Northwest **Power** and **Conservation** Council

March 5, 2024

MEMORANDUM

TO: **Council Members**

FROM: **Steven Simmons**

SUBJECT: **Approach to Solar and Electric Vehicles in the Long-Term Load Forecast**

BACKGROUND:

Presenters: Steven Simmons, Dor Hirsh Bar Gai, Dylan D'Souza

Summary: Staff will provide an update on the continued buildout of the new long-term load forecasting framework. This update will cover recent efforts to add two important load components to the overall forecast – electric vehicles and small-scale solar.

Relevance: The region is expecting to see significant load growth from electric vehicles over the coming decades. Forecasting the pace of the transition to electric will be important for power planning, as well as the expected charging profile that will be placed on the grid.

Installation of small-scale solar capacity – primarily behind-the-meter rooftop solar in the residential and commercial sectors – has been growing in recent years. Having a handle on both the magnitude and location of the capacity installations is an important input to the forecast.

Workplan: B.1.1 Finalize development of the new long-term load forecast model (ITON SAE) and update the long-term load forecast.

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More Info: For further background:

https://www.nwcouncil.org/fs/18575/2024_01_p3.pdf

https://www.nwcouncil.org/2021powerplan_transportation-model-high-electric-case/

Overview of the Long-Term Load Forecast Approach to EVs & Solar

Steven Simmons

Dor Hirsh Bar Gai

Dylan D'Souza

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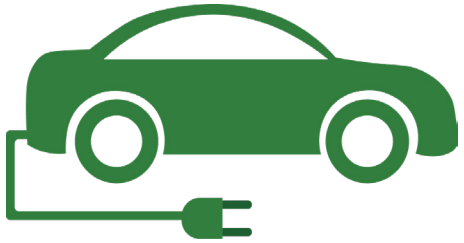

Today's Discussion

1. The Load Forecast – Steven
   a) Recent history - EVs and Small-Scale Solar
   b) Forecast development and incorporation into SAE
2. More on Electric Vehicles - Dor
3. More on Solar - Dylan

Load Forecast Project - SAE

- Done
- In progress
- Starting soon
- Not yet started

Milestone 1

- Weather zones by BA
- Weather response functions by BA
- Normal weather by BA
- Typical weather by BA

Milestone 2

- Residential end-use indices by building type
- Commercial end-use indices by building type

Milestone 3

- Industrial intensities by market segment
- Data Center indices by BA
- Behind the Meter Solar (PV) forecast of capacity by BA
- Electric Vehicle Forecast by BA

Milestone 4

- Monthly SAE Model by BA
- Apply Energy Efficiency Estimates
- Annual end-use forecast by building type and BA

Milestone 5

- Hourly end-use forecast by BA
- Forecast reports
- Training

Load Forecast

Small Scale Solar

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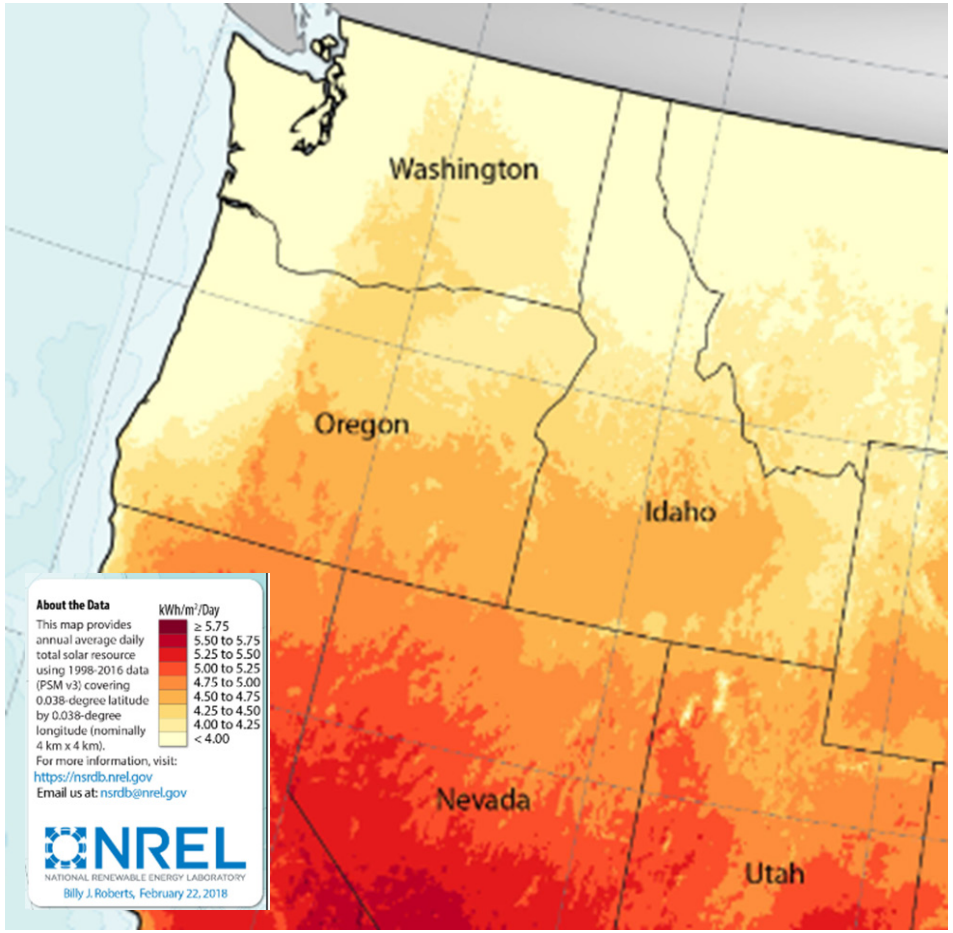
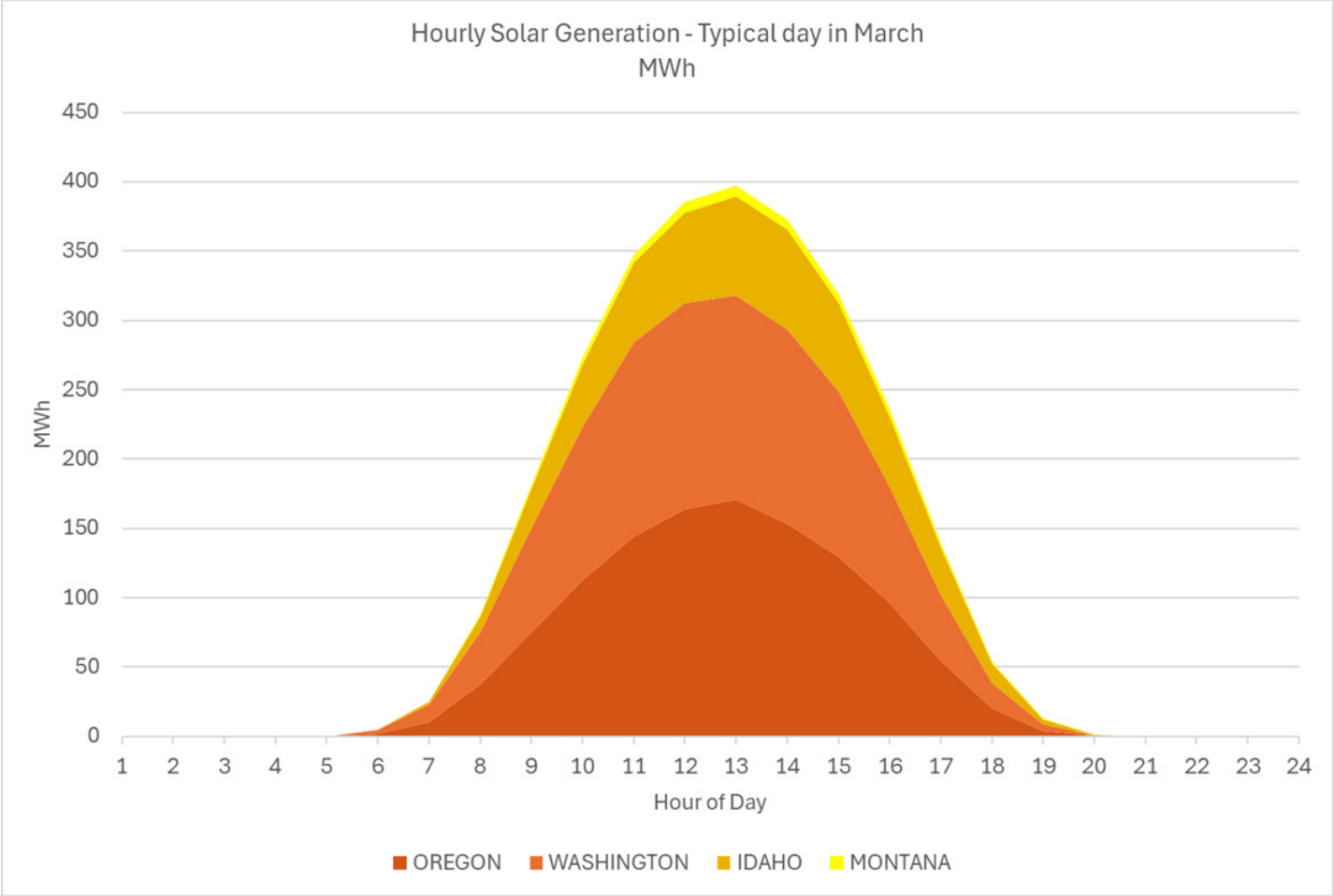
Small Scale Solar

