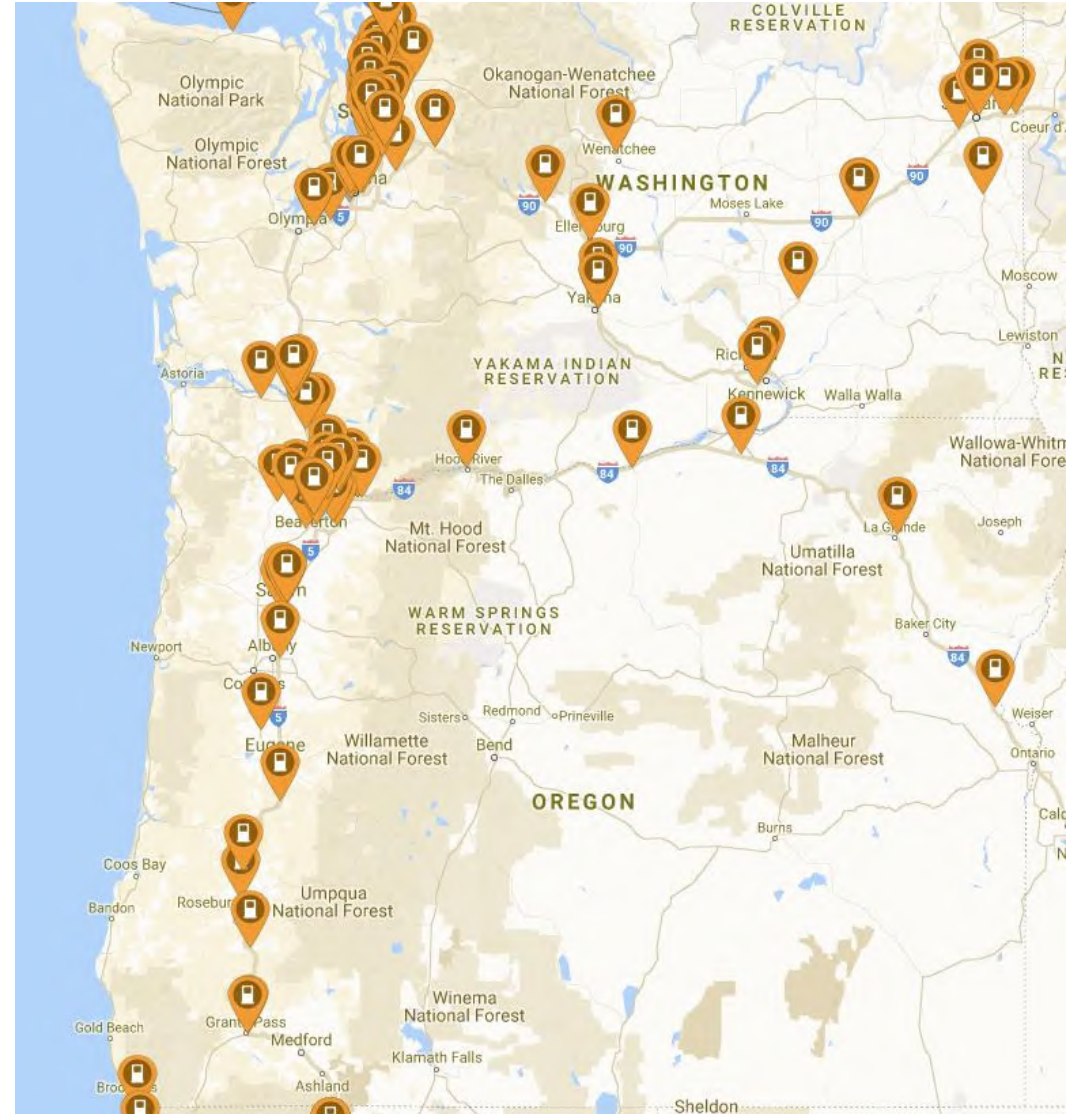


Source: PGE 2019 TE Plan, Charging Needs Assessment



# We need to expand access

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# Accelerated deployment is necessary



