Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles

Prepared By:

Cowlitz-Wahkiakum Council of Governments
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Cowlitz-Wahkiakum
Council of Governments
TRANSPORTATION

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Cowlitz-Wahkiakum Council of Governments Metropolitan and Regional Transportation Planning Organization Member Jurisdictions and Agencies

State Departments of Transportation

Washington State Department of Transportation Olympic, South Central, and Southwest Regions
Oregon Department of Transportation Region 2

US Department of Transportation

Federal Highway Administration (FHWA)
Federal Transit Administration (FTA)

Counties

Cowlitz County
Grays Harbor County
Lewis County
Pacific County
Wahkiakum County

Cities and Towns

Aberdeen
Castle Rock
Cathlamet
Centralia
Chehalis
Cosmopolis
Elma
Hoquiam
Ilwaco
Kalama
Kelso
Long Beach
Longview
McCleary
Montesano
Morton
Mossyrock
Napavine
Oakville
Ocean Shores
Pe Ell
Rainier, OR
Raymond
South Bend
Toledo
Vader
Westport
Winlock
Woodland

Port Districts

Port of Centralia
Port of Chehalis
Port of Chinook
Port of Grays Harbor
Port of Ilwaco
Port of Kalama
Port of Longview
Port of Peninsula
Port of Willapa Harbor
Port of Woodland
Wahkiakum Port District 1
Wahkiakum Port District 2

Transit Authorities

Cowlitz Transit Authority
Grays Harbor Transit Authority
Twin Transit Authority
Pacific Transit System

Other Public Transportation Providers

Coastal Community Action Program
Columbia County Rider
Human Services Council
Lewis Mountain Highway Transit
Lower Columbia Community Action Program
Wahkiakum on the Move

Tribal Governments

Chinook Nation
Confederated Tribes of the Chehalis Reservation
Cowlitz Indian Tribe
Quinault Indian Nation
Shoalwater Bay Tribe

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Funding Partners

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Table of Contents

Acronyms and Definitions

Acronym	Definition
EV	**Electric Vehicle** as used in this plan means any plug-in electric vehicle powered, fully or partially, with batteries.
BEV	**Battery Electric Vehicle** is powered only by electricity stored in batteries.
PHEV	**Plug-in Hybrid Electric Vehicle** is a vehicle powered by a combination of batteries and conventional fuel.
EVSE	**Electric Vehicle Supply Equipment** refers to the charging equipment used to charge a plug-in electric vehicle.
Level 1	**Level 1** is an electric vehicle charger using 120 volts and is the slowest way to recharge a plug-in electric vehicle.
Level 2	**Level 2** is an electric vehicle charger using 240 volts and provides a much faster re-charge than Level 1.
DC Fast Charger	A **Direct Current Fast Charger** requires a 480-volt, 3-phase power supply and is the fastest way to recharge a plug-in electric vehicle. Also referred to as Level 3 charging.
J-1772	**J-1772** is the North American Society of Automotive Engineers standard connector used on Level 2 chargers.
CHAdeMO	A type of connector used with DC Fast Chargers. Vehicles manufactured by Nissan, Mitsubishi, and Toyota use this type.
SAE Combo	SAE Combo (also known as the combined charging system or CCS) is another type of connector used with DC Fast Chargers. This is the type used by Chevrolet and BMW.
Tesla Combo	A type of connector for DC Fast Charging that is proprietary and only used by Tesla.
AV	An **Autonomous Vehicle** operates in isolation from other vehicles with use of internal sensors with minimal human assistance. There are various levels of automation.
CV	A **Connected Vehicle** communicates with nearby vehicles and infrastructure with human control.
CAV	A **Connected and Autonomous Vehicle** combines features of both a CV and AV.
RTP	The **Regional Transportation Plan** provides a 20+ year look into future needs for the regional transportation system and is intended to help guide future investment decisions.
CWCOG	Cowlitz-Wahkiakum Council of Governments
MPO	Metropolitan Planning Organization
SWRTPO	Southwest Washington Regional Transportation Planning Organization

Chapter 1 Guiding the Plan

How our transportation system moves people and goods is changing and adapting to new technologies, especially Electric Vehicles (EVs) and Connected and Autonomous Vehicles (CAVs). These new technologies are, and will, impact our regional transportation system and now is the time for planning, preparing, and beginning to think about our future transportation needs.

One of the primary reasons for developing the *Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles* plan was to develop tools and resources to aid future coordination, collaboration, or potential grant applications. This plan will also help to begin thinking about potential impacts from these new technologies. It is for these reasons that this plan was outlined in the Cowlitz-Wahkiakum Council of Governments' Unified Planning Work Program. No federal or state requirements mandated the development of this plan.

The plan is intended as a resource guide and does not propose new regional policies or strategies. It will also help inform the next Regional Transportation Plan (RTP) update. The objective of this chapter is to:

1. Further discuss why planning for these new technologies is important;
2. Describe other regional and state plans;
3. Provide a description of the planning area;
4. Review the planning process; and
5. Explain the topics explored in the rest of this plan.

Importance of Planning for Electric Vehicles and Connected and Autonomous Vehicles

Beyond the primary reasons explained above for why this plan has been completed, an initial catalyst was also tourism development and making sure the region would be able to meet the needs of people traveling from larger metropolitan areas where electric vehicles are more common. In the two subsections below are additional reasons to specifically plan for electric vehicles or connected and autonomous vehicles.

Electric Vehicles

The number of models of plug-in EVs has increased the last couple of years and more models are anticipated. According to the US Department of Energy's Alternative Fuels Data Center there were 14 companies with at least 1 plug-in EV model as of July 2019. The total number of different models available at the time was 68. Please refer to Appendix A for a complete inventory of plug-in EV models available in July 2019.

As the number of EVs on the road today increases so does the need for more places to charge. Many drivers probably have access to a home, or workplace, charger for most of their times charging is needed, but sometimes access to a public charger is unavoidable such as when traveling away from home. There are other scenarios such as people living in multifamily housing where public charging maybe the only way to charge. To further show why more public charging is needed as the number of EVs increases, please refer to the table on the next page. The table on the next page shows the estimated number of charging plugs Longview, Washington may need as plug-in EVs increase and

become a larger percentage of the total vehicle count. A couple notes about the table below are as follows.

- A lite version of the Electric Vehicle Infrastructure Projection Tool was used.
- Only a limited number of urban areas in each state are available for analysis with the tool and Longview was the only area within the five-county SWRTPO.
- A conceptual number of plug-in EVs to support (4,750 or 9,500) represents 5% or 10% of the estimated number of all light-duty vehicles in Longview at the end of 2016.
- Even though the tool represents estimates for Longview only, the tool can still be useful for other communities to help them understand better how many more places to charge maybe need as the number of plug-in EVs increases.

Type of Public Charging	Number of Charging Plugs Needed to Support 4,750 Plug-In EVs			Number of Charging Plugs Needed to Support 9,500 Plug-In EVs		
	Full Support for PHEVs	Partial Support for PHEVs	PHEVs Not Included in Estimates	Full Support for PHEVs	Partial Support for PHEVs	PHEVs Not Included in Estimates
Workplace Level 2 Charging	339	180	20	667	353	39
Public Level 2 Charging	258	137	15	466	246	27
Public DC Fast Charging	31	31	31	57	57	57

Source: US Department of Energy Alternative Fuels Data Center (https://afdc.energy.gov/evi-pro-lite)
Note: Total number of light-duty vehicles at the end of 2016 was 95,000 per the Electric Vehicle Infrastructure Projection Tool.

Private businesses and utility providers have installed, and will likely continue to install, many of the public charging stations in the SWRTPO and MPO regions, but this will probably only be a portion of the total number of charging locations needed in the future. To meet the future need for places to charge will probably involve public agencies, private businesses, and nonprofits all contributing the expansion of the charging station network.

Connected and Autonomous Vehicles

In addition to electric vehicles, it is also important to begin planning for connected and autonomous vehicles given how disruptive this technology could be to our transportation system. Even though connected and autonomous vehicles are likely to impact major metropolitan areas such as Portland, Oregon or Seattle, Washington much sooner than small urban, and rural, areas it is never too early to plan. The possible impacts from connected and autonomous vehicles will come to the SWRTPO and MPO regions someday, but probably just not as quickly as in other places. An exception however might be that the freight industry in the SWRTPO and MPO regions could begin to see impacts from connected and autonomous vehicle technology sooner.

Other Regional and Statewide Plans

Before moving on to further exploring electric vehicles and connected and autonomous vehicles, it is important to know that *Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles* was not developed as a standalone planning document. There are other existing regional and statewide plans that influenced this planning work. Two of these other plans are the Regional Transportation Plan and the Washington State Electric Vehicle Action Plan.

Regional Transportation Plan

The 2045 Regional Transportation Plan (RTP) is the current, long-range transportation plan for the Longview-Kelso-Rainier Metropolitan Planning Area and the five-county Southwest Washington Regional Transportation Planning Organization (SWRTPO) region. This regional plan sets the long-term vision, goals, and policies for what the regional transportation system should look like over the next 20-plus years. In the 2045 RTP, the first goal concerns the relationship between transportation and economic development. Underneath this first goal is a policy to support the installation of alternative energy fueling stations. *Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles* will help provide tools and resources useful in working to expand the EV charging station network.

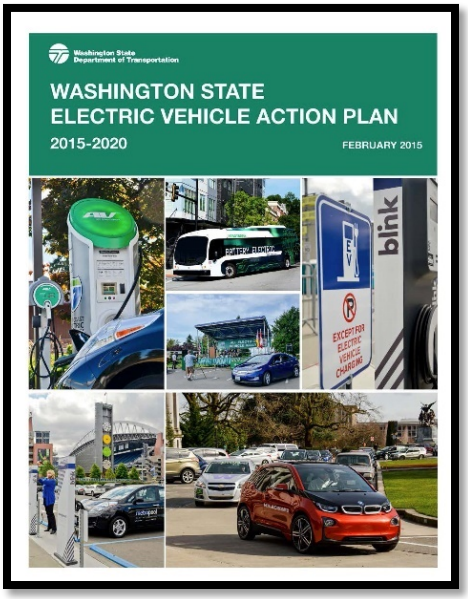
2045 Regional Transportation Plan Goal 1

Promote and support a transportation system that strengthens the region's economic competitiveness.

2045 Regional Transportation Plan Policy 1b

Install alternative energy fueling stations, including electric vehicle (EV) charging stations, to provide visitors who drive alternative energy vehicles the capability to travel easily throughout the region, increasing access to jobs, services, tourist attractions, and other key destinations.

The 2045 RTP was adopted by the SWRTPO and CWCOG (MPO) boards on December 12, 2018 and December 20, 2018, respectfully. During the next RTP update beginning in 2021, the tools and resources developed in this document will be able to inform additional discussions of emerging technologies.



