2021 Biennial Zero Emission Vehicle Report

Senate Interim Committee on Energy and the Environment

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November 16, 2021

OREGON DEPARTMENT OF ENERGY

OREGON DEPARTMENT OF ENERGY

Leading Oregon to a safe, equitable, clean, and sustainable energy future.

Our Mission

The Oregon Department of Energy helps Oregonians make informed decisions and maintain a resilient and affordable energy system. We advance solutions to shape an equitable clean energy transition, protect the environment and public health, and responsibly balance energy needs and impacts for current and future generations.

What We Do

On behalf of Oregonians across the state, the Oregon Department of Energy achieves its mission by providing:

- A Central Repository of Energy Data, Information, and Analysis
- A Venue for Problem-Solving Oregon's Energy Challenges
- Energy Education and Technical Assistance
- Regulation and Oversight
- Energy Programs and Activities

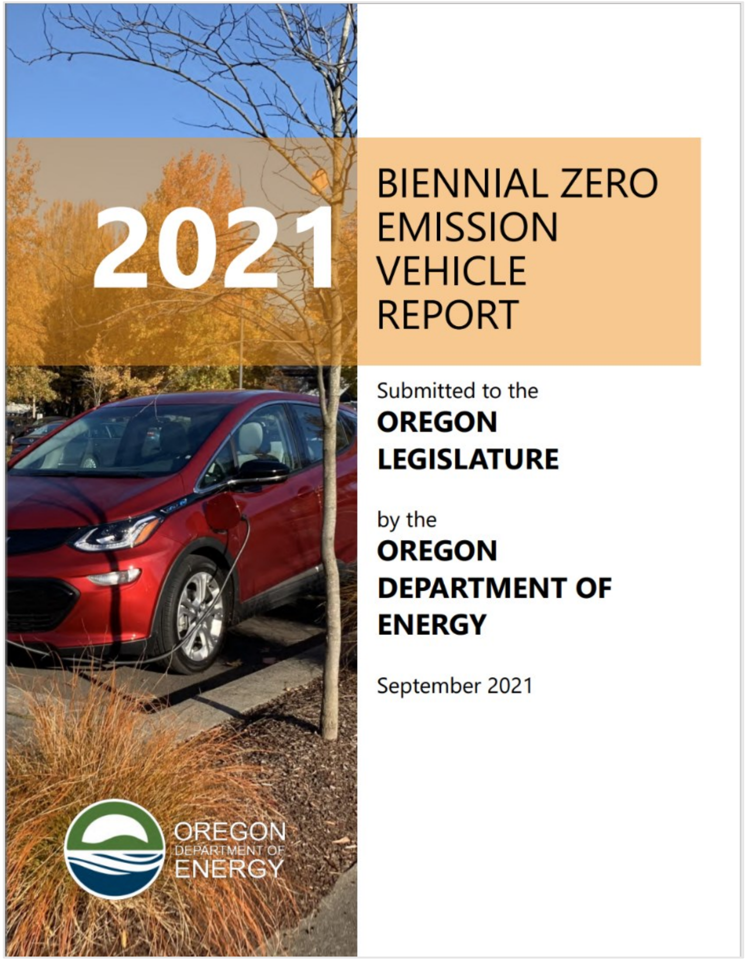
2021 BIENNIAL ZEV REPORT

SB 1044 (2019)

Established the ZEV adoption targets Oregon would need to achieve to meet the state's GHG reduction targets. Directed the Oregon Department of Energy to produce a biennial report assessing the state's progress.

Report Requirements

Shaped by existing studies, market reports, polling data, and other publicly-available information. Outline the general state of transportation electrification and respond to 11 specific reporting areas.



www.oregon.gov/energy/energy-oregon/Pages/BIZEV.aspx

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About the Report

Zero-Emission Vehicles:

Battery Electric Vehicles (BEVs)

Plug-in Hybrid Electric Vehicles (PHEV)

Fuel Cell Electric Vehicles (FCEV)

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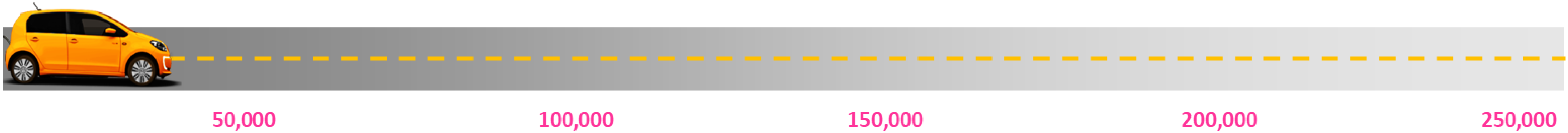
OREGON'S ZEV TARGETS

- By 2020: **50,000** registered ZEVs on Oregon roads
- By 2025: **250,000** registered ZEVs on Oregon roads
- By 2030: **25% of registered vehicles**; 50% of new vehicles sold annually are ZEVs
- By 2035: **90% of new vehicles** sold annually are ZEVs



OREGON’S GHG REDUCTION TARGETS

- By 2020: achieve GHG levels that are **10 percent below 1990 levels** (resulting in emissions of 52 million metric tons of carbon dioxide equivalent, MMTCO2e)

- By 2035: achieve GHG levels that are **45 percent below 1990 levels** (resulting in 32 MMTCO2e)

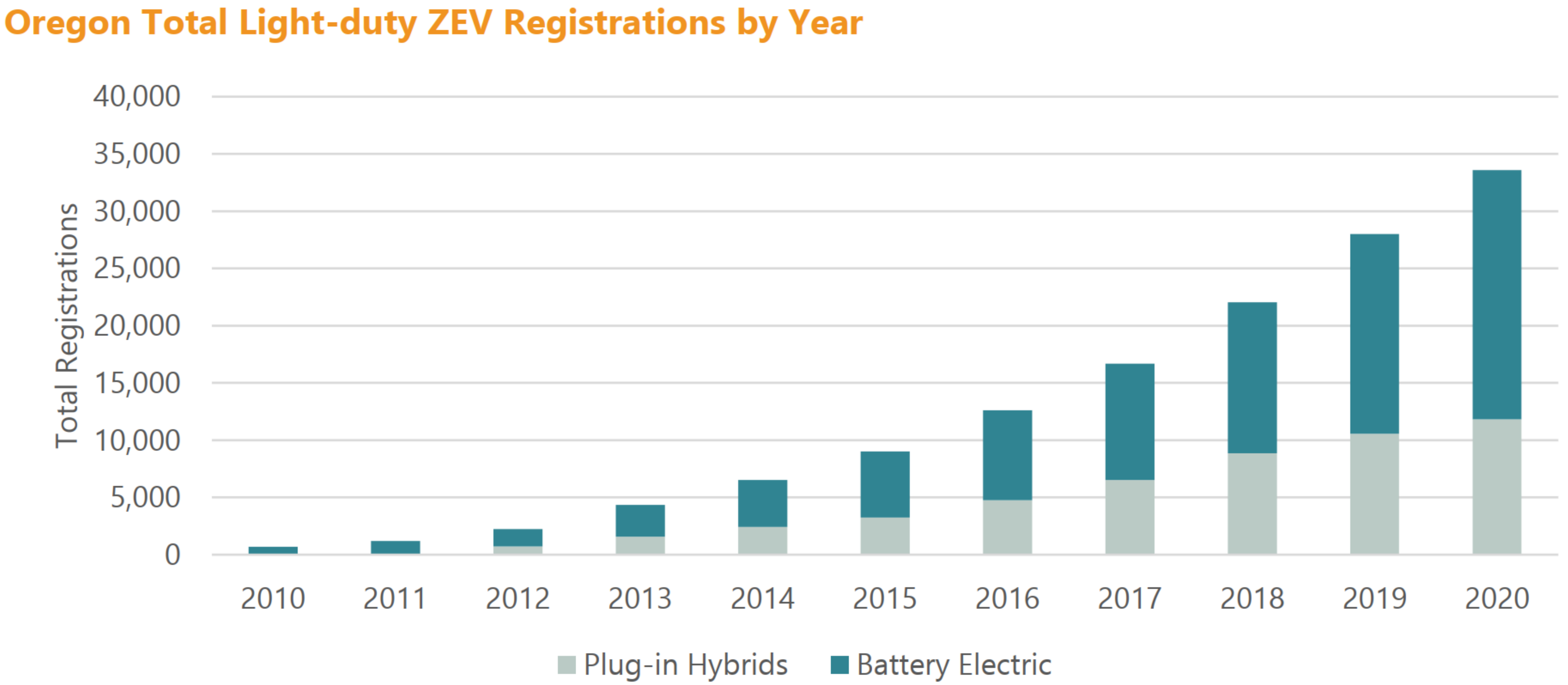
- By 2050: achieve GHG levels that are **80 percent below 1990** levels (resulting in 12 MMTCO2e)

ZEV SALES FIGURES AND PROGRESS

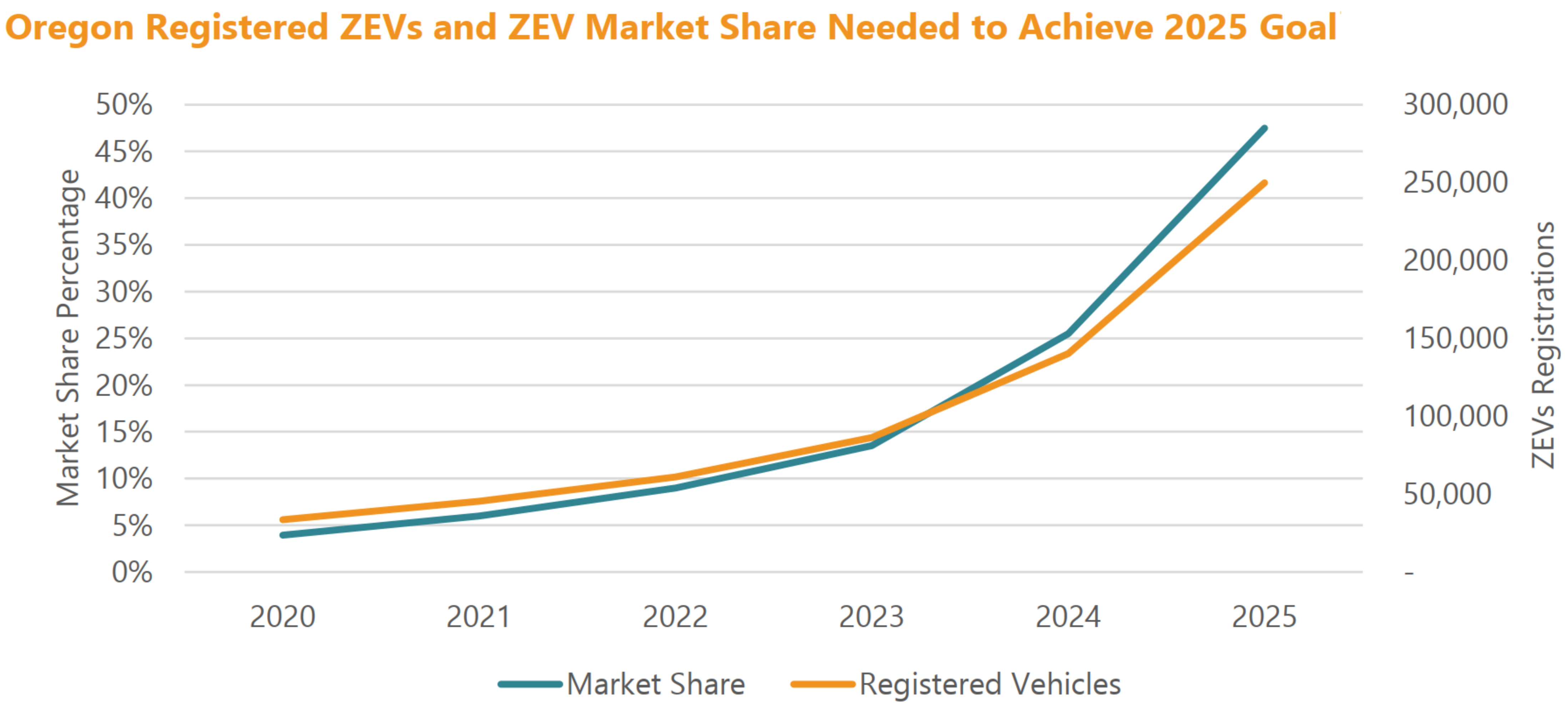
Buying an electric vehicle, Photo credit: pexels.com