# 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



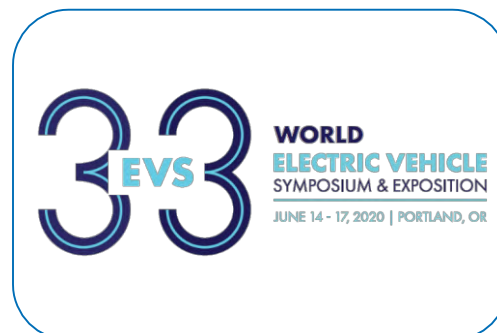
## R&D and innovation

- 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

# Policy Opportunities

## Planning & Utility Investment

- planning studies to ensure communities are in front of charging needs
- utilities role in accelerating deployment of fueling infrastructure

## Workforce Development

- create jobs, ensure equipment reliability, reduce long-term operation costs
- reduce long-term operation costs

## Codes and Standards

- vehicle and charging standards
- building codes to reduce infrastructure costs

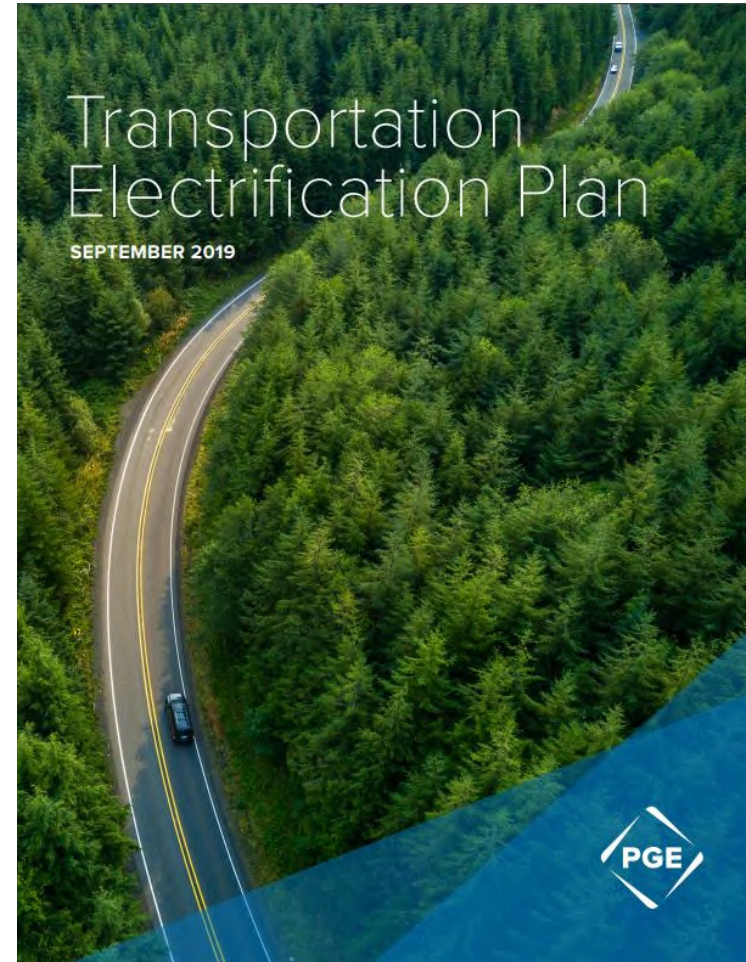


# Thank you!

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



# Appendices

Transportation Electrification Plan (UM 2033)