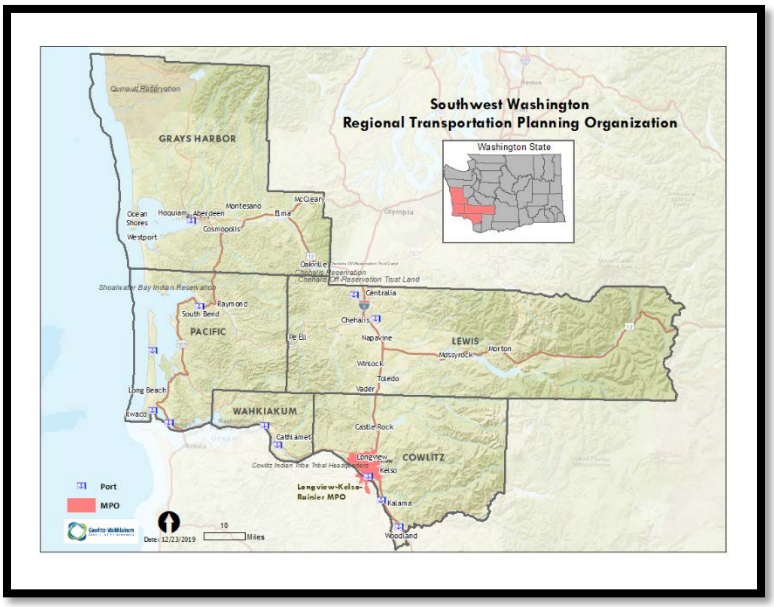
Washington State Electric Vehicle Action Plan

The State of Washington published a statewide Electric Vehicle Action Plan in February 2015. According to the Washington State Electric Vehicle Action Plan, it was "intended to inform policymakers, elected officials, and local leaders about the electric vehicle landscape" in the state. In addition, the state plan laid out 3 strategies and 13 actions to help Washington State achieve a goal of 50,000 electric vehicles by 2020 and continue previous momentum. *Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles* is about educating and setting a framework for future regional discussions to expand EV use here.

Planning Area

Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles was developed for the geographic area covered by the Southwest Washington Regional Transportation Planning Organization (SWRTPO) and the Longview-Kelso-Rainier Metropolitan Planning Organization (MPO).

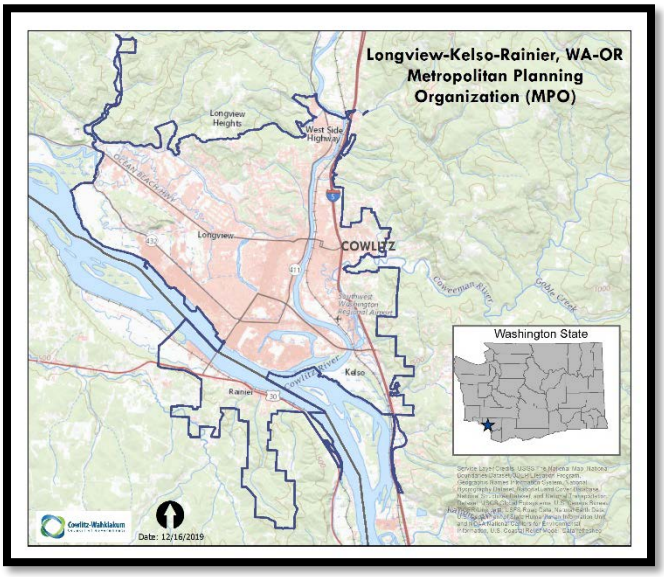
Southwest Washington Regional Transportation Planning Organization



The SWRTPO is voluntary, locally developed, and fulfills Washington State planning requirements within the five-county region of Cowlitz, Grays Harbor, Lewis, Pacific, and Wahkiakum Counties. There are 279,242 persons, per the US Census Bureau's 2016 Annual Population Estimate, living in the five counties. The membership includes 5 counties, 28 cities or towns, 12 ports, 4 public transit agencies, 5 tribes, and 3 WSDOT Regions. The map to the left shows the boundaries of the SWRTPO.

Metropolitan Planning Organization

The MPO is federally mandated and authorized to fulfill federal transportation planning requirements within the Longview-Kelso-Rainier urbanized area. After the 1980 US Census the Cities of Longview and Kelso (Washington), Rainier (Oregon), and unincorporated areas of Cowlitz (Washington) and Columbia (Oregon) Counties reached the threshold population and urban densities requiring formation of an MPO. The map to the right shows the metropolitan planning area boundary.



Planning Process

Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles was developed with the assistance and feedback of many stakeholders in the region who are part of a technical advisory committee or policy board. In addition, freight industry stakeholders were invited to provide feedback on connected and autonomous vehicles through the annual regional stakeholder

meeting and an online survey. Members of the public were able to provide feedback on electric vehicles and emerging technologies through a separate online survey. This planning process concluded with the SWRTPO and CWCOG (MPO) boards voting to accept the completed plan, *Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles,* on June 17, 2020 and June 25, 2020, respectively.

Plan Outline

Below are explanations of the topics discussed in the four remaining chapters of this plan.

- **Chapter 2 Electric Vehicles and Connected and Autonomous Vehicles: What We Know Now** begins by discussing the benefits of, and basics of the technology in, electric vehicles. The chapter then moves on to provide a snapshot of the number of electric vehicles registered in the SWRTPO and MPO regions, current public opinion on potential future use of electric vehicles, and some recent collaboration efforts underway across the region. At the end of the chapter the basics of connected and autonomous vehicle technology are explained.

- **Chapter 3 Expanding Our Electric Vehicle Charging Station Network** begins with a description of what factors make for better locations for the siting of charging stations. The chapter then moves on to discuss CWCOG's *Charging Station Siting Suitability Model*, a tool to help identify where to locate new charging stations, and reviews locations stakeholders identified as priorities for new charging stations. This chapter concludes with a presentation of some ideas for strategies that could help expand the charging station network and increase use of EVs.

- **Chapter 4 Issues and Challenges** describes some of the key issues and challenges the region may face regarding electric vehicles and connected and autonomous vehicles based on stakeholder input or research. This chapter is meant to get elected officials, local agency staff, stakeholders, and others to begin to think about the impacts to our regional transportation system from electric vehicles and connected and autonomous vehicles; and most importantly, consider steps to take to prepare.

- **Chapter 5 Next Steps** assists in taking the next steps to prepare for electric vehicles and connected and autonomous vehicles by providing additional resources.

Chapter 2 Electric Vehicles and Connected and Autonomous Vehicles: What We Know Now

In the first chapter the reasons for developing this plan, relationships to other regional and statewide plans, and how it is organized were discussed. This chapter will present a basic discussion on what we currently know about electric vehicles and connected and autonomous vehicles.

Electric Vehicle Benefits

The EV has many positive individual and community benefits. Numerous publications have discussed the benefits of EVs. A September 2017 report by the Office of Energy Efficiency and Renewable Energy at the US Department of Energy provided a chart describing the four main benefits: fuel economy, emissions reductions, fuel cost savings, and fueling flexibility. The table below explains the benefits of plug-in EVs per the US Department of Energy.

Benefits	Plug-In Hybrid Electric Vehicle	Battery Electric Vehicle
Fuel Economy	Most PHEVs achieve combined fuel economy ratings higher than 90 miles per gallon of gasoline equivalent (MPGe).	Most EVs achieve fuel economy ratings higher than 100 MPGe.
Emissions Reductions	PHEVs produce no tailpipe emissions when in electric-only mode. Life cycle emissions depend on the sources of electricity, which vary from region to region.	EVs produce no tailpipe emissions. Life cycle emissions depend on the sources of electricity, which vary from region to region. Emissions reductions are substantial in most regions of the United States.
Fuel Cost Savings	In electric-only mode, PHEV electricity costs range from about 2¢ to 4¢ per mile. On gasoline only, fuel costs range from about 5¢ to 10¢ per mile.	EVs run on electricity only. Electricity costs for a typical EV range from 2¢ to 4¢ per mile.
Fueling Flexibility	Can fuel at gas stations; Can charge at home, public charging stations, and some workplaces.	Can charge at home, public charging stations, and some workplaces.

Source: US Department of Energy, Office of Energy Efficiency and Renewable Energy, Clean Cities Coalition Report on Electric Drive Vehicles, September 2017

Generally electric vehicles are beneficial. As the Washington State Electric Vehicle Action Plan (February 2015) says “supporting the adoption and use of Electric Vehicles is sound economic, environmental, and transportation policy.”

Electric Vehicle Technology

In this next section an overview of the technology of EVs is discussed to make sure everyone has the same basic understanding of what is meant when we say EV.

Electric Vehicle Types

There are two primary types of EVs: Battery Electric Vehicles (BEV) and Plug-in Hybrid Electric Vehicles (PHEV). A BEV operates using electricity stored in batteries only with no conventional gasoline-powered engine. The PHEV operates with a combination of an internal combustion engine and rechargeable batteries. Any references to EV, or plug-in EV, in the rest of this document means both BEVs and PHEVs.

Electric Vehicle Charging

Charging Station Types

Three types of charging stations are in use today: Level 1, Level 2, and DC Fast Charging (Level 3). Below are descriptions of each one.

- Level 1 chargers need 120 volts. A standard household outlet has the same voltage requirement. An hour of charging with Level 1 adds about 2 to 5 miles of range according to the US Department of Energy's Alternative Fuels Data Center.
- Level 2 chargers need 240 volts and all have a standard connector known as the J1772. A Level 2 charger has the same voltage requirements as a standard household dryer. Level 2 chargers add about 10 to 20 miles of range per hour of charging according to the Alternative Fuels Data Center.
- DC Fast (Level 3) chargers need a 480 volt, 3-phase power supply. These chargers usually require expensive electrical upgrades to meet the required amount of power. There are two main types of connectors for DC Fast Chargers: CHAdeMO and SAE Combo. The Nissan Leaf uses a CHAdeMo connector. The Chevy Bolt uses a SAE Combo connector. Tesla Superchargers are also Level 3, but these chargers have their own proprietary connector. A DC Fast Charger needs around 20 minutes or so to recharge a depleted battery according to the Alternative Fuels Data Center.

Charging Station Networks

Most charging stations are serviced by third-party company. These companies provide support for services such as billing or maintenance and service a lot of charging stations that form a network of stations. A charging station does not need to be associated with a network, but to be competitive in the market it likely needs to be. The existing, networked charging stations in the SWRTPO and MPO regions are part of one of seven networks (see the blue box to the right).

ChargePoint – www.chargepoint.com

Blink – www.blinkcharging.com

Webasto – www.evsolutions.com

EvGO – www.evgo.com

Electify Amercia – www.electifyamerica.com

Greenlots – www.greenlots.com

SemaConnect Network – www.semaconnect.com

Using A Charging Station

To use a charging station an EV driver will usually need to set-up an account beforehand with a network company. The network companies listed above provide the ability to sign up for an account online or through a mobile application. Setting up an account involves providing some form of payment. Once an

account is set-up most network companies will provide a radio-frequency identification (RFID) card. An RFID card makes the charging process easier. Many charging stations can also be used without having an account set-up first like a gas station. As the market matures the use of charging stations will likely evolve.

