



Electric Vehicles & Charging Overview















PNNL is operated by Battelle for the U.S. Department of Energy



What is an Electric Vehicle (EV)?

A vehicle that can be powered by an electric motor that draws electricity (at least in-part) from a battery.

		 CONVENTIONAL	 HYBRID	 PLUG-IN HYBRID	 ALL-ELECTRIC
SOURCES OF ENERGY					
CONSUMPTION					
EMISSIONS					 NO EMISSION

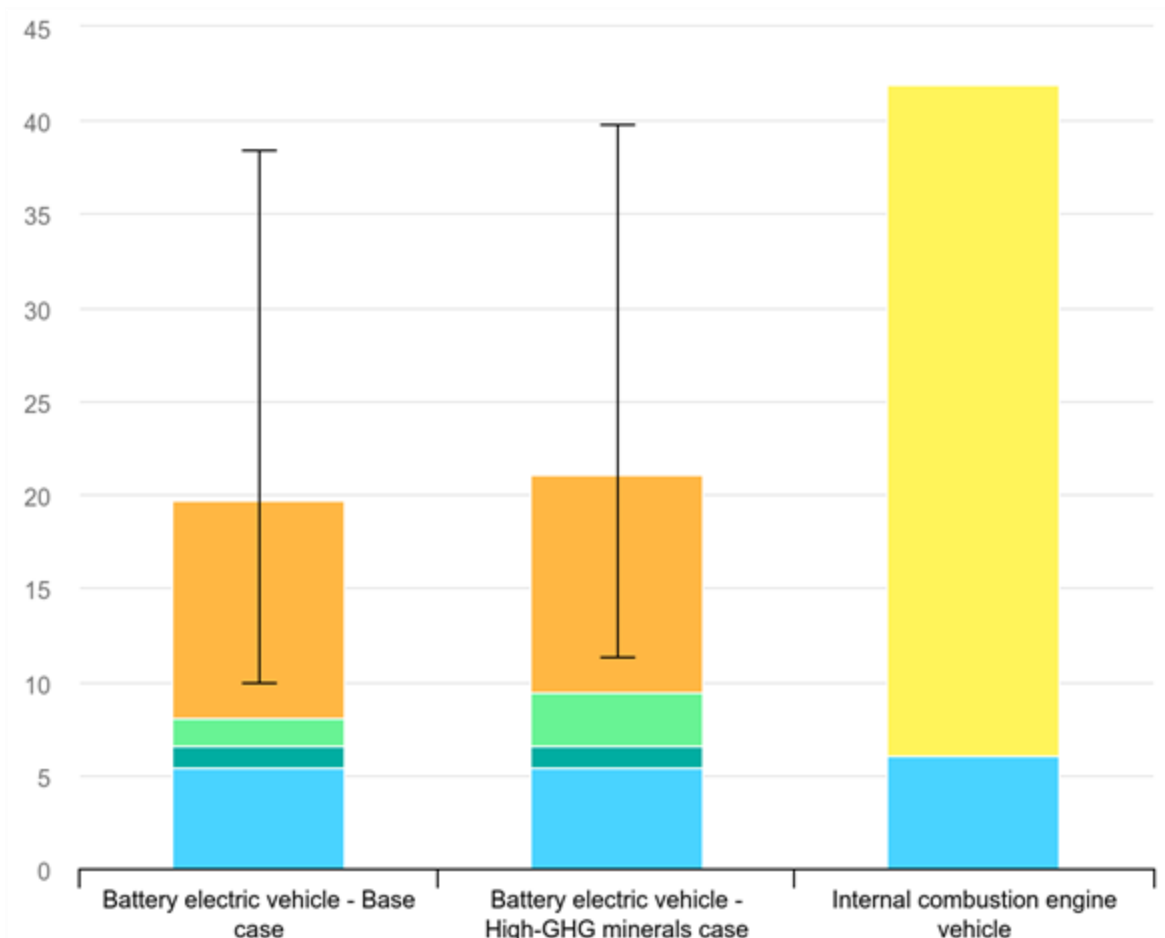
What are the benefits of EVs?