November 21, 2019

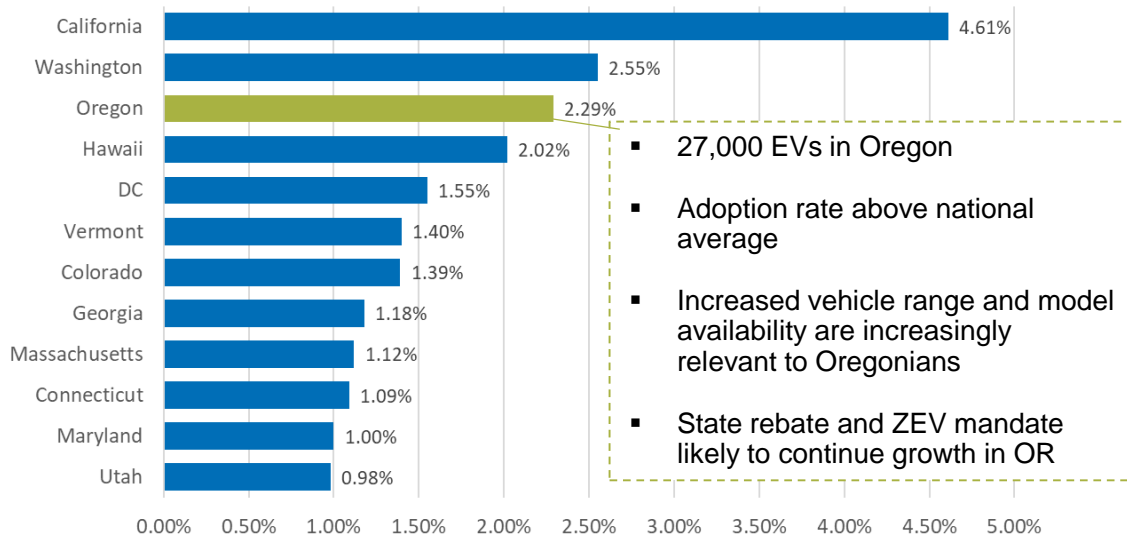


# EV market at a glance

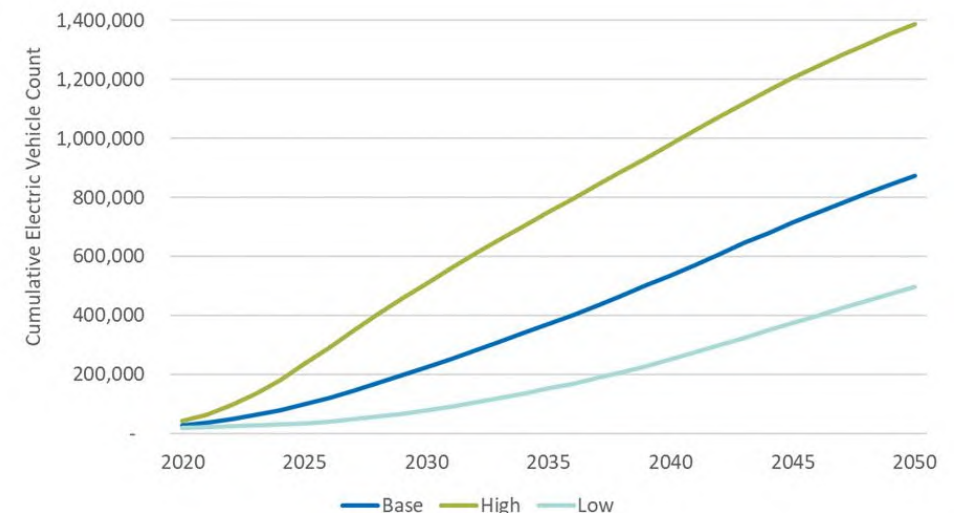
- 100M EVs projected in USA by 2040
- Auto manufacturers have committed >\$250B global investment in new EV models
- 400 EV models globally by 2025
- Transportation companies have committed more than \$5B to electrify more than 100,000 delivery trucks and vans