At a station the charging session begins by tapping or swiping the RFID card, using a network company's mobile application, or inputting a credit/debit card for those without an existing account. There are on-screen prompts to instruct someone in how to use the station to start charging and what to do when finished.

Estimated Costs for a Charging Station

The installation costs for an EV charging station vary widely depending on the charging level, whether electrical upgrades are needed, and the number of charging plugs. Many other design features of the charging equipment selected can cause variations in the cost. Electrical upgrades to support 480 volt, 3-phase power are the major factor in the much higher installation cost of DC Fast charging stations. The installation costs however are not the only considerations; there are also ongoing costs such as network company fees, the cost of electricity, and maintenance for example.

Level 2

As a resource for local agencies considering the installation of a Level 2 charging station, CWCOG did outreach to gather actual cost information on existing charging stations in a region owned by public agencies. The cost information made available to CWCOG for this plan are presented below.

City of Long Beach Charging Station

Basic Information (Address, Network, Level of Charging, Number of Charging Plugs)

- 406 Oregon Avenue South, Long Beach
- ChargePoint
- Level 2 – 2 Plugs

Cost to Charge

- Free

Installation Costs

- Not Provided

Ongoing Costs

- $3,474 for 3-year contract with ChargePoint; $96.50/month

Note: Contract includes network software services and the network company's maintenance and management program.

Cowlitz PUD Charging Station

Basic Information (Address, Network, Level of Charging, Number of Charging Plugs)

- 961 12th Avenue, Longview
- Blink
- Level 2 – 2 Plugs

Cost to Charge

- Averages about $0.39/kilowatt hour (kwh)

Installation Costs

- $2,940

Note: This amount represents all installation costs except the actual charging equipment. The charging equipment cost was paid by a grant and was not known at the time CWCOG staff contacted the PUD.

Ongoing Costs

- Electricity Cost - $673.60

Note: This was the amount spent on electricity between March 2015 and August 2019.

- Revenue Share - $553.98

Note: This was the amount of revenue Cowlitz PUD received between March 2015 and August 2019 from the network company. Transaction and network fees were deducted from the revenue share before being provided to the PUD.

- Maintenance Costs Not Available

Grays Harbor College Charging Station

Basic Information (Address, Network, Level of Charging, Number of Charging Plugs)

- 1620 Edward P. Smith Drive, Aberdeen
- Blink
- Level 2 – 2 plugs

Cost to Charge

- Free

Installation Costs

- Not Provided

Ongoing Costs

- Not Provided

The examples on the previous two pages are a small sample of the existing, public agency-owned charging stations in the region, but still provide good information on potential installation and ongoing costs associated with a Level 2 charging station. Two important points on the cost of Level 2 charging stations: 1) Costs for a charging station may differ due to the specific arrangement with the network company, and 2) A charging station should not be considered a reliable source of revenue. Other reasons such as providing a community benefit, promoting economic development, and supporting tourism should be used to justify the decision to install a charging station.

Level 3 (DC Fast)

For an idea of the costs associated with a Level 3 charging station, this region has a recent grant application prepared in 2017 to use as a resource. In 2017, for WSDOT's Electric Vehicle Infrastructure Pilot Program, Pacific Council of Governments with assistance from Grays Harbor Council of Governments submitted an application to install several Level 3 charging stations in Grays Harbor and Pacific Counties. The estimated costs included in the 2017 grant application for a proposed anchor site in Elma, Washington are listed below.

Proposed Level 3 Charging Station in Elma – Estimated Installation Costs	
Upgraded Electrical Transformer:	$45,000
Conduits, Wiring, Integration into Existing Electrical System, Permits, Labor:	$20,000
Charging Station Equipment:	$10,000 - $40,000[1]

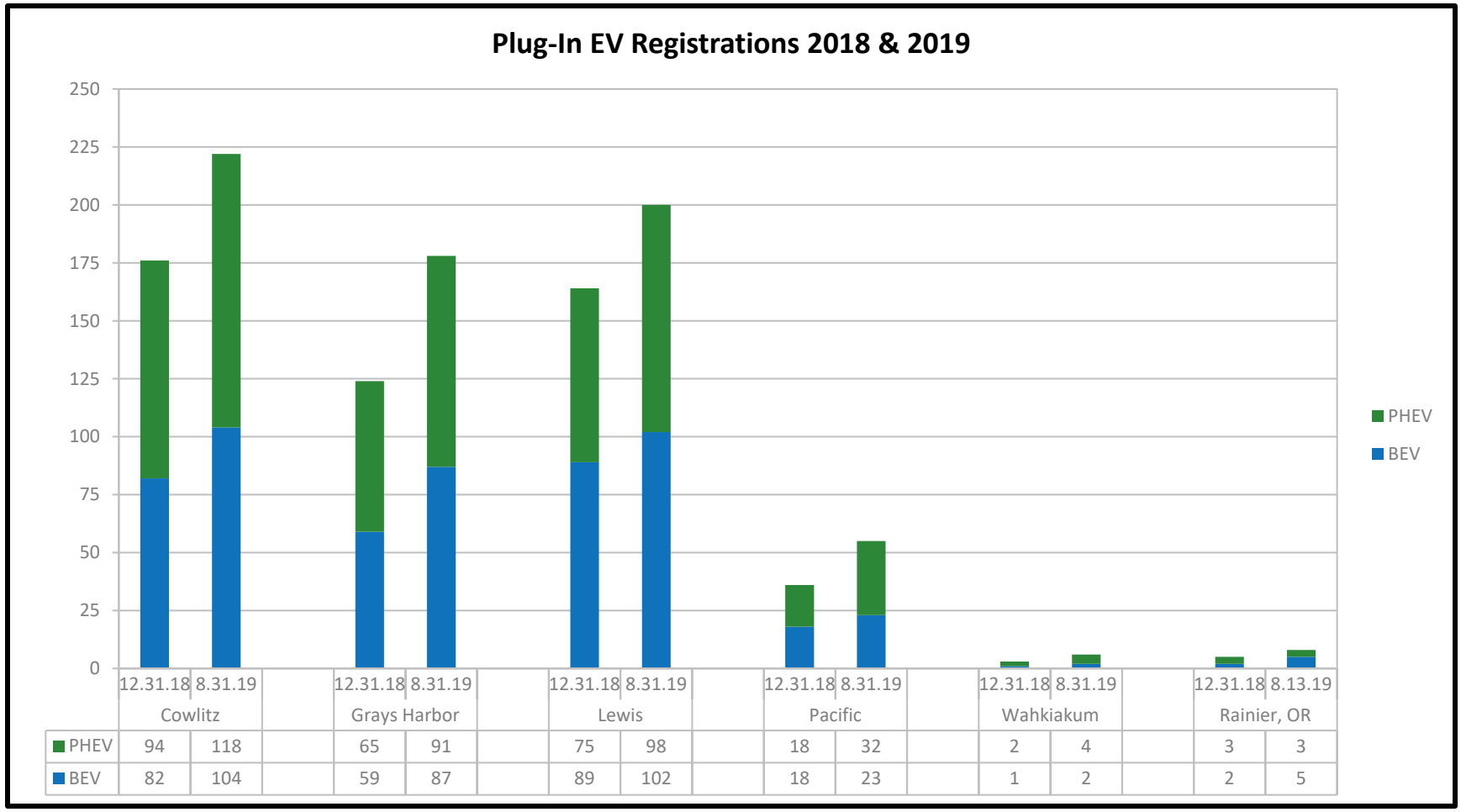
Electric Vehicles in Southwest Washington and Rainier, Oregon

Vehicle Registrations

Registrations for BEVs and PHEVs have been rising quickly since 2011. In all of the SWRTPO counties and Rainier, Oregon combined there were more than 500 plug-in EVs registered at the end of 2018. The total number had increased to more than 660 only eight months in August 2019. Cowlitz County has the most plug-in EV registrations, but Lewis and Grays Harbor Counties are not too far behind. On the next page the chart shows the plug-in EV registrations by area and type as of December 31, 2018 and August 31, 2019 (August 13, 2019 for Rainier, Oregon).

For comparison, across all of Washington State there were 42,542 plug-in EVs at the end of 2018 and the number increased to 50,447 by August 2019. Based on a report compiled by the Federal Highway Administration (FHWA), there were over 2.8 million vehicles registered in 2015 across all of Washington State. Using this total number of vehicles registered statewide as an estimate of total vehicles on the road today means that plug-in EVs probably represent about 1.8% of the vehicles on the road.

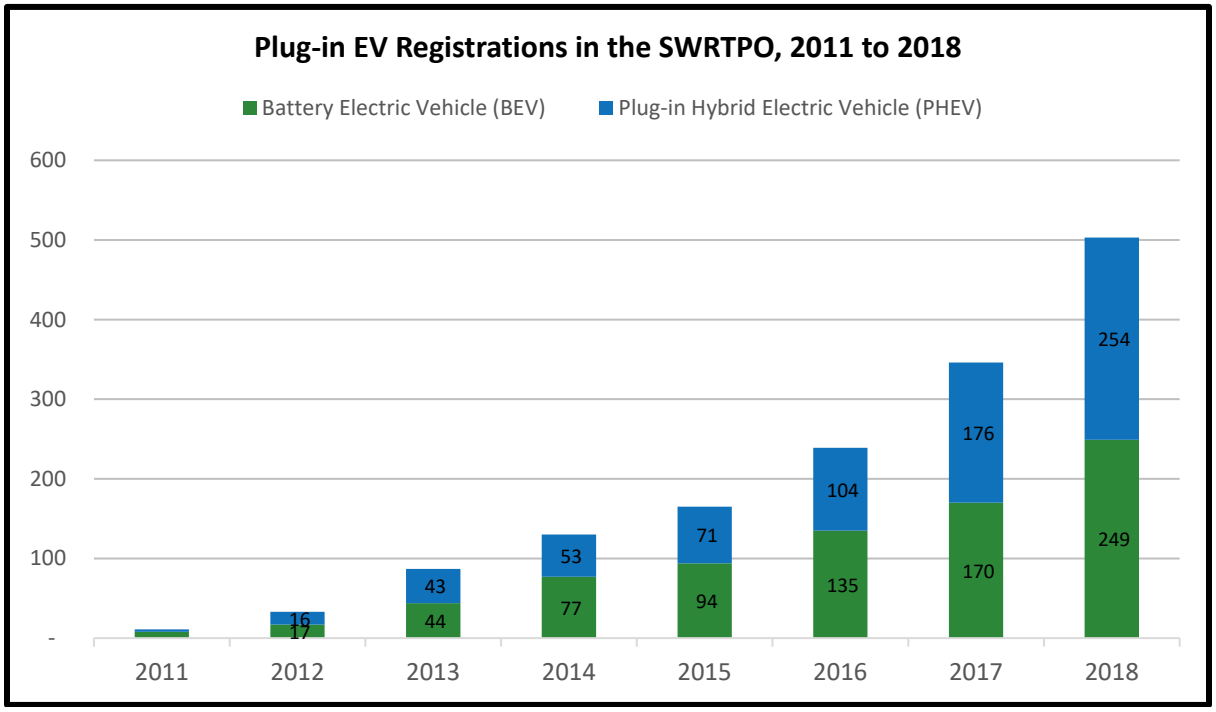
[1] US Department of Energy, *Costs Associated with Non-Residential Electric Vehicle Supply Equipment*, November 2015