ZEV SALES FIGURES AND PROGRESS

As of June 2021: 38,482 Registered ZEVs in Oregon

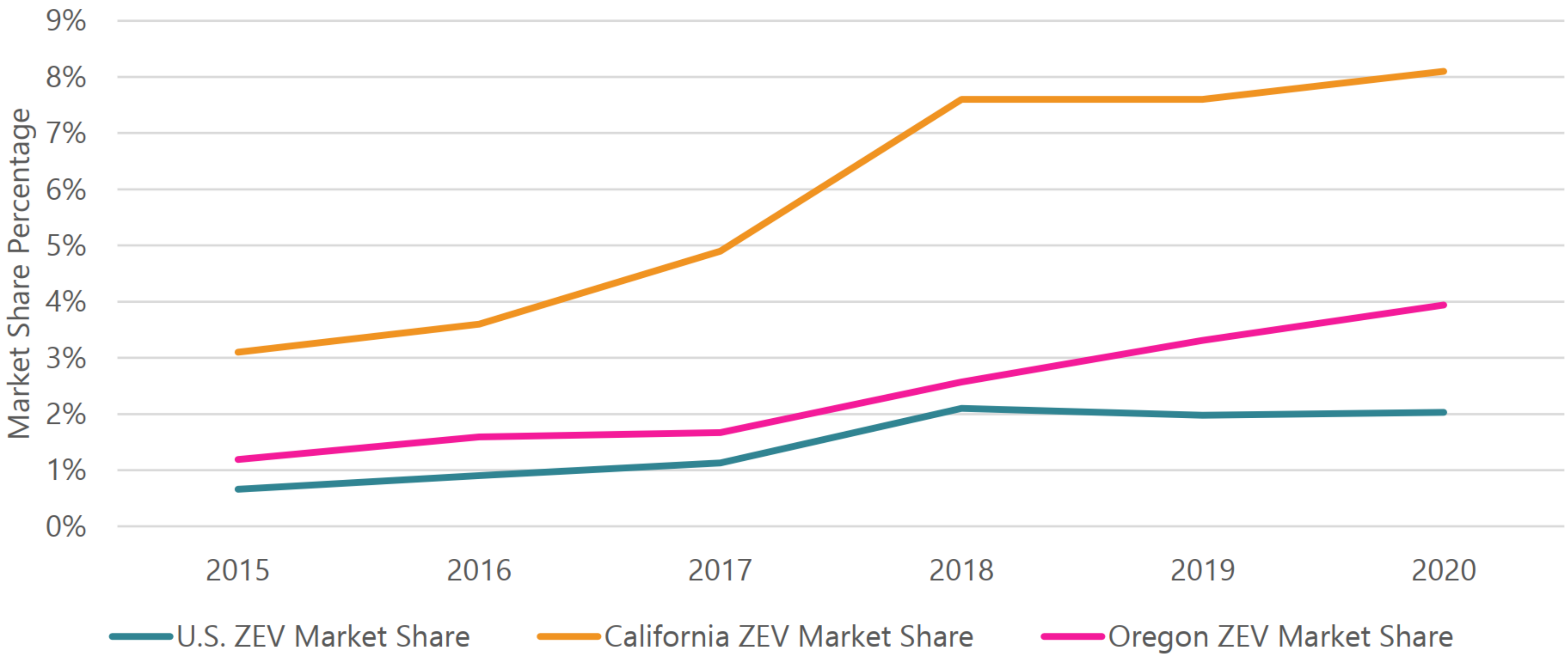


ZEV SALES FIGURES AND PROGRESS



ZEV SALES FIGURES AND PROGRESS

U.S., California, and Oregon ZEV Market Share

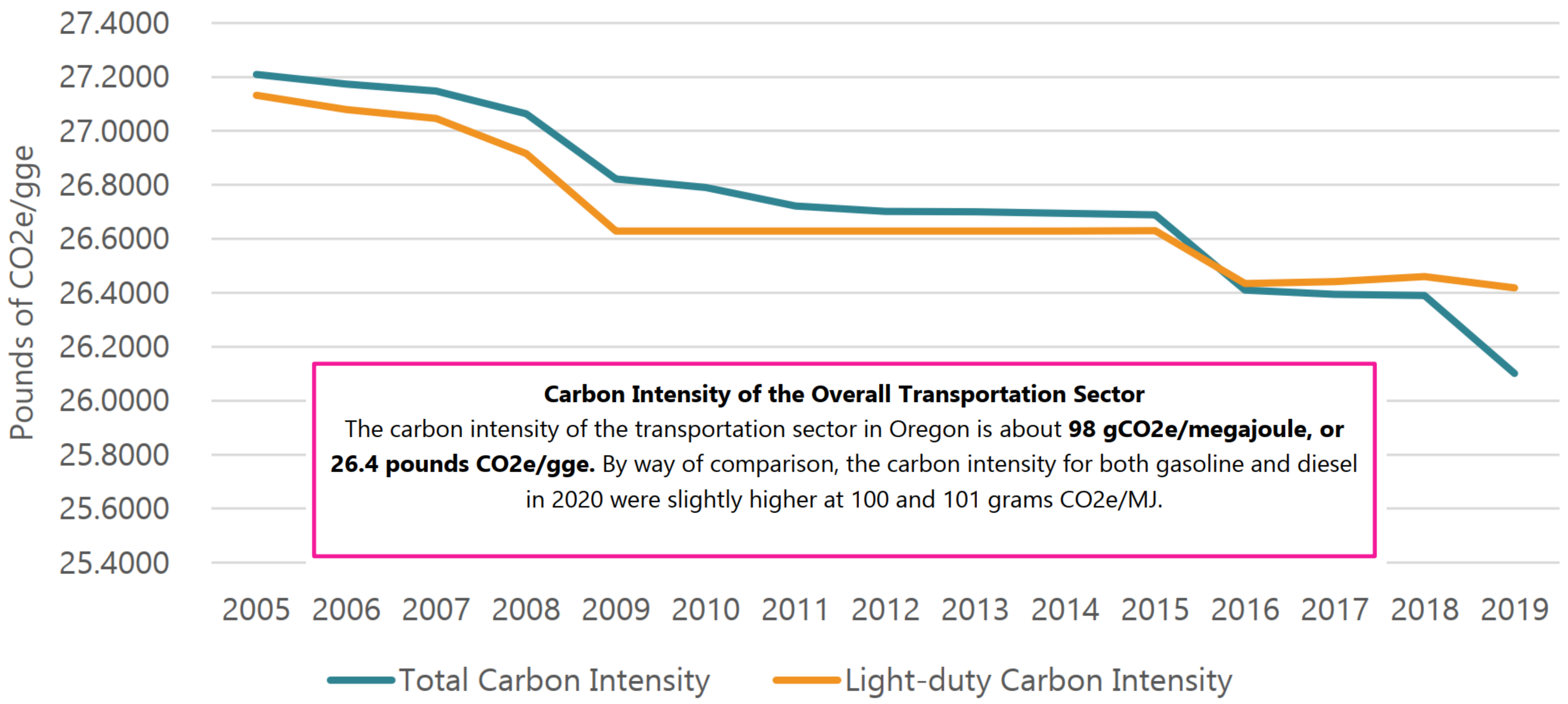


TRANSPORTATION SECTOR CARBON INTENSITY

PDX canopy, Portland, Ore., Photo Credit: Eclectic Jack via Flickr

TRANSPORTATION SECTOR CARBON INTENSITY

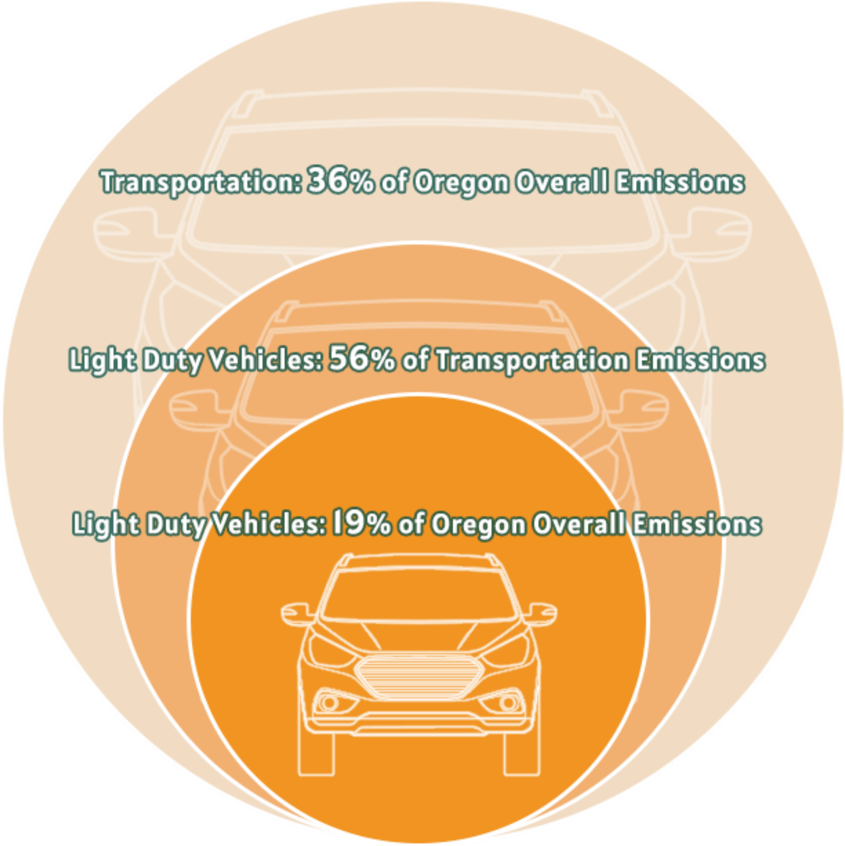
On-Highway Fuel Carbon Intensity by Year and Sector



ZEV IMPACTS ON GHG EMISSIONS

Aerial view of freeways, Portland, Ore., Photo credit: oeconline.org

ZEV IMPACTS ON GREENHOUSE GAS EMISSIONS

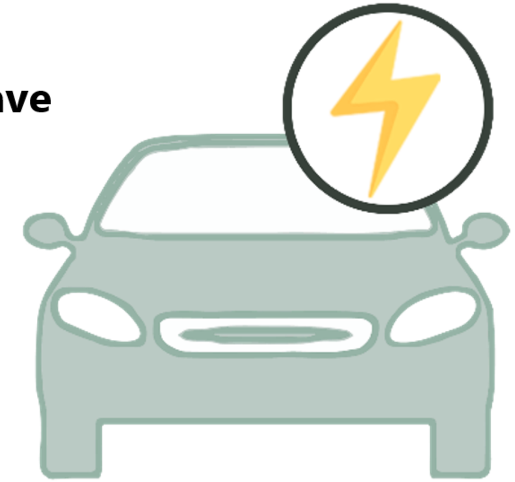


ZEVs at Work—With More Work to Do

The uptake of ZEVs (totaling about 33,579 by 2020) **avoided nearly 340,000 metric tons of in-state** and nearly 470,000 metric tons of lifecycle emissions from 2010-2019.

50,000 ZEVs (the state's 2020 target) **would have mitigated about 32,000 metric tons** of in-state emissions and 46,000 metric tons of lifecycle emissions in the year 2020 alone.

However, about **755,000 ZEVs would have been needed by 2020** to achieve the light-duty vehicles' proportionate share of the state's (in-state) GHG reduction target (10.4 MMTCO2e).



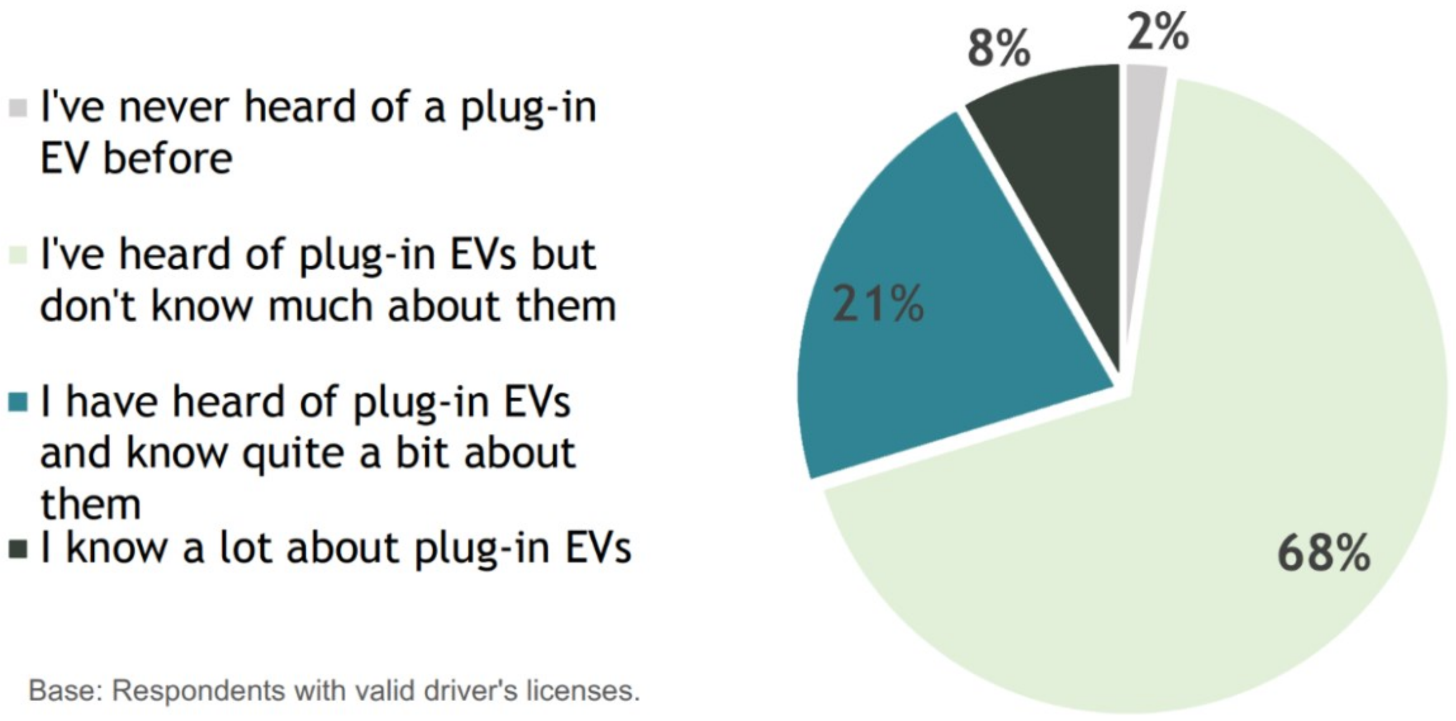
OREGONIANS AWARENESS OF ZEV OPTIONS + BENEFITS

Forth's interactive EV showroom, Portland, Ore., Photo credit: forthmobility.org

OREGONIANS' AWARENESS OF ZEV OPTIONS & BENEFITS

Consumer Reports Survey

Which of the following best describes your knowledge of plug-in electric vehicles?



Base: Respondents with valid driver's licenses.