% of new vehicle Sales that are Electric



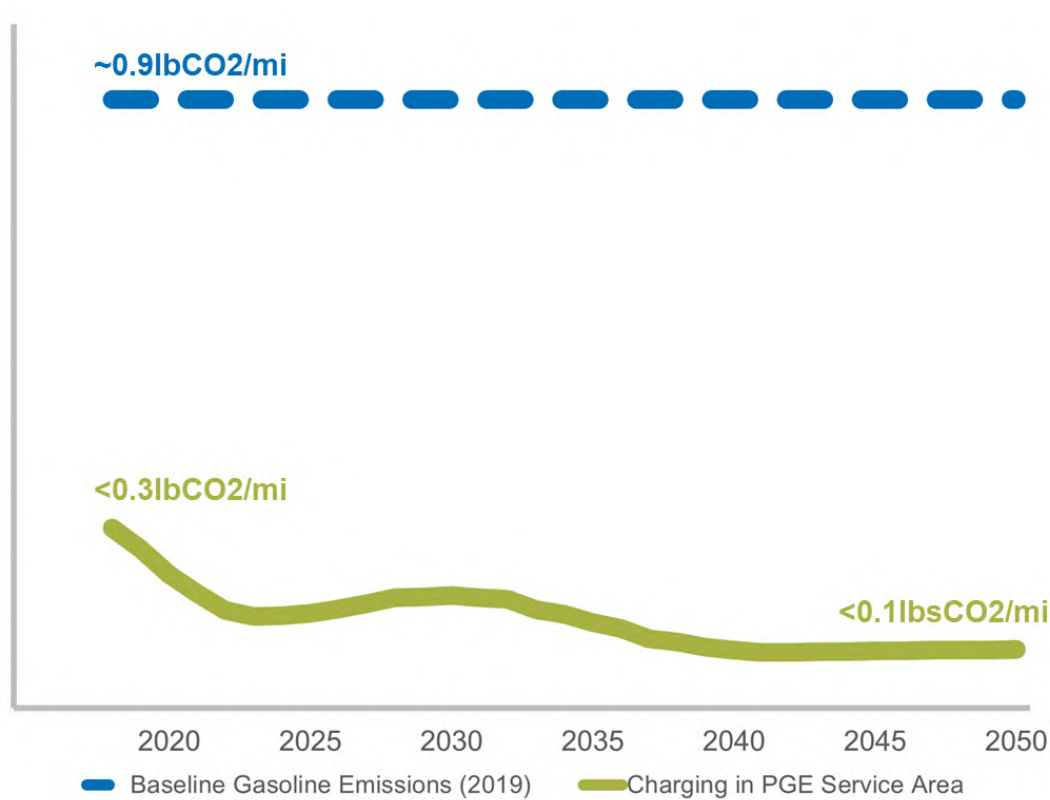
EV Forecast, PGE Service Area



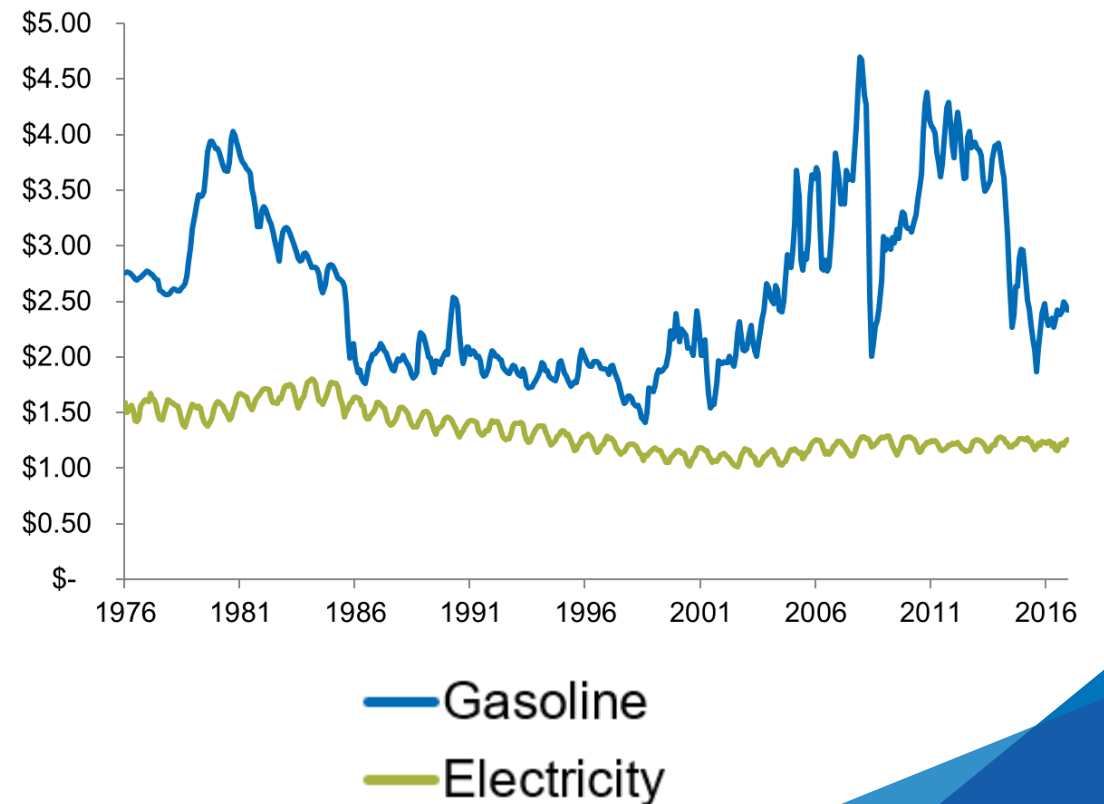


