Washington State
Department of Transportation

# WASHINGTON STATE ELECTRIC VEHICLE ACTION PLAN

## 2015-2020

**FEBRUARY 2015**


















# Washington State Electric Vehicle Action Plan

## 2015–2020




*Gov. Inslee signs Washington State "de-ICEing bill" (RCW 46.08.185) in 2014 requiring that EV charging stations are clearly identified with signs and striping. Several proposed actions in this plan require legislative approval and the Governor's signature.*

**Results Washington Goal:** 50,000 Plug-In Electric Vehicles by 2020

**Electric Vehicle Action Plan**

By:

Tonia Buell
Interim Director, Public-Private Partnerships
Washington State Department of Transportation
Tonia.Buell@wsdot.wa.gov
360.705.7439

Major contributors:

Kimberley Cline, Western Washington Clean Cities
Jeff Doyle, D'Artagnan Consulting
Rich Feldman, Electro Mobility Solutions
Jim Jensen, WSU Energy Program
Charles Knutson, Office of Governor Jay Inslee
Steve Marshall, CATES
John McCoy, Seattle Electric Vehicle Association
Peter Moulton, Commerce Energy Program

# Acknowledgments

WSDOT collaborated with more than 50 partners to gain input for developing effective strategies to support the use and growth of plug-in electric vehicles (PEVs). Representatives from several organizations provided feedback and expertise to help shape this plan. This list does not constitute endorsement of the plan's recommendations; it recognizes key stakeholders participating in discussions about advancing electric vehicles in Washington.

- AeroVironment
- Alliance of Automobile Manufacturers
- Alternative Fuels & Vehicles TAG
- Association of Global Automakers
- Association of Washington Businesses
- Avista Utilities
- Blink
- BMW Group
- C2ES
- CalETC
- California Energy Commission
- California PEV Collaborative
- Center for Advanced Transportation and Energy Solutions
- Center for Sustainable Energy
- ChargePoint
- Climate Solutions
- City of Seattle
- Coalition of 8 ZEV States
- Cyan Strategies
- Drive Oregon
- Electric Drive Transportation Assoc.
- Electro Mobility Solutions
- Federal Highway Administration
- Ford Motor Company
- General Motors
- Georgetown Climate Center
- Governor Inslee's Policy Office
- Idaho National Laboratory
- Joint Transportation Committee
- King County Metro
- Mitsubishi
- New Energy Solutions
- Nissan Motor Company
- Oregon Dept. of Transportation
- Pacific Coast Collaborative
- Plug-In America
- Plug-In North Central Washington
- Port of Seattle
- Puget Sound Clean Air Agency
- Puget Sound Energy
- Puget Sound New Energy Solutions
- Puget Sound Regional Council
- Regional PEV Workgroup
- Seattle 2030 District
- Seattle Electric Vehicle Association
- SemaConnect
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- WA Automotive Industry Assoc.
- WA EV Working Group
- WA State Dept. of Commerce
- WA State Dept. of Ecology
- WA State Dept. of Enterprise Services
- WA State Dept. of Revenue
- WA State Joint Transportation Committee
- West Coast Corridor Coalition
- Western Washington Clean Cities
- WSU Energy Program

# Glossary

The following terms are used in the EV Action Plan.

| Acronym | Definition |
|---|---|
| **AFV** | **Alternate Fuel Vehicle** is a vehicle powered by fuel other than gasoline or diesel. Examples of alternative fuels are compressed natural gas (CNG), liquefied natural gas (LNG), propane, electricity, and hydrogen. |
| **BEV** | **Battery Electric Vehicle** is an all-electric vehicle whose electricity is stored in batteries. |
| **DC Fast Charger** | **Direct Current Fast Charger** (DCFC) is a high-voltage DC fast charger that requires 3-phase electric service and can recharge an all-electric vehicle to 80% capacity in about 30 minutes. |
| **EREV** | **Extended Range Electric Vehicle** is an electric vehicle with a rechargeable battery as well as an on-board gas-powered generator to recharge the battery for extended mileage. |
| **EV** | **Electric Vehicle** is the term used throughout this Action Plan to refer to any plug-in electric vehicle (also known as a PEV), that runs, at least partially, on battery power that is recharged from the electricity grid. |
| **EVSE** | **Electric Vehicle Supply Equipment** is the charging equipment used to obtain a charge for an EV or BEV battery system. |
| **FCEV** | **Fuel Cell Electric Vehicle** is powered by pure hydrogen gas stored directly on the vehicle. It is essentially an electric vehicle, but uses a liquid to store energy rather than a battery. |
| **HEV** | **Hybrid Electric Vehicle** is a non-plug-in vehicle, such as a Toyota Prius, which is powered by both electricity and another fuel without using an external source of electricity. |
| **J-1772** | **J-1772** is the North American SAE standard connector for the Level 2 equipment. |
| **Level 1 EVSE** | **Level 1 Electric Vehicle Supply Equipment** is 120-volt charging (a standard household outlet) that fully charges an all-electric vehicle in about 18 hours and a plug-in hybrid electric vehicle in 6 hours. |
| **Level 2 EVSE** | **Level 2 Electric Vehicle Supply Equipment** is 240 volt charging equipment that provides a “medium-speed” charge to plug-in electric vehicles using a J-1772 connector. Level 2 EVSE is typically installed at home garages and shopping centers. |
| **PHEV** | **Plug-in Hybrid Electric Vehicle** has a substantial battery pack, which is able to be charged by an external source other than fossil fuel. These vehicles often have the ability to travel in a pure electric mode without using conventional fuels. |
| **ZEV** | **Zero Emissions Vehicle** has zero tailpipe emissions and is 98% cleaner than the average new model year vehicle. ZEVs include battery all-electric electric vehicles and hydrogen fuel cell electric vehicles. |

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# Executive Summary

Washington State has emerged as one of the leading regions in the nation for electric vehicle sales and adoption. This trend benefits our economy, our environment, and the health and well-being of all Washingtonians. Forward-thinking state legislators passed electric vehicle legislation in 2009 that spurred federal investment in the deployment of charging infrastructure in the Puget Sound region and prompted auto manufacturers to dispatch the first group of new electric vehicles to the state.

The Washington State Department of Transportation (WSDOT) is suggesting 13 action items to increase the adoption of plug-in electric vehicles (EVs) in Washington. Successfully implementing these actions will take leadership and support from Washington's state agencies, legislators, and EV partners. Combined, they would increase the number of plug-in electric vehicles in the state from about 10,000 in 2014 to the state's target of 50,000 by 2020. As outlined below, actions are grouped under three broad categories: EV sales incentives and outreach, electric vehicle supply equipment (EVSE) for charging, and regional coordination.

## Strategy to Accelerate Electric Vehicle Sales and Adoption

| # | Action | Action Summary |
|---|---|---|
| **1** | Renew the sales and use tax exemption for the purchase or lease of Clean Cars. | ◆ Extend the sales tax exemption for the purchase or lease of new alternative fuel vehicles to 2020 or beyond (currently set to expire July 2015).<br>◆ Consider expanding the sales tax exemption eligibility to other clean vehicles, including:<br>o Plug-in hybrid and extended range electric vehicles, such as the Chevy Volt<br>o Electric motorcycles<br>o Heavy-duty alternative fuel vehicles<br>o Electric transit buses<br>o Used electric vehicles<br>◆ Consider limiting the sales tax exemption dollar amounts.<br>◆ Consider establishing a rebate system similar to other states.<br>◆ Consider implementing a Junker Scrap Rebate Program with clean-vehicle rebates. |
| **2** | Transform public and private fleets. | ◆ Aim for 10% PEV for new procurements by 2016.<br>◆ Increase plug-in vehicles in government fleets.<br>◆ Coordinate with Western Washington Clean Cities on increasing alternative fuel vehicles in public and private fleets.<br>◆ Create a tax incentive for businesses to transition fleets to alternative fuels. |

| | | |
|---|---|---|
| **3** | Conduct public education and outreach to increase consumer awareness and demand. | ◆ Work with car manufacturers, car retailers, rental car companies, EV associations, and partners to promote EVs.<br>◆ Promote EV tourism routes, including North Cascades Loop and the US 2 "Electric Vehicle-Friendly" Scenic Byway.<br>◆ Create a technical resource center to guide retail businesses through the process of installing and promoting EV charging equipment for current and potential customers.<br>◆ Continue to manage the West Coast Electric Highway website, branding, and marketing efforts. Coordinate with local communities on ribbon cuttings, special events, and media relations.<br>◆ Create a "my next car is electric" pledge campaign and publicize community and business leaders who have EVs or have pledged to buy one. |
| **4** | Provide more EV charging signage to increase public awareness of availability. | ◆ Encourage installation of highway and follow-through signs for DC fast charging.<br>◆ Encourage signs for urban-area EV charging stations.<br>◆ Create a sign pool to assist local businesses with signing EV charging sites. |
| **5** | Explore providing other incentives to increase use of electric vehicles. | ◆ Provide financial and nonfinancial incentives to encourage use of electric vehicles.<br>◆ Remove the limit on the number of vehicles allowed when electric vehicles are used for car-sharing, taxi, and network companies such as Uber and Lyft.<br>◆ Provide a toll and ferry fare credit to EV owners. |

## Strategy to Strengthen Washington's EV Charging Network

| # | Action | Action Summary |
|---|---|---|
| **6** | Complete the build-out of Washington's fast charging network along highways. | ◆ Secure funding to strengthen and expand the West Coast Electric Highway DC fast charging network. |
| **7** | Explore funding mechanisms and business models to bolster installation of EVSE. | ◆ Create an EV infrastructure bank to provide financial assistance for the installation of publicly accessible high-speed charging stations.<br>◆ Pursue public-private partnerships for EVSE.<br>◆ Pool resources within communities to electrify tourism routes.<br>◆ Synchronize with recommendations of the JTC's Study of Business Models to Sustain EV Charging Station Networks. |

| | | |
|---|---|---|
| **8** | Support workplace charging. | ◆ Provide incentives for workplace charging.<br>◆ Raise EV awareness among CEOs and business leaders.<br>◆ Encourage employers to support the national workplace charging challenge.<br>◆ Encourage businesses to pursue other electric technologies. |
| **9** | Address building codes, policy, and zoning barriers to EV infrastructure. | ◆ Amend building and electrical codes to require "EV-readiness" in buildings.<br>◆ Offer incentives for installation of DC fast charging stations in commercial buildings.<br>◆ Explore options for potential EV owners who reside in multifamily dwellings without garages.<br>◆ Encourage businesses and retailers to use light pole power source for EV charging.<br>◆ Support EV charging at state-owned facilities. |
| **10** | Engage utilities. | ◆ Identify barriers and incentives for electric utilities to promote the use and the increased use of electricity for transportation.<br>◆ Encourage utilities to provide public education on EVs.<br>◆ Encourage all utilities in the state to support EVSE installation and rebates.<br>◆ Provide the utilities with a mandate from the Legislature to support the use and increased use of electricity for transportation.<br>◆ Expressly permit utilities to meet energy conservation and carbon reduction mandates with actions that will encourage EVs, such as installing public charging stations and converting utility fleets to electricity.<br>◆ Require electric utilities to establish an electric transportation department.<br>◆ Encourage utilities to maximize grid benefits of electric vehicles.<br>◆ Encourage utilities to purchase and redeploy used EV batteries for a secondary use. |

| | | |
|---|---|---|
| **11** | Require future state-supported DC fast charging stations to serve more vehicles. | ◆ For future state investments in fast charging infrastructure, require stations to have compatible and interoperable charging equipment with both CHAdeMO and SAE Combo connectors.<br>◆ When funding allows and it makes business sense, retrofit existing public CHAdeMO stations to add SAE Combo charging capabilities.<br>◆ Future-proof stations by planning for multiple charging ports in high-usage areas. |

## Strategy to Synergize Actions throughout the Region

| # | Action | Action Summary |
|---|---|---|
| **12** | Support and participate in regional partnerships to advance EVs. | ◆ Coordinate with the Pacific Coast Collaborative on EV initiatives.<br>◆ Coordinate with Oregon Department of Transportation and California Energy Commission on the West Coast Electric Highway.<br>◆ Explore ways to formalize and fund the Washington State EV Workgroup.<br>◆ Track other state activities supporting electric vehicles. |
| **13** | Track and participate in national EV efforts. | ◆ Participate in the multi-state DOT effort to develop toolkits for deployment of alternative-fueled vehicles and fueling stations.<br>◆ Track nationwide electric vehicle activities and participate as observer or member when appropriate. |

# Introduction

Washington has emerged as one of the best places to own and drive an electric vehicle. The current success is due to investments made by state policy makers, federal agencies, state and local governments, automakers, utilities, businesses, fleet managers, electric vehicle drivers, and other stakeholders.

This action plan provides a comprehensive overview of current and proposed efforts to increase EV adoption. The introduction covers the purpose of the plan, highlights benefits of electric vehicles to the state, provides background on electric vehicles and charging equipment, and describes major barriers to adoption. The status of EVs in Washington section includes current EV registration data by county, describes the existing public charging infrastructure, highlights statewide accomplishments, and describes federal and state EV-related laws and incentives. The 13 proposed actions are described in the next three sections, grouped by overall strategies.

RESULTS WASHINGTON

The state's Results Washington Clean Transportation Goal (3.1.1.c) is to increase the number of plug-in electric vehicles registered in Washington from approximately 8,000 in 2013 to 50,000 by 2020.

## Purpose of the EV Action Plan

This plan is intended to inform policy-makers, elected officials, and local leaders about the electric vehicle landscape in Washington, and identify actions that would drive further electric vehicle adoption. Building on efforts of The Washington Plug-In Vehicle Task Force and the Western Washington Clean Cities EV Readiness Plan, this plan sets forth actions that will ensure we continue our momentum, and achieve the state's goal of 50,000 EVs by 2020.

The plan provides recommendations on strategies, policies, and investments to increase market demand for electric vehicles. Despite early success, Washington does not have a formal structure or sustainable funding for advancing the electric vehicle industry. Several of the proposed actions require state legislative changes and funding. Once legislators determine future investments, WSDOT will coordinate with stakeholders to implement actions, measure effectiveness, and report on progress.

## Benefits of Electric Vehicles

For Washington State, supporting the adoption and use of electric vehicles is sound economic, environmental, and transportation policy. Creating a robust market for electric vehicles will help:

- Meet state goals to reduce greenhouse gas emissions.
- Protect public health and air quality.
- Promote economic growth.
- Save drivers money.



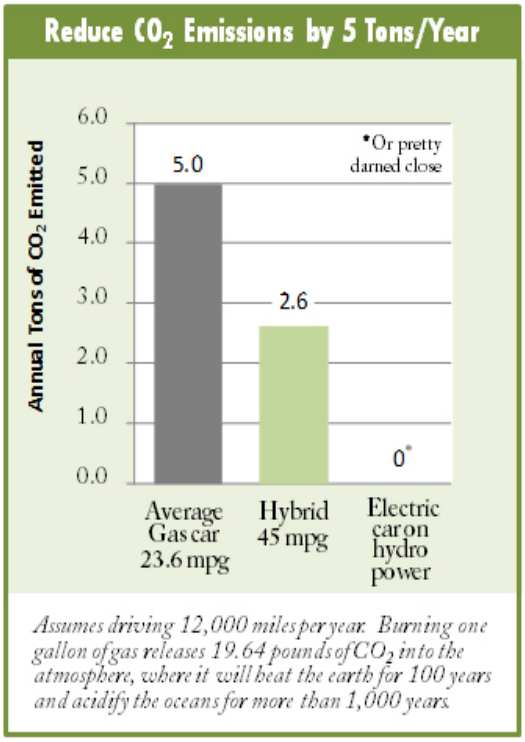
*Washington has one of the cleanest and least expensive supplies of electricity in the nation, in large part due to the BPA federal hydroelectric power project in the Columbia River Basin.*

### *Energy independence benefits*

U.S. dependence on foreign oil weakens national security, threatens our economy, and degrades the environment. Electric vehicle adoption is a key strategy for reducing our petroleum dependence.