- For the SAE Framework – we are providing the historic and forecast input data sets of installations of solar capacity by Balancing Authority
- As in the past – we use EIA 861 Monthly and Annual data sets to track installs of BTM solar in the region and to help develop forecasts of future installs
- We have developed a forecast of capacity through 2045 using historic data up through 2022
- Electricity generation from the installed capacity will be forecasted using BA level GHI values (global horizontal irradiance)



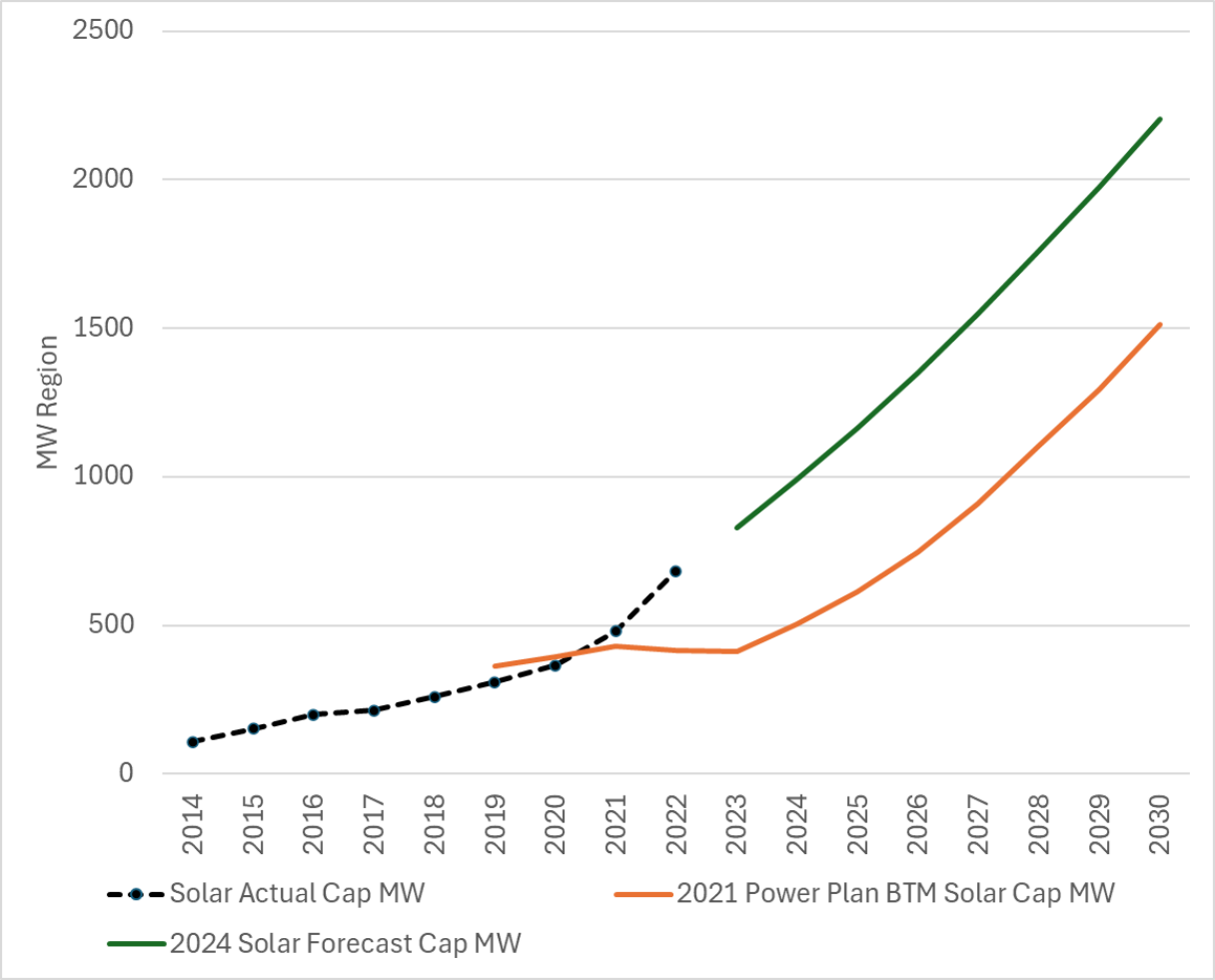
Current Small-Scale Solar

As of the end of 2022 – there were 102,789 total installations and 683 MW of Solar Capacity In Region – generating around 110 aMW			
% of regionally installed capacity – by state		% of regionally installed capacity – by BA	
OR	42 %	PACW	22 %
WA	41 %	PSEI	20 %
ID	15 %	PGE	17 %
MT	2 %	BPAT	15 %
		IPCO	12 %

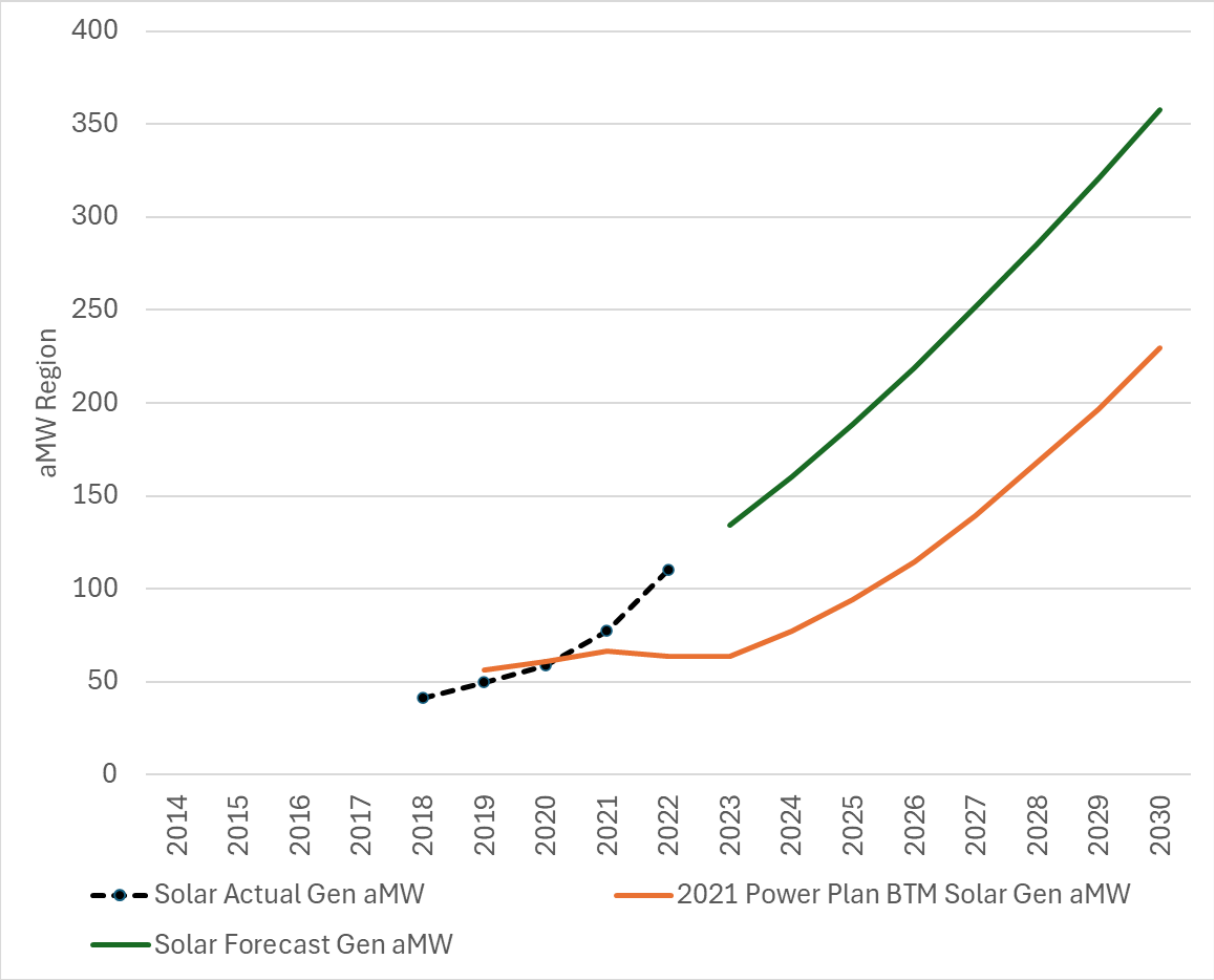


Translation of current installed capacity to generation for a typical day in March

Small Scale Solar Forecast



Historic & Forecast of Installed Capacity – for the region



Historic & Forecast of generation – for the region

Load Forecast

Electric Vehicles

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Electric Vehicles

- For the SAE Framework – similar to solar - we are providing the input data for historic and forecast of electric vehicles and their demand by Balancing Authority on an annual level
- Within the SAE - charging type estimates are made (i.e. Residential Level 2, Public Level 2, Public Level 3…..) and charging profiles will convert the vehicle forecast to monthly and hourly loads
- We are seeing strong growth in Electric Vehicle registrations in the region – primarily in Seattle and Portland
- A key for the forecast will be the pace of vehicle stock turnover