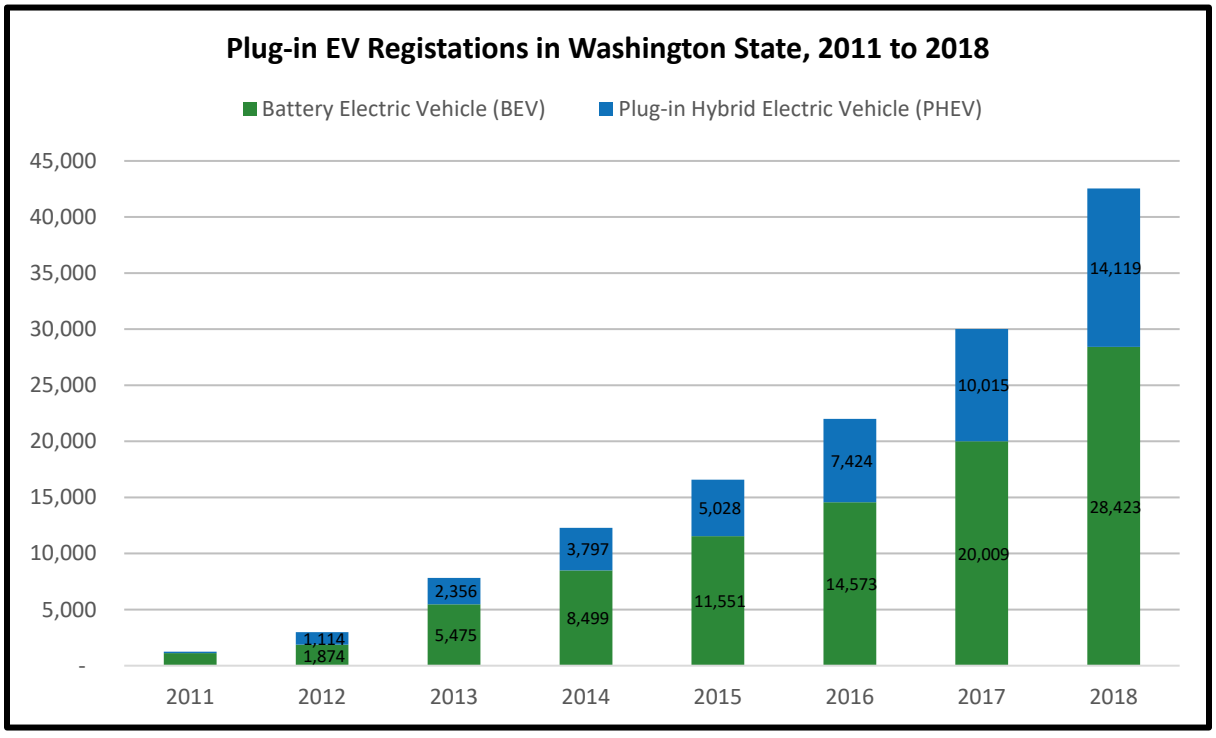
	Cowlitz		Grays Harbor		Lewis		Pacific		Wahkiakum		Rainier, OR	
	12.31.18	8.31.19	12.31.18	8.31.19	12.31.18	8.31.19	12.31.18	8.31.19	12.31.18	8.31.19	12.31.18	8.13.19
PHEV	94	118	65	91	75	98	18	32	2	4	3	3
BEV	82	104	59	87	89	102	18	23	1	2	2	5

Source: Washington State Department of Licensing and Oregon Department of Transportation

The significant growth in BEV and PHEV registrations are also shown in the next two charts. These charts show plug-in EV registrations for the entire SWRTPO combined, and for Washington State as a whole, between 2011 and 2018.

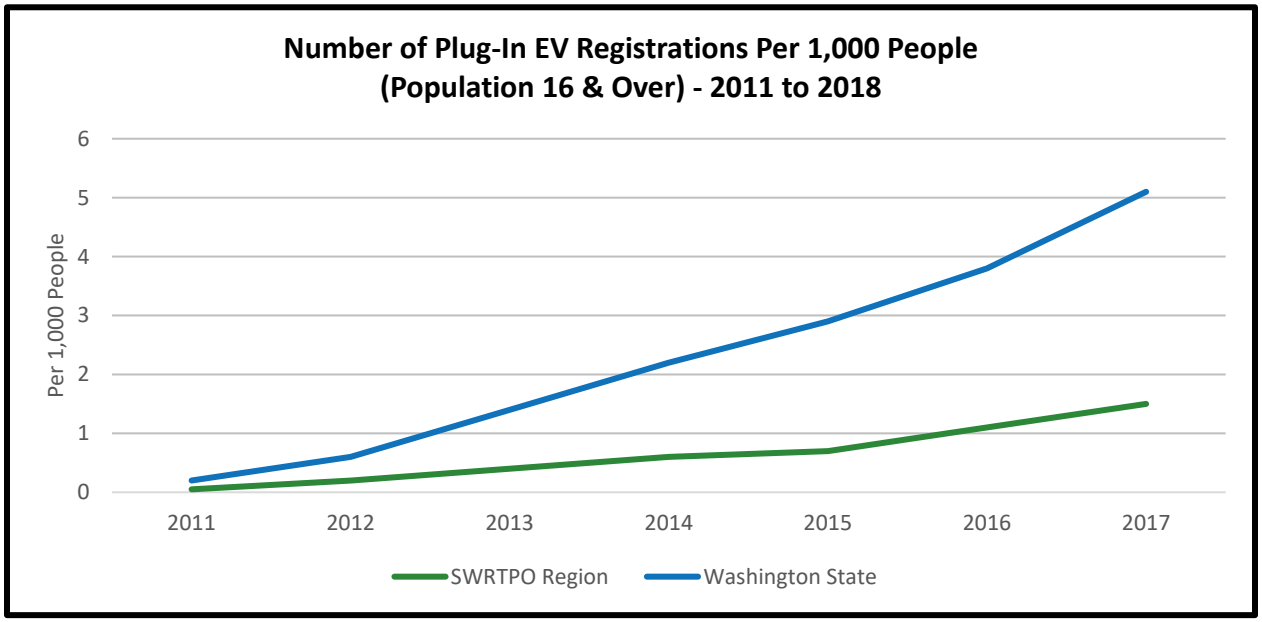


Source: Washington State Department of Licensing



Source: Washington State Department of Licensing

The next chart illustrates the number of EV registrations in the SWRTPO and statewide per 1,000 people aged 16 years and older since 2011.



Source: Washington State Department of Licensing

Existing Public Charging Stations

Station Inventory

Charging Station Web Map

http://arcg.is/H1qi10

There were 28 existing public charging stations located across the SWRTPO and MPO regions at the end of 2019. These existing charging stations combined had a total of 80 plugs. However, the Tesla Supercharger station in Centralia alone had 20 plugs. The total plugs were split about in half between Level 2 (42 plugs) and Level 3 (38 plugs). CWCOG has published a web map (see the green box to the right for the web link) and it shows the locations of these existing charging stations. More details on all of these existing charging stations are included in the tables beginning on the next page. The web map maybe updated occasionally after publication of this plan to keep up with new charging stations that become available.

County	Station Name	Street Address	City	State	Network	Type of Charging	Plug Type(s)	Number of Plugs
Columbia, Oregon	Greenlots - 53087	205 W B Street	Rainier	OR	Greenlots	DC Fast / Level 2	J1772; CHAdeMO; SAE CCS	4 (2 Level 2, 2 DC Fast)
						Totals for Columbia County:		**1 Station** **4 Total Plugs** **2 Level 2** **2 DC Fast**
Cowlitz	Castle Rock - Cascade Select Market	204 W Cowlitz Street	Castle Rock	WA	Webasto	DC Fast / Level 2	J1772; CHAdeMO	2 (1 Level 2, 1 DC Fast)
	Lakeside 24 Hour Fuel	16835 Lewis River Road	Cougar	WA	None	Level 2	J1772	1
	Three Rivers Mall	351 Three Rivers Drive	Kelso	WA	Electify America	DC Fast	CHAdeMO; SAE CCS	4
	Cowlitz County PUD	961 12th Avenue	Longview	WA	Blink	Level 2	J1772	2
	Lower Columbia College	1810 Maple Street	Longview	WA	ChargePoint	Level 2	J1772	2
	Walmart	1486 Dike Access Road	Woodland	WA	EVGo	DC Fast	CHAdeMO; SAE CCS	1
						Totals for Cowlitz County:		**6 Stations** **12 Total Plugs** **6 Level 2** **6 DC Fast**

County	Station Name	Street Address	City	State	Network	Type of Charging	Plug Type(s)	Number of Plugs
Grays Harbor	Aberdeen Tesla Supercharger	416 Wishkah Street	Aberdeen	WA	Tesla	DC Fast	Tesla	8
	Five Star Motor Chevrolet	300 S Boone Street	Aberdeen	WA	None	Level 2	J1772	1
	Honda of Grays Harbor	1720 Simpson Avenue	Aberdeen	WA	ChargePoint	Level 2	J1772	1
	Seabrook Street Parking	169 Blackberry Street	Copalis Crossing	WA	None	Level 2	J1772	1
	Gull Wing Inn	4852 Pacific Avenue	Moclips	WA	None	Level 2	J1772	1
	Moonstone Beach Motel - Tesla Destination	4849 Pacific Avenue	Moclips	WA	Tesla	Level 2		3
	Quinault Beach Resort and Casino	78 State Route 115	Ocean Shores	WA	ChargePoint	Level 2	J1772	4
	Lake Quinault Lodge	345 S Shore Road	Quinault	WA	None	Level 2	J1772	2
	Cranberry Road Winery - Tesla Destination	2858 S Forrest Street	Westport	WA	Tesla	Level 2		3
	Grays Harbor College Building 700	1620 Edward P. Smith Drive	Aberdeen	WA	Blink	Level 2	J1772	2
						Totals for Grays Harbor:		**10 Stations** **26 Total Plugs** **18 Level 2** **8 DC Fast**