## *Environmental benefits*

Electric vehicles offer significant environmental advantages over conventional gasoline- or diesel-powered cars. Electric operation reduces or eliminates tailpipe emissions, including greenhouse gases, fine particles, ozone-forming gases and toxics, and allows the use of cleaner, renewable, and more environmentally friendly energy sources.




*An electric vehicle doesn't have a tailpipe and can reduce carbon emissions by five tons per year. Source: Seattle Electric Vehicle Association.*

- ***EVs tap into clean Pacific Northwest power.*** The Pacific Northwest is home to some of the cleanest and least expensive electricity in the nation. Public Utility Districts in Washington get nearly 82% of their energy from hydropower, which is reliable, renewable, and produces almost no greenhouse gas emissions. Plugging an EV into the Northwest grid generates much less upstream pollution than filling a car with gasoline or diesel.
- ***EVs emit zero greenhouse gases.*** A gasoline-powered car emits 20 pounds of greenhouse gas pollution per gallon of fuel burned. An all-electric vehicle, however, emits zero. In Washington, the transportation sector accounts for nearly half of the state's greenhouse gas emissions, which are much higher than the national average of 34%. Encouraging a shift from petroleum-based fuels to fuels with low or no carbon emissions contributes to a suite of strategies needed to reduce the transportation sector's impact on the environment.
- ***EVs don't emit any toxic air pollution.*** Gasoline cars emit fine particles and air toxics (hazardous air pollutants such as benzene, acetaldehyde, and 1,3-butadiene) that are unhealthy to breathe.
- ***EVs do not emit any smog-causing pollution***. Gas cars emit hydrocarbons and nitrogen oxides, which are ozone precursors and lead to the formation of smog. Smog can trigger a variety of health problems, including chest pain, coughing, throat irritation, and congestion. It can also worsen bronchitis, emphysema, and asthma.
- ***EVs protect Puget Sound waterways***. EVs don't contribute as many contaminants to stormwater runoff as gasoline cars, which means less pollution in waterways and Puget Sound, reduced highway runoff mitigation construction costs, and reduced annual fish kill-off due to toxic pollutants dripped onto nonmitigated roadways.

## *Public health benefits*

Fewer vehicle emissions mean fewer pollutants in the environment, which helps improve both air quality and public health in heavily-populated urban areas. According to the Puget Sound Clean Air Agency, each year in Washington State, more than 100 premature deaths can be attributed to pollution from motor vehicles, along with many more cases of asthma, respiratory disease, and hospitalization. In the Puget Sound region alone, more than 200,000 people live within 200 meters of a major highway and are exposed to elevated pollution from vehicles almost every day. Pregnant women, young children, the elderly, and individuals with respiratory and cardiovascular disease are particularly susceptible. Reduced rates of respiratory diseases resulting from cars without tailpipe emissions would help reduce state health care costs, reduce lost work and school time, and improve quality of life.

### *Economic benefits*

Electric cars strengthen Washington's economy by keeping more money circulating locally. More than $10 billion in fuel spending leaves the state each year. According to the U.S. Energy Information Administration, two-thirds to three-quarters of the price of fossil fuels pays for the raw resources: crude oil, coal, and natural gas. Since Washington doesn't produce any fossil fuels, all that money goes elsewhere. Only one-quarter to one-third of fossil fuel money stays in the state—about 15% goes to in-state refineries, and less than 10% goes to distributors.

For a Washington resident, having the choice to drive an electric vehicle means an opportunity to save money on gasoline and maintenance. Although the purchase price is higher, the cost to drive an electric vehicle in Washington is significantly less than the cost to drive a gasoline- or diesel-powered car.

Regardless of who buys the vehicles, all residents benefit from statewide economic growth, and employment rises with the degree and scope of EV adoption. A recent UC Berkeley study found that shifting fuel purchases to other spending creates 16 times more jobs. Electric vehicle infrastructure is installed locally, creating jobs and economic investment in Washington State. More EVs on the road means more jobs for Washingtonians. EVs create a positive economic impact because electric vehicles help Washington retain 80–90% of the dollars currently being spent on gasoline and diesel.

The electric vehicle industry recognizes Washington's competitive advantage in both inexpensive electricity and early adoption rates for green technology.




In 2011, BMW and SGL opened a carbon fiber manufacturing plant in Moses Lake, Washington. Carbon fibers are used to create the tough yet lightweight carbon composite shell of BMW's electric and hybrid cars. SGL and BMW jointly invested $100 million in the facility, creating well over 100 new jobs for the community of Moses Lake. BMW and SGL recently invested $200 million to expand the plant, which aspires to be the "largest carbon fiber plant on Earth." This will triple production capabilities to 9,000 tons per year to meet the high demand for carbon fiber in automotive production for BMW's i-series line of EVs.

Now other companies are looking to co-locate near BMW to access comparatively inexpensive, clean Pacific Northwest hydropower.

Washington businesses are benefitting from the emergence of electric vehicles. To keep up with the demand for the Nissan LEAF, Nissan of the Eastside in Bellevue is building a new dealership, tripling in size and investing millions of dollars into Washington's economy. Cascadia PM, a firm in Thurston County that specializes in finding host sites for electric vehicle charging stations and cell towers, has seen a measurable increase in its business thanks to the EV charging infrastructure installed in Washington.

Government support for electric vehicle charging infrastructure is a small public investment that has leveraged, and will continue to leverage, much larger private investments.

# Electric Vehicle Basics

Plug-in electric vehicle (PEV) is a general term for any car that runs, at least partially, on battery power that is recharged from the electricity grid. Battery electric vehicles (BEVs), extended range electric vehicles (EREVs), and plug-in hybrid vehicles (PHEVs) are all considered PEVs. For this EV Action Plan, we use the term EV to represent all types of plug-in electric vehicles.

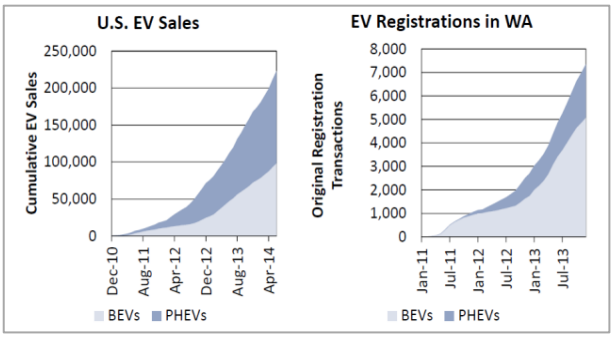
EV models are being offered by nearly every auto manufacturer. There are more than a dozen makes and models already on the market, and another dozen models are expected to roll off assembly lines in 2015. The U.S. Department of Energy's Clean Cities 2015 Vehicle Buyer's Guide provides information on each make and model of alternative fuel vehicles on the market. Some models are only available in California or other states that have adopted a Zero Emission Vehicle (ZEV) program. Following are short descriptions of the major types of plug-in electric vehicles, along with a description of the fuel cell electric vehicle (FCEV).

## *What is a battery electric vehicle?*

Battery electric vehicles (BEVs), also known as all-electric vehicles, run exclusively on electrical energy stored in on-board batteries. The batteries are charged by plugging into an off-board electrical power source and through regenerative braking. BEVs produce zero tailpipe emissions. In Washington, where electricity is generated primarily with low-cost, clean hydropower, BEVs have substantial emissions benefits. Most currently available BEVs can travel 60 to 100 miles on a single charge, depending on the model. BEVs currently for sale in Washington include:

- BMW i3
- Ford Focus Electric
- Mitsubishi i-MiEV
- Nissan Leaf
- Smart ForTwo Electric Drive
- Tesla Model S

The 100% battery electric vehicle is the most popular type of plug-in electric vehicle in Washington, accounting for about 70% of the state's total. This is contrary to the national trend where PHEVs make up the majority of plug-in electric vehicles.




*Washington sells more 100% Battery Electric Vehicles than Plug-In Hybrid Electric Vehicles, contrary to the national trend. Source: Center for Climate and Energy Solutions (C2ES)*

## *What is an extended range electric vehicle?*

An extended range electric vehicle (EREV) is a battery electric vehicle with a backup internal combustion engine that uses gasoline or diesel to also power the vehicle. Most commuters drive less than 30 miles per day and could power their vehicle primarily with electricity to reduce operating costs, petroleum use, and tailpipe emissions. The Chevrolet Volt is considered an extended range EV.

## *What is a plug-in hybrid electric vehicle?*

Plug-in hybrid electric vehicles (PHEVs) use batteries to power an electric motor and another fuel, such as gasoline or diesel, to power an internal combustion engine. The batteries can be charged from an off-board electrical power source, through regenerative braking, or by the internal combustion engine. Examples of plug-in hybrid electric vehicles sold in Washington are:

- Cadillac ELR
- Ford C-MAX Energi and Ford Fusion Energi
- Toyota Prius Plug-In

### *What is a fuel cell electric vehicle?*

Fuel cell electric vehicles (FCEVs) use an electric-only motor like a BEV. The fuel cell in FCEVs combines hydrogen gas stored in the vehicle's tank with oxygen from the air to produce electricity. The electricity from the fuel cell powers an electric motor, which powers the vehicle. The fuel cells are recharged by refilling with hydrogen so there is no need to plug in FCEVs. They are more efficient than conventional internal combustion engine vehicles and produce no harmful tailpipe exhaust—FCEVs emit water vapor and warm air.

FCEVs and the hydrogen infrastructure to fuel them are in an early stage of deployment. FCEVs can fuel in less than 10 minutes and have a driving range of around 300 miles. Major auto original equipment manufacturers are just starting to offer production vehicles in certain markets.



*Hydrogen Road Rally stops in Olympia, Washington, in 2009.*

In California, where the state is investing in a network of hydrogen fueling stations, a handful of transit agencies are operating fuel cell electric buses, and automakers will offer FCEVs for sale to the public.

## EV Charging Basics

### *How long does it take to charge an electric vehicle?*

The time it takes to charge an electric vehicle depends on the size of the battery, the amount of charge needed, and the type of charging equipment used. There are three basic levels:

- **Level 1: 120 volt**

  Level 1 (low-speed) charging uses a standard AC 120 volt outlet, with power requirements similar to a toaster. A plug-in electric vehicle with a small battery can recharge overnight with the plug-in adapter that comes with every plug-in car. Level 1 charging adds about 3 to 5 miles of range per hour of charging time.

- **Level 2: 240 volt**

  Level 2 (medium-speed) chargers are typically installed in home garages and at public locations. They require a 240-volt circuit, and have power requirements similar to clothes dryer. It takes 4 to 7 hours to fully recharge the battery, depending on the battery size and how depleted it is. Level 2 charging adds about 10 to 20 miles of range per hour of charging time.

- **DC Fast Charging**

  DC fast charging requires a high-voltage Direct Current circuit (208-440 volt) and three-phase power. It takes less than 30 minutes to reach an 80% charge, depending upon the size of the battery and how depleted it is. DC fast charge systems are typically installed in commercial and other high-traffic areas along highways for drivers traveling longer distances or to facilitate multiple trips for urban drivers. A DC fast charger can add 60 to 80 miles of range to an EV in 20 minutes.

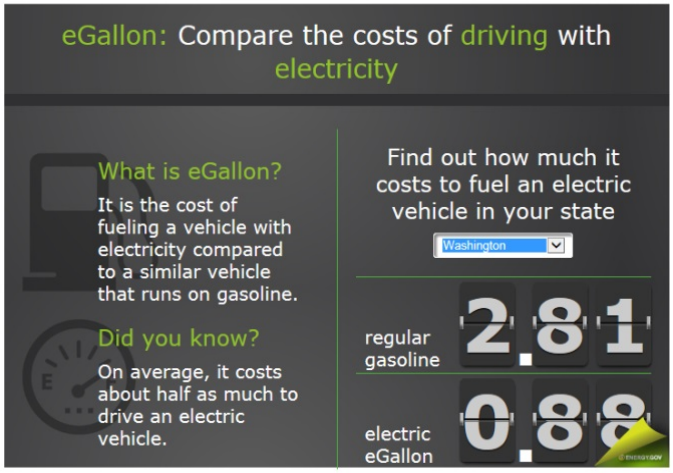


*West Coast Electric Highway locations provide publicly-accessible Level 2 and DC fast charging.*

### *How much does it cost to charge an electric vehicle?*

EV drivers spend much less on fuel than drivers of conventional vehicles. When charging at home, they will typically pay the same price per kilowatt-hour that they pay for the use of any other appliance. At publicly-accessible charging stations, the prices vary depending on the vendor and the type of charging equipment. Some locations charge by the time connected to the station, others charge a flat fee per use or offer monthly subscription services for unlimited use with a key fob or access card.

Fueling a car with electricity is about one-third the cost of fueling a car with gasoline. The U.S. Department of Energy's eGallon shows how much it costs to drive an EV on electricity compared to a gallon of unleaded gasoline in a similar car.




*In Washington, it costs about a third as much to drive an electric vehicle compared to a gas car.*

In December 2014, when the average cost of gasoline in Washington was $2.81 per gallon, the cost to fuel an electric vehicle was only 88 cents per eGallon.

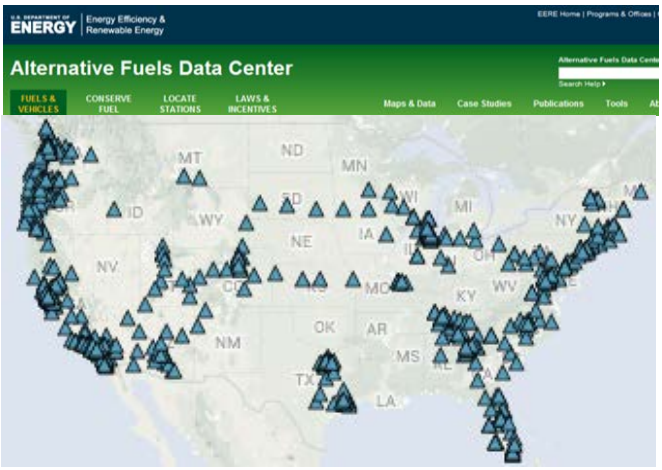
The cost of electricity is regional and much more stable than gas prices. Washington's electricity costs are lower than the national average of about $1.28 per eGallon, making Washington one of the most economical locations to drive electric.

### *Where do electric vehicle drivers recharge?*

One of the benefits of driving an EV is having the ability to charge at home instead of stopping at gas stations. Drivers typically charge their vehicles at home or at work where their cars are parked most of the time. Public charging may be found at commercial or retail locations, airports, tourist destinations, universities, restaurants, and in communities along major corridors.

There are many resources available to help drivers find electric vehicle charging stations:

- The U.S. Department of Energy has a comprehensive online map and listing of all public charging stations.
- There are mobile apps such as *Plugshare* and on-board charging station software such as *car-wings* to help drivers find the nearest charging location.