For the forecast work we looked at 3 primary sources

1. 2021 Power Plan High Electric Transportation Case

https://www.nwcouncil.org/2021powerplan_transportation-model-high-electric-case/

2. Energy Policy Simulator – this is a free, open-source modeling tool developed by Energy Innovation and RMI – to evaluate energy and climate policies

https://energypolicy.solutions/

3. PNNL GODEEP – the grid operations, decarbonization, and environmental equity program

https://godeeep.pnnl.gov/

State EV Registration Data – OR, WA, Federal

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

https://data.wa.gov/Transportation/Electric-Vehicle-Population-Data/f6w7-q2d2/about_data

https://afdc.energy.gov/transatlas/#/?year=2022&state=WA&fuel=PHEV

Electric Vehicle Forecast

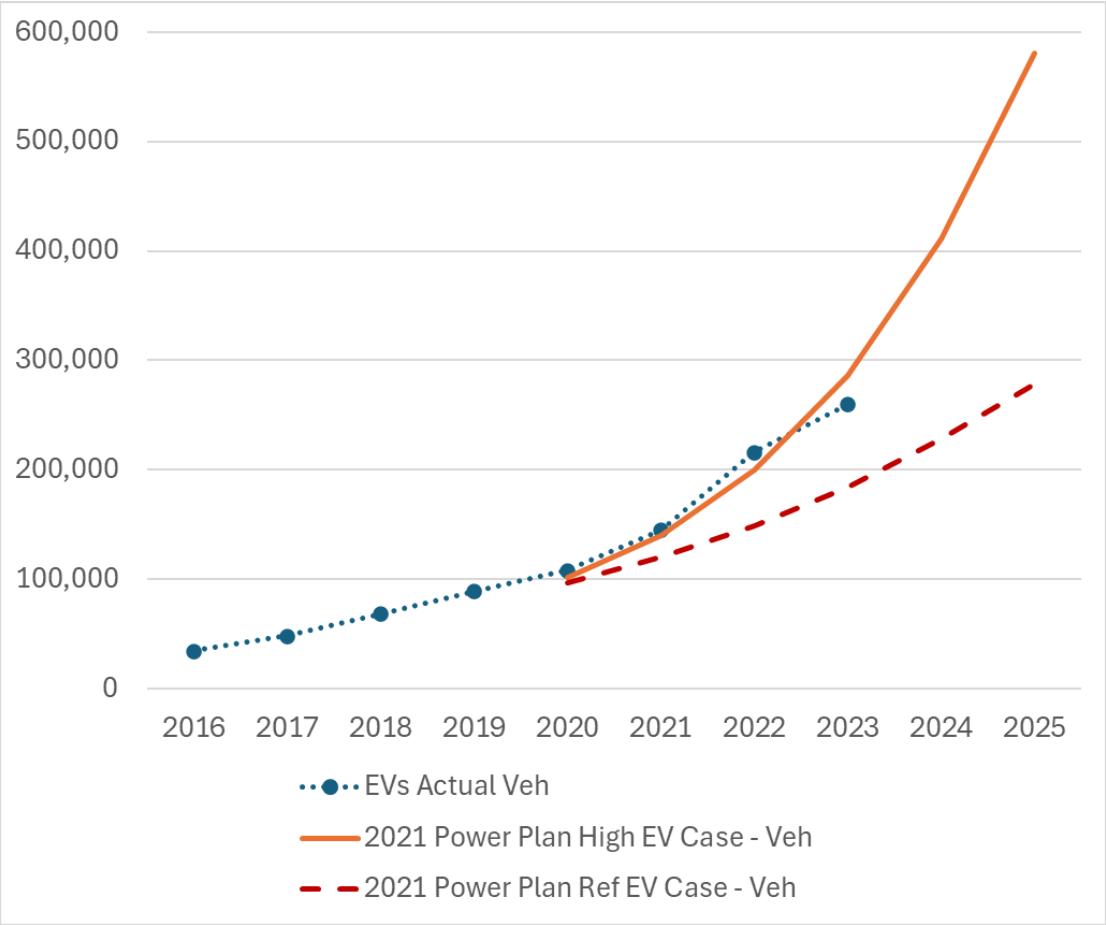
For this forecast cycle we settled on using the 2021 Power Plan High Electric Transportation Case Forecast for vehicle stock and vehicle demand – with a few updates

The forecast is on state level – so to allocate among the BAs – estimates of electric vehicle registration locations and other data was used (OR and WA EV Dashboard Data), along with IRPs from large utilities such as PSE and SCL, and various reports from Idaho and Montana

Reasons for using the Power Plan High Forecast Case:

1. The forecast was developed late in the plan to simulation EV policy that was forming in the states of WA and OR
2. Recent actuals (EV registrations by state) are in line with the forecast – giving some confidence in the numbers
3. The forecast also aligns with recent individual Utility IRP forecasts

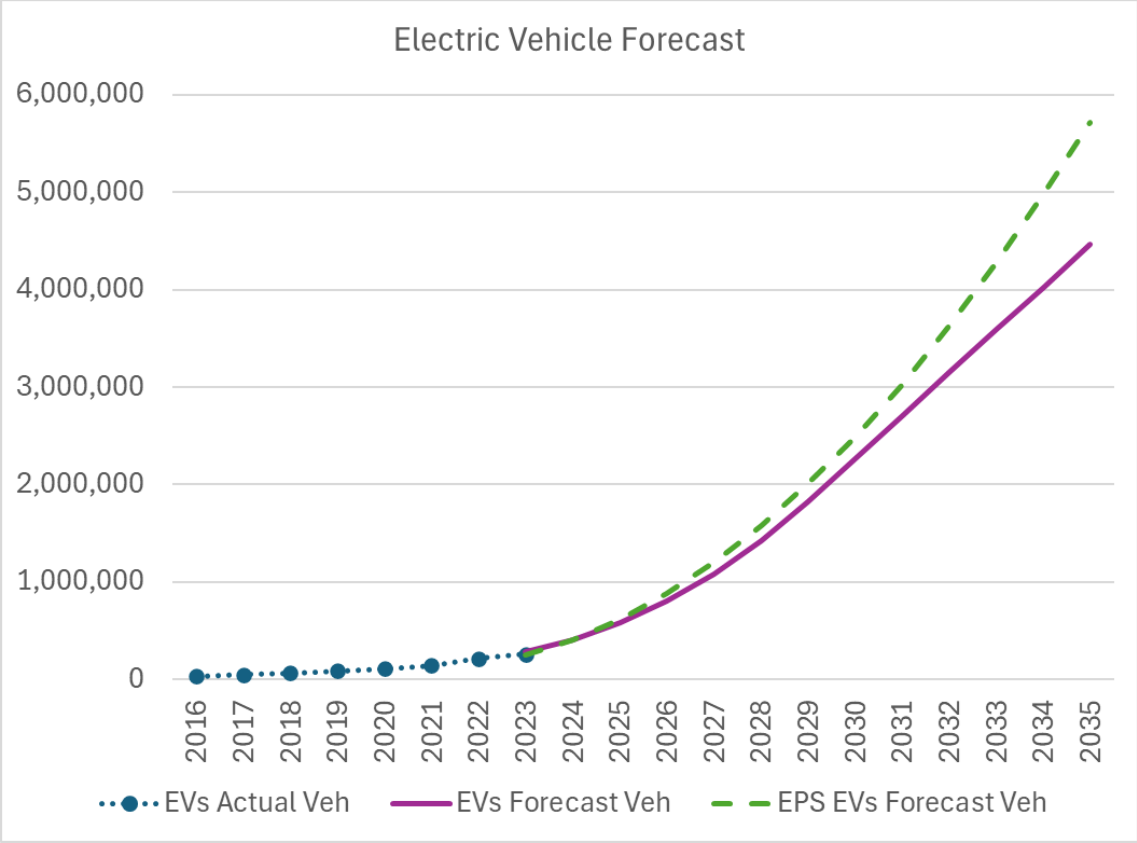
Electric vehicle data – vehicles on the road and 2021 Power Plan Forecasts