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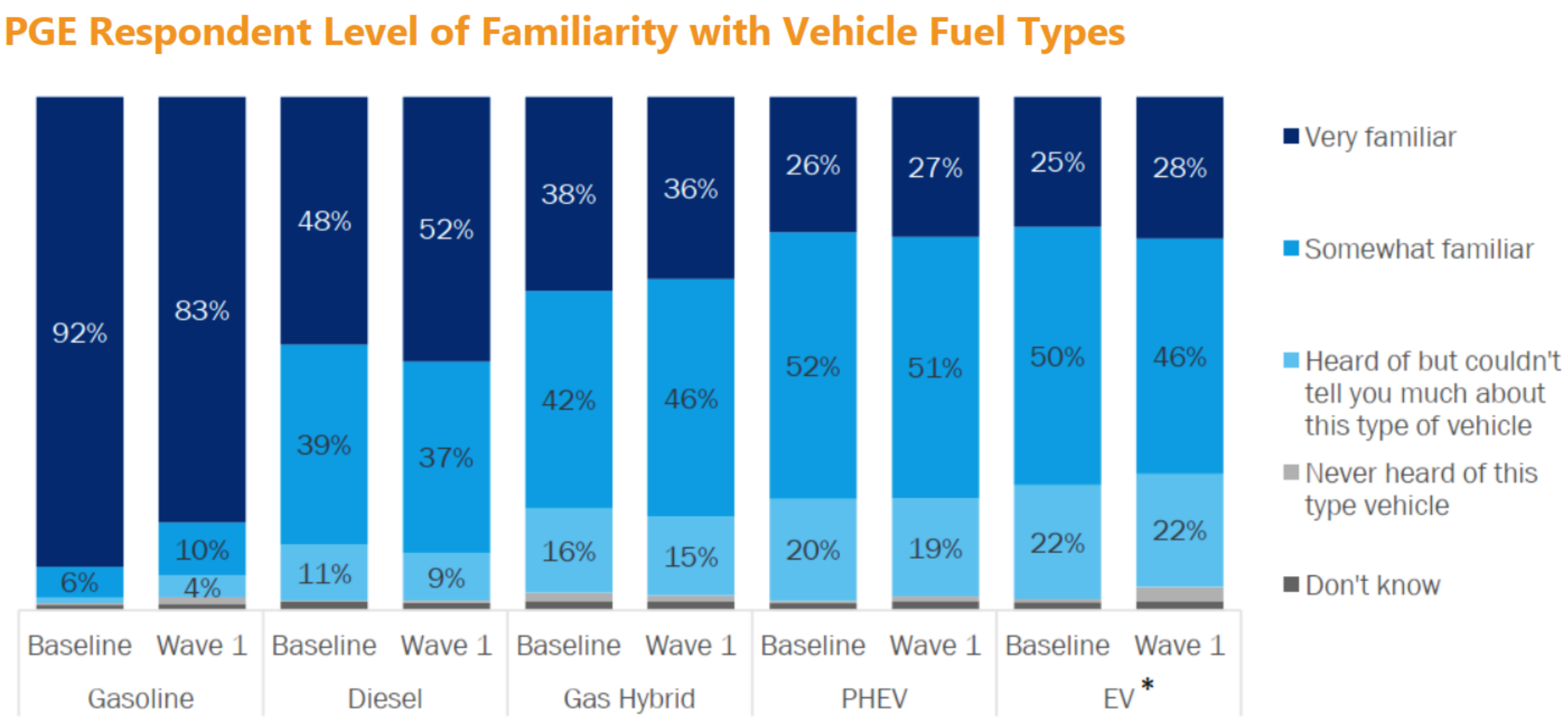
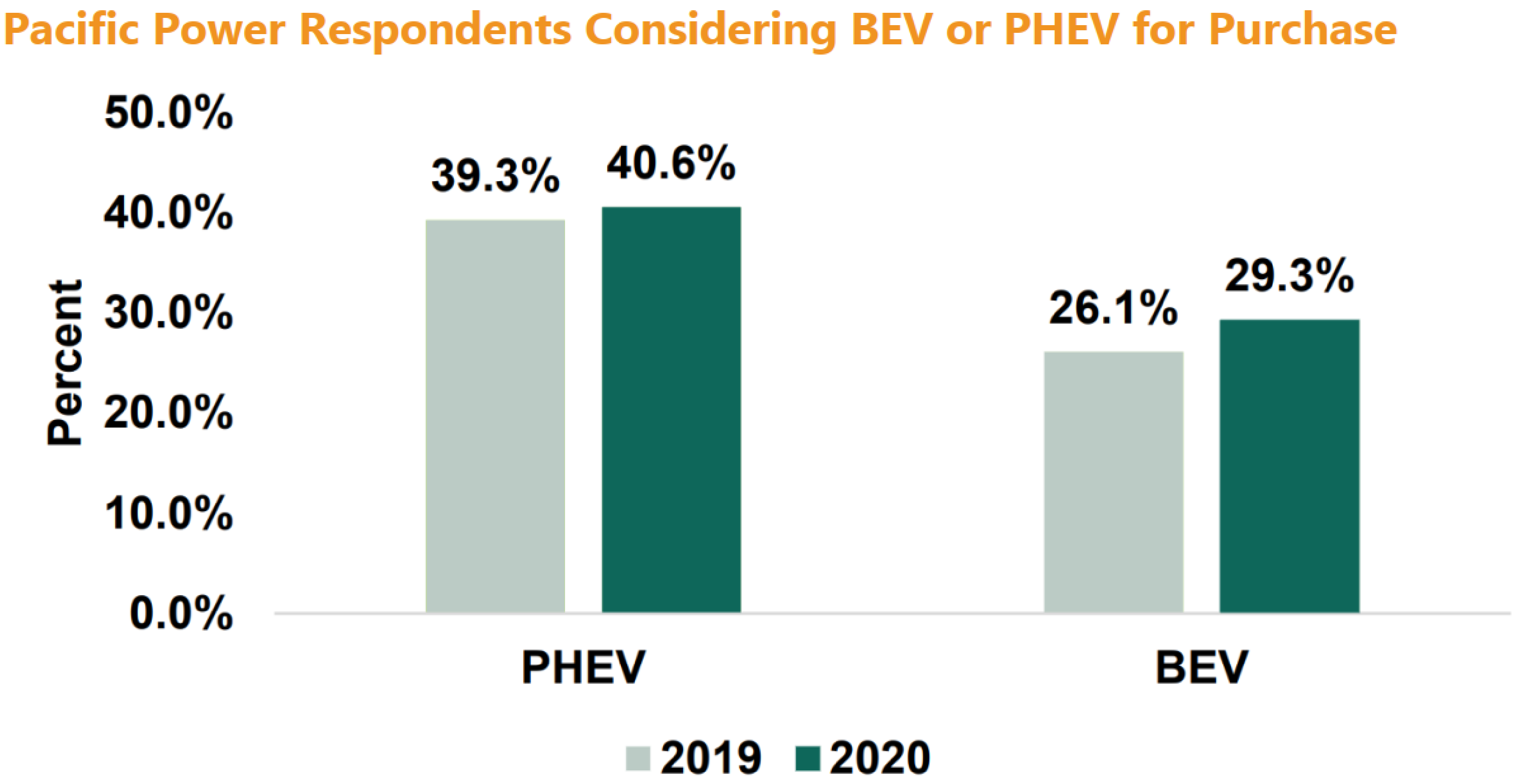
OREGONIANS' AWARENESS OF ZEV OPTIONS & BENEFITS



In this chart, EV refers to battery electric vehicles (BEVs)

OREGONIANS' AWARENESS OF ZEV OPTIONS & BENEFITS



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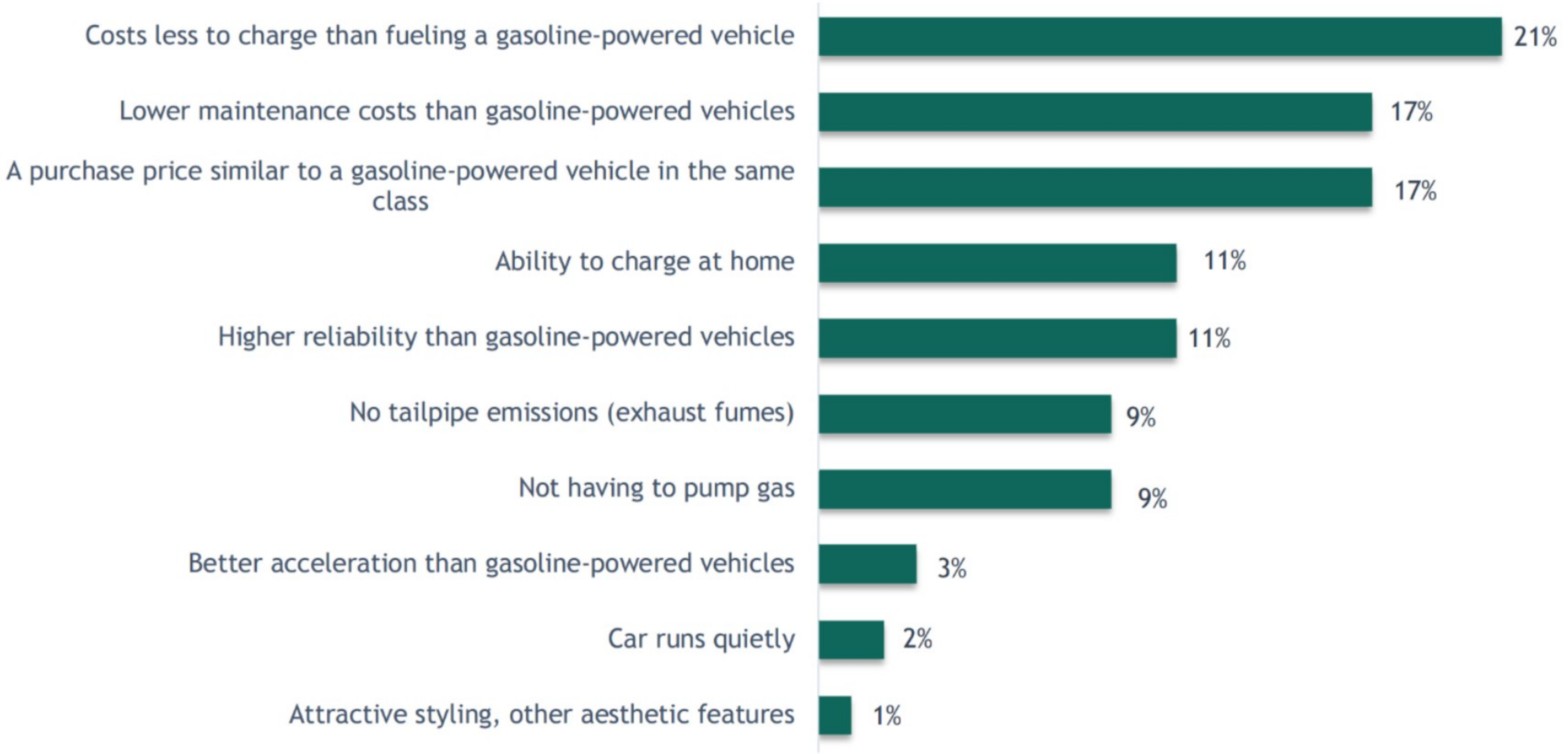
OREGONIANS' AWARENESS OF ZEV OPTIONS & BENEFITS

Consumer Reports – Electric Vehicle Attributes



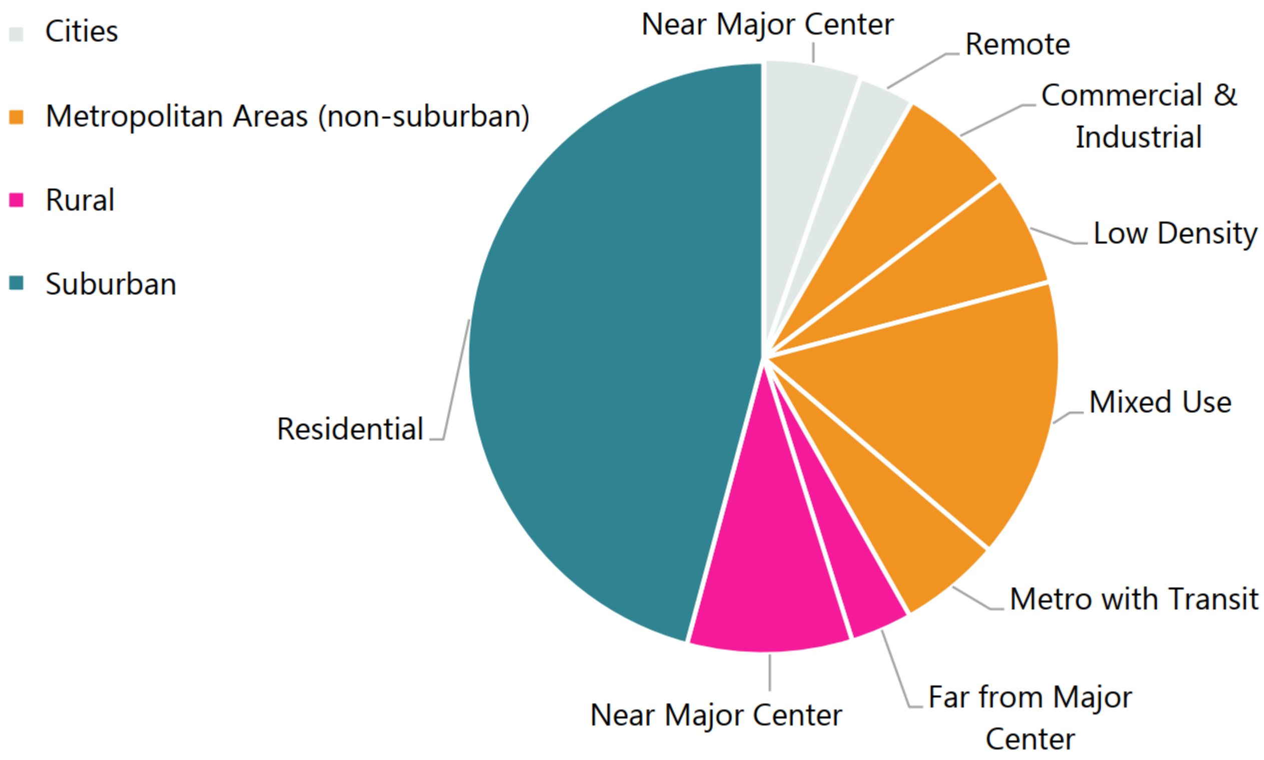
Base: Respondents with valid driver's licenses.
NOTE: Due to rounding, figures in some graphs may sum to more or less than 100%.