*Electric vehicle drivers can charge their vehicles at home, at work, and at about 9,000 public charging stations nationwide.*

In Washington, EV drivers benefit from a growing network of nearly 450 electric vehicle charging locations, including 45 DC fast chargers.

Although the Puget Sound region has a good charging network, other parts of the state have more limited access to public charging equipment.

## Barriers to EV Adoption

Some of the barriers to mainstream EV adoption include:




### *High up-front costs to low-income consumers*

In Washington, about 65% of electric vehicles are leased for two to three years. Rather than purchasing the car at the end of the lease, most drivers opt to lease a new vehicle. Soon, these previously-leased electric vehicles will be flooding the used-car market. Washington's sales tax exemption has been a major selling point for local dealers, but the incentive is set to expire in July 2015, and it only applies to the purchase or leasing of new Clean Cars. Consumers also have the up-front costs for purchasing and installing home Level 2 charging equipment. Some costs may be recovered through fuel savings, a federal tax credit, and state incentives. If the exemption was extended and also applied to the purchase of used electric vehicles, it would help lower-income drivers have better access to electric vehicles.

### *Anxiety due to limited vehicle range and scarce charging infrastructure*

Potential buyers often cite "range anxiety" as a reason they are hesitant about purchasing an EV. This refers to the fear of running out of charge before reaching the next opportunity to plug in. Most all-electric vehicles, however, can travel 60–100 miles on a single charge, making them ideal for short to medium commutes and suitable for many everyday driving needs. To build range confidence, Washington needs more public and workplace charging. As batteries improve and range expands, drivers will travel longer distances and will rely even more on public charging infrastructure.

### *Lack of consumer awareness and understanding*

Misperceptions about the benefits and viability of electric cars remain fairly widespread—with people still associating them with golf carts or as cars for only the wealthy. More consumer education and outreach is needed to inform customers of the benefits of driving electric and the lower total cost of ownership. Consumers are still largely confused about the differences among the various electric car options. Washington is fortunate to have some of the leading EV dealerships in the country. It's much more challenging and time consuming for dealers to sell electric vehicles than traditional gas cars because salespeople need to articulate all the special features such as how to set up home charging and use public charging.

### *Limited vehicle selection and availability*

Although there are more EVs available for sale in Washington than ever, the selection remains very limited. Most major car manufacturers offer EVs or have plans to add them to their product line during the next couple of years. Roughly one-third of the available makes and models, however, are only for sale in states that require a percentage of vehicle sales to be Zero Emission Vehicles, such as California. Washington has yet to adopt ZEV program requirements. Many potential customers are waiting for a broader range of vehicles, including sport utility vehicles, electric trucks, passenger vans, and delivery trucks.

### *Inability to establish charging in a multifamily home*

Almost all current EV drivers live in a single-family home with off-street parking. Being able to conveniently charge the vehicle overnight, where one sleeps, is key to successful EV driving. People who live in apartments and condominiums face significant barriers to establishing a charging station at their residence, including limited electrical capacity, high infrastructure costs, and lack of support from homeowners associations and landlords.

### *Unreliable public electric vehicle charging equipment*

EV drivers rely on public charging to be working when they need it. When they plan a trip, drivers plot out charging station locations along their route. When they stop to recharge the car's battery, they expect the public chargers to be available and operational. Unfortunately, some of the early Blink charging equipment in key locations is often not working, sometimes for weeks at a time before it's repaired. Through a federal grant program called "The EV Project," Washington anticipated an investment of more than 22 DC fast chargers in the Puget Sound Region. ECOtality, an electric vehicle charger company with responsibility for serving the greater Seattle region, filed for bankruptcy in 2013. Its assets were acquired at auction by the Car Charging Group, leaving the project unfinished, with significant gaps in the planned fast charging network along I-5 between Everett and Olympia and I-90 between Seattle and North Bend. The incomplete network continues to undergo major technical and maintenance issues and much of the equipment needs complete replacement.

With a skeletal charging network, there is not a safety net of backup chargers. The Blink charger in Fife is the most used charger in the state. It provides a lifeline for EV drivers traveling between Seattle and Olympia, and when it's down, drivers don't have many options. The AeroVironment chargers used for the West Coast Electric Highway are well maintained, dependable, and have a 97% uptime. However, in the rare cases that they are down, drivers don't have options since the chargers are spaced several miles apart.

EV drivers are using mobile apps such as *PlugShare* to get real-time information on charging availability. Through the app, drivers can pay fees to use the equipment and can leave comments on their experience. This information sharing helps EV drivers gain confidence that they will find reliable charging locations.

### *Competing fast charging standards*

An emerging challenge is that there is not one common standard for DC fast charging equipment. Although there is a national standard for Level 2 (medium-speed) charging, not all makes and models can use the same DC fast charging equipment. Nissan, Mitsubishi, and Kia vehicles use a CHAdeMO connector; Tesla uses its own proprietary connector; and BMW and Chevrolet use the new SAE Combo charging system that's just entering the market. Most of the current fast charging infrastructure in Washington is CHAdeMO-compliant. Future DC fast chargers will likely include dual ports to provide charging for most makes and models of vehicles.



# Status of Electric Vehicles in Washington

## Washington: A National Leader with More Than 12,000 Registered EVs

The number of plug-in electric vehicle registrations in Washington climbed from 7,896 at the end of 2013 to 12,351 at the end of 2014: a more than 50% increase in one year.

Washington is one of the top states in the nation for EV adoption. Some of the reasons cited for the state's success include:

- **Public charging infrastructure**

  Washington leaders proactively made public EV charging available for the roll out of the new technology. Washington secured federal support to install EV charging infrastructure though The EV Project, the West Coast Electric Highway, and Western Washington Clean Cities.

- **Early adopter mentality**

  Washington is known for its spirit of innovation, technology advances, and environmental ideology. As one of the early adopter states reaching high rates of hybrid vehicle adoption from 2000–2010, Washington was primed for the introduction of battery electric vehicles.

- **Early launch state for the Nissan LEAF**

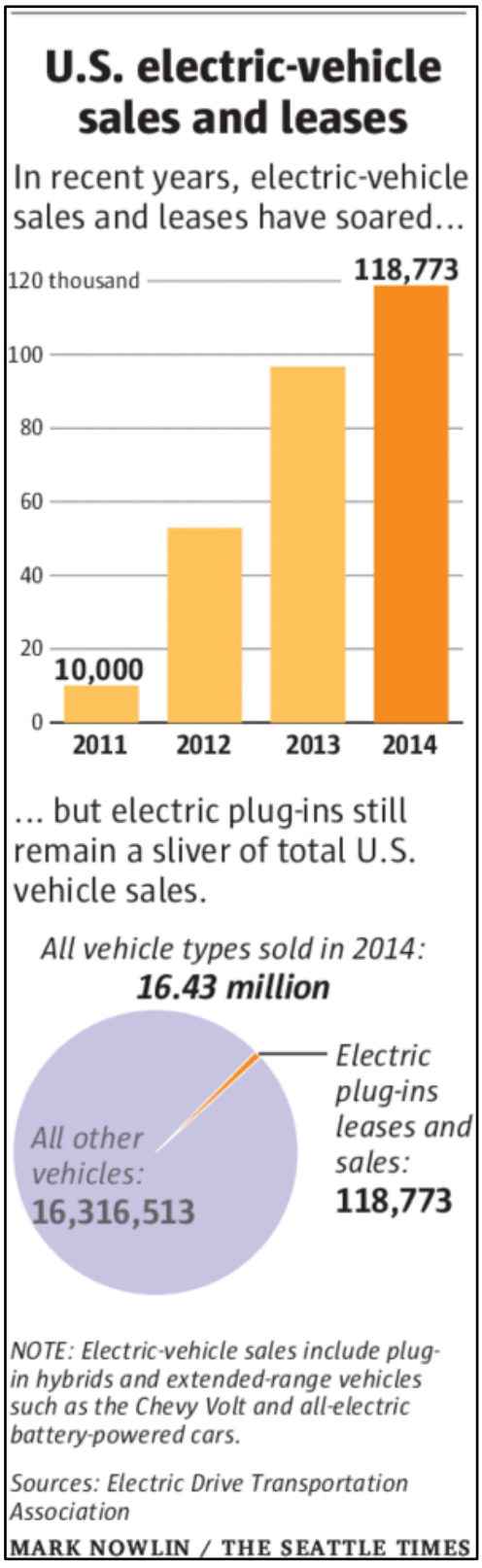
  Washington was one of five states selected by Nissan for the initial launch of the LEAF. The first LEAF was delivered to Washington in December 2010 with more rolling in to the state in 2011 and 2012. Because the LEAF has been on the market longer than in other areas, people are more likely to know of a friend, neighbor, or co-worker who drives an EV and shares positive feedback.

- **Moderate climate**

  The Puget Sound region/western Washington has ideal winter temperatures for driving all-electric vehicles. It's not too hot in the summer and not too cold in the winter.

The first mass-produced electric vehicles from a major automaker started arriving in Washington in December 2010. Since then, they have arrived at an increased pace as more makes and models become available.

In 2013, Washington was the #1 state in the nation for EV market share. By 2014, Washington dropped to #3 behind Georgia and California. Unless expiring legislation is renewed, other states that provide financial incentives and robust public charging infrastructure may continue to surpass Washington's early leadership position.

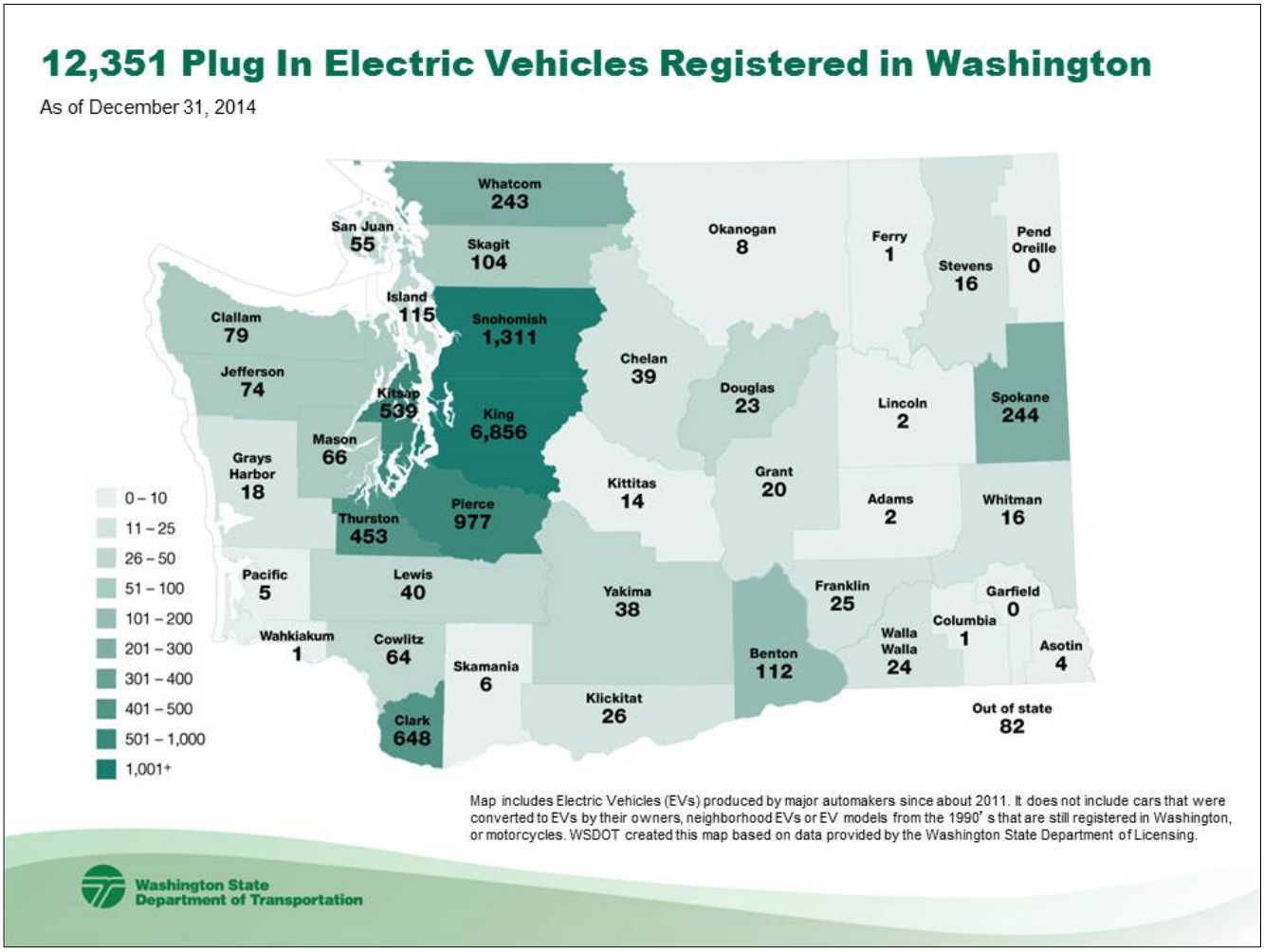


Along with California and Hawaii, Washington is one of three states that sell more than three EVs per 1,000 automobiles. Through June 2014, electric cars held a 1.13% market share in the northwestern corner of the country. National figures from the Electric Drive Transportation Association show that, while increasing at a fast pace, EV sales have yet to reach critical mass and account for only a fraction of overall automobile sales. Even when the state reaches its goal of 50,000 EVs, electric vehicles will still make up less than 1% of all passenger vehicles on Washington roads.

The economic activity represented by the 12,351 PEVs now registered in Washington represents putting about $360 million in clean energy investment to work in Washington. With each vehicle driven an annual average of 9,000 miles, these vehicles combined will drive 100 million miles per year on pure electricity. Compared to a 50 mpg gas car, EV drivers will save two million gallons of gasoline. At an average cost of $2.50 per gallon of gas saved, $5 million dollars is being recycled into Washington's economy instead of going out of the state to oil companies.

Most of the electric vehicles in Washington are registered on the west side of the state. This is likely due to shorter travel distances in the urban areas and the more extensive charging network in the Puget Sound region and along I-5. On the other hand, all Washington residents have access to inexpensive, clean electricity. The actions recommended in this plan would make sure that more people in eastern Washington could benefit.

The following map and tables show where the 11,829 plug-in electric vehicles were registered at the end of 2014 by county and by automaker. Note that 37 of 39 counties have a least one plug-in electric vehicle registered, and King County has 6,856 plug-in electric vehicles—more than half of the state's EV fleet.



