Oregon Department of **ENERGY**

Biennial Zero Emission Vehicle Report

Jessica D. Reichers
Technology & Policy Manager
September 2023

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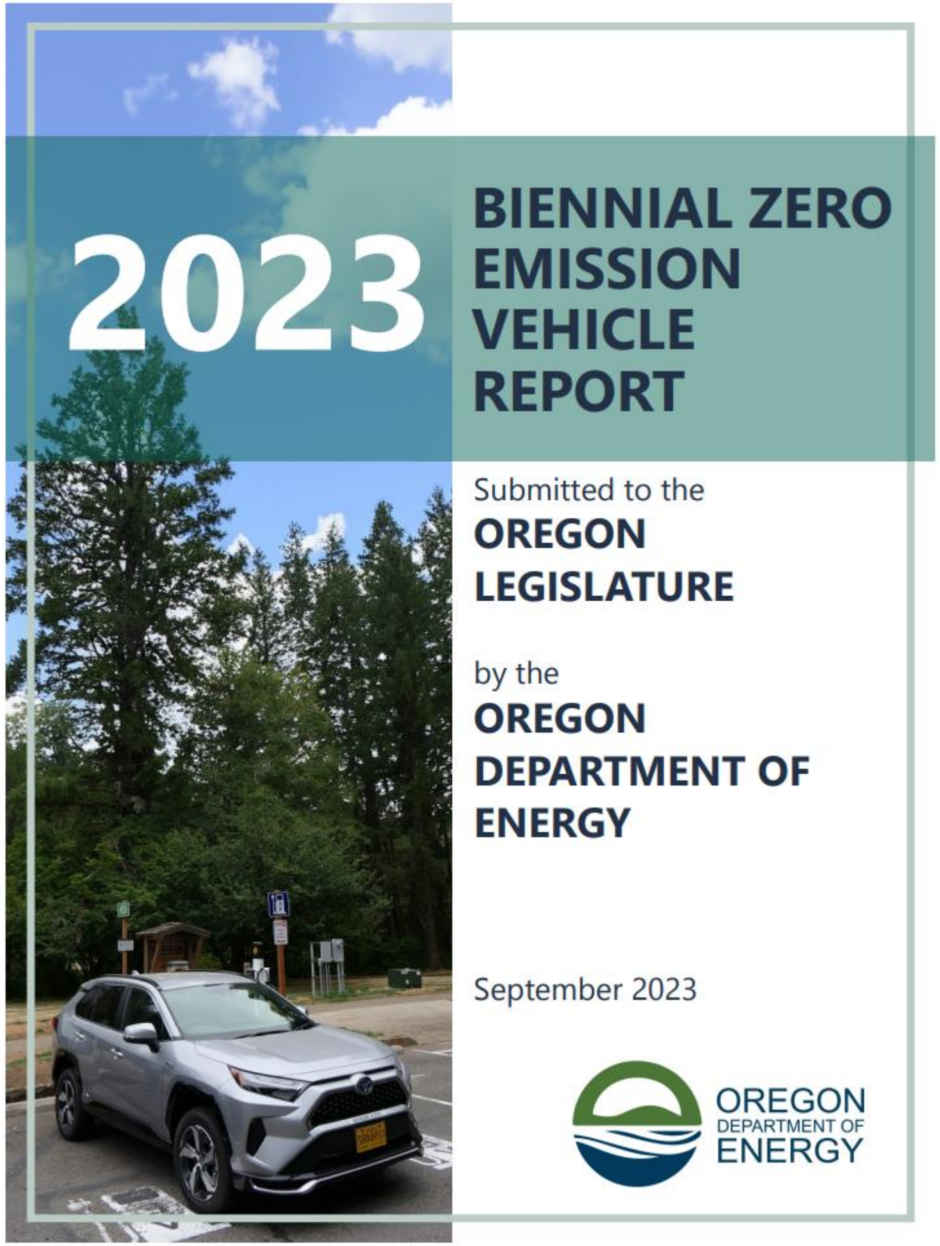
About the Report

- Established in 2019 by Senate Bill 1044
- Covers electric vehicle adoption and related progress on Oregon's greenhouse gas emissions in the transportation sector
- Focus on commercially available or near-commercially available vehicles
- Use existing studies, market reports, polling data, or other publicly available information
- 11 specific reporting requirements



https://tinyurl.com/2023BIZEV

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ZEV ⬌ EV

ZEV = Zero Emission Vehicle
EV = Electric Vehicle

Types of ZEVs/EVs

BEV = Battery Electric Vehicle – uses only electric batteries to propel the vehicle

PHEV = Plug-in Hybrid Electric Vehicle – uses a combination of electric batteries and fossil fuel to move the car, and must be able to be plugged in to charge

FCEV = Fuel Cell Electric Vehicle – uses hydrogen fuel that is converted by a fuel cell into electricity that moves the car

Sales Figures and Progress on EV Adoption Targets

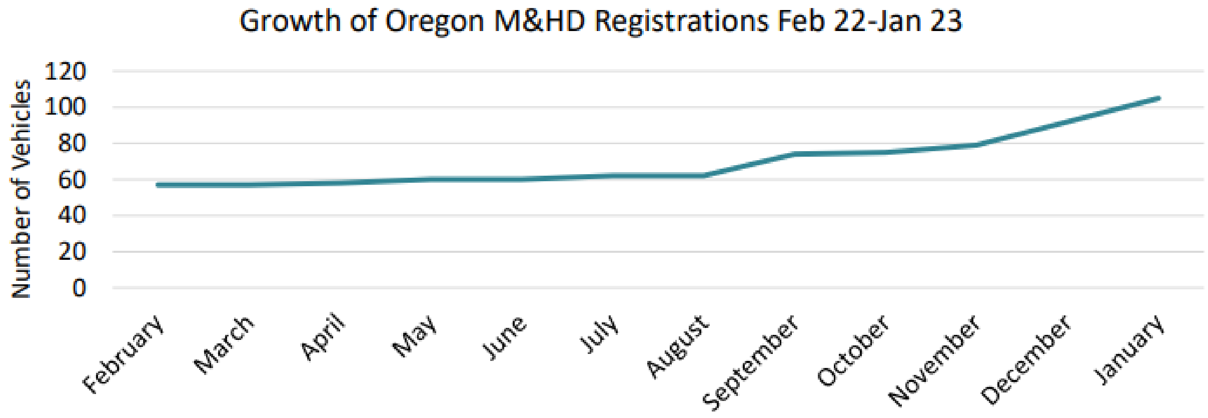
Oregon's EV Adoption Targets

- By 2020, 50,000 registered motor vehicles will be zero-emission vehicles;
- By 2025, at least 250,000 registered motor vehicles will be zero-emission vehicles;
- By 2030, at least 25 percent of registered motor vehicles, and at least 50 percent of new motor vehicles sold annually, will be zero-emission vehicles; and
- By 2035, at least 90 percent of new motor vehicles sold annually will be zero-emission vehicles.