County	Station Name	Street Address	City	State	Network	Type of Charging	Plug Type(s)	Number of Plugs
Lewis	Centralia - Wendy's	817 Harrison Avenue	Centralia	WA	Webasto	DC Fast / Level 2	J1772; CHAdeMO	2 (1 Level 2, 1 DC Fast)
	Centralia Community College	600 Centralia College Bouvelard	Centralia	WA	Blink	Level 2	J1772	2
	Centralia Outlets Tesla Supercharger	1200 Lum Road	Centralia	WA	Tesla	DC Fast	Tesla	20
	Providence Centralia Hospital	914 S Scheuber Road	Centralia	WA	Blink	Level 2	J1772	1
	Chehalis Commerce District	1701 NW Louisiana Avenue	Chehalis	WA	EVGo	DC Fast / Level 2	J1772; CHAdeMO; SAE CCS	3 (2 Level 2, 1 DC Fast)
	Adytum Sanctuary - Tesla Destination	186 Skyview Drive	Mossyrock	WA	Tesla	Level 2		2
						Totals for Lewis County:		**6 Stations** **30 Total Plugs** **8 Level 2** **22 DC Fast**

County	Station Name	Street Address	City	State	Network	Type of Charging	Plug Type(s)	Number of Plugs
Pacific	Shoalwater Bay Casino	4112 State Route 105	Grayland	WA	SemaCharge	Level 2	J1772	2
	Adrift Hotel	409 Sid Snyder Drive	Long Beach	WA	SemaCharge	Level 2	J1772	1
	Long Beach	406 Oregon Ave South	Long Beach	WA	ChargePoint	Level 2	J1772	2
	Shelburne Inn Restaurant & Pub - Tesla Destination*	4415 Pacific Way	Seaview	WA	Tesla	Level 2		1
						Totals for Pacific County:		**4 Stations** **6 Total Plugs** **6 Level 2**
Wahkiakum	Hotel Cathlamet Rear Parking Lot*	69 Main Street	Cathlamet	WA	SemaCharge Tesla	Level 2	J1772	
						Totals for Wahkiakum County:		**1 Station** **2 Total Plugs** **2 Level 2**
						Totals for the SWRTPO & MPO Regions:		**28 Stations** **80 Total Plugs** **42 Level 2** **38 DC Fast**

Source: US Department of Energy, Alternative Fuels Data Center

*Call ahead for access.

Station Use

Another useful resource for local agencies considering installing a public charging station are the usage statistics for some of the existing charging stations owned by public agencies in the SWRTPO and MPO regions. CWCOG's outreach about charging station costs also involved collecting information on usage. The statistics below show the amount of usage at some of the existing charging stations as reported by the station owner. Centralia College's charging station is included below, but was not included earlier in the section on costs because CWCOG was only provided data on usage. If a charging station has more than one plug, the numbers below are for all plugs combined.

Station Owner & Station Address	Network	Vehicles Connected [note 1]	Total Kilowatts Used [note 1]	Average Kilowatts Per Charging Session [note 1]	Average Daily Vehicle Connections [note 2]	Average Daily Kilowatts Used [note 2]
City of Long Beach 406 Oregon Ave South, Long Beach	ChargePoint	449 (for 1-year period, start/end dates not provided)	5,396 kwh (for 1-year period, start/end dates not provided)	5.05 kwh (for 1-year period, start/end dates not provided)	1.23	14.78 kwh
Cowlitz PUD 961 12th Ave, Longview	Blink	483 (2018/19 [up to 8/31/19])	4,329 kwh (2018/19 [up to 8/31/19])	9.32 kwh (2018/19 [up to 8/31/19])	0.79	7.12 kwh
Centralia College 600 Centralia College Blvd, Centralia	Blink	402 (2018/19)	Not Provided	Not Provided	0.55	Not Able to Calculate
Providence Hospital – Centralia 914 S Scheuber Rd, Centalia	Blink	13 (2019)	Not Provided	Not Provided	0.03	Not Able to Calculate

Notes: (1) Provided by the station owner
(2) Calculated by CWCOG

Public Feedback on Possible Future Use of Plug-in Electric Vehicles

CWCOG conducted an online survey using SurveyMonkey.com from April 10 to June 30, 2019. The purpose of the survey was to understand better the possible future use of plug-in EVs and any barriers that maybe impact their use. Highlights from the survey are listed below.

- Over 87% of respondents did not already own or lease a plug-in EV (either PHEV or BEV). Of the small number who responded 'yes' to owning or leasing one, all respondents except one would purchase or lease a plug-in EV again.
- When asked the likelihood of owning or leasing a PHEV or BEV in the next 5 to 10 years, the top response was 'no plans to purchase or lease.'
- The top responses for likelihood of owning or leasing a BEV or PHEV in the next 5 to 10 years, were 'no plans to purchase or lease' or 'somewhat likely.'
- Regarding barriers to owning or leasing a PHEV or BEV, the responses selected most often were 'sales/leases prices were too high', 'not enough public charging locations', and 'miles per charge was insufficient to meet their needs.'
- Survey respondents were mostly from Cowlitz County (46%) with Grays Harbor and Lewis Counties each making up about 17% of respondents. Over 40% of people who completed the survey were in their forties or fifties, just over 50% were male, and the income level of respondents was fairly well distributed.

A takeaway from the survey results would be that the barriers to plug-in EVs could be reduced or eliminated over time as more EV models become available and prices decrease, more charging stations come online, and battery improvements allow greater driving ranges. To view question-by-question results from the survey please refer to Appendix C.

Existing Work on Expanding the Charging Station Network

Around the SWRTPO and MPO regions, several efforts are underway to work on expanding the existing charging station network.

First, in Grays Harbor County where the City of Elma, Grays Harbor PUD, and Energy Northwest are working together to locate future EV charging stations as part of the larger Electric Vehicle Infrastructure Transportation Alliance (EVITA). EVITA being a group of public power utilities working to develop EV charging stations in Washington State and lead by Energy Northwest. An early meeting in this effort in Grays Harbor County happened on July 8, 2019 per Grays Harbor PUD's August 2019 *Energy* newsletter.

Next, in Lewis County where the Lewis County PUD has also engaged with Energy Northwest as part of the EVITA program. According to the Lewis County PUD website (www.lcpud.org/about-us/electric-vehicles/), a first meeting in Lewis County was held on January 11, 2019. Also, in Lewis County Twin Transit has embarked on a project called Interstate 5 and Highway 12 Electrification Initiative. The goal being to develop multiple transit stations on Interstate 5 with rapid bus charging facilities as well as park and ride lots with charging infrastructure for private vehicles. Phase 1 of this initiative would start with a zero-emission rapid transit hub in Centralia-Chehalis and expand south into Cowlitz County in future phases. The Highway 12 portion of the project would be working with the EVITA program and Energy Northwest.

In Cowlitz County, the City of Longview established a special advisory committee to evaluate and make a recommendation to the City Council on locations for a city-installed EV charging station(s). CWCOG staff directly engaged in this effort by sharing the GIS Siting Suitability Model results with the City of Longview. A meeting of the special advisory committee was held on October 15, 2019.

Connected and Autonomous Vehicles

Up to this point this chapter has discussed electric vehicles. The remainder of this chapter will be an overview of connected and autonomous vehicles and provide information on current public opinion on the technology.

Connected and Autonomous Vehicle Overview

In order to understand connected and autonomous vehicle technology requires defining the terms connected vehicle and automated vehicle. Both terms have been widely used in many publications, were included on the acronyms and definitions list on page iv, and repeated below.

> A **Connected Vehicle** communicates with nearby vehicles and infrastructure with human control.
>
> An **Automated Vehicle** operates in isolation from other vehicles with use of internal sensors with varying amounts of human assistance. There are various levels of automation.

The definition of a connected and autonomous vehicle would simply be a vehicle capable of both communicating with other nearby vehicles, or infrastructure such as traffic signals, and operating with internal sensors to drive itself with little to no human assistance. The various levels of automation referred to above are explained below.

Level of Automation	Who Does What, When
Level 0	The human driver does all the driving. Examples would be a 1967 Porsche 911 or 2018 Kia Rio.
Level 1	An advanced driver assistance system on a vehicle can sometimes assist the human driver with either steering or braking/accelerating, but not both at the same time. Example would be any vehicles with features such as adaptive cruise control.
Level 2	An advanced driver assistance system on the vehicle can by itself actually control both steering and braking/accelerating simultaneously under some circumstances. A human driver must continue to monitor the driving at all times and perform the remaining driving tasks. Examples would be Tesla Autopilot or Volvo Pilot Assist
Level 3	An automated driving system on the vehicle can by itself perform all driving tasks under some circumstances, but the human driver must be ready to take control at any time when the system requests the human driver to do so. In all other circumstances the human driver performs the driving task(s).
Level 4	An automated driving system on the vehicle can by itself perform all driving tasks and monitor the driving environment in certain circumstances. The human driver need not pay attention in those circumstances.
Level 5	An automated driving system on the vehicle can do all tasks in all circumstances. Human occupants are passengers and do not need to be involved in driving. Example would be Waymo (being tested in multiple locations in the US including Kirkland, Washington.

Source: National Highway Traffic Safety Administration and Society of Automotive Engineers (https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety#topic-road-self-driving). Examples of vehicles from https://www.caranddriver.com/features/a15079828/autonomous-self-driving-car-levels-car-levels/ and information about Waymo from www.waymo.com.

The table on the previous page illustrates the point that vehicles on the road today already have some levels of automation. Vehicles available to the public now would have up to Level 2 automation. More highly automated vehicles, Levels 3 to 5, are under development. Many companies, including Waymo, are testing Level 4 and 5 connected and autonomous vehicles. In Washington State, the Autonomous Vehicle Work Group has reported on their website (avworkgroupwa.org/) 12 companies being self-certified with the Department of Licensing to test/operate autonomous vehicles on public roads. The Washington State Autonomous Vehicle Work Group was established and convened by the State Transportation Commission in 2018 to bring together representatives from many state agencies to plan for connected and autonomous vehicles. According to the Governors Highway Safety Association's report *Preparing for Automated Vehicles: Traffic Safety Issues for State* dated August 2018, Level 4 connected and autonomous vehicles could likely be introduced by 2022. Many sources have indicated that Level 5 connected and autonomous vehicles could be many years, or decades, away from being available for widespread use.

Significant changes to our transportation system from higher levels of automated vehicles will probably be felt sooner in larger metropolitan areas. Small urban and rural areas, including the MPO and SWRTPO regions, may see little to no impact from this new vehicle technology until much later into the future. However, it is possible the freight industry could be one area of the transportation system where connected and autonomous vehicle technology could cause impacts sooner in the MPO and SWRTPO regions. Even if the impacts from connected and autonomous vehicles are decades away for the MPO and SWRTPO regions, starting discussions and planning now will be invaluable. The issues and challenges presented in Chapter 4 should be used to assist in starting ongoing discussions among state and local agencies and stakeholders.

Initial Public Feedback on Connected and Autonomous Vehicles

Even though the impacts from connected and autonomous vehicles are many years, or decades, away from significantly impacting the SWRTPO and MPO regions, CWCOG wanted to gather some initial feedback from people on this emerging technology. Question 6 of the Electric Vehicle and Emerging Technology Survey, discussed previously on pages 19 and 20, asked people if they would use a fully autonomous vehicle once these vehicles are available. A fully autonomous vehicle in the survey question would refer to Level 4 or 5. More than half of the 292 people responding to Question 6 of the survey were either not sure of whether they would use this type of vehicle or definitely would not use one. For the complete results to Question 6, please refer to Appendix C.