***Washington Battery Electric Vehicle (BEV) Registration by County*** *(as of 12/31/14)*

| **Make/** Model | **Nissan** Leaf | **Tesla** Model S Roadster | **Ford** Focus Electric | **BMW** i 3 | **Mercedes** Smart ForTwo | **Mitsubishi** i-MiEV | **Other*** | **BEV Total** |
|---|---|---|---|---|---|---|---|---|
| Adams | | | | | | | - | **-** |
| Asotin | 2 | | | | | | - | **2** |
| Benton | 39 | 9 | 3 | 2 | 1 | 1 | - | **55** |
| Chelan | 17 | 1 | 2 | 2 | | | - | **22** |
| Clallam | 34 | 3 | | | | | 1 | **38** |
| Clark | 308 | 58 | 10 | 5 | 25 | 5 | 2 | **413** |
| Columbia | | | | | | | - | **-** |
| Cowlitz | 27 | 7 | 1 | 1 | 1 | | - | **37** |
| Douglas | 13 | 4 | 1 | | | | - | **18** |
| Ferry | 1 | | | | | | - | **1** |
| Franklin | 10 | 1 | 1 | 1 | 1 | | - | **14** |
| Garfield | | | | | | | | **-** |
| Grant | 4 | 1 | | 1 | 1 | | - | **7** |
| Grays Harbor | 7 | | 1 | | | 2 | - | **10** |
| Island | 30 | 15 | | 1 | | 2 | - | **48** |
| Jefferson | 41 | 5 | 1 | 1 | 2 | | 1 | **51** |
| King | 3,694 | 1,173 | 163 | 126 | 25 | 23 | 16 | **5,220** |
| Kitsap | 348 | 40 | 9 | 4 | 4 | 2 | - | **407** |
| Kittitas | 5 | 2 | | | | | - | **7** |
| Klickitat | 10 | 4 | 1 | | | | - | **15** |
| Lewis | 12 | 6 | 1 | | 4 | | 1 | **24** |
| Lincoln | | | | 1 | | | - | **1** |
| Mason | 25 | 5 | 1 | | | | - | **31** |
| Okanogan | | | 1 | | | | - | **1** |
| Pacific | 2 | 2 | | | | | - | **4** |
| Pend Oreille | | | | | | | | **-** |
| Pierce | 494 | 74 | 28 | 12 | | 7 | 1 | **616** |
| San Juan | 28 | 6 | | 1 | 1 | 2 | - | **38** |
| Skagit | 36 | 12 | 1 | | | 1 | 1 | **51** |
| Skamania | 2 | 2 | | | | | - | **4** |
| Snohomish | 773 | 95 | 31 | 19 | 2 | 3 | 3 | **926** |
| Spokane | 111 | 24 | | 7 | 2 | 1 | - | **145** |
| Stevens | 3 | 2 | | | | | - | **5** |
| Thurston | 240 | 19 | 8 | 2 | 7 | 1 | - | **277** |
| Wahkiakum | | | | | | | - | **-** |
| Walla Walla | 4 | 3 | | | | 1 | - | **8** |
| Whatcom | 144 | 26 | 5 | 1 | 1 | 2 | 2 | **181** |
| Whitman | 4 | | | | | | - | **4** |
| Yakima | 5 | 2 | 2 | 2 | | | - | **11** |
| Out of State | 32 | 15 | 4 | | 1 | 1 | - | **53** |
| **Total** | **6,505** | **1,616** | **275** | **189** | **78** | **54** | **28** | **8,745** |

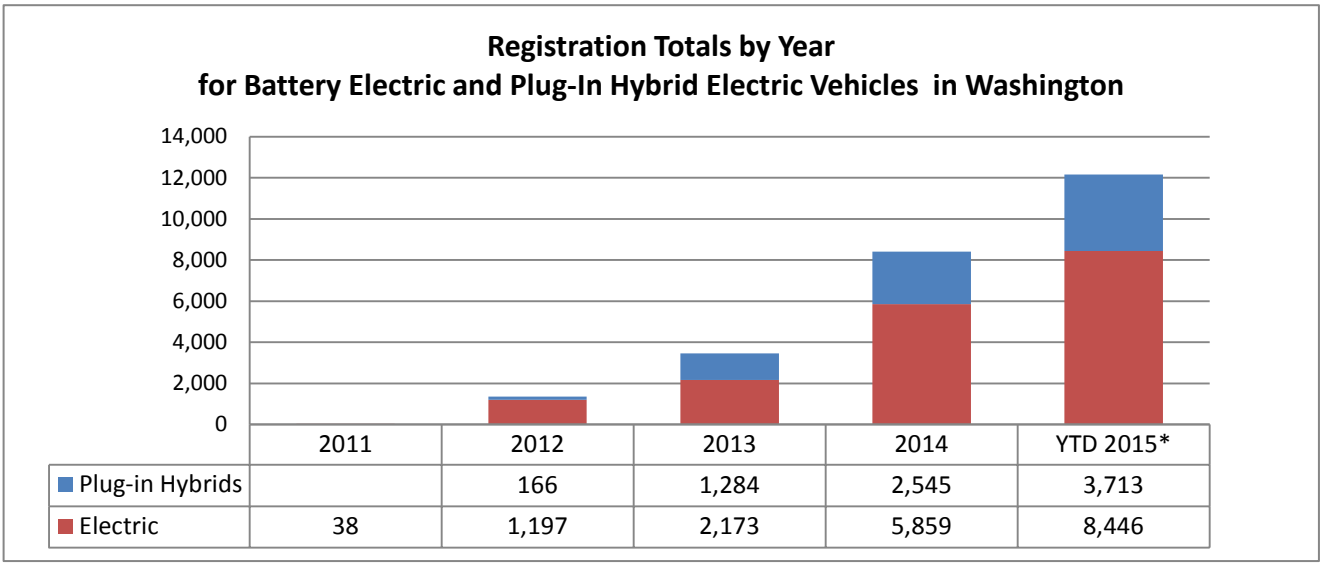
**Other includes: (15) Toyota Rav4s; (6) Fiat 500Es; (5) Chevrolet Sparks; (2) Honda Fits*

***Washington Plug In Hybrid Electric Vehicle (PHEV) Registration by County*** *(as of 12/31/14)*

| **Make/** Model | **Chevrolet** Volt | **Ford** C-Max Energi Fusion Energi | **Toyota** Prius Plug-In | **Honda** Accord Plug-In | **BMW** i 8 | **PHEV Total** | **Plug-In EV Grand Total** |
|---|---|---|---|---|---|---|---|
| Adams | 1 | | | 1 | | **2** | **2** |
| Asotin | 1 | 1 | | | | **2** | **4** |
| Benton | 25 | 20 | 6 | 6 | | **57** | **112** |
| Chelan | 8 | 3 | 5 | 1 | | **17** | **39** |
| Clallam | 16 | 8 | 16 | 1 | | **41** | **79** |
| Clark | 112 | 75 | 38 | 10 | | **235** | **648** |
| Columbia | | | 1 | | | **1** | **1** |
| Cowlitz | 15 | 6 | 5 | 1 | | **27** | **64** |
| Douglas | 3 | | 2 | | | **5** | **23** |
| Ferry | | | | | | **0** | **1** |
| Franklin | 4 | 6 | | 1 | | **11** | **25** |
| Garfield | | | | | | **-** | **-** |
| Grant | 9 | 1 | 3 | | | **13** | **20** |
| Grays Harbor | 2 | 4 | 1 | 1 | | **8** | **18** |
| Island | 32 | 27 | 7 | 1 | | **67** | **115** |
| Jefferson | 12 | 5 | 5 | 1 | | **23** | **74** |
| King | 826 | 554 | 194 | 59 | 3 | **1,636** | **6,856** |
| Kitsap | 75 | 35 | 17 | 4 | 1 | **132** | **539** |
| Kittitas | 6 | | 1 | | | **7** | **14** |
| Klickitat | 4 | 2 | 4 | 1 | | **11** | **26** |
| Lewis | 9 | 2 | 5 | | | **16** | **40** |
| Lincoln | 1 | | | | | **1** | **2** |
| Mason | 29 | 3 | 1 | 2 | | **35** | **66** |
| Okanogan | 4 | 1 | 2 | | | **7** | **8** |
| Pacific | | | 1 | | | **1** | **5** |
| Pend Oreille | | | | | | **0** | **-** |
| Pierce | 205 | 102 | 41 | 13 | | **361** | **977** |
| San Juan | 6 | 10 | 1 | | | **17** | **55** |
| Skagit | 22 | 23 | 6 | 2 | | **53** | **104** |
| Skamania | 1 | | 1 | | | **2** | **6** |
| Snohomish | 181 | 158 | 36 | 10 | | **385** | **1,311** |
| Spokane | 57 | 35 | 4 | 3 | | **99** | **244** |
| Stevens | 6 | 1 | 3 | 1 | | **11** | **16** |
| Thurston | 89 | 51 | 27 | 9 | | **176** | **453** |
| Wahkiakum | | 1 | | | | **1** | **1** |
| Walla Walla | 8 | 4 | 3 | 1 | | **16** | **24** |
| Whatcom | 29 | 15 | 15 | 3 | | **62** | **243** |
| Whitman | 4 | 4 | 4 | | | **12** | **16** |
| Yakima | 19 | 5 | 1 | 1 | 1 | **27** | **38** |
| Out of State | 16 | 7 | 5 | 1 | | **29** | **82** |
| **Total** | **1,837** | **1,169** | **461** | **134** | **5** | **3,606** | **12,351** |

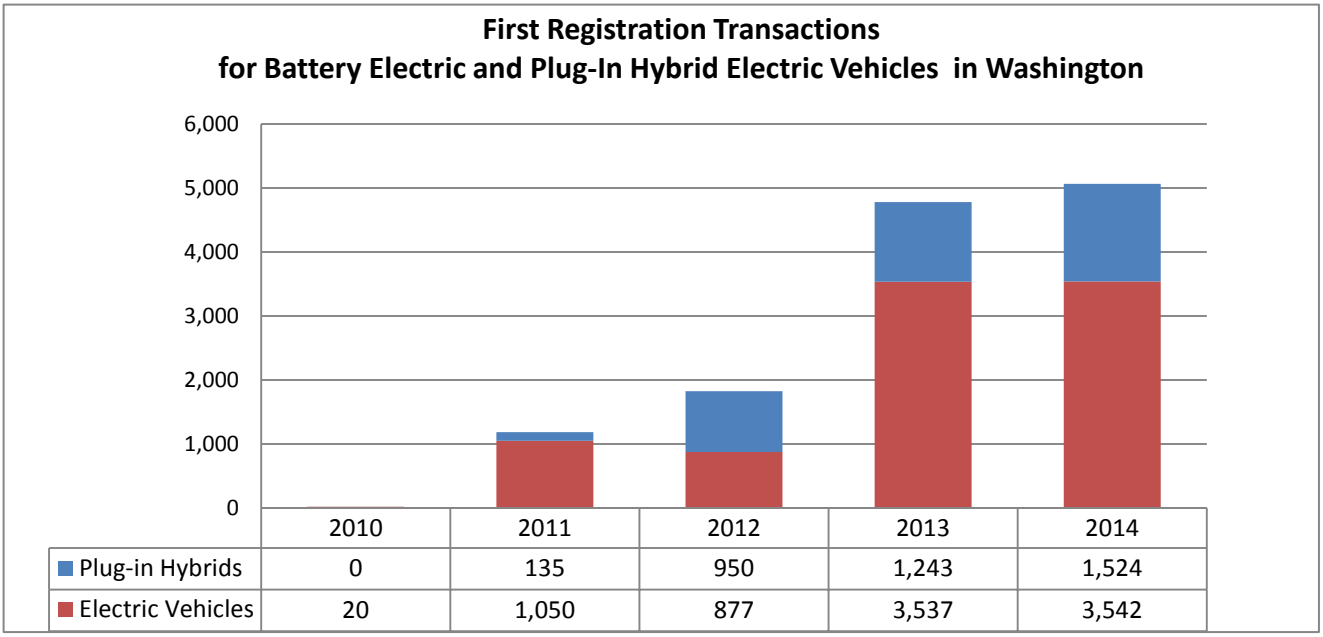
## Plug-In Electric Vehicle Sales Growth Over 5 Years

The following charts show growth trends for plug-in electric vehicle registration. The Washington State Department of Licensing (DOL) tracks plug-in electric vehicle registrations, and the DOL data analysis team provides reports for WSDOT twice per year, down to the zip code level. WSDOT then publishes the information online and shares it with utilities, legislators, local governments, and other stakeholders.




| | 2011 | 2012 | 2013 | 2014 | YTD 2015* |
|---|---|---|---|---|---|
| Plug-in Hybrids | | 166 | 1,284 | 2,545 | 3,713 |
| Electric | 38 | 1,197 | 2,173 | 5,859 | 8,446 |

Total registration of battery electric and plug-in hybrid electric vehicles continues to climb in Washington. *As of February 20, 2015, drivers had already registered or reregistered more than 12,000 plug-in electric vehicles.




| | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| Plug-in Hybrids | 0 | 135 | 950 | 1,243 | 1,524 |
| Electric Vehicles | 20 | 1,050 | 877 | 3,537 | 3,542 |

The biggest increase in plug-in electric vehicle sales was between 2012 and 2013, just after the West Coast Electric Highway DC fast charging network opened to the public and when new makes and models appeared in the marketplace.

Compared to 2013, sales of plug-in hybrid electric vehicles increased 22.6% in 2014. However, battery electric vehicles sales were flat between 2013 and 2014. There were 3,542 original registrations of battery electric vehicles in 2014, totaling just 5 more than were registered the prior year.

## Statewide Collaboration and Investments

Many public agencies and private businesses have undertaken projects to advance electric vehicle adoption. Through partnerships and collaboration, Washington has secured significant investments from the U.S. Department of Energy for electric vehicles and charging infrastructure. Following are examples of some of the innovative projects that, when combined, create a robust EV market:

**Western Washington Clean Cities**

- Western Washington Clean Cities Coalition was awarded $15 million to install charging stations and buy fleet vehicles.
- The coalition has actively promoted alternative fuels and produced an EV Guidebook.

**Cities and Counties**

- Energy Efficiency and Conservation Block Grants, administered by Commerce, were used to purchase charging stations and fleet vehicles.
- Seattle Office of Sustainability & Environment completed the report "Removing Barriers to Electric Vehicle Adoption by Increasing Access to Charging Infrastructure."
- City of Seattle was recognized as nation's most sustainable city by Star Communities, a comprehensive rating program.

**SeaTac Airport Electric Ground Service Equipment**

- Port of Seattle, Alaska Airlines, USDOE, FAA, and partners replaced 45% of fossil-burning ground support vehicles with electric-powered vehicles. The switch to moving baggage and planes with electric tugs and conveyors will save airlines $2.8 million in fuel and cut 10,000 tons of emissions annually.

**Automakers Invest in Washington**

- BMW and SGL Automotive Carbon Fibers are investing $200 million to expand the carbon fiber plant in Moses Lake, Washington, tripling production capabilities to 9,000 tons per year to meet the high demand for carbon fiber for BMW's i-series of electric cars.
- Tesla has installed SuperChargers in four Washington communities.
- Nissan has invested heavily in EV charging infrastructure, advertising, and dealer outreach.

**Federal Highway Administration**

- Granted a request from WSDOT and ODOT to test an alternative highway symbol to identify EV charging station locations on highway signs. The symbol is now used by several DOTs and communities nationwide.
- Supported pooled-fund study led by WSDOT with eight participating DOTs statewide to share best practices on advancing electric vehicles.

**The EV Project**

- USDOE funds used to install Blink charging infrastructure in the Puget Sound region anticipated $20 million investment for 1,000 Level 2 public and workplace fleet chargers, 1,000 Level 2 home chargers, and 20+ DC public fast chargers. Partially delivered.

**ChargePoint America**

- ChargePoint America received $37 million to install 5,000 charging stations in 37 regions, including eastern King County (Bellevue/Redmond).

**Washington State Legislature**

- The Legislature passed state laws to advance electric vehicle adoption.
- The State Legislature's Joint Transportation Committee conducted a study on "Business Models for Financially Sustainable EV Charging Networks."
- A bipartisan group of legislators created the nation's first bi-partisan state legislative "EV Caucus" in 2014 to focus on EV policy improvements.