DISTRIBUTION OF ZEVS BY DEMOGRAPHIC GROUPS

Aerial view of an Oregon suburban neighborhood, Photo source: Flickr.com

DISTRIBUTION OF ZEVS BY DEMOGRAPHIC GROUPS

Number of ZEVs per Geographic Place Type

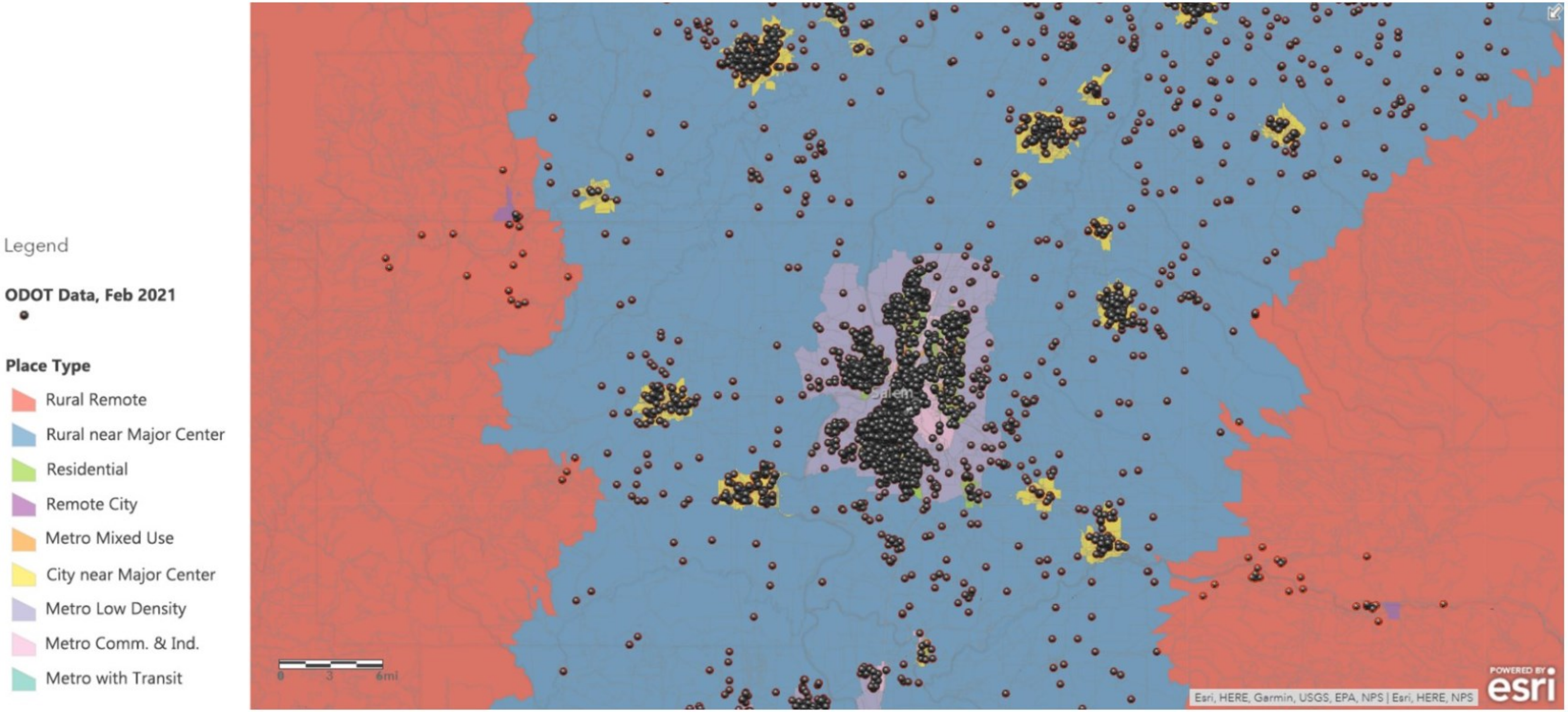


Number of ZEVs per Geographic Place Type

Place	Type	# of Evs
City	Near Major Center	1,872
	Remote	1,074
Metropolitan Areas	Commercial & Industrial	2,236
	Low Density	2,165
	Mixed Use	5,420
	Metro with Transit	1,959
Rural	Far from Major Center	1,186
	Near Major Center	3,172
Suburban	Residential	16,149

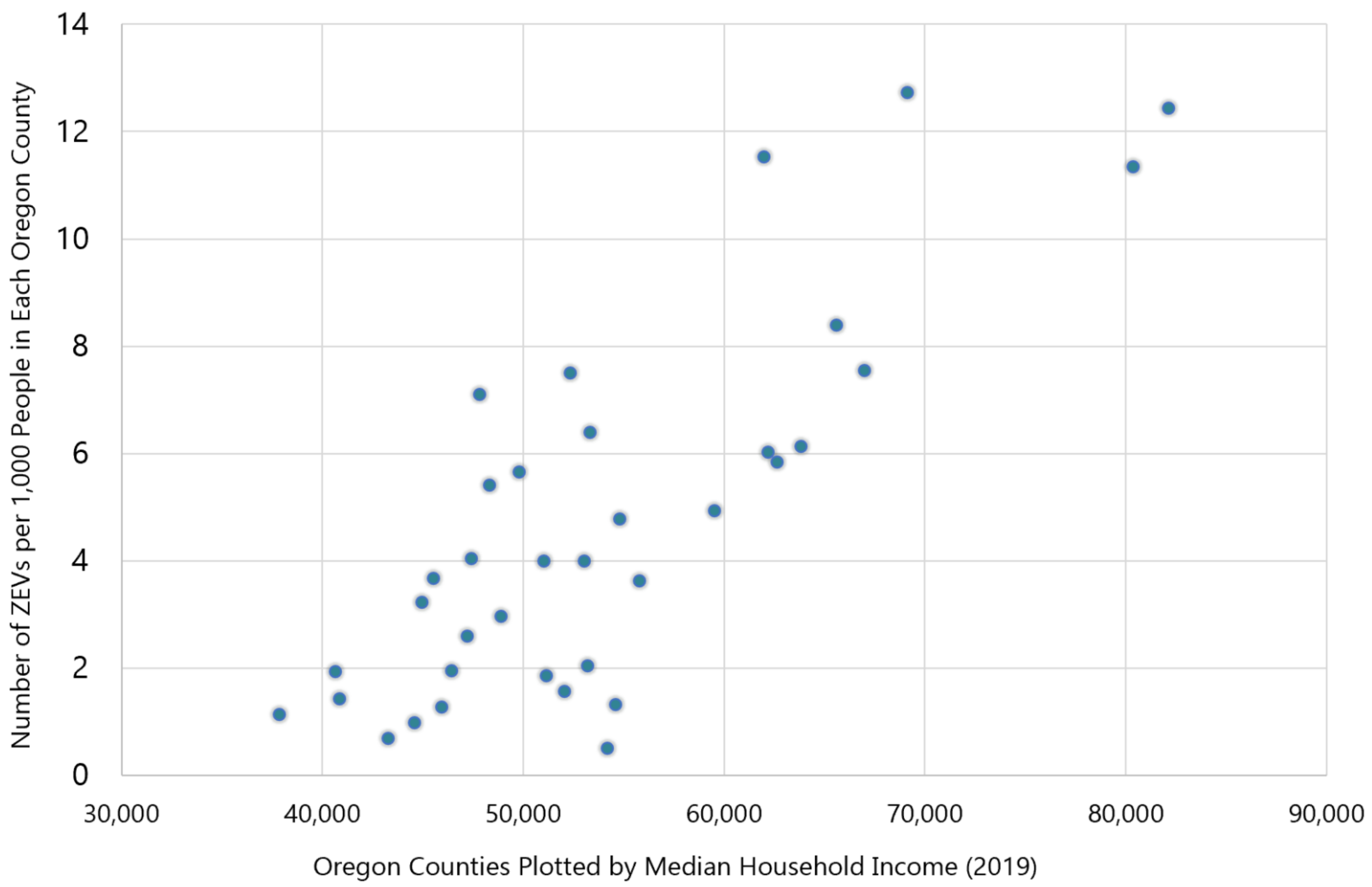
DISTRIBUTION OF ZEVS BY DEMOGRAPHIC GROUPS

ZEV Registration Distributions in Metropolitan Salem and Nearby Rural Areas



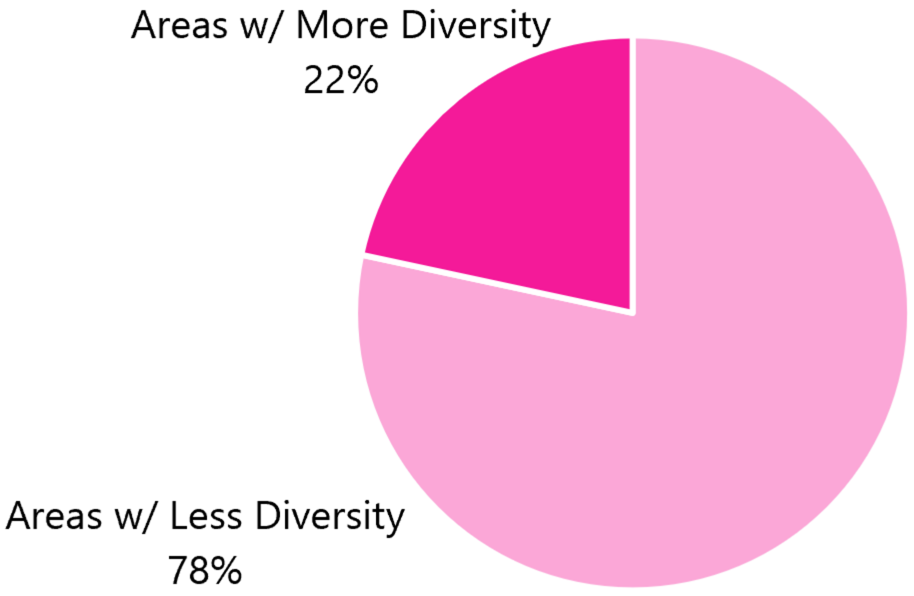
DISTRIBUTION OF ZEVS BY DEMOGRAPHIC GROUPS

Number of ZEVs per 1,000 People in Each Oregon County Compared to the Median Household Income of the County

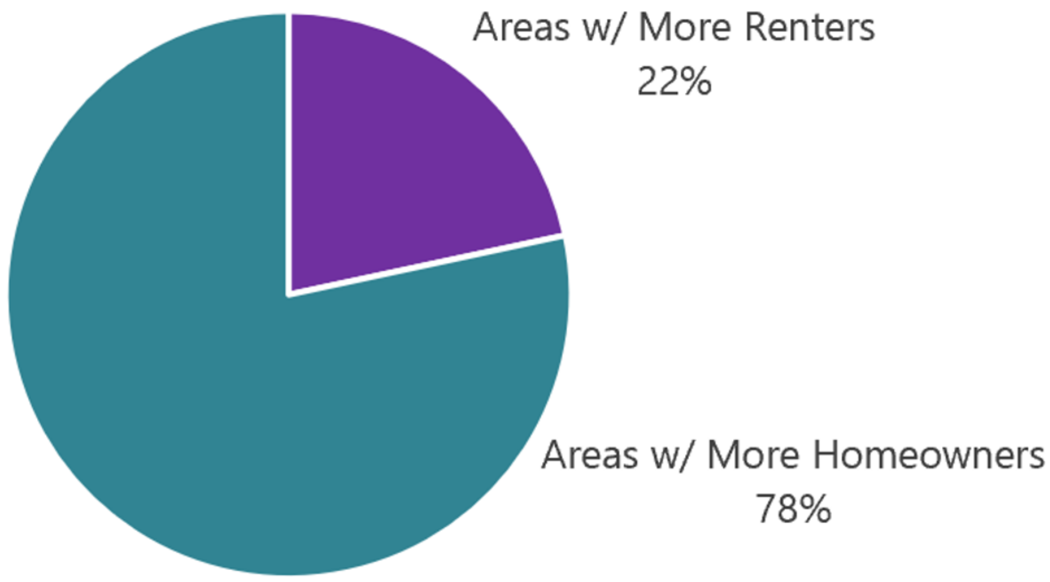


DISTRIBUTION OF ZEVS BY DEMOGRAPHIC GROUPS

ZEV Registrations in Census Block Groups Differentiated by Race, Compared to Statewide Average



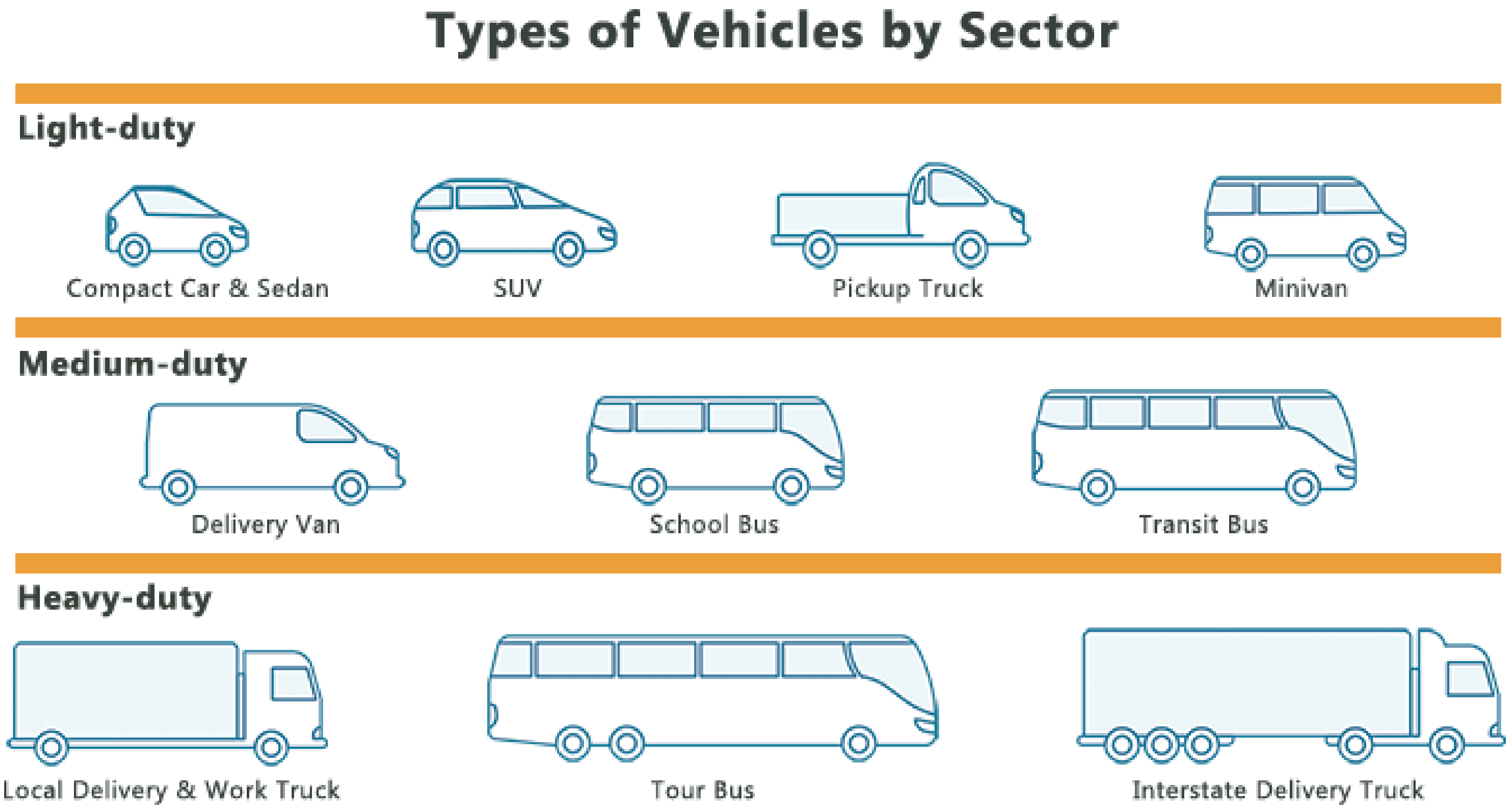
ZEV Registrations in Census Block Group Areas Differentiated by Homeowners and Renters