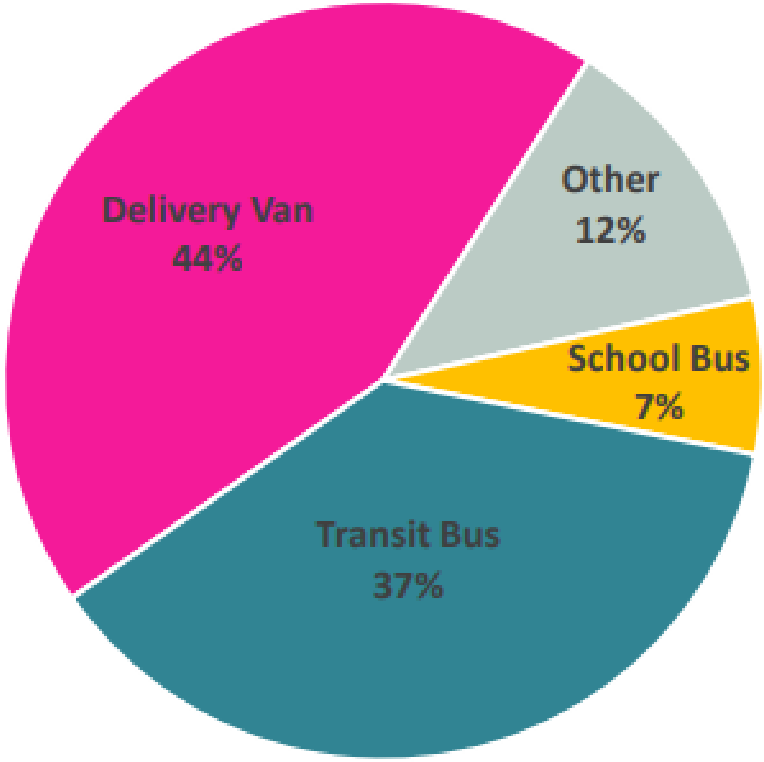
As of April 2023, Oregon has nearly 70,000 registered electric vehicles across all 36 counties

Sales Figures and Progress on EV Adoption Targets

Figure 9: Growth of Medium- and Heavy-Duty EV Registrations in Oregon Feb. 2022 – Jan. 2023[1]



Medium- and heavy-duty vehicle electrification lags light-duty, largely because it is a much more complex vehicle sector, and the barriers to adoption are often more costly and challenging.



Sales Figures and Progress on EV Adoption Targets

Interagency Actions Addressing Barriers to Zero Emission Vehicle Adoption

Vehicle Costs

- Clean Vehicle & Charge Ahead EV Rebates (DEQ)
- Investor-Owned Utility (IOU) Transportation Electrification Investments and Rates (OPUC)
- School Bus Funding (ODE, DEQ)
- Public Purpose Charge Schools Funds (ODOE)
- Diesel Emission Reduction Grants (DEQ)
- Transit Bus Funding (ODOT, DEQ)
- Utility Grants Funded by Clean Fuels Program (DEQ)
- State Fleet Pricing Agreements (DAS)

Equity

- Charge Ahead EV Rebate (DEQ)
- Every Mile Counts Equity Engagement (ODOT, DEQ, ODOE, DLCD)
- TEINA Assessment for rural, low-income, and BIPOC needs (ODOT)
- IOU TE Surcharge and CFP Investments in Underserved Communities (OPUC, DEQ)
- Prioritize Equity in Federal EV Funding (ODOT)
- Biennial ZEV Report EV Adoption Demographic Assessment (ODOE)

OVERARCHING

- ZEVIWG and Every Mile Counts Interagency Coordination (ODOT, ODOE, DEQ, OPUC, DAS, DLCD, OHA)
- Clean Fuels Program (DEQ)
- ZEV Regulations (DEQ)
- Investor-Owned Utility Transportation Electrification Investments (OPUC)
- State Fleet ZEV Goals (DAS)
- Climate Protection Program (DEQ)
- State Clean Electricity and Renewable Electricity Goals (OPUC, ODOE)
- Advanced Clean Cars I and II
- Advanced Clean Trucks

Infrastructure Needs & Costs

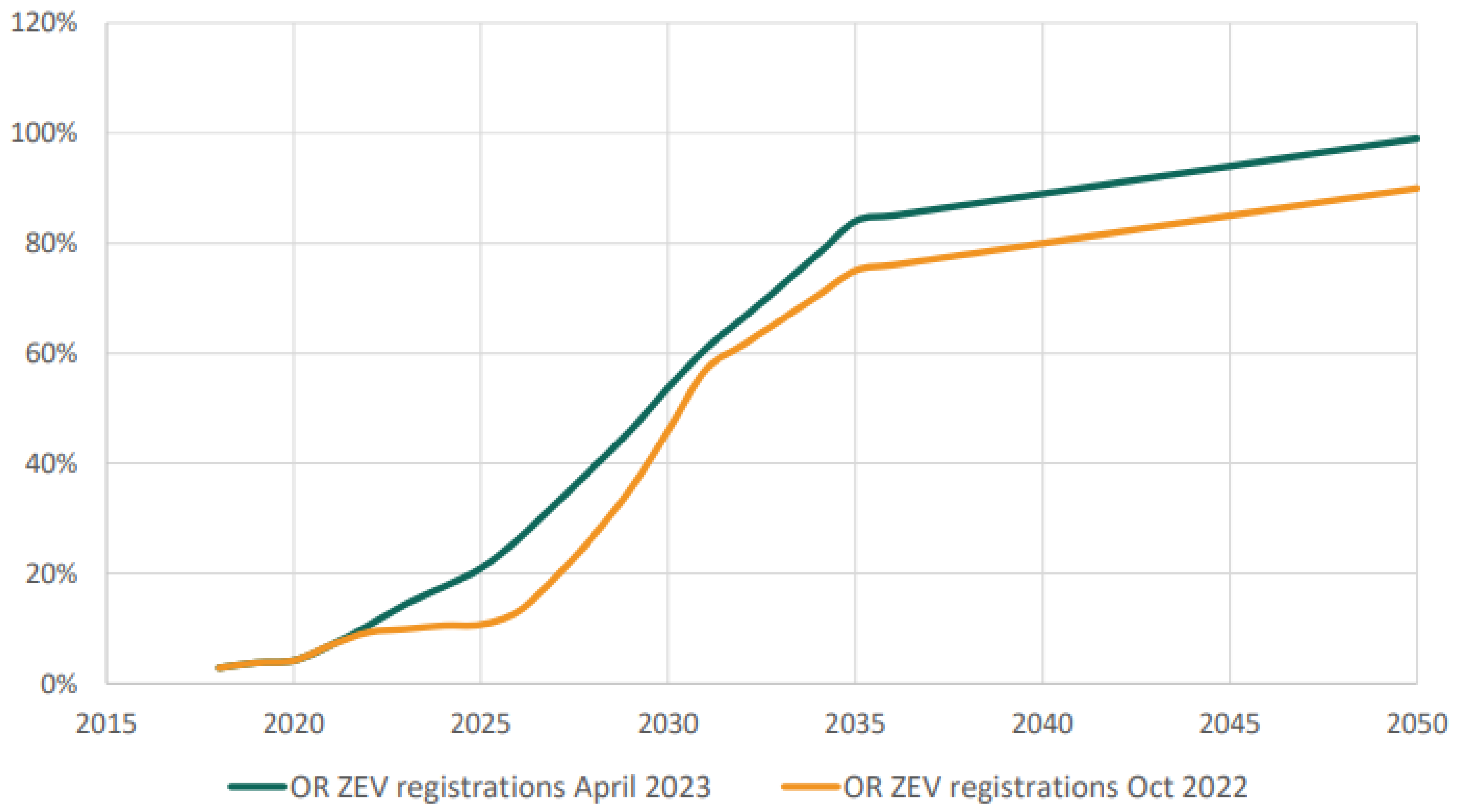
- Transportation Electrification Infrastructure Needs Analysis Study (ODOT)
- Guide for Oregon EV Charging Deployment (ODOT)
- Federal EV Funding – IIJA (ODOT, ODOE)
- Community Charging Program (ODOT)
- IOU TE Infrastructure Investments (OPUC)
- CFP funding for Chargers and Utility Grants (DEQ)
- Public Purpose Charge Schools Funds (ODOE)
- Consumer-owned Utility EV Mapping Tool (ODOE)
- State Pricing Agreements (DAS)
- State Agency EV and Infrastructure Cost Analysis Tool (DAS, ODOE)