The survey results gathered by CWCOG from a very small sample are not uncommon. A national automated vehicle survey conducted annually by the American Automobile Association (AAA) since 2016 has revealed similar feedback. The 2019 version of the AAA survey found 3 out of 4 American were afraid of fully self-driving vehicles.[2] Key findings from the AAA survey are listed in the table on the next page.

[2] Article published by AAA on March 14, 2019 summarized the survey results, includes a link to a Fact Sheet with key findings from the survey, and is found at https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey/.

American Automobile Association Automated Vehicle Survey Key Findings
About half (53 percent) of US drivers would be comfortable with fully self-driving vehicles being used for people mover systems found at airports and theme parks.
About four in ten US drivers would be comfortable with using fully self-driving vehicles for delivery services of food or packages.
Only 19 percent of US drivers would be comfortable with the use of fully self-driving vehicles to transport their children or loved ones.

Source: AAA Automated Vehicle Survey, Phase IV Fact Sheet Published in March 2019 (https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey/)

Whether through the CWCOG Electric Vehicle and Emerging Technology Survey or from a nationwide survey, it is clear that public feedback on connected and autonomous vehicles would be described as mostly negative. Hopefully, as connected and autonomous vehicle technology matures and many of the unknowns are resolved the confidence and willingness to use these types of vehicles will improve. Continual education on these emerging vehicles as the technology matures will be essential.

Chapter 3 Expanding Our Electric Vehicle Charging Station Network

The previous chapter reviewed the basics of electric vehicles and connected and autonomous vehicles. This chapter will be a deeper dive into electric vehicles with tools and resources to aid local agencies in siting charging stations as well as in future regional planning efforts.

Charging Station Siting

Many publications have discussed criteria to consider when deciding where to site new charging stations. Based on a review of available reference materials, CWCOG staff developed a list of possible siting criteria. The more of these siting criteria a location provides the better the location would be for a charging station in many cases. One exception to this idea would be that sometimes the best location would simply be the one filling the gap (or missing link) in the charging network to ensure charging availability about every 40 miles.

The initial reason for compiling this list was to assist stakeholders in understanding the characteristics that are preferred for potential charging station locations.

Potential Charging Station Siting Criteria

- Located every 40 miles along a corridor
- Within ½ mile of highway interchange
- Safe and convenient access
- 24-hour access
- Parking spaces
- Restrooms and drinking water
- Shelter and lighting
- 480V 3-phase electric power supply
- Customer amenities (food, traveler info)
- Specific Corridors or Geographic Areas
- Networking access
- Potential for Expansion
- Wide turning radius
- Retail/Shopping
- Transit Service
- Pedestrian Facilities
- Bicycle Facilities
- Near high volume roadway access points
- Park and Ride Lots
- Shopping Centers
- Placing equipment near power sources to reduce the extent of trenching for conduit runs
- Areas where wall mounting is an option (wall mount units can have lower capital/installation costs
- Outside of Environmentally-Constrained Areas (such as floodplains)

Geographic Information System Siting Suitability Model

While engaging with stakeholders to identify recommended locations for future charging stations, it was suggested there needed to be a data model to assist the selection, and validation, of potential sites. CWCOG developed a multi-factor Geographic Information System (GIS) model to identify suitable

locations for EV charging stations to meet the need. This GIS model was developed after reviewing several publications on the topic of EV charging station siting. The multi-factor method was chosen since it best kept with the approach stakeholders were using to identify recommended locations. Further, needed data layers to map the demand factors were obtainable for all SWRTPO counties. The method chosen somewhat follows the model developed by Yongqin Zhang and Kory Iman at Delta State University.[3]

Model Methodology

Data Collection and Preparation

GIS datasets characterizing the features considered important to the siting of charging stations were collected from various sources including government agencies, ESRI Demographics, and OpenStreetMap (an open source resource for free geographic data). A total of 32 demand factors are included in the model as listed in the table below.

Demand Factors		Demand Factors	
1	Employment	17	Dog Parks
2	Population	18	Gas Stations
3	Major Roads	19	Major Attractions
4	EV Charging Stations	20	Major Parking
5	Health Care Facilities	21	Marinas
6	Libraries	22	Park and Ride Lots
7	Major Road Intersections	23	Super Markets
8	Schools and Colleges	24	Train Station
9	Shopping Malls	25	Airports
10	Resorts	26	Golf Courses
11	Traffic Count Segments	27	Major Lakes
12	Department Stores	28	Major Rivers
13	Super Stores	29	Government Offices
14	Hotels and Casinos	30	Post Offices
15	Ferry Terminals	31	Places of Worship
16	Parks	32	Bathroom Facilities

Scoring Demand Factors

Each demand factor was weighted based on the perceived level of influence to the siting of charging stations. The weighted scoring system was separated into categories: high (weight of 5), moderate (weight of 3), and low (weight of 1). Employment, population, and road demand factors were assigned variable weights from 1 to 5 corresponding to the data being split into 5 class ranges from low to high. The table at the top of the next page lists the influence and weight assigned to each demand factor.

[3] Zhang, Y. and Iman, K.: A multi-factor GIS method to identify optimal geographic locations for electric vehicle (EV) charging stations, Proc. Int. Cartogr. Assoc., 1, 127, https://doi.org/10.5194/ica-proc-1-127-2018, 2018.

Input Demand Factors for Model	Influence	Weight
Employment	High	1 - 5
Population	High	1 - 5
Major Road Segments	High	1 - 5
Major Road Intersections	High	1 - 5
Health Care Facilities	High	5
Libraries	High	5
Attractions	High	5
Schools and Colleges	High	5
Shopping Malls	High	5
Resorts	High	5
Department Stores	High	5
Super Stores	High	5
Hotels and Casinos	High	5
Ferry Terminals	Moderate	3
Parks	Moderate	3
Gas Stations	Moderate	3
Major Parking	Moderate	3
Marinas	Moderate	3
Park and Ride Lots	Moderate	3
Super Markets	Moderate	3
Train Station	Moderate	3
Government Offices	Moderate	3
Dog Park	Moderate	3
Bathroom Facilities	Moderate	3
Viewpoints and Travel Info	Moderate	3
EV Charging Stations	Low	1
Airports	Low	1
Golf Courses	Low	1
Major Lakes	Low	1
Major Rivers	Low	1
Post Offices	Low	1
Places of Worship	Low	1

Stakeholder input was used to test and modify the assigned demand factor level of influence and weight.

Suitability Analysis

A regionwide ½ mile grid system was developed for the suitability model and used to evaluate the demand factors. When a demand factor was present within one of the ½ mile grid cells, the weighted score for the specific factor was added to the overall score for the particular grid cell. Using all the demand factors impacting a particular grid cell, a composite suitability score was calculated for each cell.

In the cases of demand factors with variable weights (employment, population, major roads, and intersections), the highest score for a grid cell was used. The number of points of interest were tallied by grid cell and the sum of their weighted scores was added to the composite score.

Results and Intended Uses

The siting suitability model produced a GIS layer of ½ mile grids where each cell has an assigned composite score based on the availability of demand factors. The composite scores are mapped using a color ramp where the most suitable areas (highest scores) are shown with the darkest shade and the least suitable areas (lowest scores) are the lightest shade. Using the link in the green box below at the start of the next section shows a web map that includes the suitability model result across the entire region.

When looking at the model grid, darker colors represent areas drivers maybe more likely to want to stop and charge their electric vehicle given the availability of more attractions and services. The model results are intended to identify and prioritize locations on a regional scale with a focus on the need for more charging stations in every area of the SWRTPO and MPO regions. Results are not intended to be used to compare an urban area, such as Longview, with a rural area, such as Naselle. Further, the model should not be used for identifying specific sites. Model results are meant to assist in narrowing down the optimal locations for charging stations, validating the suitability of stakeholder-identified sites, and for assisting the prioritization process of where to install charging stations.

Adjustments were made to the model to ensure the more highly suitable charging station areas were identified and the overall support for charging infrastructure throughout the region was demonstrated. Future model enhancements may allow for more site-specific analysis with considerations for environmental constraints, cost and availability of power, and charging level requirements as examples.

Recommendation for Charging Station Locations

Charging Station Web Map

http://arcg.is/H1qi10

Stakeholders throughout the SWRTPO and MPO regions helped to identify many locations where charging stations would be recommended. In Grays Harbor, Pacific, and Wahkiakum Counties stakeholders came up with recommended locations based on the list of potential siting criteria presented at the beginning of this chapter as well as local knowledge. For these three counties the locations were validated using the siting suitability model. In Cowlitz and Lewis Counties, recommended locations were mostly selected using the model results.

There are 93 recommended locations identified throughout the region. It is important to note that this plan presents these recommended locations as a potential vision for how the charging station network could be expanded. Information in the future may result in one or more recommended locations no longer be viable, or one or more new locations may emerge as a great alternative that should be considered as a priority charging station location.

Potential Regional Strategies

While this plan, *Transportation Innovations: Preparing for Electric Vehicles and Connected and Autonomous Vehicles,* does not propose new regional policies or strategies, some potential regional

strategy ideas came out of the stakeholder involvement process. These potential strategies presented below are meant to inform discussions that will happen as part of the update to the 2045 Regional Transportation Plan. The ideas are grouped into categories: Overarching, Education/Planning, and Partnerships.

Overarching

- Regional priorities for future charging station locations should generally be areas shown as most suitable on the siting suitability model results with the exception that charging stations are also a regional priority in less suitable areas along highway corridors to ensure distances between charging stations are about 40 miles.
- Level 2 charging stations have lower costs and with improvements in battery technology allowing longer driving ranges the regional could consider them a higher priority unless a site has the infrastructure readily available for Level 3 charging.
- Encourage the removal of restrictions that do not allow public utilities to offer incentives for installing charging stations.

Education/Planning

- Continue monitoring plug-in EV registrations across the SWRTPO and MPO regions and provide regular updates to stakeholders.
- Promote education for businesses on EVs and the growing need for charging access by customers and employees.
- Encourage local ordinances to regulate the use, siting, and design of charging stations including within the public right-of-way.
- Encourage charging stations to be built for use by e-bikes as well.

Partnerships

- Promote public-private partnerships as a method to install more charging stations similar to the effort between the City of Elma, Grays Harbor PUD, and Energy Northwest.
- Encourage regional entities and/or public utility districts to take the lead in charging station installation along major highway corridors.

Potential Funding Sources for Charging Stations

The success of the region in expanding the EV charging network depends on finding additional funding and having demand for plug-in electric vehicles continue to increase. This section provides local agencies with potential state funding programs that have been available in the recent past to prepare local agencies with a list of potential programs to monitor for potential future grant funding opportunities. A potential federal funding source has also been provided below as well.