ZEV PLATFORMS AVAILABLE IN ALL SECTORS

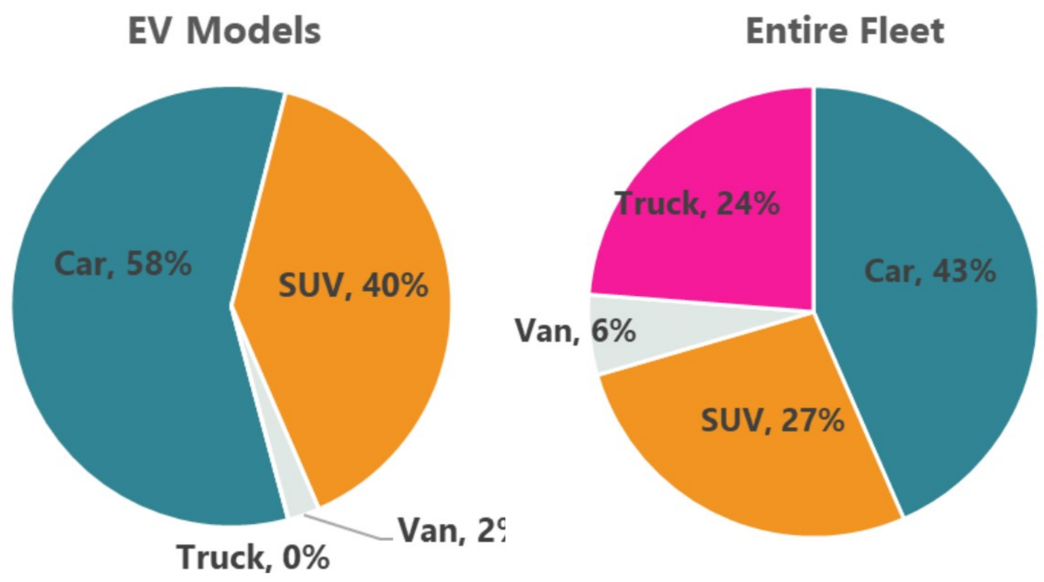
Freightliner eCascadia charges at Duck Island charging station in Portland, Ore., Photo credit: FleetOwner.com

ZEV PLATFORMS AVAILABLE IN ALL SECTORS



ZEV PLATFORMS AVAILABLE IN ALL SECTORS

Light-Duty Vehicle Platforms as a Percentage of the EV Fleet Compared to the Entire Fleet



Top 2020 and 2021 Model Year Light-Duty Vehicles Registered in Oregon

Make	Model	# Registered	Type	Format
Tesla	Model Y	1,801	BEV	Car
Tesla	Model 3	1,646	BEV	Car
Chevrolet	Bolt	782	BEV	Car
Toyota	Prius Prime	605	PHEV	Car
Nissan	Leaf	507	BEV	SUV
Tesla	Model X	371	BEV	SUV
Hyundai	Kona	272	BEV	SUV
Hyundai	Ioniq	242	BEV or PHEV	Car
Toyota	RAV4 Prime	210	PHEV	SUV
Chrysler	Pacifica	206	PHEV	Van

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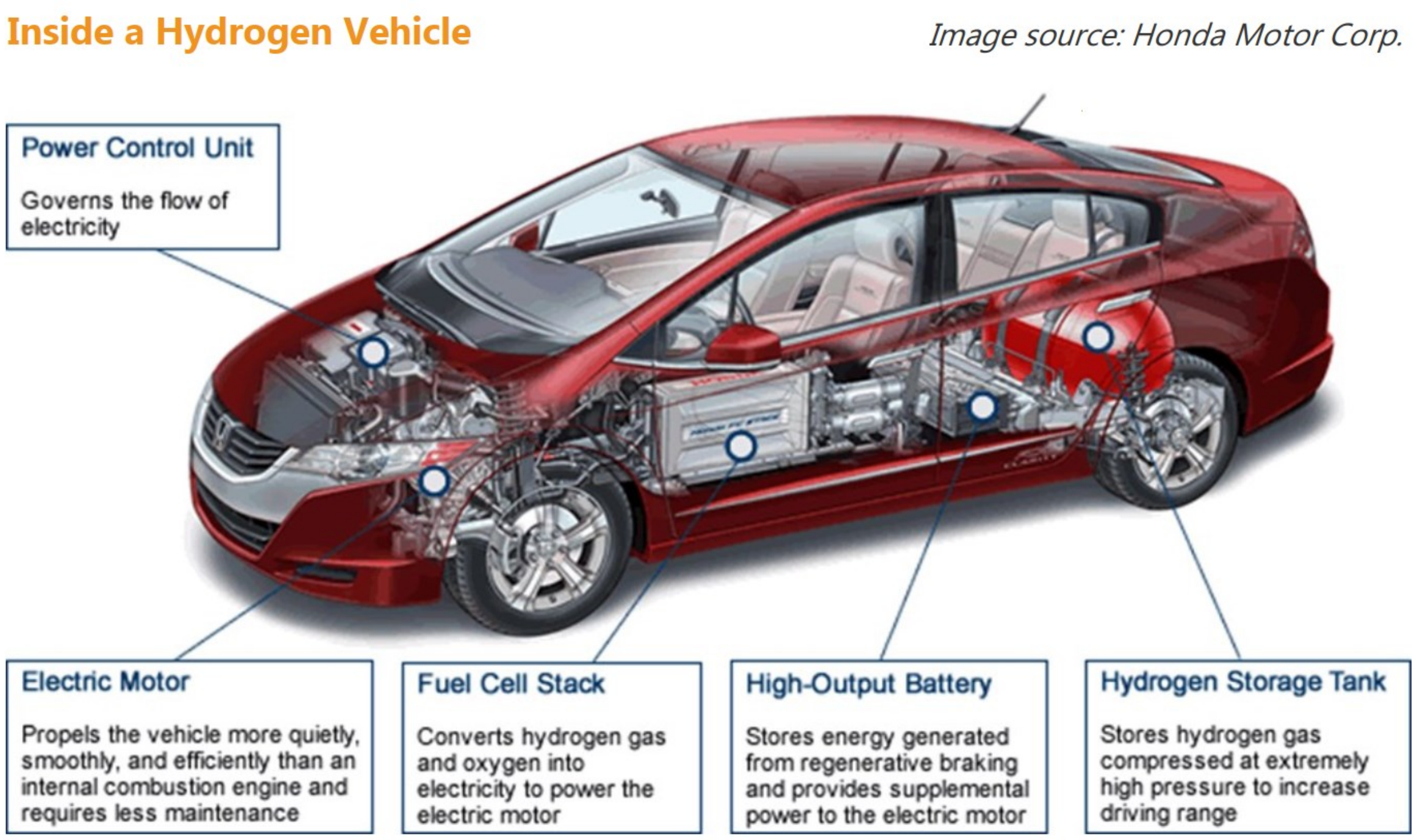
ZEV PLATFORMS AVAILABLE IN ALL SECTORS

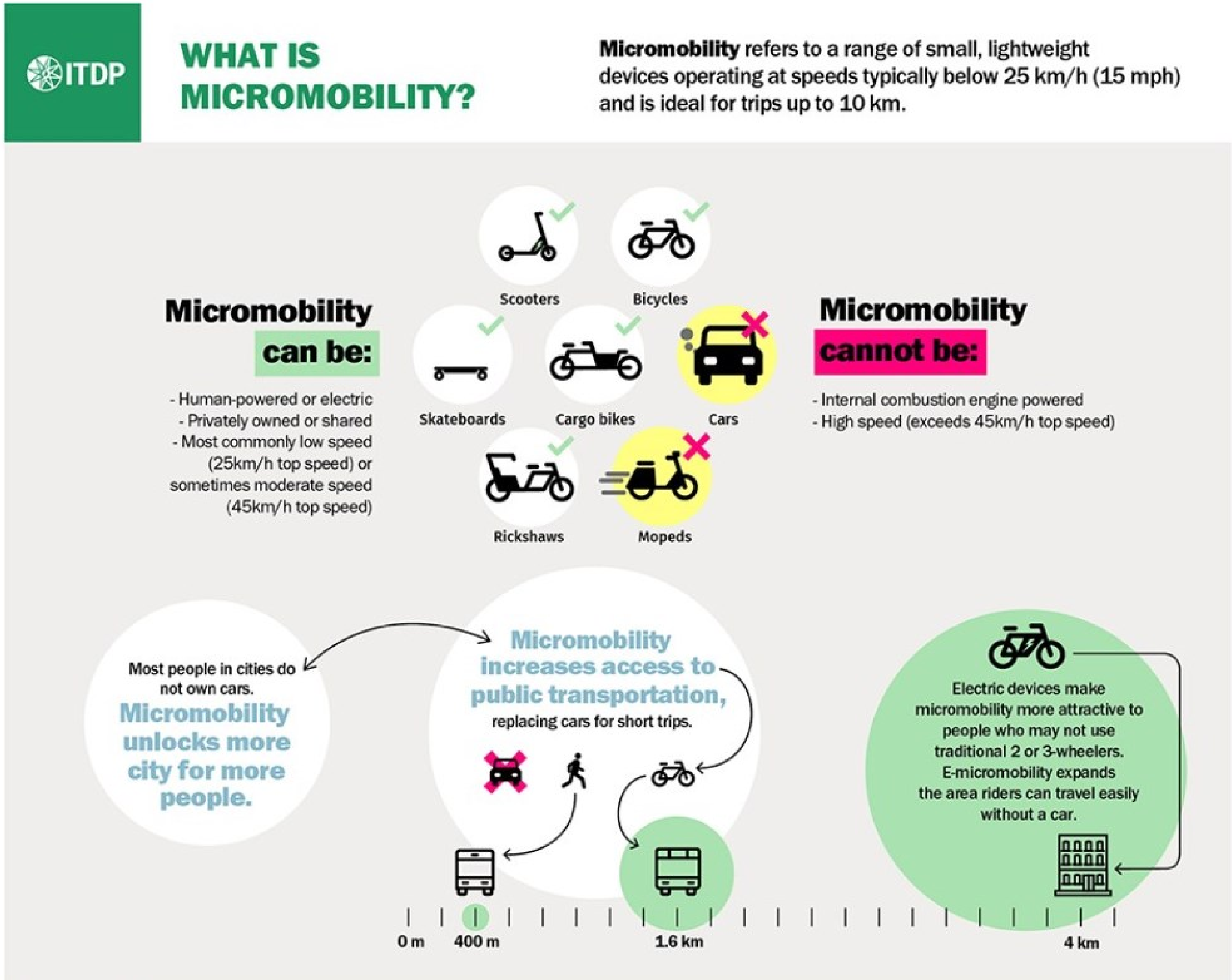
Where are the Hydrogen Vehicles?

Although Oregon currently has no authorized retail dealers for hydrogen fuel-cell ZEVs, models are available in California where hydrogen fueling infrastructure is available. Fuel Cell Electric Vehicle models available include:

- Honda Clarity
- Hyundai Nexo
- Toyota Mirai



ZEV PLATFORMS AVAILABLE IN ALL SECTORS



Micromobility can be:

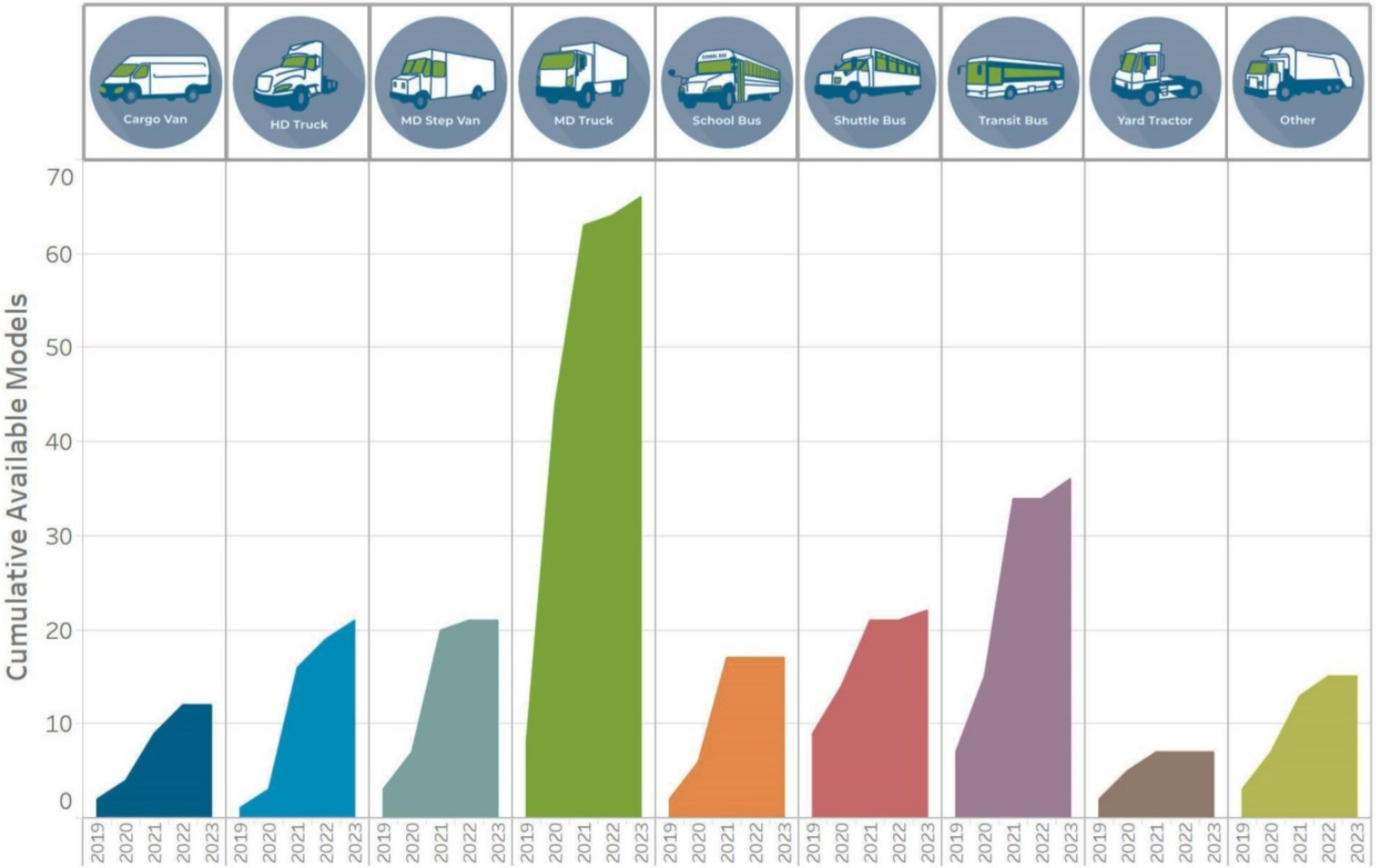
- Human powered or electric
- Privately owned or shared
- Most commonly low speed (16 mph top speed) or sometimes moderate speed (28 mph top speed)