Awareness

- Biennial ZEV Report (ODOE)
- Go Electric Website (ODOE)
- EV Dashboard (ODOE)
- EV Rebate Outreach (DEQ)
- Community Charging Program Outreach (ODOT)
- Transit and School Bus Cost Analysis Tools & Electric Bus Guidebooks (ODOE, ODOT, DEQ)
- Oregoin' Electric Support (DEQ, ODOT, ODOE, DAS, OPUC)
- Biennial Energy Report (ODOE)

Sales Figures and Progress on EV Adoption Targets

Figure 16: ODOT Forecast: EV Share of Oregon Registrations[79]



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Carbon Intensity of Oregon's Transportation Sector

Figure 3: 2021 Transportation Fuel Consumption in Oregon[1]

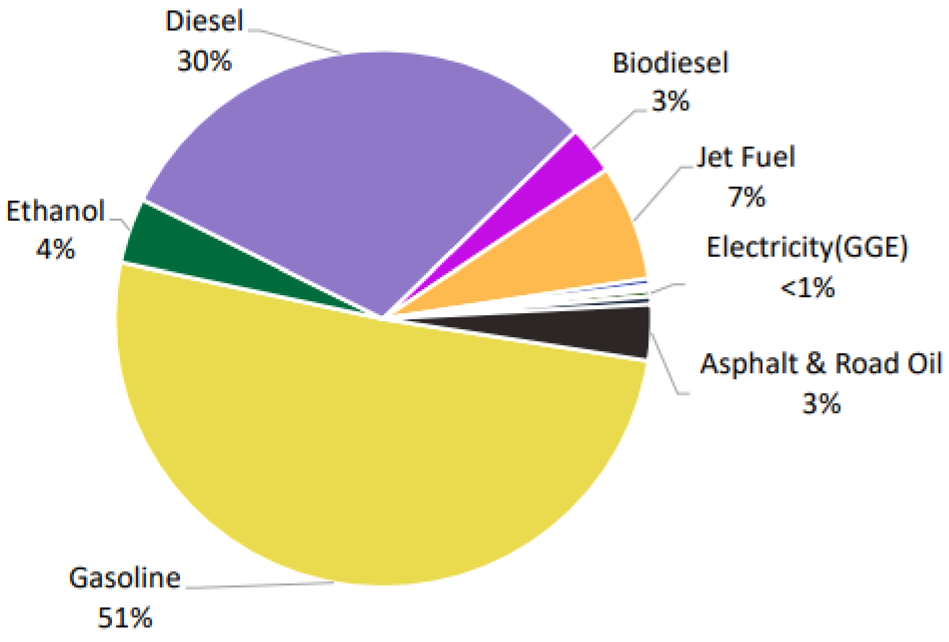

Table 1: 2021 Oregon Transportation Sector Fuel Consumption and CI[1]

		Carbon Intensity	
Fuel Type	GGE	lbCO2e/ GGE	gCO2e/MJ
Hydrogen	20,437	42.35	156.84
Diesel	808,442,432	29.87	100.74
Lubricants	12,529,680	29.87	100.74
Asphalt & Road Oil	89,204,148	29.87	100.74
Gasoline	1,351,415,916	27.04	100.14
Aviation Gasoline	2,747,718	27.04	100.14
Jet Fuel	184,393,471	24.49	90.70
CNG	359,230	21.58	79.92
LPG	1,576,772	15.98	59.19
Ethanol	104,458,357	14.50	53.72
Biodiesel	78,005,874	11.21	41.51
Renewable Diesel	10,462,444	9.98	36.97
Bio CNG	3,825,170	8.53	31.59
Renewable LPG	211,772	6.85	25.36
Electricity (GGE)[1]	9,639,743	6.85	25.35
Total	2,657,293,162		

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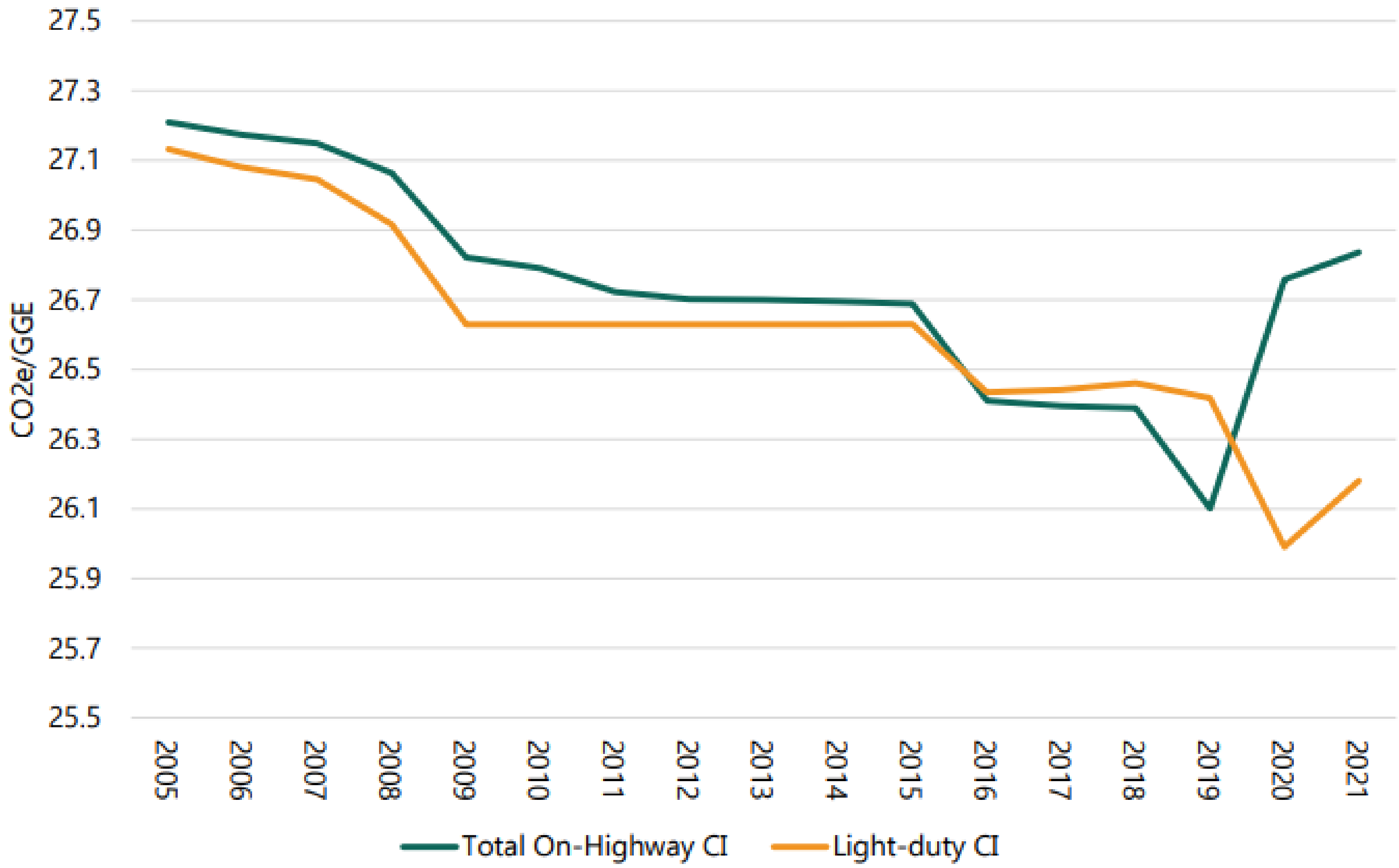
Carbon Intensity of Oregon's Transportation Sector

The increase in the transportation sector-wide carbon intensity is related only to an increase in total fuel consumption of diesel and gasoline, and not the actual carbon intensity of individual fuels.