BENEFIT	PLUG-IN HYBRID ELECTRIC VEHICLES	ALL-ELECTRIC VEHICLES
FUEL ECONOMY	Most achieve combined fuel economy ratings higher than 90 miles per gallon equivalent (mpge).*	Most achieve fuel economy ratings higher than 100 mpge.*
EMISSIONS REDUCTIONS	PHEVs produce no tailpipe emissions when in electric-only mode. Generally, they produce less than half the emissions.	All-electric vehicles produce no tailpipe emissions. Generally, they produce one-third the emissions.
FUEL COST SAVINGS	In electric-only mode, electricity costs range about \$0.03-\$0.10 per mile. On gasoline only, fuel costs are about \$0.04-\$0.36 per mile.	Electricity costs are \$0.02-\$0.06 per mile.
FUEL FLEXIBILITY	PHEVs can fuel at gas stations. PHEVs can be charged at: <ul style="list-style-type: none"> • Home • Public charging stations • Some workplaces. 	All-electric vehicles can be charged at: <ul style="list-style-type: none"> • Home • Public charging stations • Some workplaces.
SAFETY	PHEVs meet federal motor vehicle safety standards.	All-electric vehicles meet federal motor vehicle safety standards.
MAINTENANCE	PHEVs require maintenance similar to conventional vehicles. Brake systems typically last longer.	All-electric vehicles require less maintenance with fewer moving parts and fluids to change. Brake systems typically last longer.

* Mpge represents the number of miles a vehicle can travel using a quantity of fuel (or electricity) with the same energy content as a gallon of gasoline.

What are the benefits of EVs (cont.)?