Micromobility cannot be:

- Internal combustion engine powered
- High speed (exceeds 28 mph top speed)

ZEV PLATFORMS AVAILABLE IN ALL SECTORS

Medium- and Heavy-Duty ZEV Model Availability in North America by Vehicle Type and Year (Source: CALSTART)



ZEV PLATFORMS AVAILABLE IN ALL SECTORS

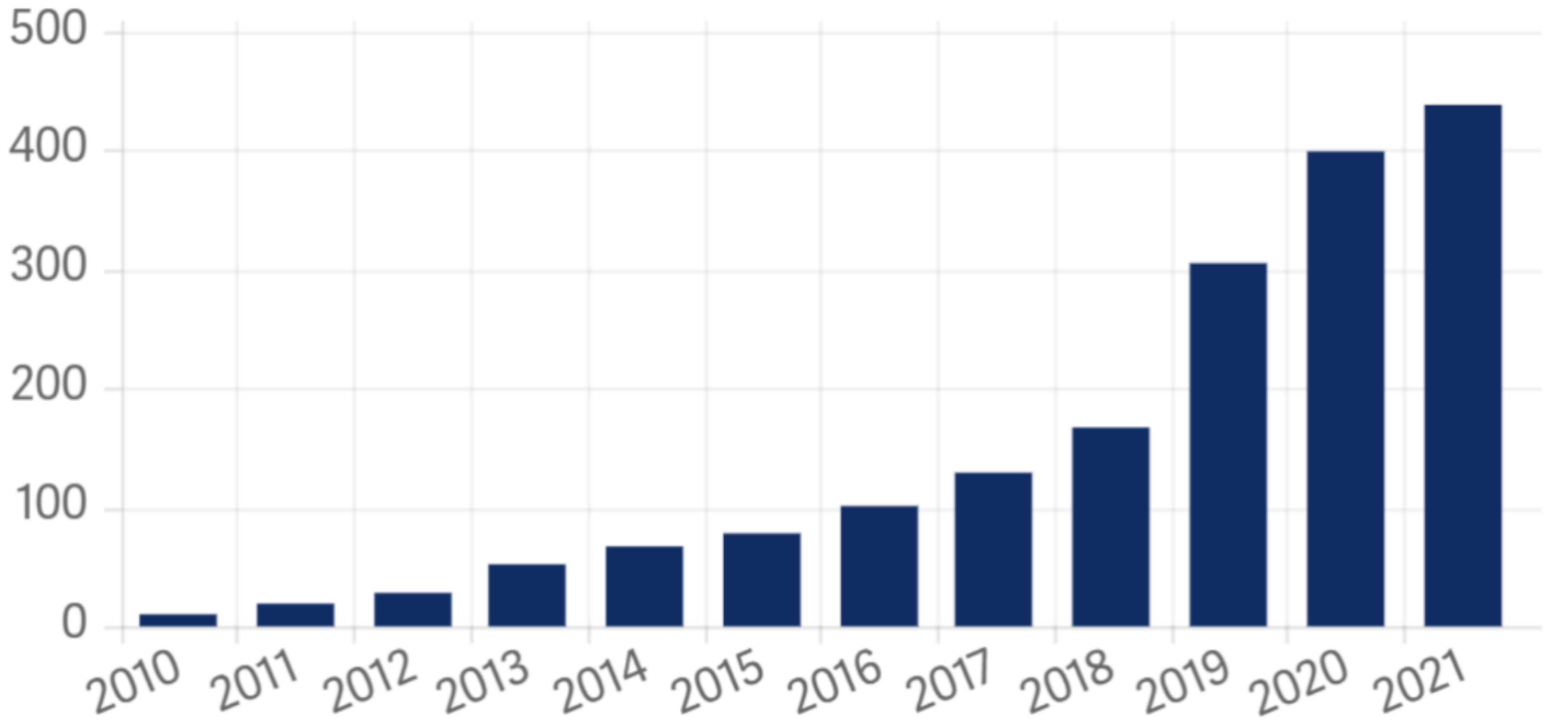
Buses shown are examples of types A, B, C, and D. Photo source: blue-bird.com

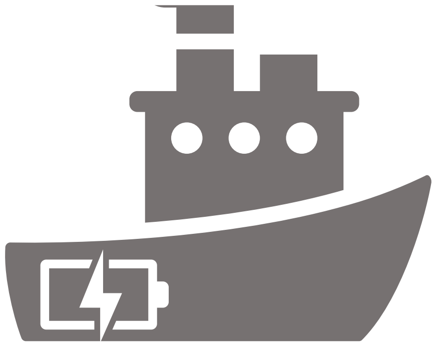
Electric School Buses Procured with Awards from PGE's Electric School Bus Program

District	Bus	Charger
Beaverton	2x Blue Bird Type D	Nuvve 19-kW Level 2
Reynolds	Blue Bird Type D	OpConnect 19-kW Level 2
Salem Keizer	Microbird Type A	Enel X 19-kW Level 2
PPS	Lion Type A	Enel X 19-kW Level 2
Newberg	Blue Bird Type C	Nuvve 60 kW DCFC

ZEV PLATFORMS AVAILABLE IN ALL SECTORS

Total Number of Ships with Batteries in Operation or on Order Worldwide (Source: Maritime Battery Forum 2021)





COST DIFFERENCES BETWEEN ZEVS + NON-ZEVs

2020 Hyundai Kona EV vs Kona ICE vehicle comparison, Photo credit: motortrend.com

COST DIFFERENCES

Unprompted Barriers Mentioned to Purchasing or Leasing an EV or PHEV (PGE Respondents)

Main Barrier to Purchasing or Leasing an EV/PHEV (Unprompted)	All Likely Vehicle Purchasers		Wave 1 - All Likely Vehicle Purchasers		
	Baseline (n= 929)	Wave 1 (n=1026)	EV/PHEV Non-Considerers (n=526) (A)	EV/PHEV Considerers (n=253) (B)	EV/PHEV Intenders (n=247) (C)
Cost/affordability (unspecified)	28%	30%	19% B C	33% A C	51% A B
Range/battery life	23%	14% *	18% B C	10% A	10% A
Recharge stations/infrastructure	22%	13% *	16% C	11%	10% A
Cost of vehicle	11%	10%	8%	10%	12%
Convenience/ease of use	7%	7%	10% B C	3% A	3% A
Cost of electricity/cost to use	5%	4%	6%	3%	2%
Cost of repairs/maintenance	6%	4% *	5% C	2%	2% A
Power/able to pull and tow	4%	4%	5% C	3%	1% A
Don't know	13%	17% *	18% C	24% C	10% A B

Note: Letters A - C indicate statistically significant differences between likely vehicle purchaser segments (z-test for proportions, p<.05).

* Indicates a statistically significant difference between Baseline and Wave 1 survey all likely vehicle purchasers (z-test for proportions, p<.05).

COST DIFFERENCES

Comparison of Up-front Costs Between EVs and Gasoline Vehicles

Up-Front Costs					
		MSRP	**Incentives**	**Registration**	**Net Cost**
Trax LS (Gas)	Hatchback/CUV	$22,930	-	$132	$23,062
Bolt LT (BEV)	Hatchback/CUV	$39,295	$7,500	$306	$32,101 ↑
Volvo XC 40 T5 (Gas)	SUV	$43,155	-	$132	$43,287
Volvo XC 40 P8 (BEV)	SUV	$59,555	$15,000	$306	$44,861 ↑
2021 Pacifica Touring (Gas)	Van	$39,300	-	$132	$39,432
2021 Pacifica Touring (PHEV)	Van	$44,125	$15,000	$306	$29,431 ↓
2021 F-150 XL (Gas)	Pickup	$35,280	-	$132	$35,412
2022 F-150 Lightning (BEV)	Pickup	$39,974	$15,000	$306	$25,280 ↓

COST DIFFERENCES

Comparison of Operational Costs Between EVs and Gasoline Vehicles

Operating Costs					
Make & Model	**Model Type**	**Mileage**	**Fuel Cost***	**Maintenance Cost****	**Total Operational Costs**
Trax LS (Gas)	CUV	26 MPG	$1,333	$710	$2,043
Bolt LT (BEV)	CUV	3.45 MPkWh	$369	$363	$731
Volvo XC 40 T5 (Gas)	SUV	26 MPG	$1,333	$710	$2,043
Volvo XC 40 P8 (BEV)	SUV	2.33 MPkWh	$547	$363	$909
2021 Pacifica Touring (Gas)	Van	22 MPG	$1,576	$710	$2,286
2021 Pacifica Touring (PHEV)	Van	2.44 MPkWh	$521	$342	$863
2021 F-150 XL (Gas)	Pickup	20 MPG	$1,733	$710	$2,443
2022 F-150 Lightning (BEV)	Pickup	2.17 MPkWh	$585	$363	$947

Calculator from ODOE's Oregon Electric Vehicle Dashboard

Questions? Ask Energy

How Much Can You Save With a BEV?

What BEV model are you thinking about getting?

Hyundai Kona Electric 2020

How many miles do you drive per week?

221.62 miles

How many MPG do you get with your current car?

25.00 MPG

What price do you normally buy your gas at?

$3.00/gallon

What Is the average cost per kWh at your home or where you regularly plan to charge? The default cost of $0.1095/kWh is the average statewide residential rate of electric...

$0.11/kWh

Which electric utility currently serves your home?

City of Ashland Electric Department

Gasoline Annual Fuel Cost **$1,386.72** – BEV Annual Fuel Cost **$347.73**

= Annual Fuel Savings **$1,038.99** / Monthly Fuel Savings **$86.58**

Gasoline Annual Emissions **12,046.0 lbs CO2e**

BEV Annual Emissions **119.4 lbs CO2e**

*221.62 miles driven per week is the average for all light-duty vehicles. $0.1095/kWh is the Oregon residential average as of March 2020.

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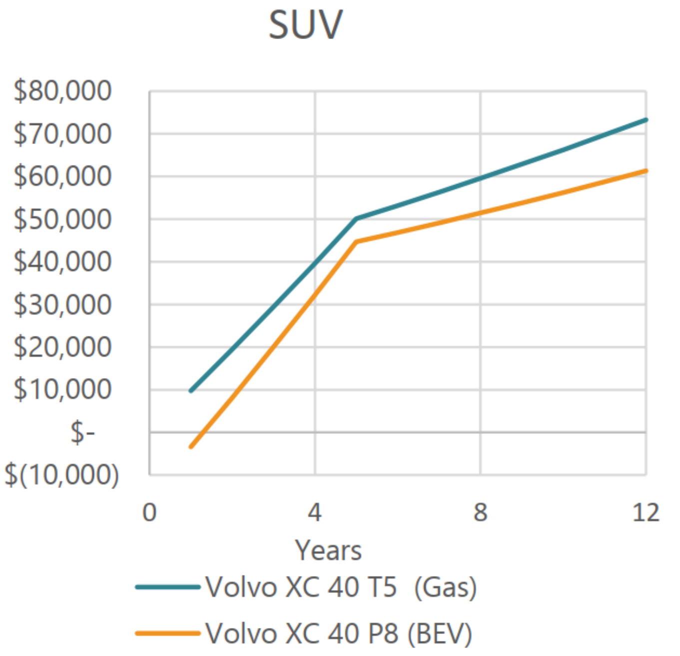
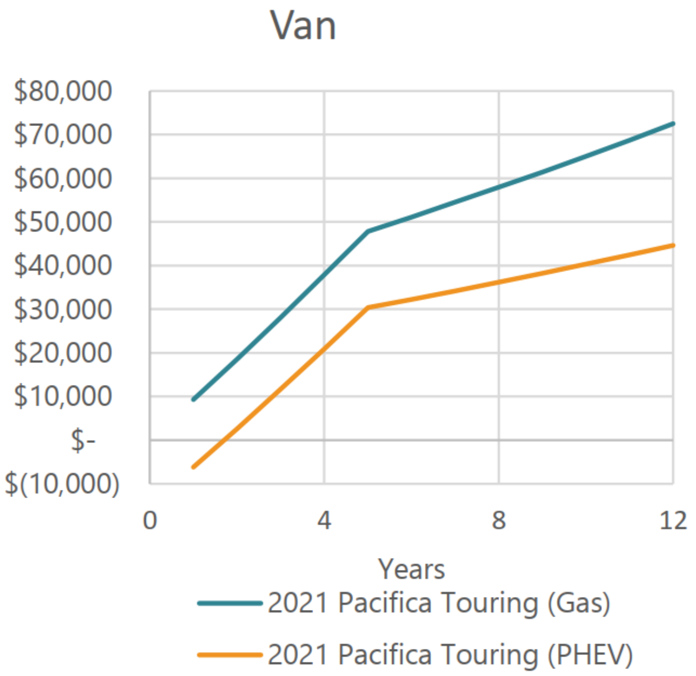
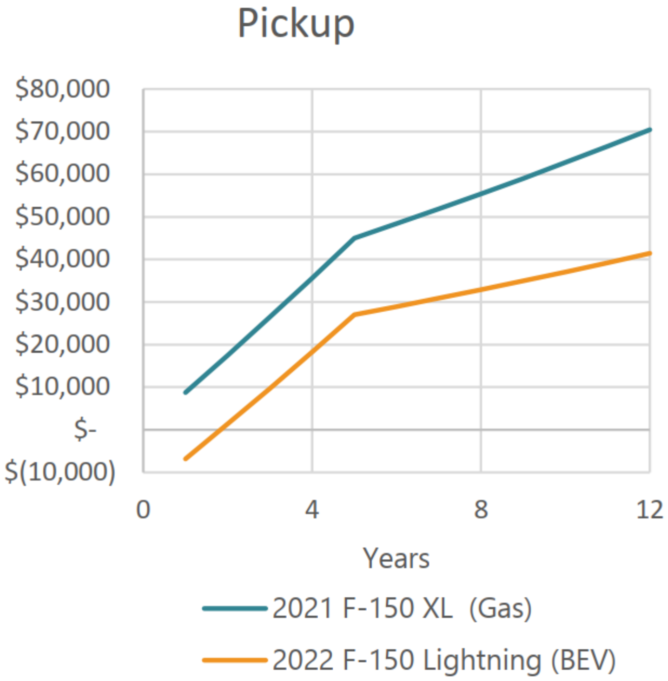
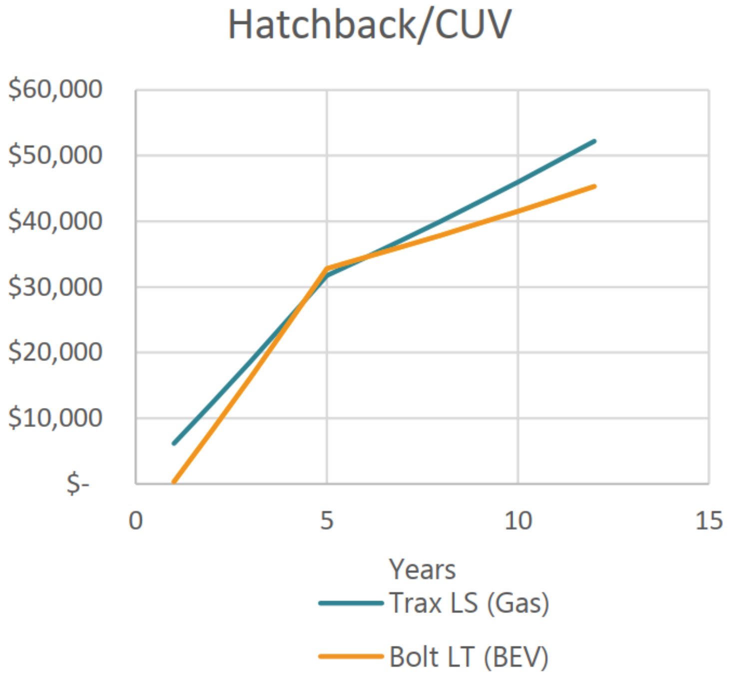
www.oregon.gov/energy/Data-and-Reports/Pages/Oregon-Electric-Vehicle-Dashboard.aspx

Cumulative Cost of Ownership with Financing









AVAILABILITY + RELIABILITY OF CHARGING

Oregonian and pup charging vehicle, Photo credit: ODOT

AVAILABILITY & RELIABILITY OF CHARGING

Reliability is commonly used to address whether charging equipment works (the terms uptime and downtime refer to whether equipment is operational or not), how often it breaks down, how long it's out of service, and how this is communicated to drivers.