	# of EVs on the road at the end of 2023	% of region
WA	166,795	64 %
OR	78,967	30 %
ID	12,100	5 %
MT	2,565	1 %

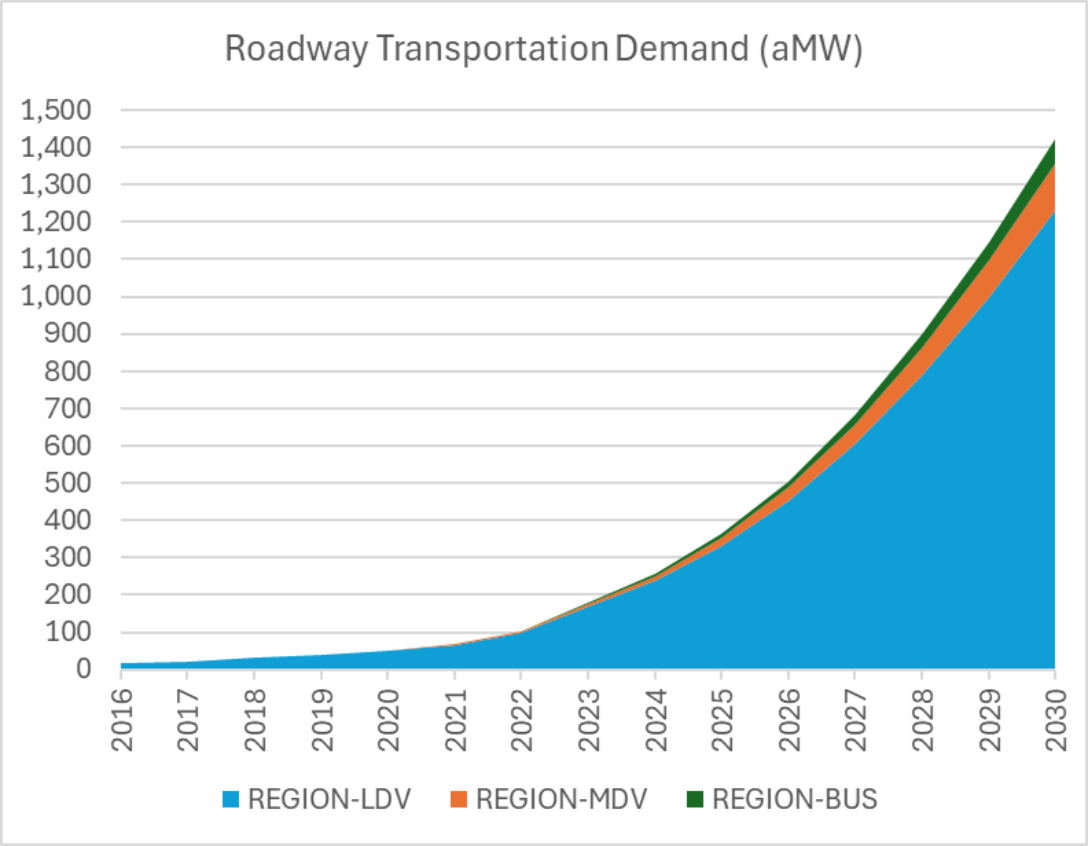
WA – updated Feb 14,2024
Total 173,533:
EVs 135,617
PHEV 37,916