Figure 5: Total On-Road and Light-Duty Only Carbon Intensities (lbCO2e/GGE)[15]



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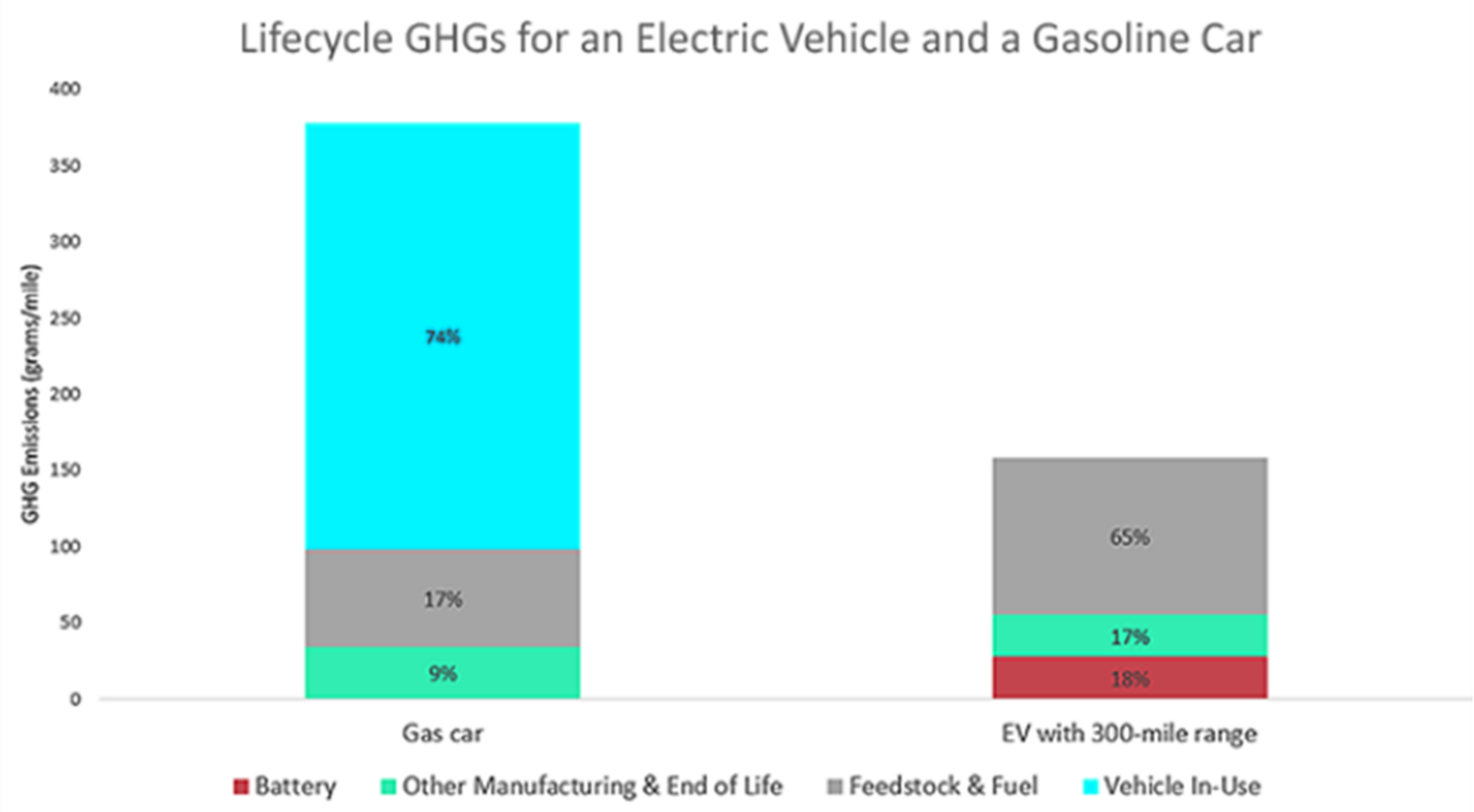
EV Impacts on Greenhouse Gas Emissions



EV Impacts on Greenhouse Gas Emissions

While transportation sector motor vehicle emissions were well above the 2020 goal proportionate share, significant action was taken in the last couple of years that put the state on a better path to meet its greenhouse gas goals.

Table 3: Tailpipe and Total Sector-Based Transportation Emissions Compared to 2020 State GHG Goal Proportionate Share (2020-2021)

		2020		2021	
	2020 Goal Share (MMTCO2e)	**Actual (MMTCO2e)**	**% Above 2020 Goal Share**	**Actual (MMTCO2e)**	**% Above 2020 Goal Share**
Light-Duty Vehicles (LDV)	10.3	10.9	6%	12.1	17%
Medium- and Heavy-Duty Vehicles (MHD)	5.7	6.8	20%	7.4	30%
Total LDV and MHD	16.1	17.7	10%	19.4	21%
Total Transportation	18.6	19.6	5%	21.7	16%

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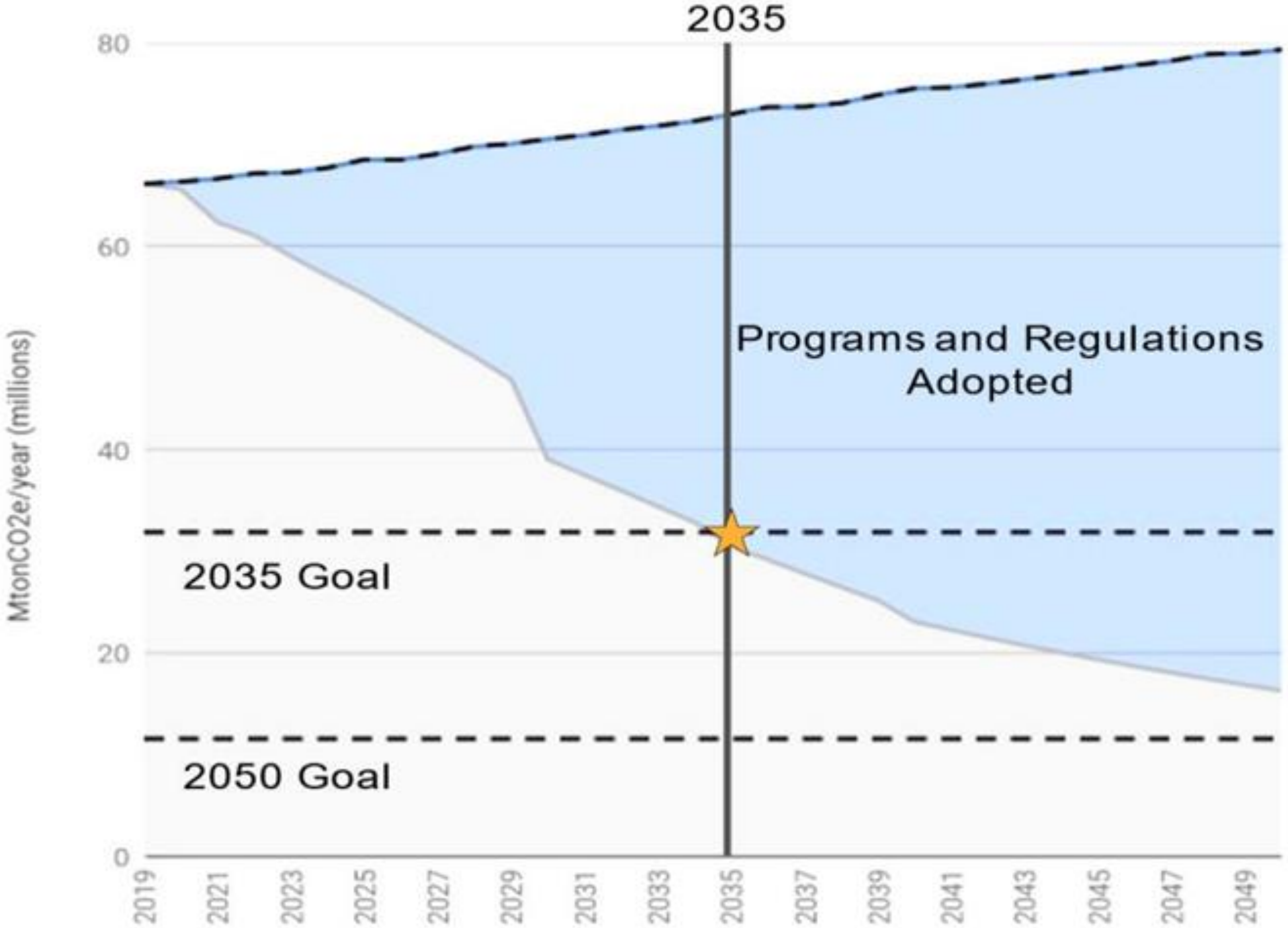
EV Impacts on Greenhouse Gas Emissions