# Electricity is clean, affordable, local

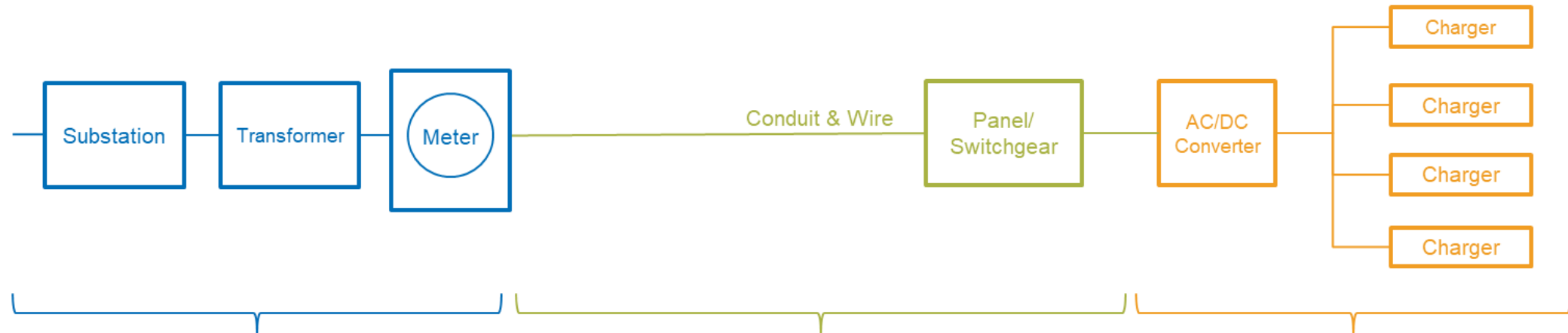
Carbon Intensity of new gas vehicle vs. EV