Comparative life-cycle greenhouse gas emissions of a midsize BEV and ICE vehicle

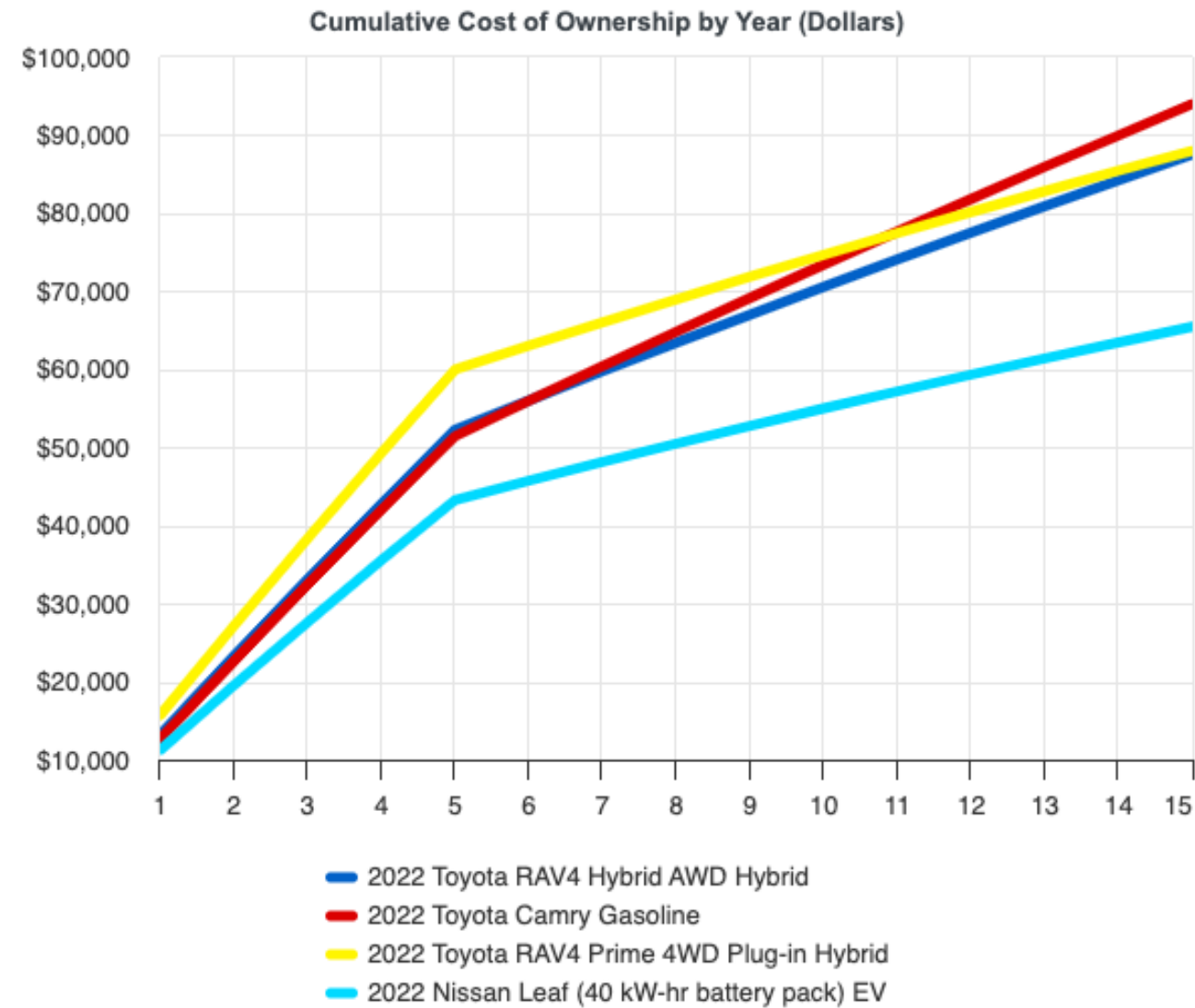


Other emissions avoided include:

- Carbon monoxide
- Nitrogen dioxide
- Particulate matter
- Sulfur dioxide
- Volatile organic compounds (VOCs)
- Polycyclic aromatic hydrocarbons

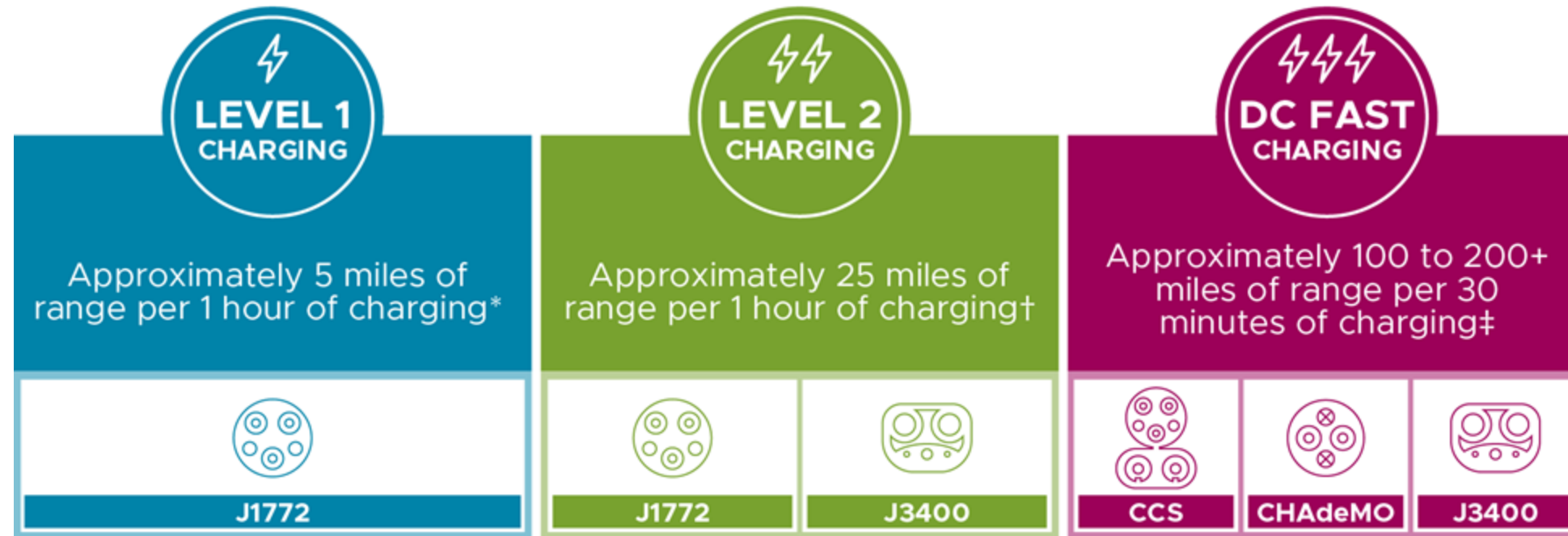
Source: Iea. "Comparative Life-Cycle Greenhouse Gas Emissions of a Mid-Size BEV and Ice Vehicle – Charts – Data & Statistics." IEA. Accessed October 8, 2024. <https://www.iea.org/data-and-statistics/charts/comparative-life-cycle-greenhouse-gas-emissions-of-a-mid-size-bev-and-ice-vehicle>.