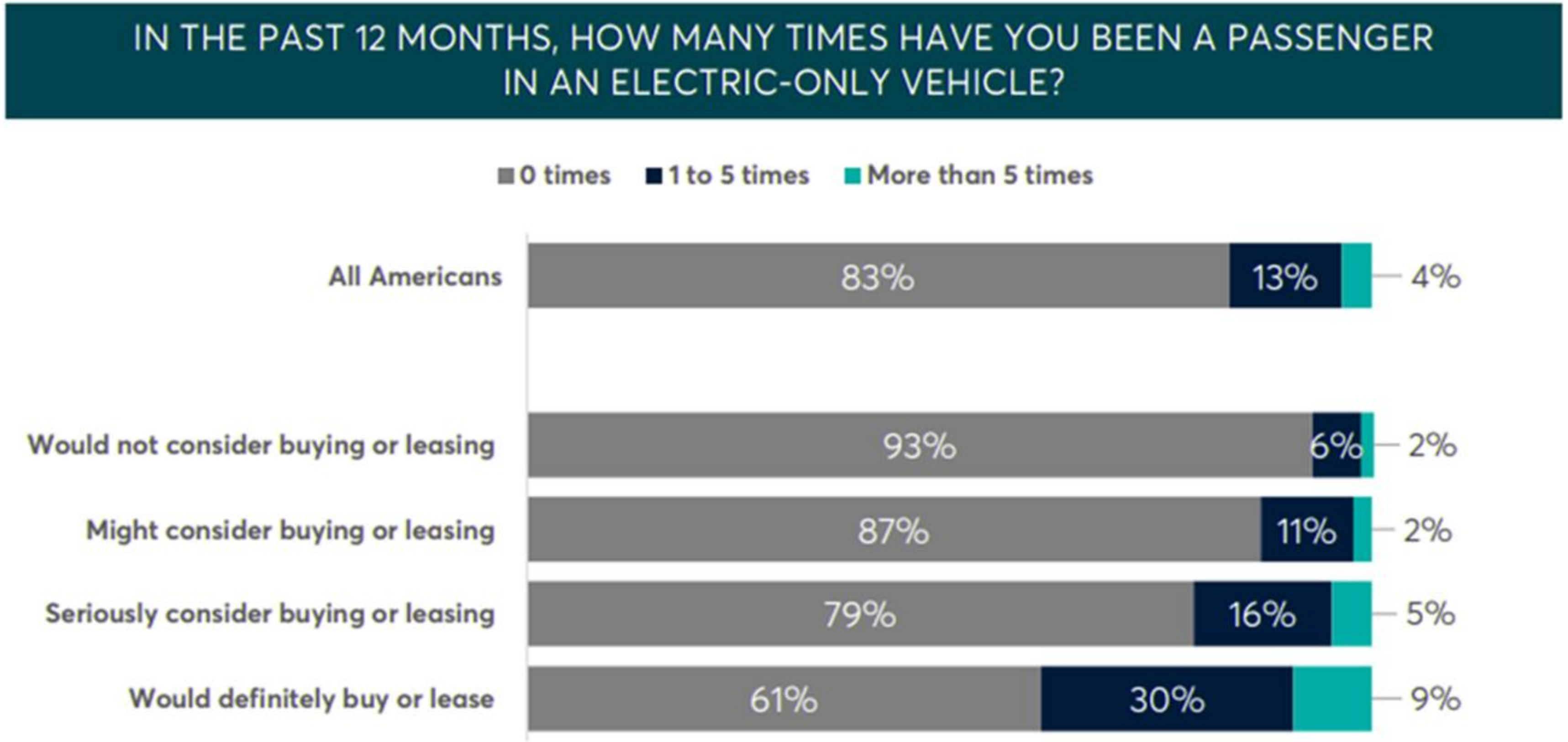
The transportation sector may need to do more than its proportionate share to meet Oregon's goals because other sectors may be harder to decarbonize.

Figure 1: TIGHGER-Projected Overall State GHG Emission Reductions from Programs and Regulations Adopted



Oregonians' Awareness of EV Options & Benefits

Figure 3: Consumer Reports Survey Results[1]



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Demographic Distribution of EVs

Demographic data largely matched 2021 Biennial Zero Emission Vehicle Report findings

Geographic Area

- Highest adoption in suburban areas
- Small gains in rural areas and towns

Income Level

- Income level strongly correlated with EV ownership
- No change since 2021

Single or Multi-Unit Homes

- More EVs in single-unit homes
- More growth in areas with multi-unit homes

Own or Rent

- Most EV owners live in areas with more homeowners.
- Fewer BIPOC Oregonians own their own homes.

Table 1: EV Registration Growth Rate in Areas with Different Percentages of Single-Family Homes[14]

Percent Single-Family Homes	<50%	50 – <75%	75 – <100%	100%
Percent Increase in EV Registrations Since 2021	76.5	75.6	74.1	61