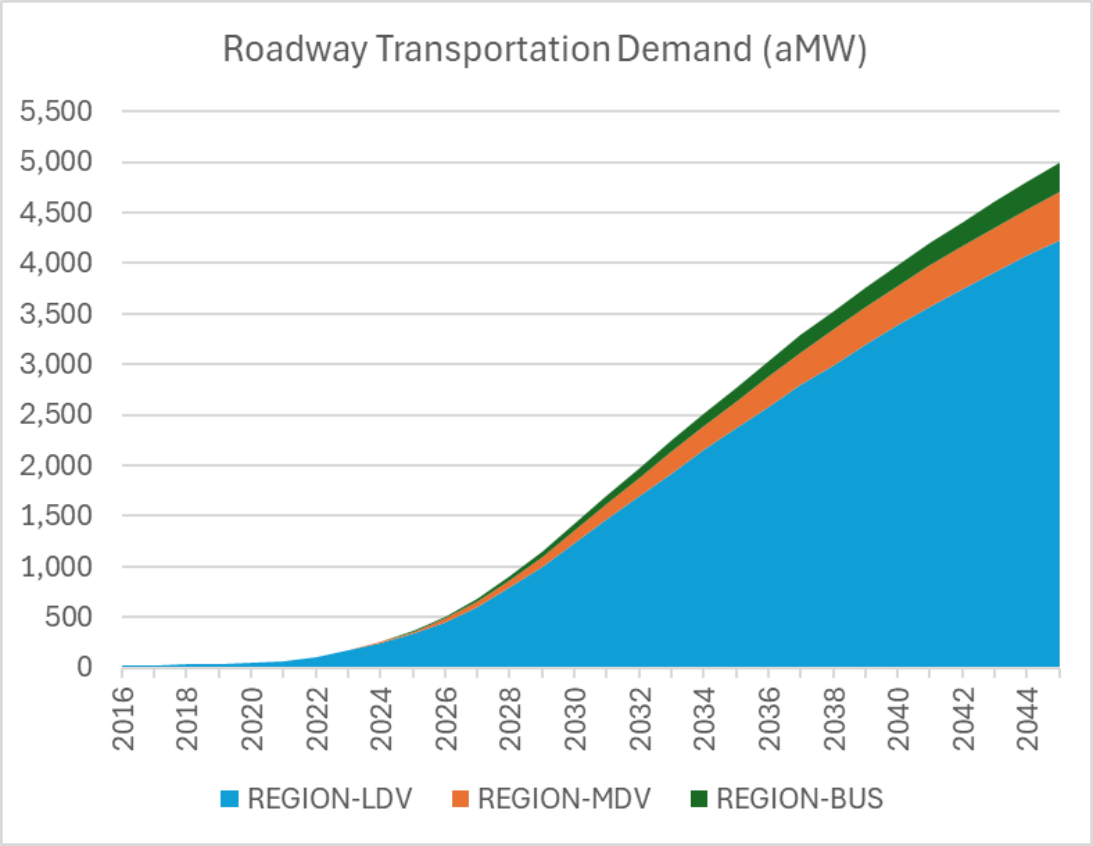
Electric Vehicle Forecast – LDV



Actual Regional Load in 2023	21,769 aMW
Year	Forecast EV Load aMW
2025	331
2030	1,232
2035	2,367
2040	3,381

Roadway Transportation Demand Forecast Passenger cars, Trucks, BUS





More on Electric Vehicles

Overview & Models

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Model Drivers

Class 1-8

Policies & Economic Growth

Electrification goals (EV sales)

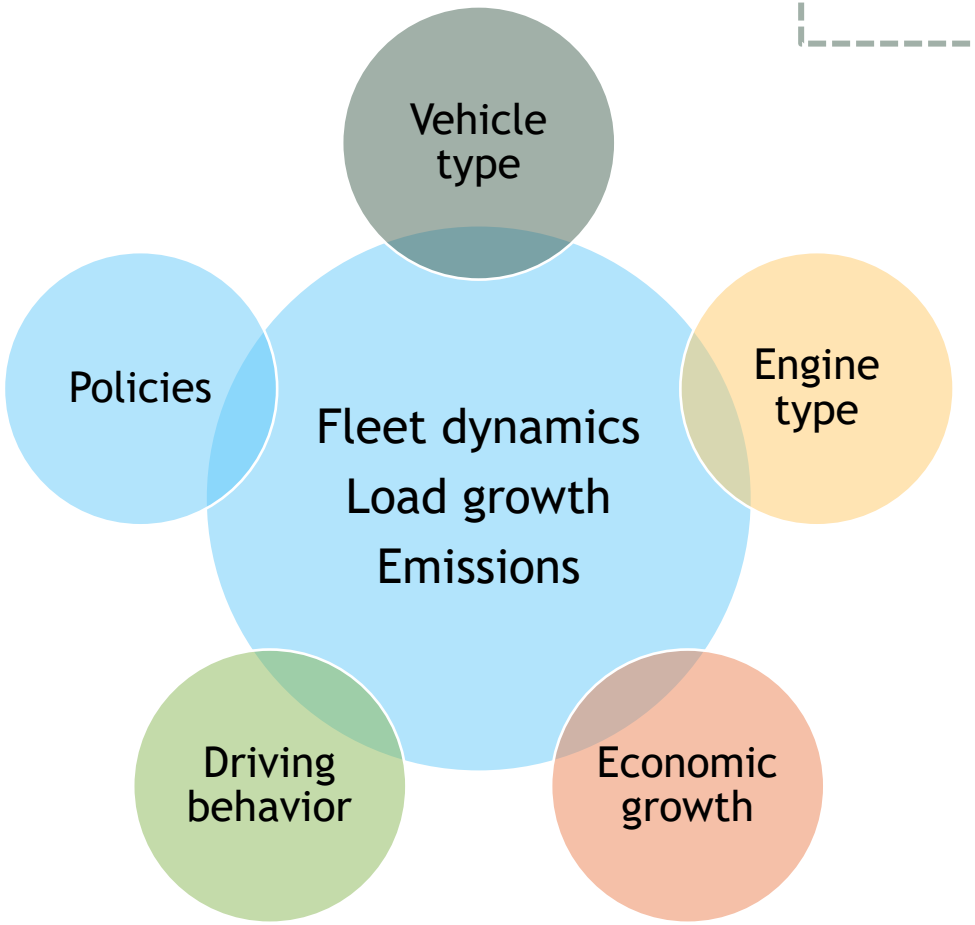
Inflation Reduction Act

Fuel efficiency standards

Behavior

Vehicle Miles Traveled

Charging profiles



Engine Type

Gasoline

Diesel

Natural gas

Electricity (EV, PHEV)