Vehicle Cost Comparison Examples



Source: "Vehicle Cost Calculator." Alternative Fuels Data Center: Vehicle Cost Calculator. Accessed October 8, 2024. <https://afdc.energy.gov/calc/>.

Light Duty EV Charging Options

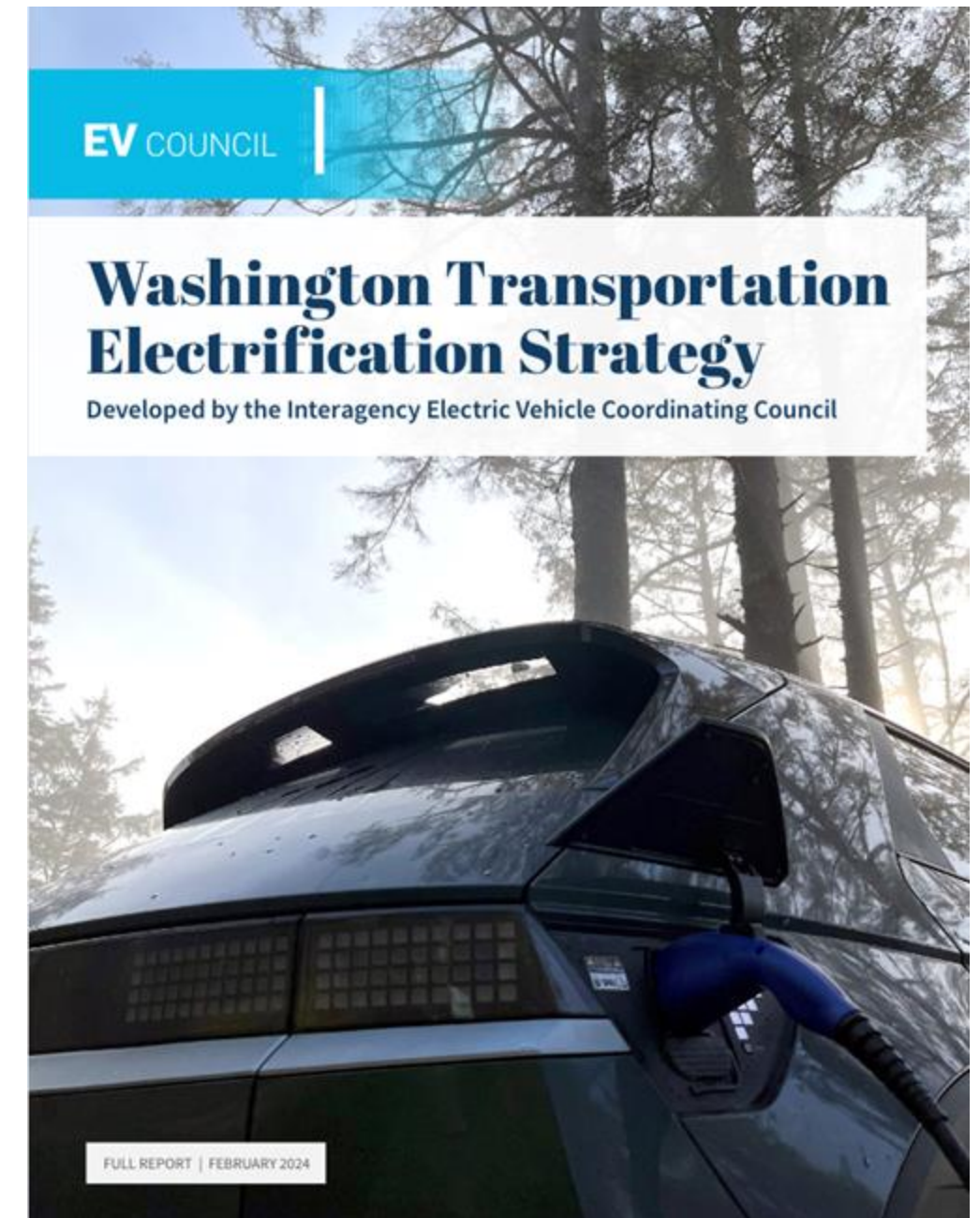


Typical Uses

- At-home charging
- At-home charging
- Public charging
- Workplace charging
- Public charging

EVs in Washington State