EV Platforms Available

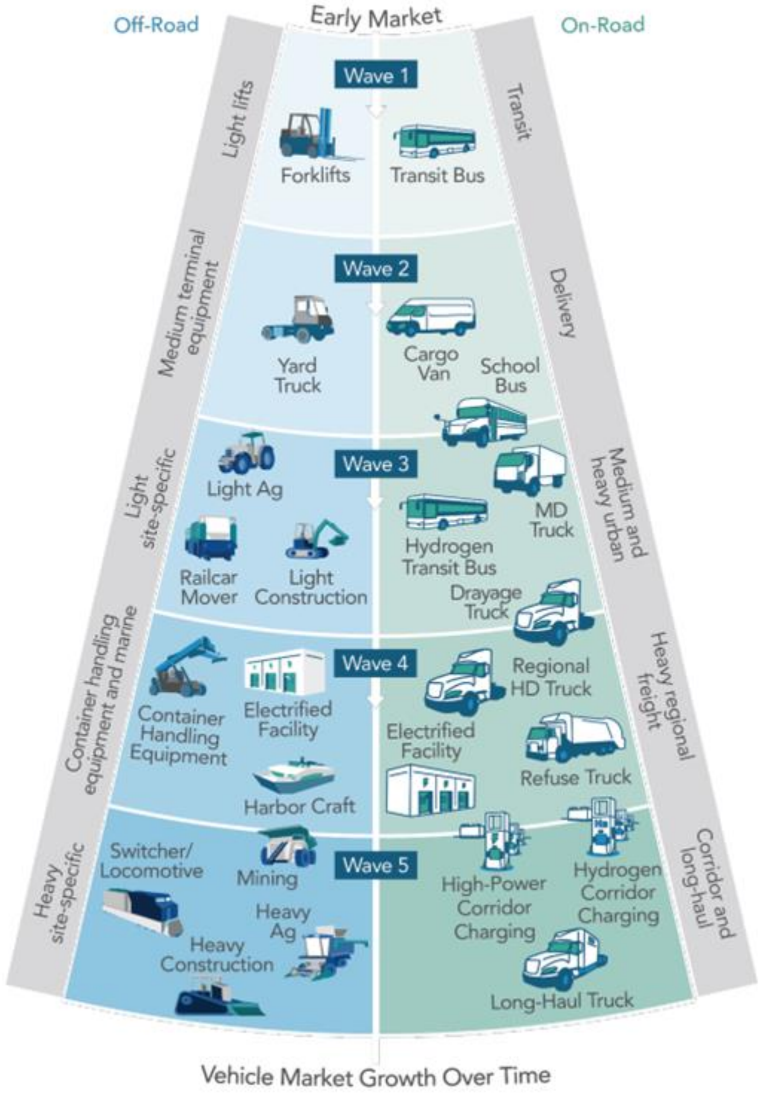
More than 70 models of passenger electric vehicles are available for purchase, and there is an increasing variety of options, including sedans, crossovers, SUVs, and pickup trucks.

Table 3: Aspirational EV Production Goals from Light-duty Auto Manufacturers[8]

Manufacturer	Statement
American Honda Motor Co.	aims for all its sales to be electrified vehicles by 2040
BMW North America	says it will bring roughly a dozen new EVs to market by 2025
Ford Motor Company	says it will produce more than 2 million EVs annually by 2026
General Motors	aims to have 20 EVs available in the U.S. by 2025 as it moves to an all-electric model lineup by 2035
Hyundai Motor Company	has committed to becoming carbon-neutral by 2045
Tata Motors	announced that all Jaguar and Land Rover models will have an electric version by the end of the decade
Kia Motors America	announced a road map with a target of 1.2 million annual BEV sales worldwide by 2030
Mazda Motor Company	will expand MX-30 availability to other states in 2022 (currently limited to CA)
Mercedes-Benz USA	announced that all newly launched vehicle platforms will be electric-only from 2025 onward
Mitsubishi Motors	plans to expand its electrified lineup to 50 percent of global sales by 2030, then on to 100 percent electrified by 2035
Nissan North America	will launch 23 electrified models, including 15 EVs, worldwide by 2030
Stellantis North America	aims to have its first battery electric vehicle by 2025 and to have an all-electric lineup by 2028
Subaru of America	made its entrance into the electric vehicle market in 2022 with an all-electric SUV called the Solterra
Tesla Motors	makes exclusively electric vehicles
Toyota Motor Sales	is promising to build 3.5 million battery-only electric vehicles per year, worldwide, by 2030
Volkswagen Group of America	says it will launch 70 pure electric vehicles and 60 hybrids by the end of the decade
Volvo Group North America	has a plan to build only pure electric vehicles by the end of the decade

EV Platforms Available

There were 209 models of medium- and heavy-duty vehicle models available in the U.S. and Canada in 2022, up from 161 in 2021 – and model availability continues to grow.



EV Cost Differences with Internal Combustion

Light-Duty Vehicles Continue to Approach Cost Parity

- Battery costs are anticipated to drop below $100/kilowatt-hour between 2025-2027.
- Lifetime costs of EVs continue to be lower than internal combustion vehicles.
- The $7,500 for new and $4,000 for used federal tax credit in the Inflation Reduction Act is a key policy addressing costs.
- The effects of the suspension of Oregon's Clean Vehicle and Charge Ahead rebates are not yet known, but the costs for purchasing an EV are higher for Oregonians who cannot access the rebates.

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EV Cost Differences with Internal Combustion

High up-front costs are likely to remain a barrier to widespread adoption of medium- and heavy-duty EVs through at least 2030, when some analysts are predicting they will reach cost parity for diesel counterparts.

Table 7: Total cost of ownership analysis of four MHDV classes.

	Daily Miles per Vehicle	Days Used per Week	EV Vehicle Price	Gas Diesel Price	Rebates/ Incentives	**10 Year TCO Gas**	**10 Year TCO Electric**	**Savings/Loss (electrification)**
Municipal Bus								
Reference	120	7	$785,000	$400,000	$62,650	**$1,093,623**	**$844,590**	$148,377
Low-cost	120	7	$628,000	$400,000	$62,650	**$1,093,623**	**$687,590**	$406,034
High Usage	144	7	$785,000	$400,000	$62,650	**$1,198,503**	**$837,525**	$360,978
School Bus								
Reference	46	5	$342,500	$100,000	$46,580	**$193,738**	**$322,623**	$(128,885)
Low-cost	46	5	$274,000	$100,000	$46,580	**$193,738**	**$254,123**	$(60,385)
High Usage	55	5	$342,500	$100,000	$46,580	**$206,415**	**$320,463**	$(114,048)
Refuse Truck								
Reference	80	6	$675,000	$350,000	$62,650	**$830,499**	**$804,432**	$26,067
Low-cost	80	6	$540,000	$350,000	$62,650	**$830,499**	**$669,432**	$161,067
High Usage	96	6	$675,000	$350,000	$62,650	**$882,559**	**$805,201**	$77,358
Delivery Van								
Reference	48	5	$65,000	$50,000	$14,080	**$142,526**	**$82,025**	$60,500
Low-cost	48	5	$52,000	$50,000	$14,080	**$142,526**	**$69,025**	$73,500
High Usage	57	5	$65,000	$50,000	$14,080	**$153,372**	**$81,183**	$72,188

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EV Charging Availability & Reliability

Charging infrastructure growth in Oregon is outpacing national growth, with 1,922 Level 2 and 714 DC Fast Chargers as of August 23, 2023.

Figure 3: DC Fast Chargers Available in Oregon[16]