State Funding Sources

Agency:	WSDOT
Program:	Electric Vehicle Infrastructure Partnership Program (EVIPP)
For Additional Information:	https://www.wsdot.wa.gov/business/innovative-partnerships/electric-vehicle-charging-infrastructure
About this Program:	An initial round of funding ($1 million) was awarded to projects during 2017/2019 as a pilot program. Based on the success of the pilot, the state legislature in the Green Transportation Package (HB 2042) provided $1 million per year for the next ten years to continue the program. With the passage of I-976 and the modified state transportation budget by the Legislature in 2020 it is unclear when the first opportunity could be opened up under this program. From the previous grant funding round, WSDOT could award these funds to nonprofit organizations, state government agencies, cities, towns, counties, transit agencies, and tribes.

Agency:	Department of Ecology
Program:	Washington's Federal Volkswagen Settlement
For Additional Information:	https://ecology.wa.gov/Air-Climate/Air-quality/Vehicle-emissions/Volkswagen-enforcement-action/VW-federal-enforcement-action#VWfunding
About this Program:	Washington State filed a mitigation plan on November 6, 2018 as part of the Volkswagen Settlement. To use the funding made available to the state from the settlement, several rounds of funding opportunities occurred in 2019 and 2020. There may not be funding under this program moving forward, but the Department of Ecology could be a state agency for funding opportunities in the future under a new program name.

Agency:	Department of Commerce
Program:	Electrification of Transportation Program
For Additional Information:	https://www.commerce.wa.gov/growing-the-economy/energy/clean-energy-fund/electrification-of-transportation/
About this Program:	The Department of Commerce during Spring 2020 has completed a grant funding opportunity for $10.67 million of funding to install EV charging stations. There may not be funding under this program moving forward, but the Department of Commerce could be a state agency for funding opportunities in the future under a new program name.

Federal Funding Sources

Agency:	CWCOG
Program:	Surface Transportation Block Grant Program (STBGP) [Longview-Kelso-Rainier Urban Area Only]
For Additional Information:	https://www.wsdot.wa.gov/LocalPrograms/ProgramMgmt/STP.htm
About this Program:	The STBGP provides the most flexible funding for transportation projects and programs. STBGP funding is typically used for highway and bridge construction or repair; transit capital; bicycle, pedestrian, and recreational trails; and construction of ferry boats and terminals, electric vehicle charging stations in conjunction with truck parking facilities and fringe and corridor parking facilities are also allowed (23 USC 133(b)(1)(E) and (b)(5)). CWCOG could consider approving projects to install charging stations in conjunction with park and rides in the Longview/Kelso metropolitan area.

Chapter 4 Issues and Challenges

Up to this point several topics have been discussed including: 1) Importance of planning for electric vehicles and connected and autonomous vehicles; 2) Background information regarding the planning process; 3) Fundamentals of both electric vehicles and connected and autonomous vehicles; and 4) Resources and tools to assist in expanding the electric vehicle charging network. In this chapter the focus shifts towards an initial discussion of some key issues or challenges for electric vehicles and connected and autonomous vehicles moving forward. The issues and challenges presented are designed to inform people about these emerging technologies with the hope that the potential impacts continue to be discussed and integrated into all future planning efforts.

Electric Vehicles

Five categories of issues or challenges could summarize much of the concerns with electric vehicles in the future. These issues or challenges were all mentioned by stakeholders in the SWRTPO and MPO regions in various discussions during plan development.

Battery Technology

Batteries used in plug-in electric vehicles have continued to improve. Improvements in batteries are, and should continue, allowing vehicles to travel farther without needing to charge. The impact of longer driving ranges would mean more people could do most charging at home for all their normal, short daily trips. For a longer weekend trip such as from Longview to Long Beach to enjoy the beach, could be done by charging at home prior to departure and charging again during lunch in Long Beach at a public, Level 2 charger for maybe 2 hours. The Level 2 charger could provide maybe 20 to 25 miles of added range, combined with a better battery still having charge remaining from the trip from Longview, and be enough to get home. The better battery technology in this scenario would make public, Level 2 charging an acceptable alternative to the much more expensive Level 3 charging stations. The actual development of battery technology should be monitored to see if this scenario could become reality. If it does then the more expensive Level 3 charging station installations could be completed only along major highway corridors, or in heavily congested areas, long distance travelers need them to charge quickly become continuing on the road.

Standard Level 3 Charging Plug

Another issue or challenge could be the lack of a standard Level 3 charging plug. All Level 1 charging uses a standard household outlet and Level 2 the standard J1772 plug. No standard plug exists yet for Level 3 charging. As mentioned earlier the three main plugs for Level 3, DC Fast, chargers are CHAdeMO, SAE Combo, and Tesla. Not having a standard Level 3 charging plug creates risk for any agency or business installing a Level 3 charging station because you have to take a chance that the plug type selected will still be used several years later. Will there become one recognized Level 3 charging plug compatible with all vehicles? Only time will tell, but this is another issue to watch carefully.

Environmental Concerns

Some stakeholders in the SWRTPO and MPO regions have pointed out that plug-in electric vehicles negatively impact the environment. One of the concerns mentioned by stakeholders was stormwater pollution from leaking battery acid that could happen as a result of the batteries catching fire.

According to some publications there are other environmental concerns such as where the source of the electricity comes from to charge the electric vehicle. If the electricity originates at a carbon-producing power plant instead of one powered by wind, hydroelectric, or solar for example the benefits of no tailpipe emissions maybe cancelled out. However, other studies have showed all emissions from electric vehicles being less than from gasoline vehicles in all instances. For example, an article titled *Are Electric Vehicles Really Better for the Climate? Yes, Here's Why* from the Union of Concerned Scientists found that "driving the average EV is responsible for fewer global warming emissions than the average new gasoline car everywhere in the US."

Land Use Regulations

Another issue or challenge may not be much of one now in the SWRTPO and MPO regions because the amount of EVs on the road is still low, but as the numbers of EVs increase land use regulations will become much more important. A land use development ordinance for a city or county could be used to regulate the following.

1. Where electric vehicle charging stations are allowed;
2. Whether charging stations are permitted outright or upon approval of a conditional use permit;
3. The electric vehicle parking space design and location standards; and
4. The minimum EV parking spaces required of certain uses.

An example of land use regulations would be a city could allow Level 1 or 2 charging stations in any zoning district, but restrict Level 3 (DC Fast) charging stations to commercial or industrial zones.

In Washington State, several cities and counties have already adopted provisions to regulate electric vehicle charging provisions. Please refer to the following Municipal Research & Service Center (MRSC) website for more information: http://mrsc.org/Home/Explore-Topics/Environment/Energy-Topics/Planning-for-Electric-Vehicles.aspx. This MRSC website can also be found in the additional resources included in Chapter 5. For more guidance on how local development ordinances could regulate electric vehicle charging stations, the Great Plains Institute published a report by Claire Cooke and Brian Ross in June 2019 titled *Summary of Best Practices in Electric Vehicle Ordinances*. This Great Plains institute report provides short summaries of what several cities or counties around the country (including some in Washington) do to regulate different aspects of electric vehicle charging. As Chapter 5 explains, CWCOG has a copy of the Great Plains Institute report available to send to agencies upon request.

Having land use regulations in place dealing with electric vehicle charging could also help prevent unintended impacts on neighborhoods. An example of an unintended impact would be in older neighborhoods where off-street parking may not be available for many houses and people could start running charging cords from their houses to the street to charge their electric vehicle. This might not be a big issue for one or two electric vehicles, but for many electric vehicles, this could become a safety and aesthetic concern. One way to address this potential concern would be setting up a permitting process for the installation of electric vehicle chargers in the public right-of-way. In Washington, the City of Tacoma has a pilot program set-up for this purpose (please refer to Tacoma's Fact Sheet on the program for details https://www.tacomapermits.org/tip-sheet-index/evcs).

Charging Station Financial Viability

Another issue raised by stakeholders was the financial viability of electric vehicle charging stations. In short, charging station profitability. One recent report on the financial viability of electric vehicle charging stations published in September 2018 at the Harvard Kennedy School of Government completed a model on the economics of residential and commercial charging based on different infrastructure and fixed/variable costs. The result of the modeling showed residential home charging to be competitive with some of the most efficient gasoline-powered vehicles, but at current utilization rates commercial chargers are almost universally not economically profitable and a significant increase in demand will be needed.[4] This report also says for Level 3 commercial chargers that a 40% utilization rate would be needed for a charging station to be competitive with more efficient gasoline-powered vehicles. In addition, Lee and Clark provide details on a simulation of Level 2 commercial charging included in a 2014 Journal of the Transportation Research Board article titled *Pricing Workplace Charging: Financial Viability* by Williams and DeShazo. The Williams and DeShazo simulation of Level 2 commercial charging suggested that with a 6.25% utilization rate and a charging price of $0.33 per kilowatt hours only $1,000 - $2,000 of investment over the lifetime of a charging station could be recouped. Further, Williams and DeShazo said utilization would need to be 25% in order to recoup about $9,000 in investment.

Another report in August 2012 also looked into the profitability of electric vehicle charging stations. This report from the UCLA Luskin Center for Innovation and the Anderson School of Management titled *Financial Viability of Non-Residential Electric Vehicle Charging Stations* by Daniel Chang and others found three variables with the greatest impact on charging station profitability. These variables are utilization, willingness to pay, and parking turnover.[5]

Based on the low usage of the few existing stations listed in Chapter 2 and these studies, it appears charging stations in the SWRTPO and MPO regions will need a lot more use before station owners could expect profits. The challenge for the SWRTPO and MPO regions will be that any agency or business installing a charging station will need to be able to sustain it without a profit for the long term.

Charging Stations for Multiple Users

A final issue regarding electric vehicles moving forward would be adapting charging stations for use by e-bikes too. E-bikes are becoming a popular travel mode as a traditional bicycle alternative that helps expand cycling to more users. In addition, e-bikes may also be able to replace vehicle trips as well. While most e-bike users will likely charge at home, as the number of e-bikes on the road increases the need for public charging options will become important. Adapting charging stations to be an option for e-bike users would help to meet this future need.

[4] Lee, Henry and Clark, Alex: Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption, Harvard Kennedy School, September 2018.
[5] Chang, Daniel et al.: Financial Viability of Non-Residential Electric Vehicle Charging Stations, UCLA Luskin Center for Innovation and Anderson School of Management, August 2012.

Connected and Autonomous Vehicles

The previous section discussed some of the key issues and challenges regarding electric vehicles in the future. Now the focus shifts to connected and autonomous vehicles. With the highest levels of connected and autonomous vehicles still under development and many years away from public use, there are many unknowns. Given the many unknowns there are multiple possibilities for how connected and autonomous vehicles could shape our transportation system, both positive and negative.

To help people in beginning to think about the potential impacts from connected and autonomous vehicles, the table below provides some possible negative and positive outcomes for cities per the *Blueprint for Autonomous Urbanism, Second Edition* published by the National Association of City Transportation Officials (NACTO).