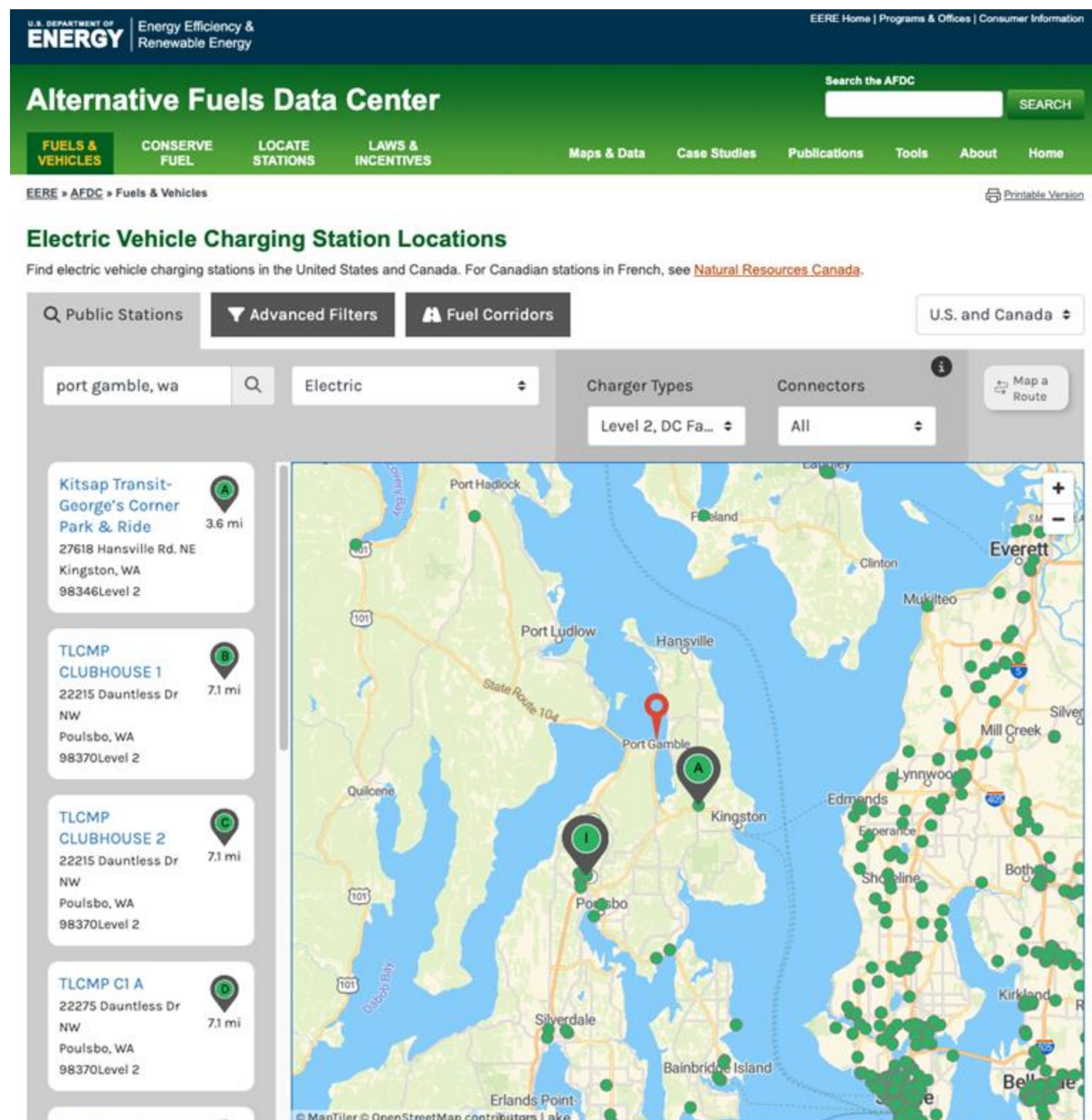
- **Move Ahead Washington Goal (non-binding):** all cars sold, purchased, or registered be electric by 2030.
- **Adopted CA's Advanced Clean Cars I and II:** requires 100% EV sales by 2035 for light duty, 40-75% of sales for medium- and heavy-duty depending on weight class
- Transportation Electrification Strategy (2024) outlines plan to achieve these and other clean transportation goals