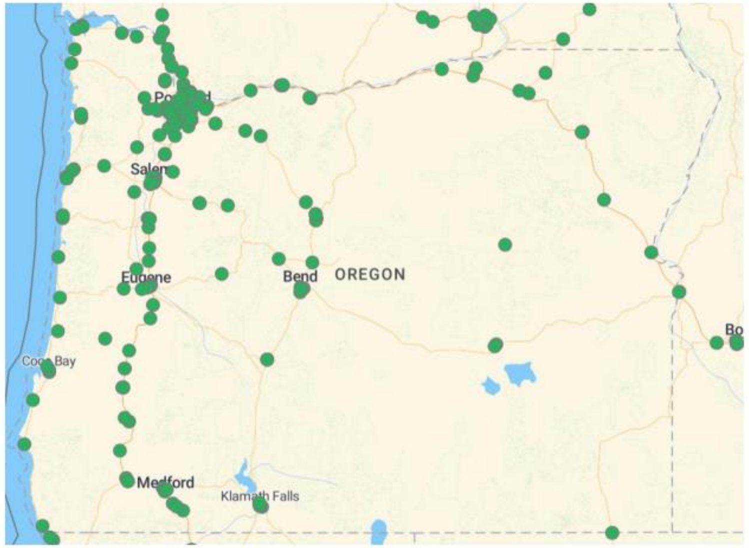
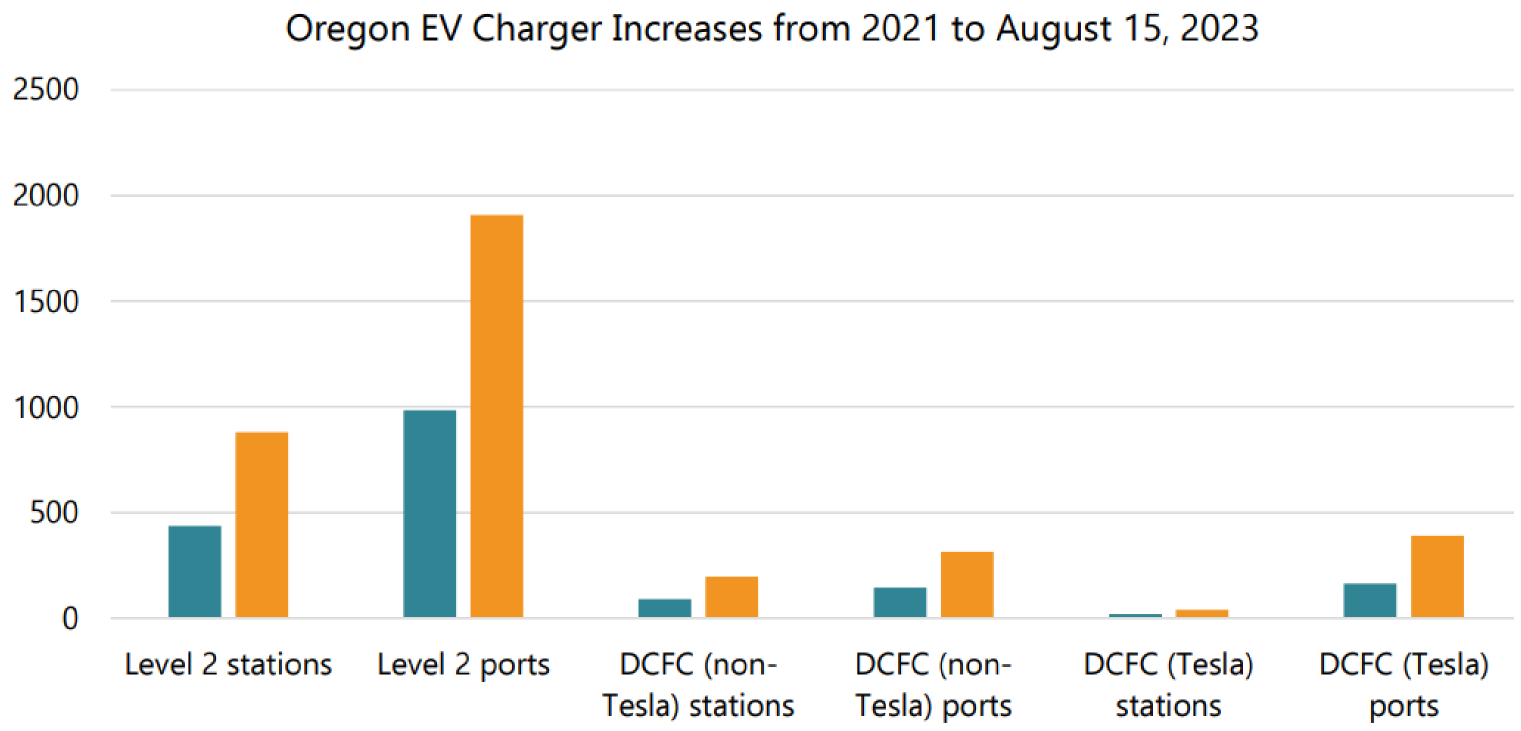


Figure 2: Oregon Growth of Public EV Charging Ports and Stations[4]



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EV Charging Availability & Reliability

More work is needed especially for Oregonians living in multi-unit homes and rural areas, where widely available public EV charging infrastructure needs to be in place before driving an EV can be a viable transportation option.

EV Charging Availability & Reliability

Table 2: Medium- and Heavy-Duty Charging Needs by Vehicle Type

Home Base, Level 2	Home Base, Level 3	Public
• Heavy-duty Pickup & Van • School Bus • Delivery Van • Service Van • Service Truck • Box Truck (Class 3 – 5) • Stake Truck (Class 3 – 5) • Stake Truck (Class 6 – 7)	• Heavy-duty Pickup • *Regional Haul Tractor* • Transit Bus • Shuttle Bus • Delivery Truck • Refuse Hauler • *Box Truck (Class 6 – 7)* • *Box Truck (Class 8)* • Dump Truck	• Long Haul Tractor • *Regional Haul Tractor* • *Box Truck (Class 6 – 7)* • *Box Truck (Class 8)*

Table 3: Average Costs for Different Types of Commercial EV Chargers

	L1	L2	DCFC - 50 kW	DCFC - 150 kW	DCFC - 350 kW
Equipment Costs	Up to $350	$1,100 to $7,000	$22,000 to $50,000	$80,000 to $120,000	$150,000 to $180,000

The cost to install charging is highly uncertain, depending on many variables, including the number of chargers to be sited, the amount of land needed, and power requirements.

Power requirements are the most variable portion of installation costs, depending on the type of charger needed, available electric circuit capacity, distance from the nearest utility interconnection, and the potential for distribution system upgrades.

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EV Charging Availability & Reliability

Federal and state policies supporting EV charger availability

- Federal Inflation Reduction Act Business and Personal Tax Credits for EV Chargers and Installation
- ODOT National Electric Vehicle Infrastructure (NEVI) Formula Program
- ODOT Charging and Fueling Infrastructure Discretionary Grant Program
- ODOT Community Charging Rebates Program
- ODOT Carbon Reduction Program
- DEQ Clean Fuels Program
- DEQ Zero-Emission Fueling Infrastructure Grant Pilot Program
- ODOE Public Purpose Charge Schools Program
- OPRD Charging Infrastructure at Oregon State Parks
- DCBS Building Codes