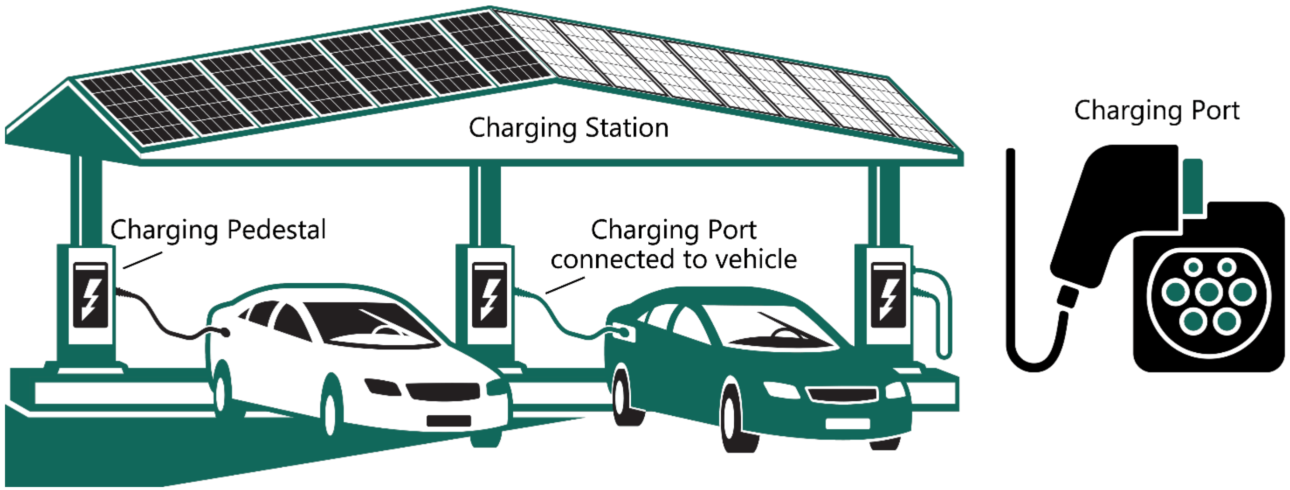
Availability can refer to whether a driver must be a member of a company's program to use its chargers, whether the charging is accessible day and night, or whether the price of a charging session is clearly marked.

New Electrify America charging station in Newport, OR

AVAILABILITY & RELIABILITY OF CHARGING

ODOE Categorization of NESCAUM Recommendations for Contract Language by Availability or Reliability

Availability	Reliability
Open access	Uptime
Payment options	Operations & maintenance
Pricing transparency	Repairs
Accessibility	Operational status
Redundancy	Redundancy
	Customer service support

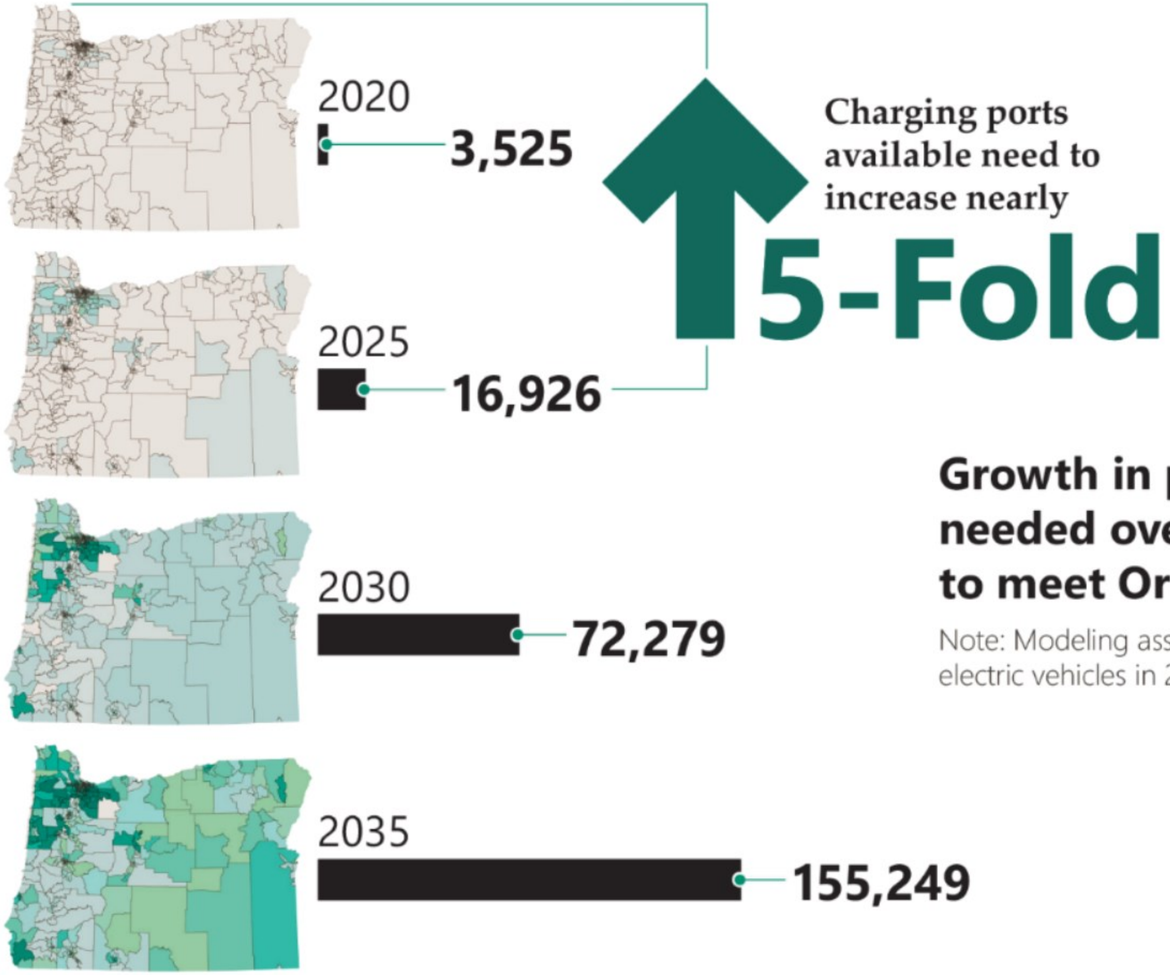


EFFECTS OF ZEVS ON THE GRID

EV Charging pedestal in front of electricity transmission lines. Photo source: betterenergy.org

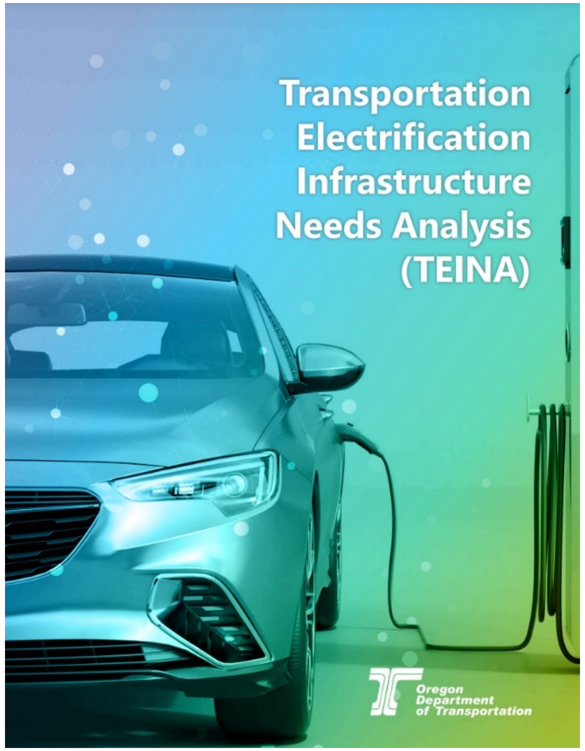
EFFECTS OF ZEVS ON THE ELECTRIC GRID

Transportation Electrification Business-as-Usual Modeling for EV Charger Growth Needed to Meet Oregon's ZEV Adoption Goals



Growth in public charging ports needed over the next 15 years to meet Oregon's 2035 goal.

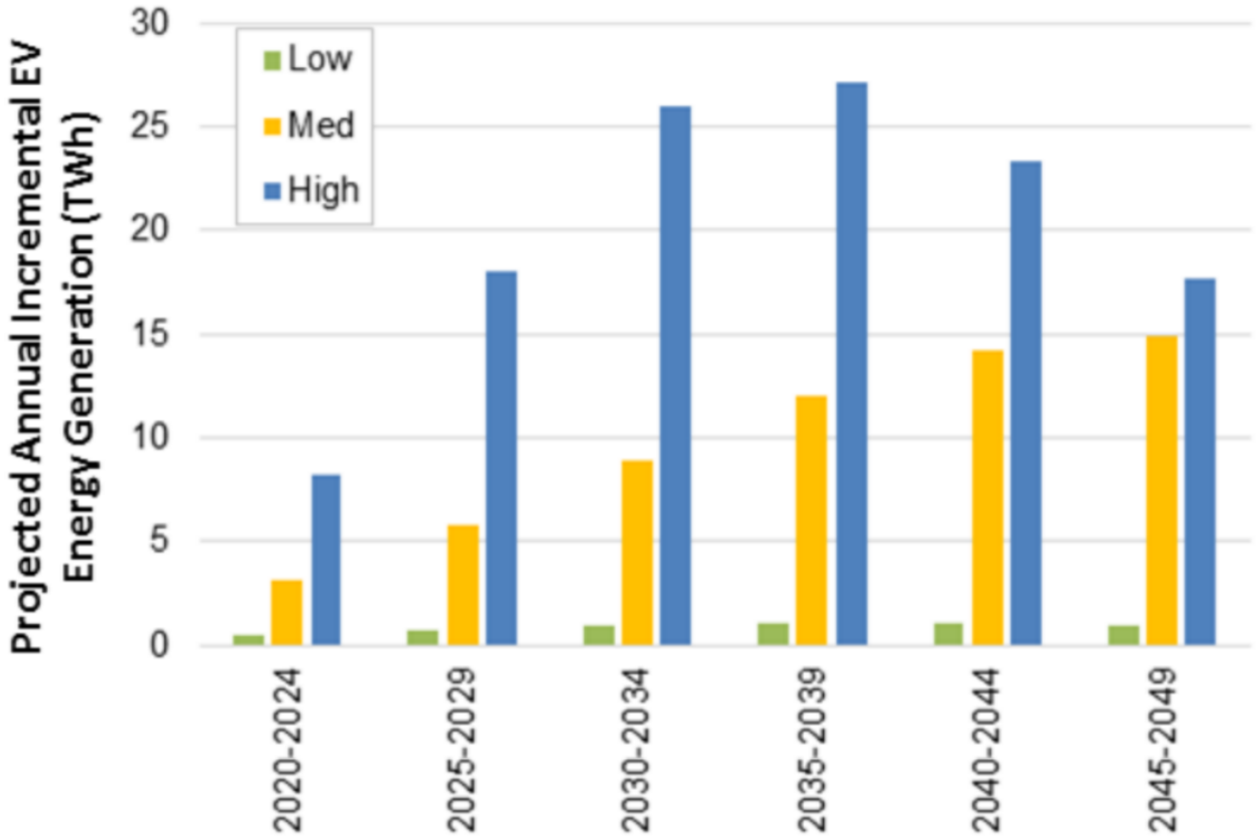
Note: Modeling assumes 50,000 electric vehicles in 2020.



EFFECTS OF ZEVS ON THE ELECTRIC GRID

While the growth in demand for electricity from electrification of light-duty vehicles is likely to be significant in gross terms, it is expected to be comparable to the rates of historic annualized load growth—both with respect to peak demand and total energy consumption—that the electric industry has successfully managed for many decades.