Source: Rep. *Washington Transportation Electrification Strategy*, 2024.

Challenges with EV Adoption

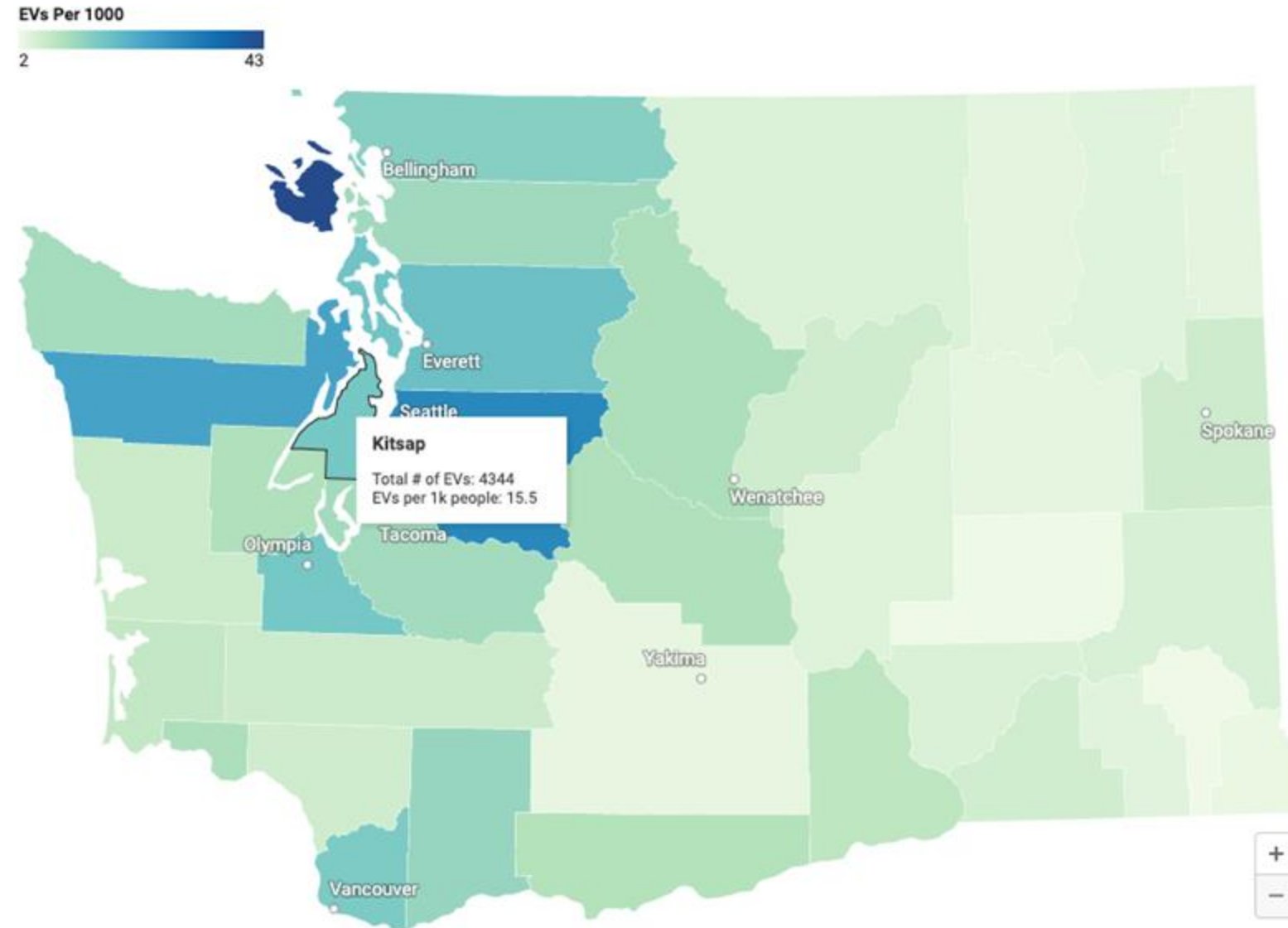
- High upfront cost of EVs
- Lack of reliable charging infrastructure
 - At-home
 - Public
 - Workplace
- Range anxiety
- Limited EV availability, especially of certain vehicle models
- Lack of clear, trusted information sources
- Inequitable access to electric transportation