**State Agencies**

- WSDOT and Commerce created The Washington Plug-In Electric Vehicle Task Force to help get the state EV-ready. State agency clean car and electric vehicle staff meet monthly to coordinate efforts. Commerce leads the state's Alternative Fuels & Vehicles Technical Advisory Group for fleet managers.
- The Department of Enterprise Services offers alternative fuel and electric vehicles and EVSE for government fleet purchase through state contracts.
- WSDOT installed the state's first EV fast charger in 2010 and added six Nissan LEAFs and two Chevy Volts to its fleet.
- Using USDOE funding, the Department of Commerce and the Puget Sound Regional Council convened a multi-stakeholder process to develop a model ordinance and guidance for the zoning, siting, and installation of EVSE.

**Electric Public Transportation**

- Sound Transit operates 20 miles of Link Light Rail, and voters approved an expansion to add another 30 miles of track.
- Ben Franklin Transit converted a diesel fuel bus to a Zero Emissions Propulsion System (ZEPS) with a 100-mile range through Complete Coach Works, reducing operating costs from $1.05/mile to $.07/mile.
- Link Transit operates five 22-foot electric trolley buses in Wenatchee.

**King County Metro**

- King County Metro's 100% electric vanpool and vanshare commuting program for large employers (Microsoft, Amazon) uses twenty 2011 Nissan LEAFs. In 2013, this program eliminated 232 metric tons of tailpipe emissions and 10,000 gallons of fuel compared to traditional gas-powered vanpools. This program was so popular that Metro added five LEAFs in 2013.
- King County Metro operates the second-largest fleet of electric trolley buses (wired electric buses) in the country. Metro plans to test two all-electric battery transit buses in 2015 and may purchase 200 to replace older buses.

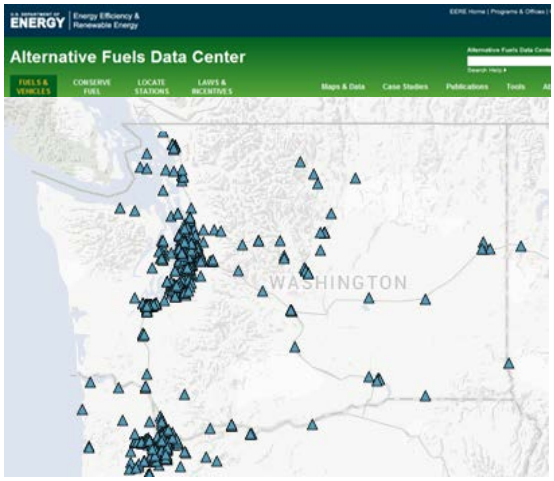
**Electric Vehicle Associations**

- The Seattle Electric Vehicle Association (SEVA), a nonprofit organization serving the Puget Sound region since 1979, actively pursued its mission to educate, demonstrate, and proliferate the adoption of EVs. Members participated in numerous events with their EVs.
- Plug-In America conceived National Drive Electric Week (formerly National Plug In Day) to accelerate adoption of plug-in vehicles through hands-on experiences with electric cars. In 2014, six communities in Washington State held EV public events. The 5th annual National Drive Electric Week is September 12–20, 2015.

## Charging Infrastructure: More Than 400 Public Charging Stations

According to the U.S. Department of Energy's Alternative Fuels Data Center, as of December 2014, Washington had 449 EV charging locations, including 45 DC fast chargers.

The charging equipment is located primarily in the Puget Sound region, along the length of I-5, and around Vancouver. The charging network also stretches along US 2 out to Wenatchee and along I-90. The charging infrastructure makes some corridor travel possible. From Seattle, residents can travel to British Columbia, Oregon, Wenatchee, and Ellensburg. Tesla has four SuperCharger locations in Washington, including two on each side of the state, allowing Tesla Model S drivers with 200+ miles of range to travel anywhere in the state.




*43% of the Nation's 722 DC fast chargers are located on the West Coast. Washington has 45, Oregon has 70, and California has 196, for a total of 311.*

### *Major corridor charging infrastructure gaps*

Many parts of the state lack public charging infrastructure. It is currently not possible to travel across the state to Spokane using DC fast charging. Access to the Pacific Coast is also limited, and entire segments of I-90, US 395, I-82, and Route 12 are not yet electrified with DC fast charging.

### *West Coast Electric Highway*

Washington is home to the "West Coast Electric Highway," an extensive network of DC fast charging stations located every 25 to 50 miles along I-5 and other major roadways. Washington's segment connects drivers to similar corridor fast charging networks in British Columbia, Oregon, and eventually, California. WSDOT leads the Washington segment, the Oregon Department of Transportation leads the Oregon segment, an interagency group led by the California Governor's Office leads the California segment, and the BC Ministry of Environment and BC Hydro lead the British Columbia segment.

In Washington, electric vehicle drivers can find West Coast Electric Highway charging stations in 12 communities along I-5, US 2, and parts of I-90. With this robust charging network, drivers can now travel "border to border" along the 276 miles of I-5 between the borders of Canada and Oregon. These fast charge stations provide a seamless charging backbone for EV drivers traveling between regions or taking road trips, providing "range confidence" that charging is available along the route.

The fast charge technology allows drivers to recharge mass-produced all-electric vehicles such as the Nissan Leaf and Mitsubishi "i-MiEV" in 30 minutes or less. Each location also includes Level 2 equipment to recharge other plug-in electric vehicles such as the Chevrolet Volt.

Initial funding was provided by the U.S. Department of Energy through the State Energy Program (SEP) administered by the Washington State Department of Commerce. Commerce invested $1.6 million of SEP grants as seed funding, and WSDOT developed the partnerships to implement the Electric Highway network with private businesses, utilities, local government, and electric vehicle drivers.




*The West Coast Electric Highway spans 13,800 miles from British Columbia to Baja California (BC to BC).*

### *West Coast Electric Highway Charging Stations in Washington*



*Bellingham Sehome Village*



*Tumwater Shell Station*



*Centralia Wendy's*




*Outlet Shoppes at Burlington*



*Castle Rock Cascade Select Market*




*Ridgefield Country Cafe*




*Sultan Visitor Center*



*Skykomish Sky Deli*



*Snoqualmie Pass Chevron*



*Leavenworth City Hall*



*Wenatchee Convention Center*

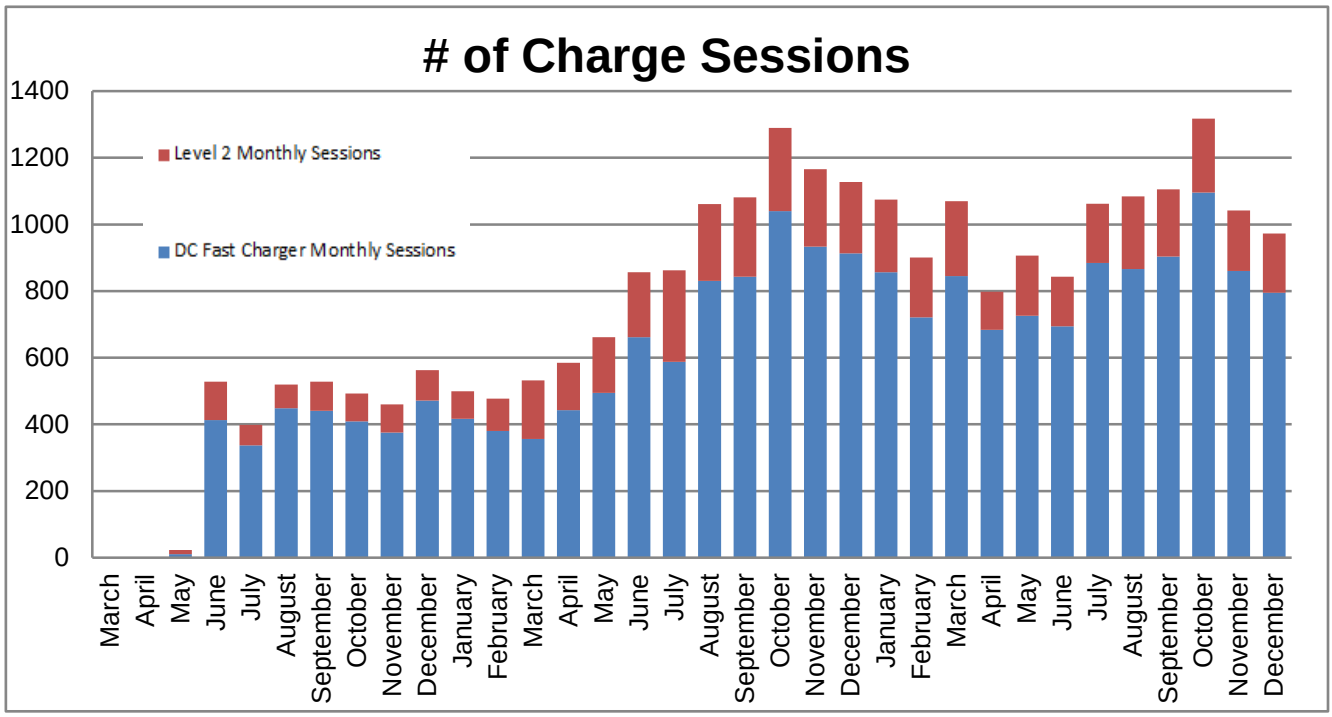


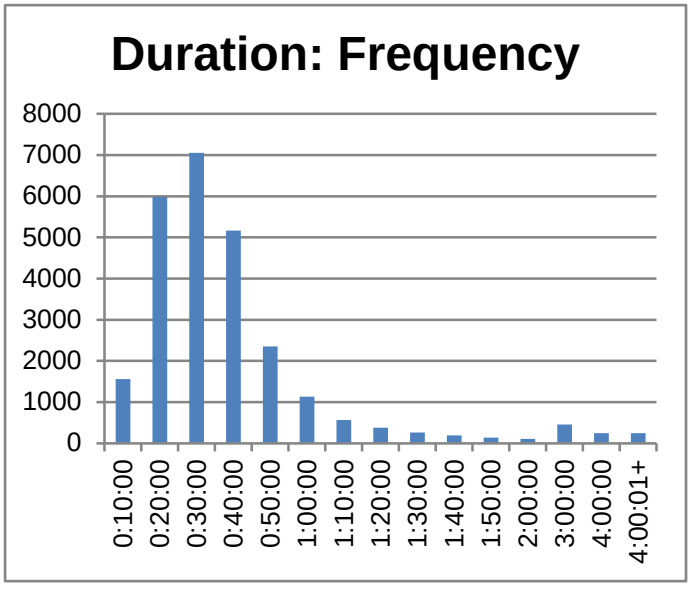
*Cle Elum Suncadia Resort*

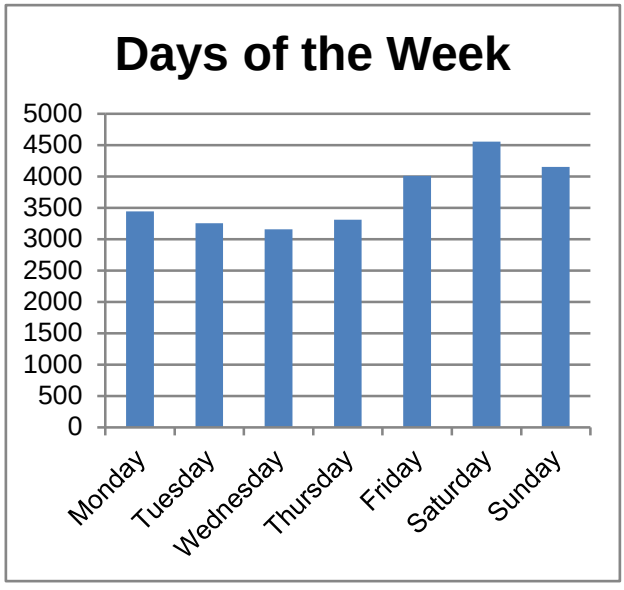
Electric Highway charging stations are strategically placed at shopping centers, fueling stations, and restaurants within a half mile of highway interchanges. WSDOT's Public-Private Partnerships staff coordinated with the Oregon Department of Transportation's Innovative Partnerships Office to develop equipment standards, signage, and branding so EV drivers would have a consistent driving experience along the West Coast. Now the West Coast Electric Highway is used as a model for other states planning corridor electrification, including the 300-mile stretch of Route 66 and roadways in Florida, Tennessee, and Pennsylvania.

Washington's West Coast Electric Highway chargers, owned and operated by AeroVironment, are among the most used chargers in the nation. Even after the free trial ended in April 2014, and drivers started paying $7.50 per use or a $20 monthly subscription fee for unlimited use, charger usage remained high. Since the stations were first opened in 2012, they have been used 25,888 times to supply 228,725 kWh of energy, directly displacing 22,397 gallons of gas.

The following charts show some of the performance metrics for Washington stations:




The Electric Highway, one of the first and most robust highway charging networks in the world, has spurred similar alternative fuel corridor projects across America. The goal of these early stations was to offer DC fast chargers at prominent locations in order to give drivers the confidence they needed to make longer trips. Because of this, sites were not chosen based solely on their projected usage. The strategic design was to maximize visibility, raise PEV awareness, demonstrate that longer PEV trips are possible, and encourage sales of electric vehicles.

## Federal Tax Incentives

Federal incentives are helping boost electric vehicle purchases:

### *Qualified Plug-In Electric Drive Motor Vehicle Tax Credit*

A federal tax credit is available for the purchase of a new qualified plug-in electric drive motor vehicle that draws propulsion using a battery with at least 5 kilowatt hours (kWh) of capacity, uses an external source of energy to recharge the battery, has a gross vehicle weight rating of up to 14,000 pounds, and meets specified emission standards. The minimum credit is $2,500, and may be up to $7,500 based on each vehicle's battery capacity and gross vehicle weight. The credit will begin to be phased out for each manufacturer following the calendar quarter in which they've sold a minimum of 200,000 qualified plug-in electric drive vehicles. This tax credit applies to vehicles acquired after December 31, 2009.

### *Alternative Fuel Infrastructure Tax Credit*

Fueling equipment for natural gas, propane, electricity, E85, or diesel fuel blends containing a minimum of 20% biodiesel installed between January 1, 2006, and December 31, 2014, is eligible for a tax credit of 30% of the cost, not to exceed $30,000. Permitting and inspection fees are not included in covered expenses. Fueling station owners who install qualified equipment at multiple sites are allowed to use the credit toward each location. Consumers who purchased qualified residential fueling equipment prior to December 31, 2014, may receive a tax credit of up to $1,000. Unused credits qualifying as general business tax credits, as defined by the Internal Revenue Service, may be carried backward one year and forward 20 years.