Biodiesel

Hydrogen

Forecast Methodology for 2021-2050

Forecast model

Vehicle Stocks by state / BA

- Fleet growth
- Electrification policy
- Retirement

→

Annual fuel/load consumption

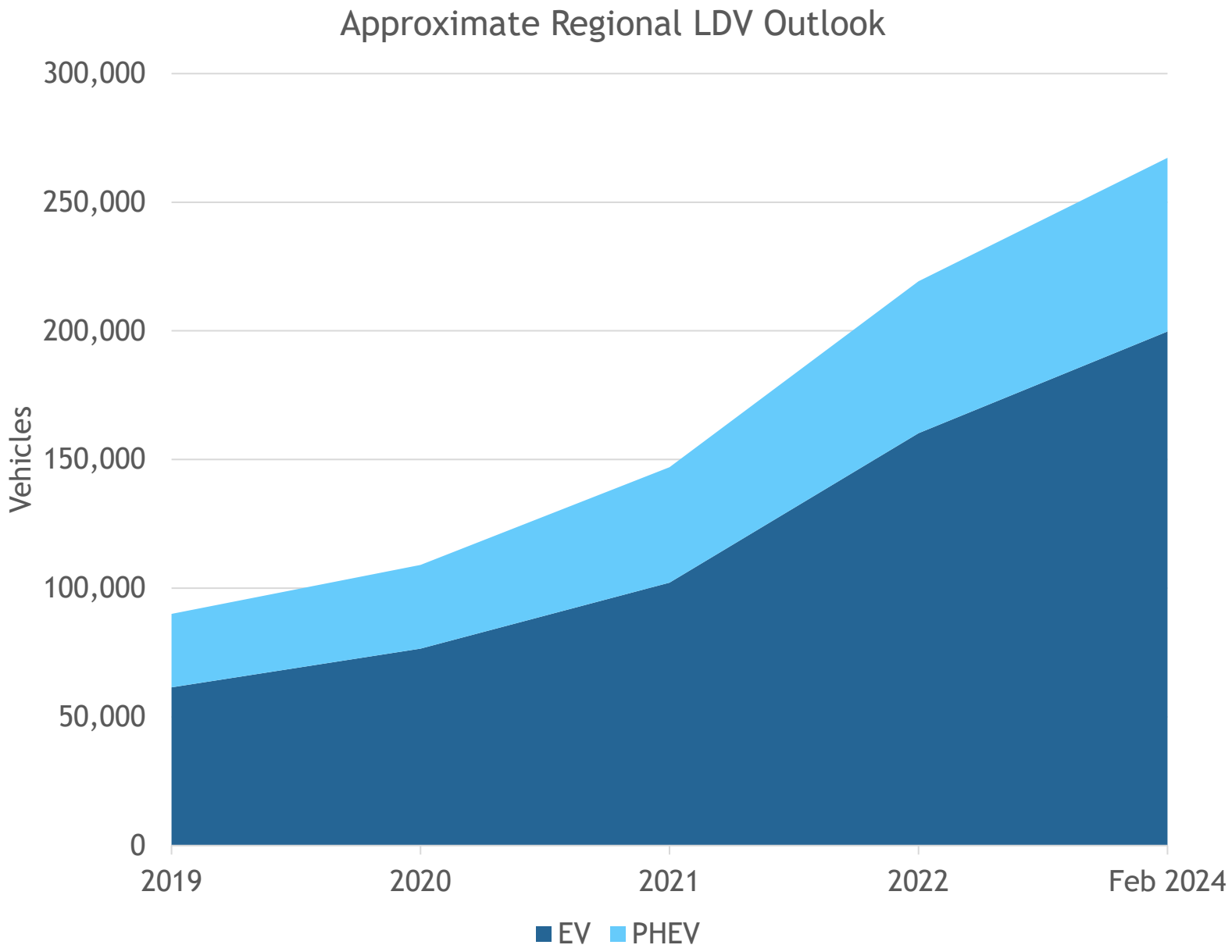
- Fuel economy
- Vehicles Miles traveled
- CO2e Emissions
  - Tailpipe
  - Indirect

→

Post-processing

Hourly load shape

- Charging profiles
- State/BA-level outputs



OR updated 2023

ID & MT updated 2022

WA updated Feb 2024

Forecast Exploration

In-house development	Existing models/datasets	Utility IRPs
• Vensim • Ventity	• PNNL GODEEP • Energy Policy Simulator	• PGE • PSE • Avista • PAC • IP • SCL • TP • Snohomish PUD • EWEB • Clark PUD • Northwestern • BPA

Next Steps

- Stakeholder Feedback on modeling efforts:
  - EVSE supply chain challenges
  - Demand side influence (TOU, DR, charging incentives)
  - Account for regional/locational differences
  - Role of hydrogen in MHDV load forecast

- Continued comparison of actual sales/registration and utility IRPs to forecasts as we move closer to the next Power Plan

More on Solar

Behind the Meter Solar

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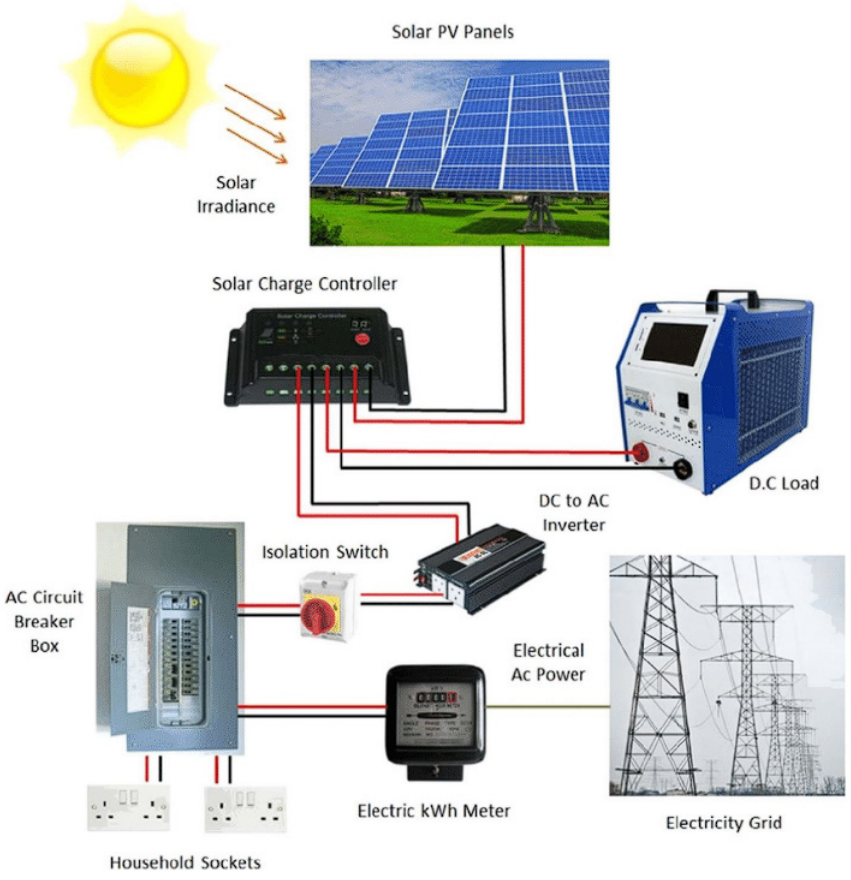
Background on Behind-the-Meter Systems