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



# 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.






# 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
<b>TOTAL</b>	<b>\$ 248</b>	<b>407</b>



- 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

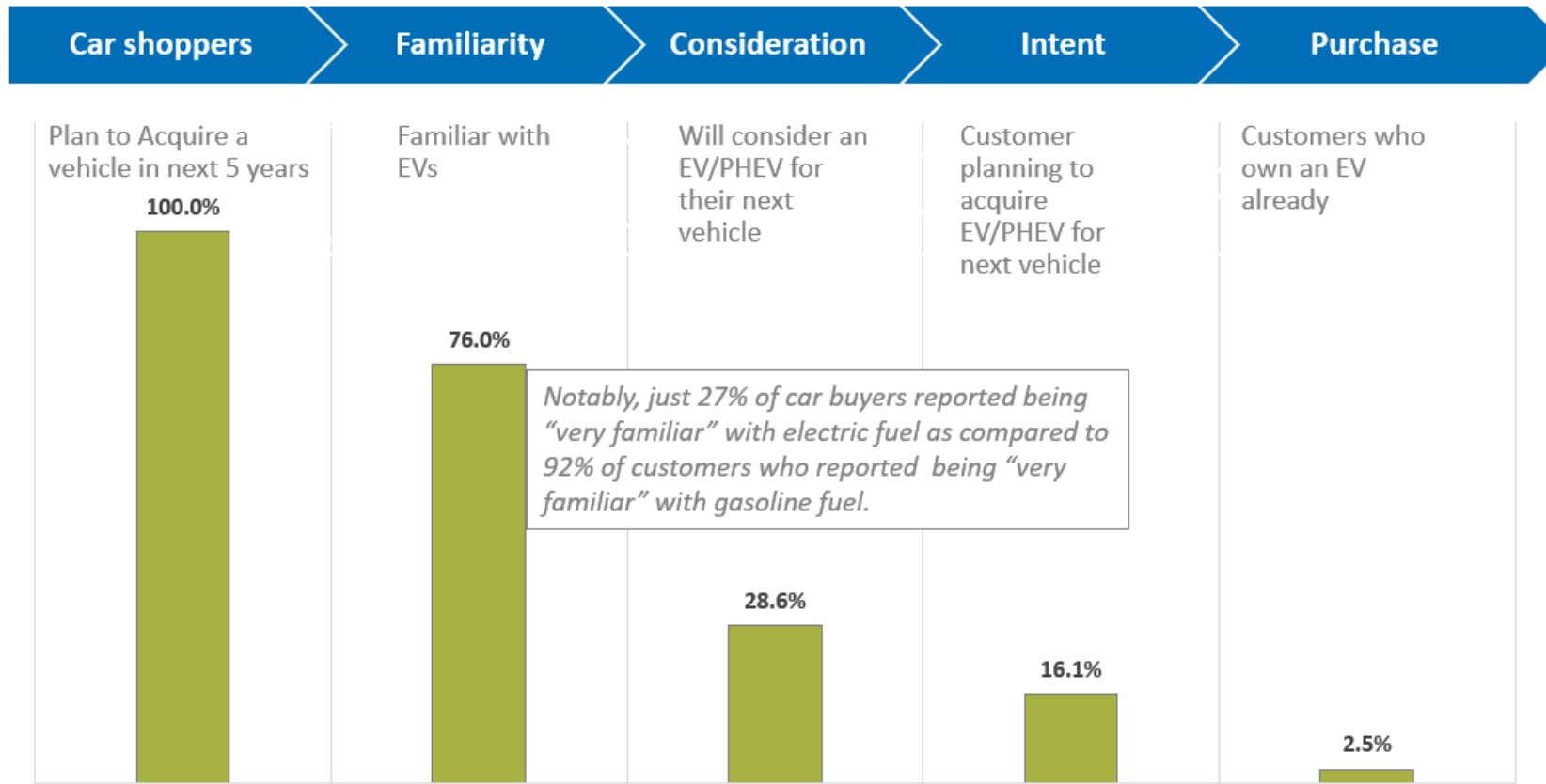
# Infrastructure is coming but must keep pace



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)