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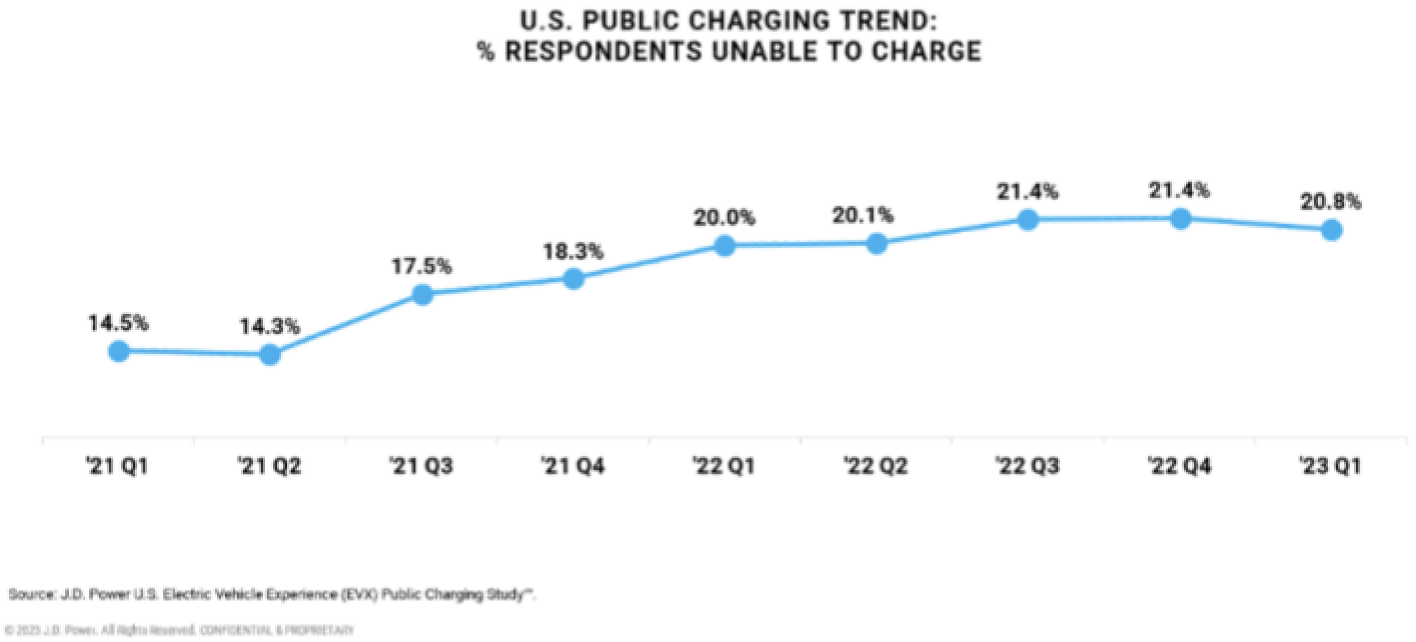
EV Charging Availability & Reliability

Figure 15: EV Charging Infrastructure Reliability Over Time[111]



"There is perhaps no charging infrastructure topic more urgent at this moment than ensuring that all new installations going forward are designed and supported over the long term with reliability front of mind."

- National Renewable Energy Laboratory

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Minimizing Effects of EVs on the Electric Grid

Oregon electric utilities, and the broader western grid, are not expecting resource adequacy issues associated with adoption of electric vehicles over the next five years.

Table 1: Portland General Electric's Reference Case Load Growth Forecasts 2023-2030 in aMW[5] [6]

Year	Base Load[5]	EV Loads[6]	Building Electrification[5]	Energy Efficiency[5]	Total Annual Energy[5] [6]
2023	2,334	17	4	-31	2,323
2024	2,402	29	7	-61	2,376
2025	2,463	43	10	-91	2,422
2026	2,530	63	13	-121	2,480
2027	2,594	83	17	-151	2,535
2028	2,649	110	20	-181	2,586
2029	2,703	141	23	-214	2,635
2030	2,759	177	27	-247	2,691

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Minimizing Effects of EVs on the Electric Grid

Electric vehicle charging and other electrification measures represent significant new loads on local utility distribution systems and can trigger the need for upgrades, usually in the form of a utility service transformer replacement.

Table 3: Load Profiles for Large Electric End Uses in Typical Homes

Device	Estimated Peak Demand (kW)	Estimated Annual Electricity Consumption (kWh)
Electric Furnace	10 to 20+	13,695
Electric Baseboard	10 to 20+	10,396
Electric Heat Pump	10 to 20 (Includes electric resistance backup element)	6,182
Electric Vehicle Charger (level 2)	6 to 20	3,800
Electric Water Heater	4.5 (typical)	3,030
All other Major Appliances	NA	3,145
Gas Furnace	< 1	1,054

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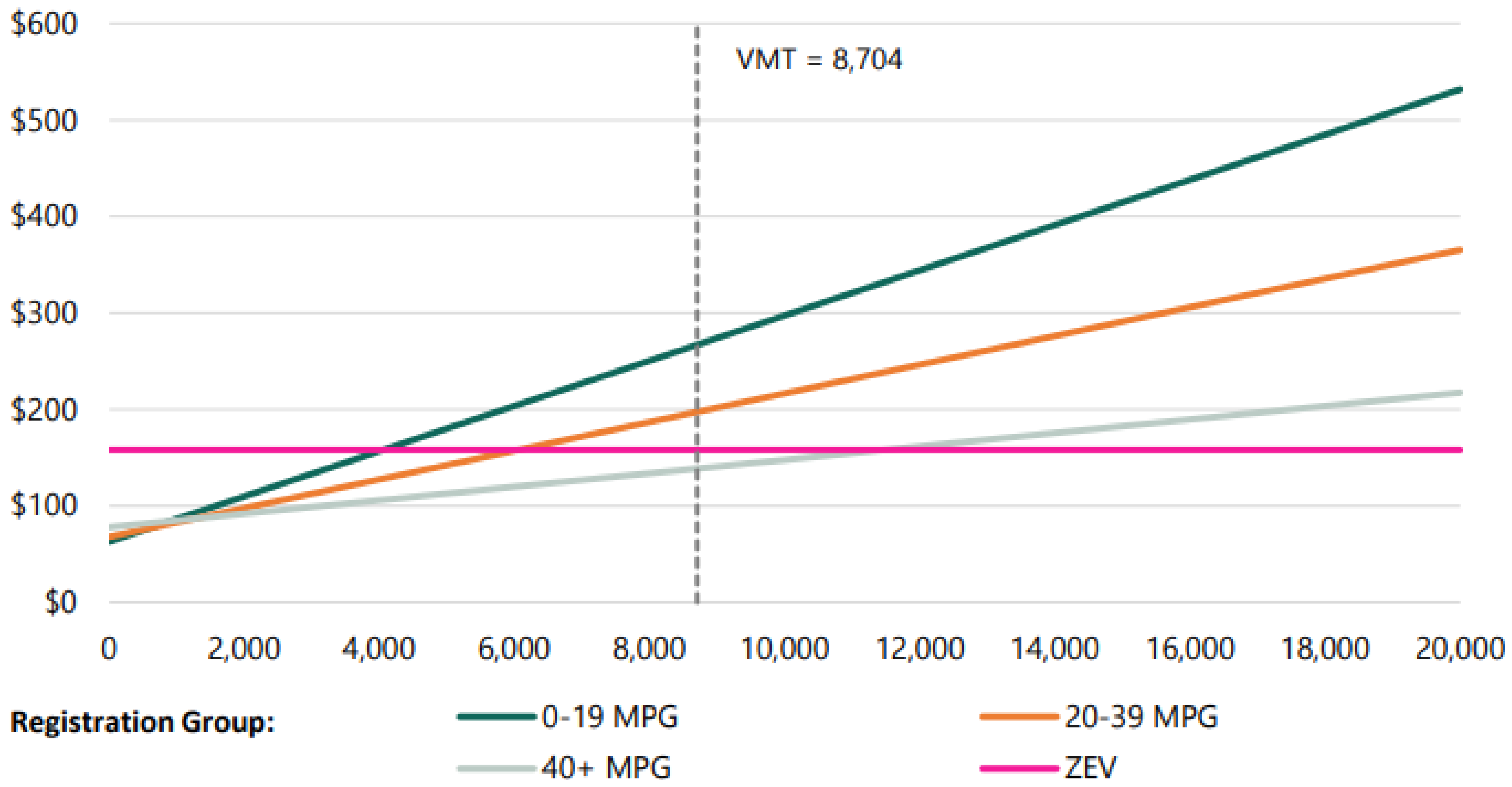
Impacts to the State Highway Fund

Switching from an internal combustion vehicle to an EV does not always lead to reduced highway fund revenue, but it becomes more likely for a driver with higher VMT that has switched from a vehicle with a lower fuel economy.

Figure 6: Annualized Highway Fund Revenue Per Vehicle (Registration + Fuel Tax) [3 7 12]



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Thank You

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Contact: Jessica Reichers, Technology & Policy Manager

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