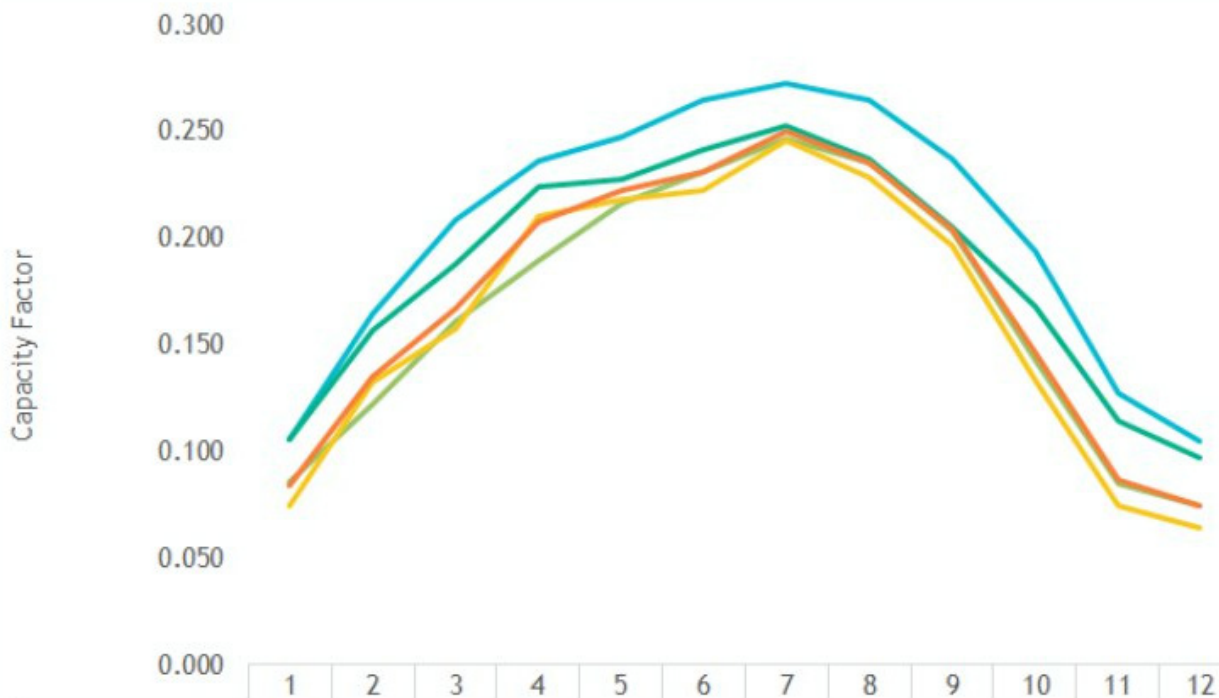
- Behind the meter means any technology that is located on the customer's side of the utility meter – not controlled by the utility.
- Two main types: Solar and Solar + Battery



Net Metering

- A billing arrangement that allows residential customers to earn credit for the excess electricity that their solar panels produce.
- Oregon, Washington, and Montana have compensation policies in place
- Idaho puts the incentive determination in the utility's hands
- Net Billing
- Utility Specifics and Changes
  - PGE, PacifiCorp, etc.
- Requirements for grid interactive systems

Behind the Meter Rooftop Solar Potential Assessment



	1	2	3	4	5	6	7	8	9	10	11	12
IDAHO	0.106	0.164	0.209	0.236	0.248	0.265	0.273	0.265	0.237	0.193	0.128	0.105
MONTANA	0.106	0.157	0.188	0.224	0.228	0.241	0.253	0.237	0.205	0.168	0.114	0.097
OREGON	0.085	0.122	0.161	0.189	0.217	0.231	0.247	0.235	0.203	0.143	0.085	0.074
WASHINGTON	0.075	0.133	0.157	0.210	0.218	0.222	0.246	0.229	0.196	0.134	0.074	0.064
NORTHWEST	0.084	0.135	0.167	0.208	0.222	0.231	0.250	0.235	0.204	0.146	0.087	0.074

- Solar Potential for the Region

	Technical Potential Capacity total (GW)
Oregon	14.1
Montana	3.2
Washington	22.8
Idaho	4.7

As per NREL Study Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment (2016)

Behind the Meter Trends in the Region

- Growth in Residential Solar Systems
- In Oregon, going into 2023 about 5% of projects has storage, by end of 2023 that rose up to 10%
- Microgrids for large industrial projects
- Changes or updates to Policy
- As with the rest of the west, two main constraints
  - Interconnection
  - Land use

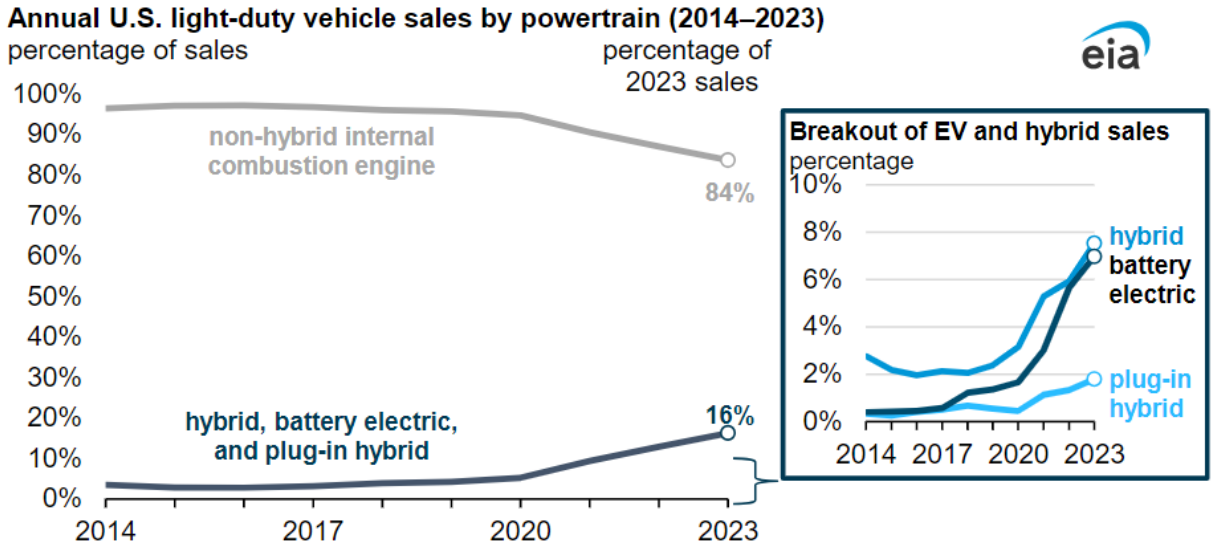
Extra Slides

Is there an EV slow down?

IN-BRIEF ANALYSIS

JANUARY 31, 2024

Electric vehicles and hybrids surpass 16% of total 2023 U.S. light-duty vehicle sales



Data source: Wards Intelligence
Note: EV = electric vehicle, which includes both battery electric and plug-in hybrid electric vehicles.

Combined sales of hybrid vehicles, plug-in hybrid electric vehicles, and battery electric vehicles (BEV) in the United States rose to 16.3% of total new light-duty vehicle (LDV) sales in 2023, according to data from Wards Intelligence. In 2022, hybrid, plug-in hybrid, and BEV sales were 12.9% of total sales.