## Washington State EV Laws and Incentives

Washington has adopted a set of coordinated policies to grow our economy and reduce our greenhouse gas emissions. The following policies and programs help advance the market for electric vehicles:

### *Alternative Fuel Vehicle (AFV) Tax Exemption*

New passenger cars, light-duty trucks, and medium-duty passenger vehicles that are dedicated AFVs are exempt from the state motor vehicle sales and use taxes. Qualified vehicles must operate exclusively on natural gas, propane, hydrogen, or electricity; meet California motor vehicle emissions standards; and comply with Washington State Department of Ecology rules. This exemption also applies to qualified used vehicles modified with a U.S. Environmental Protection Agency certified aftermarket conversion kit, as long as the vehicle is being sold for the first time after modification. The converted vehicle must be part of a fleet of at least five vehicles owned by the same person and have an odometer reading of less than 30,000 miles. This tax exemption expires July 1, 2015. (RCW 82.08.809 and 82.12.809)

### *Electric Vehicle (EV) Infrastructure and Battery Tax Exemptions*

Public lands used for installing, maintaining, and operating EV infrastructure are exempt from leasehold excise taxes until January 1, 2020. Additionally, the state sales and use taxes do not apply to: EV batteries; labor and services for installing, repairing, altering or improving EV batteries and EV infrastructure; and the sale of property used for EV infrastructure. (RCW 82.29A.125, 82.08.816, and 82.12.816)

### *AFV and Hybrid Electric Vehicle (HEV) Emissions Inspection Exemption*

Dedicated electric, compressed natural gas, and propane vehicles are exempt from state emissions control inspections. HEVs that obtain a U.S. Environmental Protection Agency fuel economy rating of at least 50 miles per gallon during city driving are also exempt from these inspections. (RCW 46.16A.060)

### *Clean and Efficient Fleet Assistance*

The Western Washington Clean Cities Coalition, in partnership with the Puget Sound Clean Air Agency, provides fleet managers with tools to help "green" public and private fleets, reduce pollution, and save money. Western Washington Clean Cities offers technical assistance and education to help fleet managers identify the most effective way to green their fleets, including buying greener vehicles, switching to cleaner fuels, and improving fleet efficiency.

### *EV Promotion and Infrastructure Development*

Any regional transportation planning organization containing a county with a population greater than one million must collaborate with state and local governments to promote EV use, invest in EV infrastructure, and seek federal or private funding for these efforts. Collaborative planning efforts may include: (a) developing short- and long-term plans outlining how state, regional, and local governments may construct EV charging locations and ensure the infrastructure can be electrically supported; (b) supporting public education and training programs on EVs; (c) developing an implementation plan for counties with a population greater than 500,000 to have 10% of public and private parking spaces ready for EV charging by December 31, 2018; and (d) developing model ordinances and guidance for local governments for site assessment and installing EV infrastructure. (RCW 47.80.090)

### *EV Charging Infrastructure Availability*

Publicly and privately owned EVs may be charged at state office locations where the vehicles are used for state business, operated by visitors conducting business with the state, or used as commuter vehicles. Additionally, contingent upon funding, the state must install electrical outlets suitable for charging EVs in each of the state's fleet parking and maintenance facilities, as well as every state-operated highway rest stop, by December 31, 2015. (RCW 43.01.250, 43.19.648, and 47.38.075)

### *EV Fee*

Effective February 1, 2013, EV operators must pay an annual vehicle registration renewal fee of $100. The fee applies to vehicles capable of driving more than 35 miles per hour. Proceeds are used to mitigate the impact of vehicles on state roads and highways, and evaluate the feasibility of transitioning from a revenue collection system based on fuel taxes to a road user assessment system. As a comparison, the EV fee is about the equivalent of what a Toyota Prius hybrid owner driving 12,000 miles pays each year in state gasoline taxes. This fee expires if the Legislature imposes a vehicle miles traveled fee or tax in the state. (RCW 46.17.325)

### *Local Government Plug-in Electric Vehicle (PEV) Infrastructure Requirements*

Jurisdictions must develop regulations to allow PEV infrastructure and battery charging stations in all areas except critical areas or areas zoned for residential or resource use. This regulation applies to jurisdictions that meet specific location criteria. The Washington State Department of Commerce included a model ordinance, development regulations, and guidance for local governments for site assessment and installing PEV infrastructure in "Electric Vehicle Infrastructure: A Guide for Local Governments in Washington State." Additionally, cities or municipalities may adopt incentive programs to encourage retrofitting of existing structures capable of charging PEVs. (RCW 35.63.126, 35.63.127, 35A.63.107, 36.70.695, and 36.70A.695)

### *Electric Vehicle Supply Equipment (EVSE) and Battery Exchange Station Regulations*

State and local governments may lease land for installing, maintaining, and operating EVSE or electric vehicle battery exchange stations for up to 50 years. Additionally, the installation of battery charging and exchange stations is categorically exempt from the Washington Environmental Policy Act. (RCW 79.13.100 and 43.21C.410)

### *EV Infrastructure Definitions*

EV infrastructure is defined as structures, machinery, and equipment necessary and integral to support an EV, including battery charging stations, rapid charging stations, and battery exchange stations.

- A *battery charging station* is defined as an electrical component assembly or cluster of component assemblies designed specifically to charge batteries within an EV.
- A *rapid charging station* is defined as an industrial-grade electrical outlet that allows for faster recharging of EV batteries through higher power levels.
- A *battery exchange station* is defined as a fully automated facility that will enable an EV with a swappable battery to enter a drive lane and exchange the depleted battery with a fully charged battery through a fully automated process.

Infrastructure must meet or exceed any applicable state building standards, codes, and regulations. (RCW 19.27.540 and 19.28)

### *Provision for Alternative Fuels Corridor Pilot Projects*

WSDOT may enter into partnership agreements with other public and private entities to use land for alternative fuel corridor pilot projects. Minimum requirements apply, and these agreements are subject to funding availability. (RCW 47.38.070)

### *Alternative Fuel Use Requirement*

Effective June 1, 2015, all state agencies must use biofuels or electricity to operate publicly owned vehicles to the extent practicable, under rules determined by the Washington State Department of Commerce. State agencies replacing passenger vehicles are expected to purchase EVs if the cost is within 5% of the cost of conventional hybrid passenger vehicles. Effective June 1, 2018, all local governments must also use biofuels or electricity to the extent practicable to operate publicly owned vehicles. Transit agencies using compressed natural gas are exempt from this requirement. To allow vehicle fuel needs to be satisfied by Washington-produced biofuels, the Department of Enterprise Services and local governments may contract in advance and execute contracts with public or private producers and suppliers for the purchase of appropriate biofuels. Government agencies may substitute compressed natural gas, liquefied natural gas, or propane in vehicles if Commerce determines that biofuels and electricity are not reasonably available. (WAC 194-28 and RCW 43.19.647 through 43.19.648)

### *State Vehicle Purchasing Guidance*

The Department of Enterprise Services must develop guidelines and criteria for the purchase of high-mileage gasoline vehicles, as well as alternative fuel vehicles and systems that reduce overall costs and energy use in the state. The guidance should include investigations into all opportunities to aggregate the purchasing of clean technologies with state and local governments, as well as federal fuel economy standards. (RCW 39.26.090)

### *Low-Carbon Fuel and Fuel-Efficient Vehicle Acquisition Requirement*

Washington state agencies must consider purchasing ultra-low-carbon fuel vehicles or converting conventional vehicles to use ultra-low-carbon fuels when financially comparable over the vehicle's useful life. Ultra-low-carbon fuels include hydrogen, biomethane, electricity, or at least 90% natural gas. State agencies must phase in fuel economy standards for motor pools and leased vehicles to achieve an average fuel economy of 36 miles per gallon for passenger vehicle fleets by the end of 2015. State agencies must purchase ultra-low-carbon fuel vehicles or, when purchasing new vehicles, achieve an average fuel economy of 40 mpg for light-duty passenger vehicles and 27 mpg for light-duty vans and sport utility vehicles. When calculating average fuel economy, the following are excluded: emergency response vehicles, passenger vans with a gross vehicle weight rating of 8,500 pounds or greater, off-road vehicles, ultra-low-carbon fuel vehicles, and vehicles driven less than 2,000 miles per year. (RCW 43.41.130)

### *Greenhouse Gas Emissions Limits*

State greenhouse gas emissions reduction goals in law (RCW 70.235.020) are as follows:

- Return to 1990 levels by 2020
- By 2035, reduce emissions to 25% below 1990 levels
- By 2050, reduce emissions to 50% below 1990 levels

### *State Agency Coordination*

On April 29, 2014, Governor Jay Inslee signed Executive Order 14-04, "Washington Carbon Pollution Reduction and Clean Energy Action," outlining a multiagency, multipronged effort to reduce carbon pollution and improve energy independence through use of clean energy. Clean transportation is one key area that requires agencies and governments at all levels to promote strategies, policies, and investments that support electrification of our transportation system, lower-emission multimodal options, and clean fuels.

WSDOT is the lead for five areas under the Clean Transportation component of the Executive Order, which is in alignment with WSDOT's Strategic Plan, Results WSDOT, and the agency's sustainable transportation efforts. The department has been advancing sustainable transportation through greenhouse gas reduction, alternative fuel usage, vehicle miles traveled reduction strategies, statewide transportation system efficiency strategies, and development support for the Electric Highway.

This Electric Vehicle Action Plan is in response to the Executive Order directing WSDOT, in collaboration with federal, state, regional, and local partners, to develop an action plan to advance electric vehicle use, and to include recommendations on targeted strategies and policies for financial and nonfinancial incentives for consumers and businesses, infrastructure funding mechanisms, signage, and building codes. The Executive Order also directs WSDOT to continue to build out the electric vehicle charging network along state highways and at key destinations, as funding and partnerships allow.

The Governor's Executive Order also directs other state agencies to lead efforts that could contribute to the advancement of electric vehicles:

- **Clean Fuel Standard**: The Office of Financial Management is leading an evaluation of the technical feasibility, costs and benefits, and employment implications of adopting a Clean Fuel Standard.
- **Zero Emission Vehicles**: The Department of Ecology is reviewing the state's motor vehicle emission standards and recommending updates to clean car standards and ZEV policies.
- **Public Sector EV Procurement**: The Department of Commerce, in collaboration with the departments of Enterprise Services and Ecology, is evaluating life cycle costs, including carbon emissions (Total Cost of Ownership tool) and procurement incentives for public fleets.

# Strategy to Accelerate Electric Vehicle Sales and Adoption

Incentives that substantially drive down the total cost of owning and operating electric vehicles are likely to be the most effective means of spurring EV sales.

## Action #1: Renew the sales and use tax exemption for the purchase or lease of Clean Cars.

States with robust incentives, such as California and Georgia, have higher rates of EV sales. Once Georgia started offering a $5,000 income tax credit to EV buyers, sales quickly surpassed Washington's.

Washington currently provides a sales tax waiver, which is credited with being a top motivating factor for people interested in buying or leasing a new EV. This waiver is scheduled to expire July 1, 2015. Priority should be given to extending this incentive.




*Carlos Ghosn, Renault-Nissan Alliance CEO and Chairman, congratulates Ray Ishak from Magic Nissan in Everett, Washington, as the 2013* ***World's Top LEAF Salesperson****!*

- **Priority: Extend the sales tax exemption for the purchase or lease of new alternative fuel (electric, natural gas, propane, and hydrogen) vehicles to 2020 or beyond.**

  Set to expire in the summer of 2015, this sales and use tax exemption is considered the single most important factor for future success of electric vehicles in our state. With a sales tax exemption (the total sales and use tax falls between 7.9% and 9.8%, state sales tax is 6.5%, use tax to finance transportation improvements is 0.3%, and local tax rates vary), buyers can save $3,000–4,000 on a $40,000 purchase depending on their local sales tax rate, or lower initial and monthly lease payments, which are also taxed. That savings can make a big difference in the purchasing decision of whether to buy an electric vehicle or a lower-priced gas car.

  There is a federal income tax credit for the purchase of a new electric vehicle, ranging from $2,500 to $7,500, which is taken directly by a purchaser or by the leasing company and passed through to the lessee in lower lease costs. However, even with this credit, electric vehicles have higher initial purchase costs than comparable gasoline vehicles due to the cost of batteries. While electric vehicles have far lower operating costs—roughly equivalent to $1 per gallon gasoline—consumers primarily focus on a vehicle's initial purchase cost. Furthermore, an estimated 80% of taxpayers do not have enough tax liability to fully take advantage of the federal tax credit, and the delay between vehicle purchase and receipt of the credit also reduces its impact.

- **Consider expanding sales tax exemption eligibility to other clean vehicles, including:**
  - Plug-in hybrid and extended range electric vehicles, such as the Chevy Volt
  - Electric motorcycles
  - Heavy-duty alternative fuel vehicles
  - Electric transit buses
  - Used electric vehicles

**Plug-in hybrids:** Washington's incentive for the purchase of new 100% alternative fuel vehicles does not currently apply to plug-in hybrid electric vehicles. The average driver in the U.S. travels only 29 miles per day, a distance that can be driven in pure electricity mode in some plug-in hybrids. A minimum standard could be set that only plug-in hybrids with the capacity to drive at least 30 miles in electric mode would qualify for the sales tax exemption.

Nationally, the trend is toward plug-in hybrids; however, the reverse is true in Washington. Here, battery electric vehicles (BEVs) are more popular than plug-in hybrids. About 70% of the plug-in vehicles registered in Washington are BEVs. This could be due, in part, to plug-in hybrid vehicles not qualifying for Washington's purchase incentive.

**Electric motorcycles:** Electric motorcycle drivers pay the annual $100 registration renewal fee for electric vehicles, but don't qualify for the sales tax exemption. These laws could be aligned by adding electric motorcycles to the alternative fuel exemption. In 2014, there were only about 100 electric motorcycles registered in Washington; a sales tax exemption might spur additional sales.

**Heavy-duty alternative fuel vehicles:** The biggest impact on fuel and emission reductions comes from adoption of heavy-duty clean fuel vehicles. The current law only applies to new passenger cars, light-duty trucks, and medium-duty passenger vehicles.

**All-electric battery buses:** EV transit buses have lower operating costs, lower emissions, and higher performance than their diesel counterparts. EV buses also have a higher purchase price. Transit systems in several cities, including Seattle, are testing EV buses made by BYD and Proterra. To help bring down the upfront costs and encourage transit systems to provide the new technology, communities would benefit from reducing or eliminating the sales tax on the purchase price of all-electric buses.




*BYD Motors demonstrates its 40-foot electric bus with 150 miles of range and zero tailpipe emissions at the Electric Vehicle Showcase in Olympia, Washington, on February 25, 2014.*

**Used electric vehicles:** Used electric cars don't hold their value well, in part because of their higher up-front cost. In addition, consumers wary of new technology are less willing to take a chance on buying used electric cars, despite eight-year battery warranties. According to the Kelley Blue Book, electric cars have the lowest residual value of any vehicle types, at around 20% of the purchase price after 60 months.

The first mass-produced electric vehicles from major automakers started arriving in December 2010. In Washington, about 65% of electric vehicles are leased for two to three years. Rather than purchasing the car at the end of the lease, most drivers opt to lease a new vehicle. Soon, these electric vehicles will be flooding the used car market. The current sales tax exemption only applies to the purchase of new Clean Cars. If the exemption was extended to the purchase of used electric vehicles, it would help lower-income drivers have better access to electric vehicles.

- **Consider limiting the sales tax exemption dollar amounts.**

  Capping the sales tax exemption at a certain purchase price could help change the misperception that only wealthy people can afford electric cars. Limiting the incentive would also reduce the state's financial investment.

- **Consider establishing a rebate system similar to other states.**

  Using sales tax exemption funds, Washington could switch to a rebate system where all new EV buyers would receive the same dollar amount, regardless of the purchase price of the vehicle. Consistent, clear signals from industry and consumer groups indicate that a "visible" direct incentive project holds many advantages over a tax credit. According to the Center for Sustainable Energy, the advantages of rebates include the following:

  - Direct incentives provide richer data and allow for more effective evaluation work. The customer's relationship with the program can be leveraged to elicit information on purchase motivations and use. Better data would be helpful for informing policies regarding further development of the market.
  - Direct incentives typically managed by the state or a third party allow for the inclusion of impactful project outreach and education components.
  - Direct incentives allow for a more formalized infrastructure to coordinate and disseminate information that will in turn facilitate market growth and further emphasize public-private partnerships at early stages in advanced technology market development.