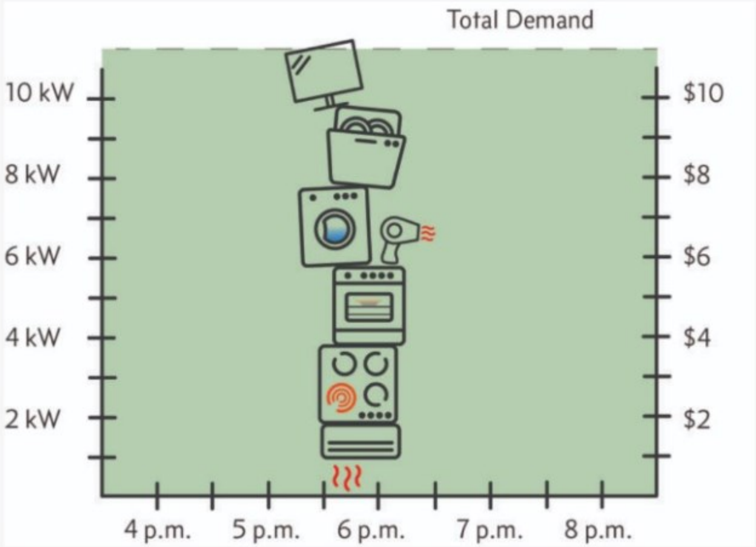
Projected Annual Incremental Energy Generation to Support EVs (5-Year Periods)



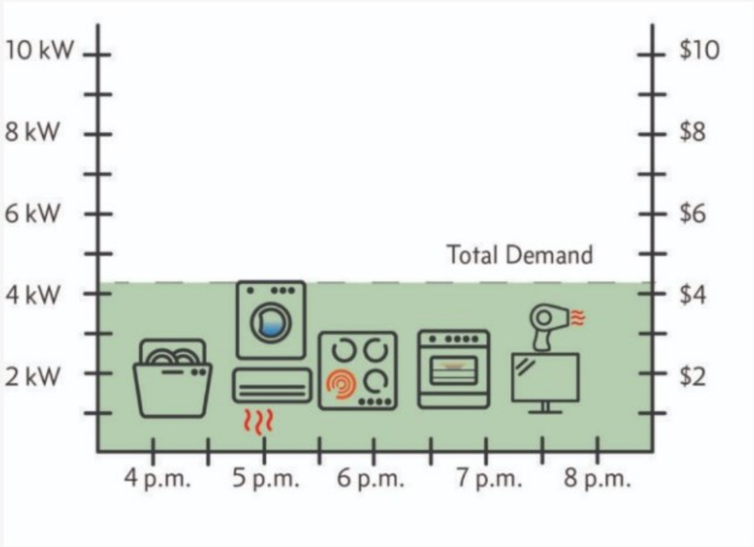
Projected annual incremental energy generation to support EVs, averaged to five-year periods for the low, medium, and high market penetration scenarios.

EFFECTS OF ZEVS ON THE ELECTRIC GRID

Columbia River PUD Graphic Showing Effects on Overall Demand by Staggering Appliance Use



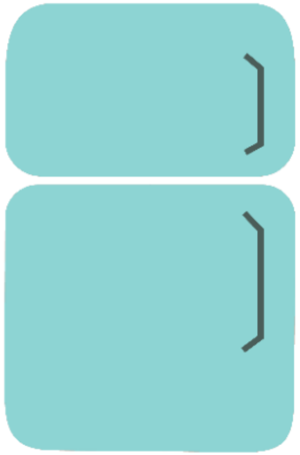
Using several electric appliances at the same time will increase your Demand usage.



Spreading your electric appliance use over a period of time will reduce your Demand usage.

What does 350 kW of demand look like to the grid?

0.5 kW

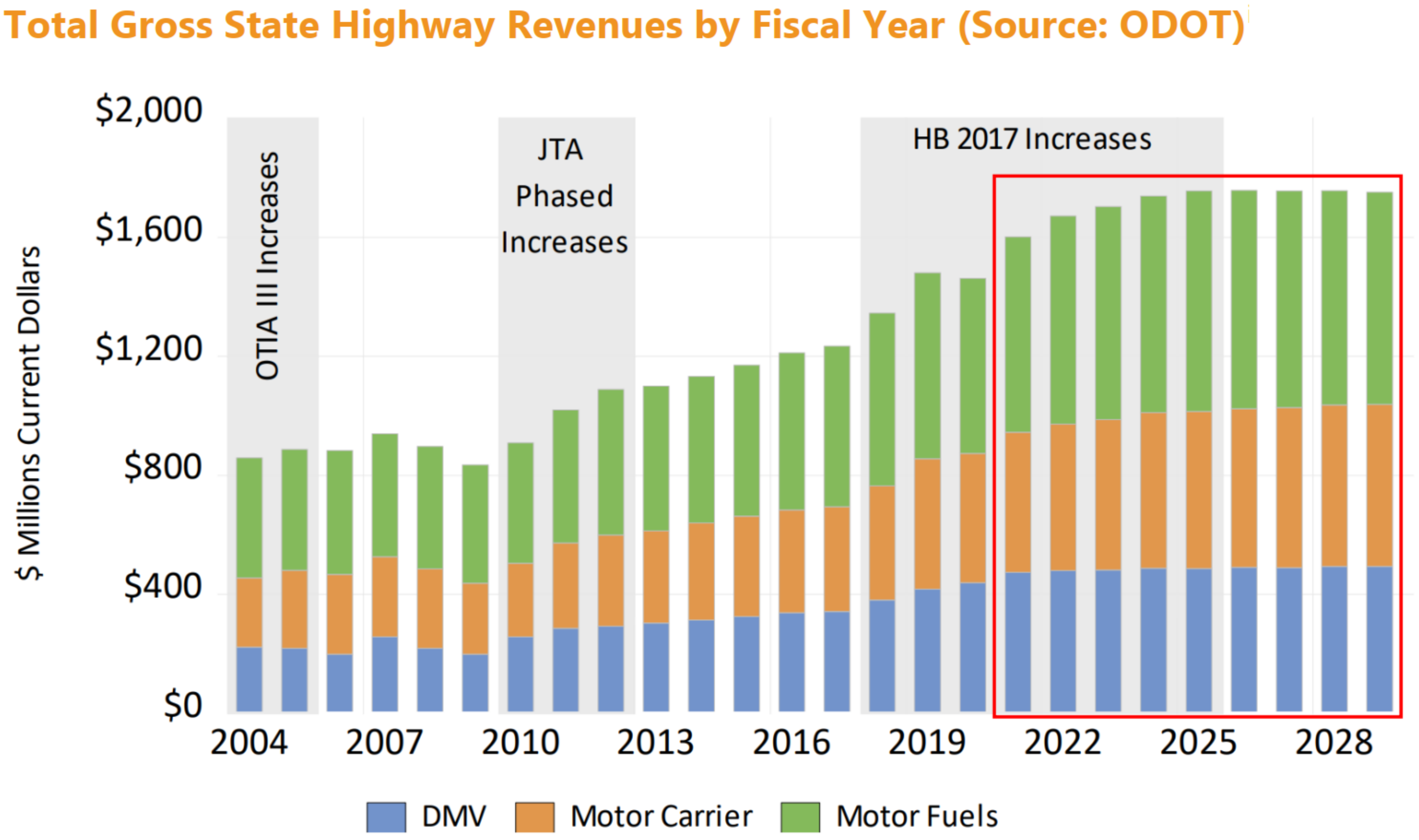


A typical refrigerator has a peak demand of around 0.5 kW. So an EV charging at a 350 kW DC Fast Charger would have the same power draw on the electric grid as 700 typical refrigerators!

EFFECTS OF ZEVS ON THE STATE HIGHWAY FUND

I-5 Fern Valley Interchange, Phoenix, Ore., Photo credit: ODOT via Flickr

EFFECTS OF ZEVS ON THE STATE HIGHWAY FUND

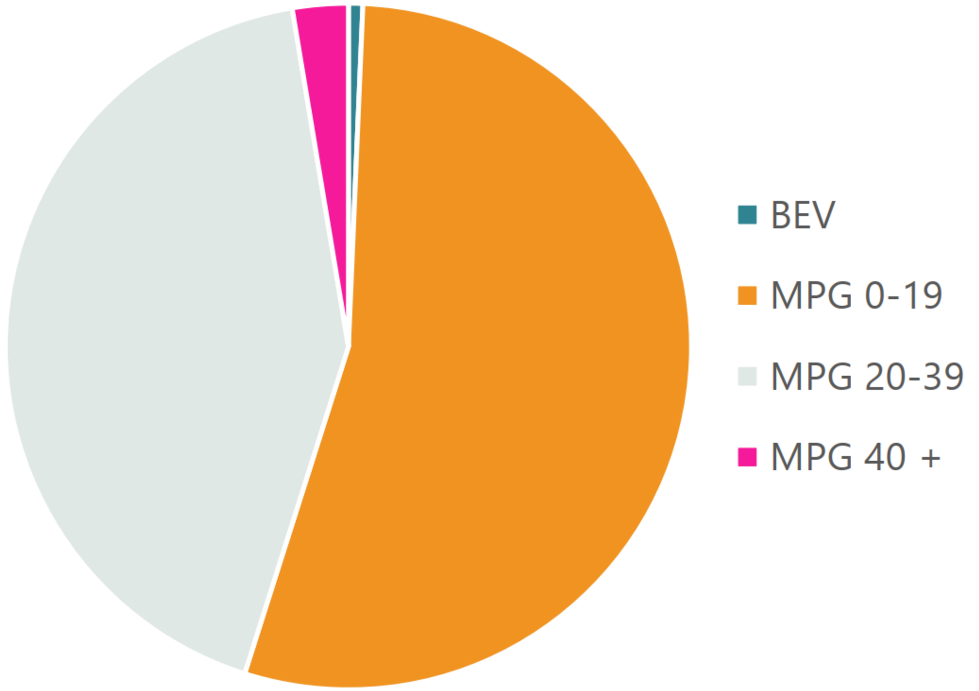


EFFECTS OF ZEVS ON THE STATE HIGHWAY FUND

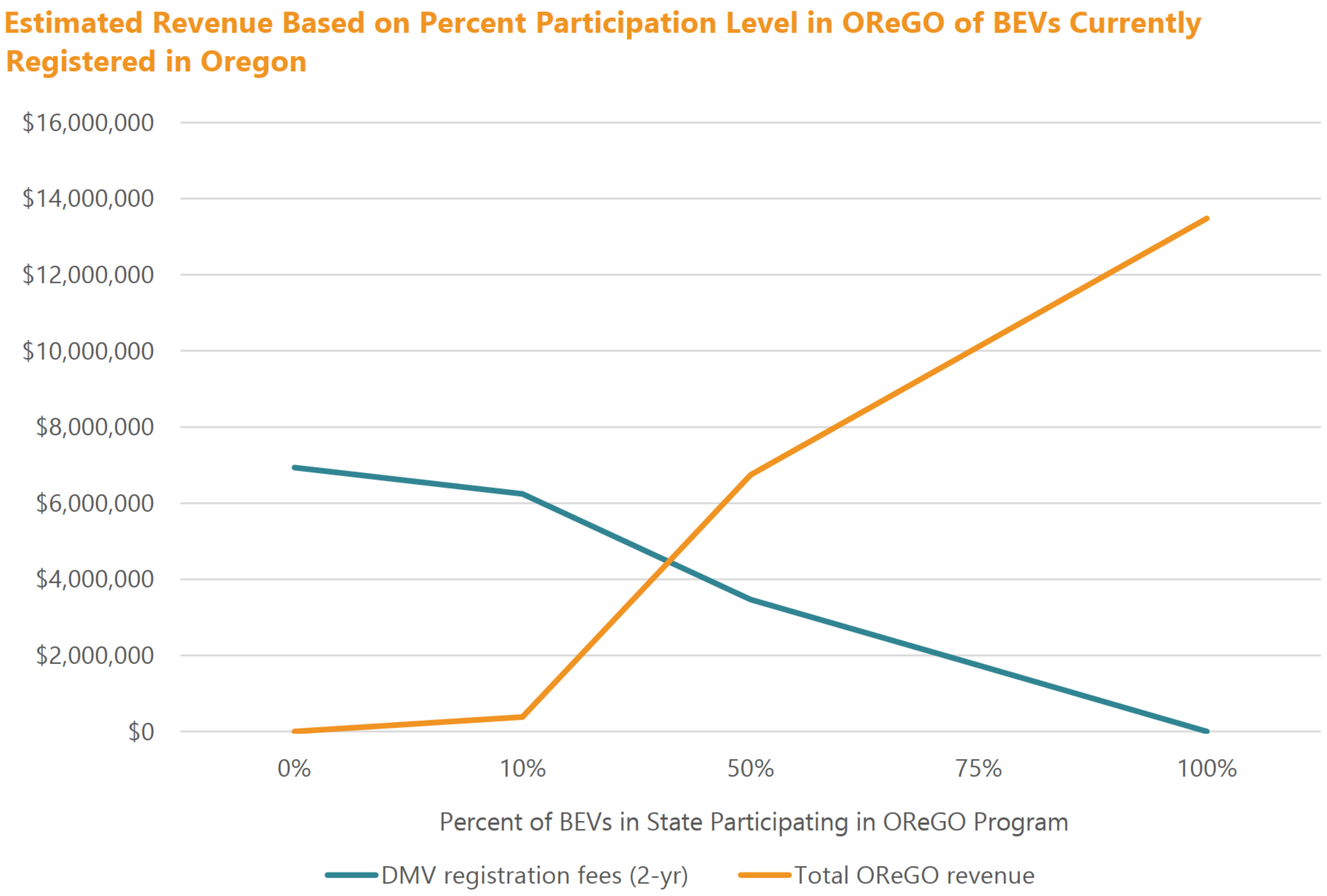
Estimated Annual Gas Tax Revenue for All Light-Duty Vehicle Types by DMV Registration Group

DMV Registration Group	Estimated Annual Fuels Tax Revenue ($0.36/gal)
MPG 0-19	$330,167,936
MPG 20-39	$195,336,774
MPG 40 +	$6,485,439
Total	$532,582,784

Total Light-Duty Vehicles by DMV Registration Category as of February 2021



EFFECTS OF ZEVS ON THE STATE HIGHWAY FUND



REPORT RECOMMENDATIONS

REPORT RECOMMENDATIONS

Because the state is not on track to achieve the zero-emission vehicle adoption targets established in Senate Bill 1044 (2019), the Legislature directed the Oregon Department of Energy to **include recommendations to support greater ZEV adoption** and set the state on a course to achieve its future goals.

1. Support the policy recommendations in the Oregon Department of Transportation's Transportation Electrification Infrastructure Needs Analysis Study to **significantly increase access to electric vehicle charging in Oregon**.

2. Identify and implement best practices for **collecting and assessing ZEV adoption data** across different segments of the transportation sector to better inform policy makers about options to support increased ZEV adoption across the entire transportation landscape.

REPORT RECOMMENDATIONS

3 Develop a methodology for assessing effects of ZEV adoption on Oregon's greenhouse gas emissions to **provide consistent reporting across state agencies**, and as a tool for local governments and businesses to assess and monitor policies and programs that address emissions for their jurisdictions or transportation operations.

4 **Engage with underserved communities** to assess ZEV adoption data and inform the development of metrics that can track equitable access to ZEVs and ZEV fueling.

5 Support **Oregon-focused data collection and studies** to provide greater insight into ZEV awareness across the state and among Oregon's diverse communities.

6 Consider **adopting standardized definitions and metrics** for electric vehicle charger availability and reliability to enable consistent assessment of Oregon's electric vehicle fueling infrastructure.

Questions?

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