Source: "Electric Vehicle Charging Station Locations." Alternative Fuels Data Center: Electric Vehicle Charging Station Locations. Accessed October 8, 2024. <https://afdc.energy.gov/fuels/electricity-locations#/find/nearest?fuel=ELEC>.

Electric vehicles per 1,000 people in Washington counties

Based on state vehicle registration data updated May 10, 2023.



Created with [Datawrapper](#)

(Data: Washington State Department of Licensing, [Data.WA.gov](https://data.wa.gov) / Chart: Washington State Standard)

Source: Lucia, Bill. "Where Are Electric Vehicles Most Popular in Washington State? • Washington State Standard." Washington State Standard, June 9, 2023. <https://washingtonstatestandard.com/2023/06/09/where-are-electric-vehicles-most-popular-in-washington-state/>.

EV Charging Considerations (Part 1)

- Charging need
 - Corridor
 - Community
 - Site
- Charging speed – Level 1/Level 2/ Level 3
- Payments?
- Public vs. Private
- Ownership and maintenance models
- Costs
 - Electric infrastructure upgrade costs
 - Charging equipment costs
 - Design, permitting, construction costs



EV Charging Station at The Point Casino
Image Source:
<https://www.plugshare.com/location/354865>

EV Charging Considerations (Part 2)

- Costs (note: subject to change based on business model selected)
 - One-time costs:
 - ✓ Electric infrastructure upgrade costs
 - ✓ Charging equipment costs
 - ✓ Design, permitting, construction costs
 - Ongoing costs:
 - ✓ Electricity
 - ✓ Maintenance
 - ✓ Charging management system (optional)
 - ✓ Lease price
- Incentives & Funding Opportunities
 - Federal - tax credits for EVs and chargers, NEVI program (2022-2026), grants
 - Washington - EV instant rebate program, EV infrastructure tax exemption, grants
 - PSE - Up & Go Electric Program

EV Project Examples



Solar-powered EV charging at Tribal Governance Center for Confederated Tribes of Grand Ronde. (Image Source: <https://www.smokesignals.org/articles/2023/07/31/tribal-campus-is-charging-up/>)



CruSE Project for community carsharing at affordable housing site in Hood River, Oregon. Project included EVs and EV charging stations. (Image Source: <https://forthmobility.org/our-work/cruse>)



Electric school buses serving the Eastern Band of Cherokee Indians, funded through Clean School Bus Grant. Photo: Scott Mckie B.P./One Feather Photo) (Image Source: <https://theonefeather.com/2024/01/12/leading-the-way-cherokee-to-receive-15-more-electric-school-buses/>)

Thank you