  ***Examples of Clean Vehicle Rebate Programs***

  Several states offer rebate programs for plug-in electric vehicle purchases. A single-payment rebate check is mailed directly to the applicant on a first-come, first-served basis, generally within 90 days of approval, regardless of whether the vehicle is purchased or leased. For example:

  - **California** has offered rebates for the purchase or lease of plug-in electric vehicles through the Clean Vehicle Rebate Project (CVRP) since 2010. Individuals, nonprofits, government entities, and business owners may apply for a rebate in the amount of $2,500 for battery electric vehicles, $1,500 for plug-in hybrid electric vehicles, and $5,000 for fuel-cell vehicles. Since the program's launch, approximately $166 million has been invested through over 80,000 rebates. According to a survey of CVRP recipients, about 74% of participants indicated that the rebate was an "extremely" or "very" important factor in their decision to buy an EV.
  - **Illinois** offers rebates for the purchase of both plug-in electric vehicles and electric vehicle supply equipment. The EV rebate is administered by the Illinois Environmental Protection Agency, and is part of the broader Illinois Alternate Fuels Rebate Program. For EVs without a conventional vehicle equivalent, the rebate may be 10% of the retail price; for EVs with a conventional vehicle equivalent (e.g., the Ford Focus Plug-In), the rebate may be equal to 80% of the incremental cost. The Illinois Electric Vehicle Charging Infrastructure Rebate Program was launched in 2012 and provides rebates for residential and nonresidential EVSE installations of Level 1, Level 2, and DC fast chargers.
  - **Massachusetts Offers Rebates for Electric Vehicles** (MOR-EV) launched an incentive program in June 2014 to offer consumer rebates of up to $2,500 to accelerate deployment of electric vehicles by incentivizing residents to purchase or lease eligible vehicles.

- **Consider implementing a Junker Scrap Rebate Program with clean vehicle rebates.**

  Consider adopting a clean vehicle rebate program similar to California's SB359, passed in 2013. Rebates between $1,000 and $1,500 would be provided for the voluntary retirement of high-polluting vehicles, contingent on replacing the scrapped vehicle with an electric vehicle.

## Action #2: Transform public and private fleets.

There are many efforts currently underway to improve the efficiency and environmental performance of public and private fleets. This recommendation aligns well with those of other initiatives, so efforts should be made to coordinate implementation as much as possible.

- **Aim for 10% PEV for new procurements by 2016.**

  Pacific Coast Collaborative leaders from California, Oregon, Washington, and British Columbia signed the Pacific Coast Action Plan on Climate and Energy in October 2013. The plan includes actions to expand the use of electric vehicles, aiming for 10% of new vehicle purchases in public and private fleets by 2016. West Coast Electric Fleets encourages organizations to pledge to incorporate EVs into their fleets to help meet this goal.



*Washington Secretary of Transportation Lynn Peterson drives electric.*

- **Increase plug-in vehicles in government fleets.**

  State agencies such as Commerce and Enterprise Services provide tools for state and local government agencies, such as a Total Cost of Ownership Calculator and Agency EV-EVSE Guide. The state is exploring contracting with a telematics company to track current fleet use and determine which vehicles would most benefit from transitioning to plug-in electric.

- **Coordinate with Western Washington Clean Cities on increasing alternative fuel vehicles in public and private fleets.**

  Clean Cities provides guidance and tools such as training and model policies for fleet managers.

- **Create a tax incentive for businesses to transition fleets to alternative fuels.**

## Action #3: Conduct public education and outreach to increase consumer awareness and demand.

To pique consumer interest and boost EV sales, many myths and misperceptions must be addressed. Although sales tax exemptions can save consumers a significant amount of money, many potential EV owners are not aware of the exemption.

- **Work with car manufacturers, car retailers, rental car companies, EV associations, and partners to promote EVs.**

  Working together, partners can host a series of Ride & Drive events where drivers can experience EVs first hand. Plug In America and the Seattle Electric Vehicle Association are well poised to lead this effort.

- **Promote EV tourism routes, including the North Cascades Loop and the US 2 "Electric Vehicle-Friendly" Scenic Byway.**

- **Create a technical resource center to guide retail businesses through the process of installing and promoting EV charging equipment for current and potential customers.**

- **Continue to manage the West Coast Electric Highway website, branding, and marketing efforts. Coordinate with local communities on ribbon cuttings, special events, and media relations.**

- **Create a "my next car is electric" pledge campaign, and publicize community and business leaders who have EVs or have pledged to buy one.**

## Action #4: Provide more EV charging signage to increase public awareness of availability.

The departments of transportation in Washington, Oregon, and California adopted a standardized symbol to identify publicly accessible electric vehicle charging stations along major roadways. The West Coast states are using the Alternate Electric Vehicle Charging Symbol sign (D9-11b Alternate) approved by the Federal Highway Administration.

- **Encourage the installation of highway and follow-through signs for DC fast charging.**

  Although EV drivers can find charging locations using mobile apps and on-board station locators, highway signs help increase public awareness of charging infrastructure.

- **Encourage signs for urban area EV charging stations.**

- **Create a sign pool to assist local businesses with signing EV charging sites.**

  A "sign pool" would help businesses and municipalities install signs at charging sites. The sign pool could include bulk pricing on sign production and technical support for installation. Clear and consistent signage would discourage Internal Combustion Engine (ICE) vehicles from blocking access to charging equipment (ICEing).

  The signs would meet the Washington State "de-ICEing" law (RCW 46.08.185) that requires EV charging stations to be clearly identified with regulatory signs and striping, including:

  1. An "EV Charging Station" sign
  2. A "No Parking Except for Electric Vehicle Charging" sign
  3. Green pavement markings

  The law also states that it is a "parking infraction, with a monetary penalty of one hundred twenty-four dollars, for any person to park a vehicle in an electric vehicle charging station provided on public or private property if the vehicle is not connected to the charging equipment."




*Roadway signs along state highways, county roads, and city streets help guide motorists to EV charging locations.*




*Examples of EV charging station signs and pavement markings.*

## Action #5: Explore providing other incentives to increase use of electric vehicles.

Manufacturer research and real-world evidence suggests that an additional state incentive can substantially accelerate vehicle sales.

- **Provide financial and nonfinancial incentives to encourage use of electric vehicles.**

  Explore incentives for driving electric vehicles, such as access to free or preferred parking, utility-rate discounts, and insurance discounts.

- **Remove the limit on the number of vehicles allowed when electric vehicles are used for car-sharing, taxi, and network companies such as Uber and Lyft.**

- **Provide a toll and ferry fare credit to EV owners.**

  In recent surveys, EV owners cite the following as their top three motivators for purchasing or leasing an EV: saving money, gaining access to high-occupancy vehicle (HOV) lanes, and helping the environment. In Washington, many HOV lanes are already at capacity. Adding EVs into those lanes isn't feasible at this time. Other benefits, such as tolling discounts or reduced ferry fares, might be of interest to potential EV drivers.

  The Governor's proposed Operating Budget for 2015–2017 includes a credit for driving an electric vehicle using existing payment tools. EV drivers who buy a pass could receive a credit on their "Good To Go" or "Wave To Go" account to use on the Tacoma Narrows Bridge, SR 520, HOT lanes, express lanes, or Washington State Ferries.



# Strategy to Strengthen Washington's EV Charging Network

Widespread EV adoption depends on having a robust charging network. Many parts of the state are not accessible to EV drivers who rely on publicly available charging locations. Despite advances in vehicle technology and vehicle availability, range anxiety remains a significant barrier to EV adoption. A key to more EV sales is increasing the EV charging infrastructure.

## Action #6: Complete the build-out of Washington's fast charging network along highways.

Ensuring a comprehensive network of charging stations that connect the state's most popular cities and destinations will alleviate range anxiety and attract more interest in EVs.

- **Secure funding to strengthen and expand the West Coast Electric Highway DC fast charging network.**

  The I-5 portion of the West Coast Electric Highway currently extends from Vancouver, British Columbia, through Washington and Oregon, to the California border. Although Washington has one of the highest percentages of public DC fast charger uses in the nation, the network is incomplete, with only a partial route over I-90 to Cle Elum, few stations in the most heavily-traveled central Puget Sound region, and no stations supporting key travel corridors serving Yakima, the Tri-Cities, Spokane, and other metropolitan areas.

**Map of Existing and Proposed Electric Vehicle Fast Charging Network Infill and Expansion**




Funding a budget proposal for $1.5 million for DC fast charging stations in communities along I-5 and I-90 would leverage partnerships to provide key linkages in Washington's public fast charging network on the east-west corridor, and would fill the gaps in the network from the planned, but not completed, Blink fast charging network. Locating infill stations in the Puget Sound region and extending the network will serve the currently registered all-electric vehicles and spur future EV sales.

## Action #7: Explore funding mechanisms and business models to bolster installation of EVSE.

A significant market barrier for EV adoption is the lack of a proven, sustainable business model for owning and operating electric vehicle supply equipment (EVSE). It's a newer technology without a track record of profit and loan performance. Federal funds have subsidized the initial costs of most public charging equipment in the state and across the nation. As future federal funding is uncertain, Washington needs to explore other funding mechanisms. Public sector intervention with financial assistance would help the private sector expand the charging network in the near term. Public subsidies will no longer be needed once the market stabilizes, station utilization grows, and equipment costs decline.

- **Create an EV infrastructure bank to provide financial assistance for the installation of publicly accessible high-speed charging stations.**

  The EV Infrastructure Bank would be the first of its kind in the nation. The idea stems from Clean Energy Banks (or Green Banks) used by some state governments to encourage private investment in energy efficiency or renewable energy. What makes it unique is that it would be funded by EV drivers using an existing fee and would directly benefit current and future EV drivers.

  Legislators first proposed this concept in 2014 as part of the House and Senate transportation packages. The current $100 EV annual registration renewal fee on EVs would be used to fund the EV Infrastructure Bank. WSDOT's Public-Private Partnership Office would administer the EV Infrastructure Bank and would provide financing support for the capital cost of installing EV charging stations, while the operating costs for the stations would continue to be borne by private firms and EV drivers. The EV Infrastructure Bank can be scaled up when there are more EVs on the road and more charging infrastructure is needed. Once the EV market begins to take hold and the state reaches its goal for EV registration, renewal fees would return to the general motor vehicle fund for road operation and maintenance or other transportation purposes.

- **Pursue public-private partnerships for EVSE.**

  WSDOT used a public-private partnership agreement to deploy the West Coast Electric Highway network of fast charging stations in 12 communities along I-5, US 2, and I-90. The initial infrastructure was commissioned in 2012 with federal seed funding of $1.6 million provided by the U.S. Department of Energy through the State Energy Program. WSDOT's private partner, AeroVironment, contributed over $600,000 in additional value (e.g., extended warranties; payment of all electricity dispensed, including demand charges; additional Level 2 charging equipment; communications and marketing support; and project oversight).

- **Pool resources within communities to electrify tourism routes.**

  Building on the success of tourist routes such as the "Nation's First EV-Friendly Scenic Byway" along US 2, explore other routes to electrify. The stakeholders along the routes could contribute to installing an EVSE network. Potential routes could serve Walla Walla wineries, Washington's coastline, and the Olympic Peninsula national parks.

- **Synchronize with recommendations of the Joint Transportation Committee's Study of Business Models to Sustain Electric Vehicle Charging Station Networks.**

  The Joint Transportation Committee is conducting a study to develop potential business models for financially-sustainable electric vehicle charging networks, and alternative roles for public and private sector participation in those models. Research includes consultation with local governments, stakeholders in the electric vehicle industry, and electric vehicle users, and also stakeholders representing manufacturers and operators of electric vehicle charging stations.

## Action #8: Support workplace charging.

Being able to charge at work can be an important consideration for those in the market for an EV, particularly if they don't have access to home charging. Workplace charging fills a critical gap in EV charging infrastructure needs by extending electric miles, building range confidence, and creating second "EV showrooms" that help increase sales and technology adoption among employees.

Workplace charging benefits employers as it helps them achieve environmental leadership goals, provides a benefit to attract and retain talented employees, and enhances the company's brand as socially and environmentally responsible.

Washington is well known for the high-tech and sustainable companies that were created here, such as Boeing, Microsoft, Amazon, Starbucks, UPS, Costco, and Nordstrom. Some Washington employers, such as Microsoft and the City of Seattle, already offer EV charging for their employees and work with car manufacturers to obtain special employee EV purchasing rates. For example, Nissan offers a Vehicle Purchase Program to employees of businesses that invest in workplace charging, fleet purchases, employee incentives, and EV Ride & Drive promotions.

- **Provide incentives for workplace charging.**

  Leverage efforts with other air quality endeavors such as the state's Commute Trip Reduction Program and regional mobility projects. Give employers credit for installing and providing EVSE at the workplace for zero emission carpool and vanpool vehicles. Give extra credit for employees carpooling in EVs.

- **Raise EV Awareness among CEOs and business leaders.**

  Create a Governor's award program to recognize employers who demonstrate a commitment to advancing EVs, which may motivate other companies to explore workplace charging. Hold a media event similar the California's "Drive the Dream," where the Governor and corporate leaders announced commitments to provide workplace charging for their employees.



*Governor Inslee and business partners congratulate 100,000-mile Nissan LEAF driver and his employer who installed workplace charging.*

- **Encourage employers to support the national workplace charging challenge.**

  The U.S. Department of Energy reported findings from a study through its EV Everywhere Workplace Charging Challenge that employees of companies with at-work charging are 20 times more likely to drive a plug-in car than those who work at companies with no provision for electric car charging.

- **Encourage businesses to pursue other electric technologies.**

  While this plan focuses on passenger electric vehicles, it's worth noting that there are other electric technologies that businesses might want to explore. The California Transportation Electrification Assessment shows a high benefit/cost ratio and life cycle cost savings when transitioning to electricity for forklifts, truck stops, truck refrigeration units, port equipment, airport ground support, and tugs.

## Action #9: Address building codes, policy, and zoning barriers to EV infrastructure.

Addressing barriers such as cost, zoning, and building codes will also make it easier for businesses and interested parties to install electric vehicle supply equipment (EVSE). Hawaii, California, and New York have adopted building codes to support electric vehicle charging.

- **Amend building and electrical codes to require "EV-readiness" in buildings.**

  Require new construction in urban areas to be "electric vehicle supply equipment-ready," with appropriately-sized electrical panels and conduits installed near parking spaces so that EV charging stations can be easily added later to residential, commercial, and industrial buildings. For example, the 2014 Seattle Electrical Code (Article 625.27) includes requirements for future installation of charging outlets in all occupancies. One of the following is required: space reserved in the electrical service equipment for installation of an overcurrent protective device to serve electric vehicle charging system branch circuits, or a designated location, together with the required working clearances, for a future electric vehicle charging system panel board. In addition, Seattle's code has a flexible allowance for calculating EV loads, which significantly reduces infrastructure costs.

- **Offer incentives for installation of DC fast charging stations in commercial buildings.**

  Require urban cities and counties to adopt incentive programs to encourage the fitting of new structures and the retrofitting of existing structures with charging stations for electric vehicles.

- **Explore options for potential EV owners who reside in multifamily dwellings without garages.**

  Consider requiring homeowner and condominium associations to allow residents to install EVSE if installed and operated at their own expense. Condominium and apartment residents are great candidates for EV ownership due to shorter driving distances in a dense urban environment, though owning an EV may not be practical because they don't have access to convenient home charging.

- **Encourage businesses and retailers to use light pole power sources for EV charging.**

  Major retailers with large parking lots would benefit from providing EV charging to their customers. A creative, low-cost approach is to install charging points on lamp posts. Retailers may be interested in combining LED street light upgrades with electric vehicle charging, which reduces new wiring and saves up to 50% of the cost of energy and bulb replacements. Combining street light pole and EV charging is a new technique under development in Europe that could be investigated for parking lots, car sharing, and residential parking in urban areas.

- **Support EV charging at state-owned facilities.**

  Adding equipment at state buildings and facilities would help state agencies reach alternative fuel and fuel reduction goals, support state employees at worksites, and serve the public using state facilities. In addition to state-owned buildings and facilities, the state might support low-cost 120-volt charging outlets at park and ride lots, SeaTac parking, and ferry terminals using a simplified permit system.

  **State Parks** would be ideal places to spend time while a vehicle is charging. Level 2 chargers would likely be adequate. Many parks already have higher-voltage connections for RVs, which would only require a simple converter to supply power for EVs.

  **Ferry Terminals** with Level 1 or Level 2 charging might benefit ferry riders who leave their EVs parked at the terminal all day and take a passenger ferry to and from work. Potential sites include Anacortes, Southworth, and Lopez Island. The department has installed buried conduit at two locations to prepare for future charging stations, but needs funding for the equipment and installation. WSF would also need to find a network provider with a reservation system to give those traveling long distances the reliability that charging will be available when they arrive at the terminal.

## Action #10: Engage utilities.

Encourage electric power utilities to become leaders in moving from oil to electricity in surface transportation. Increasing the use of electricity for transportation provides net benefits for both society and utility ratepayers.

- **Identify barriers and incentives for electric utilities to promote the use and increased use of electricity for transportation.**

  Utility laws and regulations may limit utilities' ability to increase electric use or to use ratepayer funds to provide grants and financing for transportation electrification similar to electricity conservation programs.

- **Encourage utilities to provide public education on EVs.**

  Electric utilities are in an excellent position to provide public information about electric vehicles and electric vehicle supply equipment. The public sees utilities as a trustworthy information source and expects them to be knowledgeable about electric vehicles.

- **Encourage all utilities in the state to support EVSE installation and rebates.**

  Electric utilities should support their business and residential customers who are transitioning to electric vehicles. Under a pilot program approved by the Washington UTC to study the impact of EV charging on load, Puget Sound Energy (PSE) provides a $500 rebate to qualified customers for the purchase and installation of Level 2 EVSE. Eligible applicants must be PSE residential electric customers, be the registered owner of an EV, and install a Level 2 EVSE within a specified timeframe. The rebate is available on a first come, first served basis to the first 5,000 qualified customers. PSE expects the rebate program to remain open until November 1, 2016, depending on available funds.

- **Provide the utilities with a mandate from the Legislature to support the use and the increased use of electricity for transportation.**

  Other states such as California provide a clear legislative mandate that increasing the use of electricity for transportation is in the ratepayers' interest (see CA PUC Code 740.8). Washington needs to provide a clear statement and legal authority to use ratepayer funds to offer rebates, install charging, and transition fleet vehicles to electric. Expand the legislative definition of Renewable Energy Credits (REC) to include measures by utilities to move from oil to electricity in transportation.

- **Expressly permit utilities to meet energy conservation and carbon-reduction mandates with actions that will encourage EVs, such as installing public charging stations and converting utility fleets to electricity.**

  Broaden the definition of "energy conservation" to include not just conservation of electricity, but also of oil. Energy conservation should include replacing oil use in transportation. Electric kilowatts and barrels of oil can both be measured in BTUs and compared for effectiveness and savings. And since it is cost-effective to replace oil with electricity in transportation, while at the same time producing lower carbon emissions, the broader definition of energy conservation will lead to better public policy.

- **Require electric utilities to establish an electric transportation department.**

  Electric utilities should show leadership by creating and administering programs to accelerate electric transportation. Utilities should be required to submit annual progress reports on activities and should be expressly allowed to include expenses for these programs in their rates.

- **Encourage utilities to maximize grid benefits of electric vehicles.**

  Electric power providers should develop pilot projects that seek to reduce daily peak energy use, such as using time-of-use rates or discounts for charging EVs during off-peak hours when the power grid is underutilized. Shifting charging to evening hours will help make better use of expensive generation, transmission, and distribution infrastructure.

- **Encourage utilities to purchase and redeploy used EV batteries for a secondary use.**

  One of the most effective ways to reduce the total cost of EV ownership is to create a market for used batteries. Electric utilities are in the best position to jump start the secondary battery market. Batteries that are no longer optimal for cars can serve as a cost-effective back-up power source for emergency use and for storing intermittent solar or wind energy.

## Action #11: Require future state-supported DC fast charging stations to serve more vehicles.

As with all new technology, it takes time to gain consensus and adopt industry standards. Level 2 charging equipment is compatible with most electric cars, including the Ford Focus, Nissan Leaf, and Chevy Volt. Major automakers have agreed on a standard J-1772 plug for Level 2 charging, the most common type of charging in homes and public places. However, with DC fast charging, there are three different standards:

1. CHAdeMO connectors charge vehicles such as the Nissan Leaf and Mitsubishi i-MiEV.
2. Tesla has proprietary super-charging equipment for their models.
3. The SAE Combo charging system is the standard for many American and European cars just entering the EV market, such as the BMW i-series and the Chevy Spark.

- **For future state investments in fast charging infrastructure, require stations to have compatible and interoperable charging equipment with both CHAdeMO and SAE Combo connectors.**

  Future DC fast chargers will likely include dual chargers to provide charging for most makes and models of vehicles.

- **When funding allows and it makes business sense, retrofit existing public CHAdeMO stations to add SAE Combo charging capabilities.**

  Most of the current fast charging infrastructure in Washington is CHAdeMO-compliant, including the stations along the West Coast Electric Highway. It might be worthwhile to add SAE Combo charging capabilities at these locations rather than creating a separate network. The most expensive part of DC fast chargers is not the equipment, it's finding a location, negotiating the lease, upgrading the electrical equipment, getting permits, installing conduit, and commissioning service. There are still equipment and installation costs that would need to be covered in order to make the stations fully compatible for both standards.

- **Future-proof stations by planning for multiple charging ports in high-usage areas.**



Many DC fast charging locations can only charge one vehicle at a time, which can be discouraging and inconvenient when several cars show up at once needing to charge. This limited capacity issue is on the rise at certain high-volume stations such as Burlington and Fife. During busy commute hours at popular locations, EV drivers sometimes have to line up and wait for more than an hour to use the equipment. State-supported charging stations should have guidelines for requiring multiple simultaneous plugs at future charging locations.

# Strategy to Synergize Actions throughout the Region

Regional coordination is critical to the success of EV adoption. Activities to support and promote electric vehicles are underway in communities across the state and region. By synergizing efforts, we can make the biggest difference in advancing electric vehicle adoption.

## Action #12: Support and participate in regional partnerships to advance EVs.

- **Coordinate with the Pacific Coast Collaborative on EV initiatives.**

  Leaders from Washington, Oregon, California, and British Columbia have pledged to work together on clean transportation and alternative fuel vehicles through the Pacific Coast Collaborative.

- **Coordinate with Oregon Department of Transportation and California Energy Commission on the West Coast Electric Highway.**

  The coordination between the Washington and Oregon departments of transportation ensured electric vehicle drivers would have a unique driving experience along the West Coast Electric Highway, with consistent equipment standards, signage, and branding along the I-5 corridor across state borders. The transportation agencies continue to coordinate on marketing, outreach, and system improvements.



*Washington State and British Columbia symbolically connect their EV fast charging networks during a Golden Plug Ceremony held at the U.S. and Canadian border at Peace Arch Park.*




- **Explore ways to formalize and fund the Washington State EV Workgroup.**

  WSDOT and Commerce created and led a Washington State Plug-In Electric Vehicle Task Force in 2011–2012 with representatives from the public and private sectors. After the group completed its primary mission of preparing the state to be EV-ready, the group disbanded. Many of the original members continue to gather informally to share information and coordinate EV activities through a Washington State EV Working Group led by the City of Seattle. It's clear Washington would benefit from a more formal PEV association with a strong voice from stakeholders outside of government.

  The states with the most successful formal EV work groups have sustainable funding through membership dues or state budgets. Examples include the following:

- **Drive Oregon:** driveoregon.org

  Drive Oregon is funded in part with Oregon State Lottery funds administered by Business Oregon. It is one of six Oregon Innovation Council initiatives supporting innovation and long-term economic growth. Its mission is to promote, support, and grow the EV industry in Oregon. It's a nonprofit with diverse membership from a range of companies involved in electrifying the transportation system, including those that develop and produce vehicles and components, perform conversions, and provide consulting services for EVs and energy storage technologies.

- **California Plug-In Electric Vehicle Collaborative**: www.evcollaborative.org

  The California Plug-In Electric Vehicle Collaborative is a public-private organization focused on accelerating the adoption of PEVs to meet California's economic, energy, and environmental goals. Using the expertise of each member, the PEV Collaborative convenes, collaborates, and communicates on emerging PEV market trends and works to address challenges and enable strong PEV market growth. The Collaborative has a chairman, executive director, and full-time staff.

Other organizations viewed as models for future organizational development in Washington:

- **Plug In America:** www.pluginamerica.org
- **Clean Tech Alliance Washington:** wacleantech.org
- **Western Washington Clean Cities:** www.wwcleancities.org
- **Transportation Electrification Executive Council:** orsolutions.org/osproject/transportation-electrification-executive-council
- **CALSTART:** www.calstart.org

◆ **Track other state activities supporting electric vehicles.**

Monitor state agency efforts under Executive Order 14-04 that could contribute to the advancement of electric vehicles, including Ecology's review of Clean Car standards and a Zero Emission Vehicle program, Office of Financial Management's evaluation of clean fuel standards, and Commerce's life cycle cost analysis as the basis for agency vehicle procurement.

## Action #13: Track and participate in national EV efforts.

◆ **Participate in the multi-state DOT effort to develop toolkits for deployment of alternative-fueled vehicles and fueling stations.**

Join the U.S. DOT's Transportation Pooled Fund Program "Toolkit for the Deployment of Alternative Vehicle and Fuel Technologies." Participate in regional, topic-based workshops to develop a "toolkit" for state and local transportation agencies.

◆ **Track nationwide electric vehicle activities and participate as observer or member when appropriate.**

Align Washington's efforts with the Multi-State ZEV Action Plan developed through the Governors' Memorandum of Understanding and Action Plan signed by the governors of California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont.



*DOT representatives from 13 states met in North Carolina to collaborate on advancing the adoption of EVs through a pooled fund project led by WSDOT.*

# EV Action Plan Sources and Links

The following sources and links are in the EV Action Plan:

**2014 Seattle Electrical Code**
www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p2214467.pdf

**California Clean Vehicle Rebate Project (CVRP)**
energycenter.org/clean-vehicle-rebate-project

**California Transportation Electrification Assessment**
www.caletc.com/wp-content/uploads/2014/09/caletc_tea_phase_1-final_updated_092014.pdf

**Clean Transportation component of the Executive Order**
www.wsdot.wa.gov/sustainabletransportation/cleantranspo.htm

**Electric Drive Transportation Association**
www.electricdrive.org/sales

**Electric Vehicle Infrastructure: A Guide for Local Governments in Washington State**
www.psrc.org/transportation/ev/model-guidance

**Electric Vehicle Sign Guidelines**
www.westcoastgreenhighway.com/evsigns.htm

**Electric Vehicles for Washington's Public Fleets and Facilities**
www.commerce.wa.gov/documents/agency%20ev-evse%20guide%20(oct%202014).pdf

**EV Consumer Survey from CVRP**
energycenter.org/clean-vehicle-rebate-project/survey-dashboard

**EV Everywhere Workplace Charging Challenge**
energy.gov/eere/vehicles/ev-everywhere-workplace-charging-challenge

**FHWA Interim Approval for Optional Use of an Alternative Electric Vehicle Charging Sign**
mutcd.fhwa.dot.gov/resources/interim_approval/ia13/index.htm

**Governor Jay Inslee Executive Order 14-04**
http://www.governor.wa.gov/issues/issues/energy-and-climate/carbon-pollution-executive-order

**Joint Transportation Committee's Study of Business Models to Sustain EV Charging Station Networks**
leg.wa.gov/jtc/pages/electricvehiclechargingstationnetworksstudy.aspx

**Illinois Alternate Fuels Rebate Program**
www.illinoisgreenfleets.org/rebates/

**Motor Vehicle Emission Standards**
app.leg.wa.gov/rcw/default.aspx?cite=70.120a

**Multi-State ZEV Action Plan**
www.nescaum.org/topics/zero-emission-vehicles/multi-state-zev-action-plan

**Plug-In America**
www.pluginamerica.org

**Plug-In Electric Vehicle Readiness Plan for the State of Washington**
wwcleancities.org/wp-content/uploads/2014/07/ev_readiness_wa.pdf

**Results Washington Clean Transportation Goal**
www.results.wa.gov/what-we-do/measure-results/sustainable-energy-clean-environment/goal-map

**Results WSDOT**
www.wsdot.wa.gov/secretary/resultswsdot.htm

**Seattle Electric Vehicle Association**
www.seattleeva.org

**Seattle Office of Sustainability & Environment's report "Removing Barriers to Electric Vehicle Adoption by Increasing Access to Charging Infrastructure"**
www.seattle.gov/documents/departments/ose/final%20report_removing%20barriers%20to%20ev%20adoption_to%20post.pdf

**SGL/BMW Carbon Fiber Plant in Moses Lake**
www.sglacf.com/en/production/moses-lake-usa.html

**Star Communities recognizes Seattle as nation's most sustainable city**
http://www.seattle.gov/environment/star

**Total Cost of Ownership Tool**
www.commerce.wa.gov/programs/energy/electric-vehicles/pages/default.aspx

**UC Berkeley Economic Assessment of Plug-in EV Deployment in California**
are.berkeley.edu/~dwrh/ceres_web/docs/etc_pev_rh_final120920.pdf

**U.S. Department of Energy Clean Cities 2015 Vehicle Buyer's Guide**
http://www.afdc.energy.gov/uploads/publication/2015_vehicle_buyers_guide.pdf

**U.S. Department of Energy's Alternative Fuels Data Center Map of EV Charging Locations**
www.afdc.energy.gov/fuels/electricity_locations.html

**U.S. Department of Energy's eGallon**
energy.gov/articles/egallon-how-much-cheaper-it-drive-electricity

**U.S. Energy Information Administration**
www.eia.gov/state/data.cfm?sid=wa%20-%20reservessupply

**Washington Plug-In Electric Vehicle Task Force Maximizing Washington's Investments in Electric Transportation**
www.commerce.wa.gov/documents/pev-task-force-gov-rpt-2013.pdf

**Washington State "de-ICEing" law (RCW 46.08.185)**
apps.leg.wa.gov/rcw/supdefault.aspx?cite=46.08.185

**Welcome to the Evolution: The Future of Cars in Here**
wwcleancities.org/wp-content/uploads/2014/07/ev_guidebook_wwcc.pdf

**West Coast Electric Highway**
www.westcoastelectrichighway.com

**WSDOT Sustainable Transportation**
www.wsdot.wa.gov/sustainabletransportation/