Area of Impact	Positive Outcome	Negative Outcome
Safety	Federal and state governments adopt objective and verifiable safety performance tests that set a high performance bar that protects all right-of-way users, including those in urban areas. AVs, programmed to travel at 25 mph or less depending on street context, dictate the speed of traffic for all motorized vehicles, reducing the overall speed on urban streets and, as a result, reducing the frequency and severity of crashes. Excess road space, created by slower moving, more efficient AVs, is used to build better, safer places for people walking and on bikes. Safer street design helps cities	Federal and state governments authorize AVs to operate on public streets before developing objective and verifiable safety performance standards and tests that ensure automated driving prevents injury collisions and fatalities among all right-of-way users. Governments fail to hold companies accountable for fully complying with traffic laws. These failures result in no improvement in today's street safety record while creating new risks and hazards.
Transit	Transit agencies and street departments work together to redesign streets, adopt new technologies, and modernize network planning, making transit faster and more reliable. New technologies, including real-time information, flex-route vans, limited ride-hail services, and integrations of active mobility into transit trips allow transit to cover more of the city, bridging the gap to lower-density places. Trip planning apps and other information/communications tools allow for smarter transit planning and route development. Mobility becomes smarter, while also becoming more equitable and reliable.	Elected officials demonize transit as inefficient and archaic, state and federal support wanes, systems begin to cut or privatize service, and demand declines. People who rely on transit are increasingly stranded as service deteriorates. Privatized services adopt large-scale loyalty rewards programs, re-stratifying transportation into a system of haves and have-nots, with longer wait times and less convenient routing for those without means.
Freight	Coordinated freight management reduces the number of large vehicles in and around urban areas. Local delivery, which is complex, nuanced, and varied, remains a human job. Freight distribution centers allow the majority of deliveries to take place via e-bikes or other small, high-efficiency modes. Workforce transition plans provide real opportunities for people formerly employed in freight.	High speed platoons of autonomous freight vehicles make roads increasingly dangerous or impassable. In cities, sidewalk bots proliferate, taking away valuable space from pedestrians and cyclists. Delivery drones increase noise in urban areas to unhealthy levels. Unemployment rises as AV-based freight services put people out of work.

Streets	Cities and the private sector together embrace streets as public spaces, fostering design and engineering practices that balance walking, biking, driving, and transit. AV-only lanes are reserved solely for automated mass transit.	Federal and state officials require dedicated AV lanes, taking street space from other uses. As individuals choose private AVs over transit and travel costs plummet, congestion increases, and pedestrians and cyclists become second-class citizens, relegated to walkways above or below grade for their own safety.
Curbs	Cities pass new curbside management plans committing any space savings from reduced parking or lane requirements to public use. Cities use curbside space for parklets, green infrastructure, bus lanes, bike lanes, and small-scale vendors and kiosks.	States prohibit local governments from regulating private mobility companies, so curbs become increasingly cluttered as companies compete, unimpeded, for space to pick up and drop off passengers.

Source: National Association of City Transportation Officials, *Blueprint for Autonomous Urbanism, Second Edition*, pages 20 and 21

It will remain to be seen whether these positive or negative outcomes per the National Association of City Transportation Officials happen as described. Depending on the outcomes connected and autonomous vehicles bring upon our transportation system, the overall impacts from connected and autonomous vehicles could improve or worsen traffic safety, congestion, pollution, land development patterns, and mobility.[6] Based on research, there seem to be a few things local agencies in the SWRTPO and MPO regions could do now to benefit the regional transportation system now and in the future when connected and autonomous vehicles begin to share our roads.

1. Maintain a focus on pedestrian/bicyclist safety and continue to explore and implement projects to expand the pedestrian and bicyclist network.
2. Promote, and work to expand when possible, public transportation services to ensure mobility for people with special needs.
3. Keep current on the latest developments with connected and autonomous vehicles in order to be ready to adapt to changing conditions such as the need for zoning ordinance amendments to adjust to potential land development changes.

With there being so many unknowns regarding connected and autonomous vehicles, this short overview of potential issues hopefully will help to have a little better understanding of this emerging technology. A better understanding will allow for ongoing coordination and collaboration on connected and autonomous vehicles. Ongoing coordination and collaboration will help to expand on the overview of issues and challenges above for future planning efforts.

A final tool this plan will provide are some available resources to further an understanding of electric vehicles and connected and autonomous vehicles and these are presented in the next chapter.

[6] National Academies of Science, Engineering, and Medicine, Advancing Automated and Connected Vehicles: Policy and Planning Strategies for State and Local Transportation Agencies, 2017

Chapter 5 Next Steps

The next steps for the SWRTPO and MPO regions are to use the information presented in this plan to continually educate, collaborate, and coordinate on a regional basis to prepared to address the needs of emerging technologies. To assist in learning more about electric vehicles and connected and autonomous vehicles, please explore the additional resources in the following table.

Publication	Author	Date	Download Link
Electric Vehicles			
Washington State Electric Vehicle Action Plan	WSDOT	February 2015	https://www.wsdot.wa.gov/NR/rdonlyres/C921B7B6-B542-4D94-8093-70DFB54B2A34/0/WAEVActionPlanFebruary2015Print.pdf
Planning for Electric Vehicles	MRSC	Not Applicable	http://mrsc.org/Home/Explore-Topics/Environment/Energy-Topics/Planning-for-Electric-Vehicles.aspx
Electric Drive Washington	Washington Department of Commerce	Not Applicable	https://www.commerce.wa.gov/growing-the-economy/energy/electric-vehicles/
Electric-Drive Vehicles	US Department of Energy	September 2017	https://afdc.energy.gov/files/u/publication/electric_vehicles.pdf
Electric Vehicle Infrastructure Transportation Alliance (EVITA) Website	Energy Northwest	Not Applicable	https://www.energy-northwest.com/doingbusinesswithus/Pages/EVITA.aspx
Summary of Best Practices in Electric Vehicle Ordinances	Claire Cooke and Brian Ross	June 2019	Please contact CWCOG for a copy.
Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption	Henry Lee and Alex Clark; Harvard Kennedy School of Government	September 2018	Please contact CWCOG for a copy.
Financial Viability of Non-Residential Electric Vehicle Charging Stations	Daniel Chang et al.; UCLA Luskin Center for Innovation and Anderson School of Management	August 2012	Please contact CWCOG for a copy.

Connected and Autonomous Vehicles			
Blueprint for Autonomous Urbanism, Second Edition	NACTO	September 2019	Please contact CWCOG for a copy.
Preparing for the Future of Transportation: Autonomous Vehicles 3.0	USDOT	October 2018	https://www.transportation.gov/av/3/preparing-future-transportation-automated-vehicles-3
Advancing Automated and Connected Vehicles: Policy and Planning Strategies for State and Local Transportation Agencies	National Academies of Science, Engineering, and Medicine	2017	Please contact CWCOG for a copy.
Autonomous Vehicles: A Policy Preparation Guide	National League of Cities: Center for City Solutions	Not Available	Please contact CWCOG for a copy.
Automated Vehicle Safety Expert Panel: Engaging Drivers and Law Enforcement	Governors Highway Safety Association	August 2019	Please contact CWCOG for a copy.

Appendix A 2019 Plug-In Electric Vehicle Inventory

The tables provided in this appendix list all the BEVs and PHEVs available for the 2019 model year according to the US Department of Energy, Alternative Fuels Data Center.

Model Year 2019 Battery Electric Vehicles

Make	Model	Fuel Economy (City/ Combined/Highway) [MPGe]	All-Electric Range (miles)
Audi	e-tron	74/74/73	204
BMW	I3	124/113/102	153
BMW	I3s	124/113/102	153
BYD Motors	e6	73/72/71	187
Chevrolet	Bolt EV	128/119/110	238
Fiat	500e	121/112/103	84
Ford	Transit Van / Wagon	N/A	120
Ford	Transit Van / Wagon	N/A	60
Honda	Clarity	126/114/103	89
Hyundai	Ioniq Electric	150/136/122	124
Hyundai	Kona Electric	132/120/108	258
Jaguar	I-PACE	80/76/72	234
Kia	Niro Electric	123/112/102	235
Kia	Soul Electric	124/108/93	111
Nissan	LEAF (40 kWh battery pack)	124/112/99	150
Nissan	LEAF (62-kWh battery pack)	118/108/97	226
Nissan	LEAF SV/SL (62 kWh battery pk)	114/104/94	215
Smart	EQ fortwo convertible	112/102/91	57
Smart	EQ fortwo coupe	124/108/94	58
Tesla	Model 3 Long Range	136/130/123	310
Tesla	Model 3 Long Range AWD	120/116/112	310
Tesla	Model 3 Long Range AWD Perf.	120/116/112	310
Tesla	Model 3 Mid Range	128/123/117	264
Tesla	Model 3 Standard Range	138/131/124	220
Tesla	Model 3 Standard Range Plus	140/133/124	240
Tesla	Model S 75D	102/103/105	259

Make	Model	Fuel Economy (City/ Combined/Highway) [MPGe]	All-Electric Range (miles)
Tesla	Model S 100D	101/102/102	335
Tesla	Model S P100D	92/98/105	315
Tesla	Model S Long Range	115/111/107	370
Tesla	Model S Performance (19" Wheels)	104/104/104	345
Tesla	Model S Standard Range	113/109/105	285
Tesla	Model X 75D	91/93/95	238
Tesla	Model X 100D	86/87/89	295
Tesla	Model X P100D	83/85/89	289
Tesla	Model X Long Range	99/96/93	325
Tesla	Model X Performance (22" Wheels)	80/79/77	270
Volkswagen	e-Golf	126/119/111	125
	Total Number of BEVs Makes:		**14**
	Total Number of BEVs Models:		**37**

Model Year 2019 Plug-In Hybrid Electric Vehicle

Make	Model	Fuel Economy, Gasoline Only Use (City/ Combined/Highway) [MPG]	Combined Fuel Economy [MPGe]	All-Electric Range (miles)
BMW	530e	27/29/30	72	16
BMW	530e xDrive	27/28/31	67	15
BMW	740e xDrive	25/27/29	64	14
BMW	I3 with Range Extender	30/31/31	100	135
BMW	I3s with Range Extender	30/31/31	110	135
BMW	i8 Coupe	26/26/29	69	18
BMW	i8 Roadster	26/26/29	69	18
Chevrolet	Volt	43/42/42	110	53
Chrysler	Pacifi Hybrid	29/30/30	82	32
Ford	F-150	N/A	N/A	N/A
Ford	Fusion Energi Plug- in Hybrid FWD	43/42/40	103	26
Ford	Fusion Special Service Vehicle PHEV	43/42/40	102	26
Ford	Super Duty F-250 2WD/4WD	N/A	N/A	N/A
Honda	Clarity	44/42/40	110	48
Hyundai	Ioniq Plug-In Hybrid	53/52/52	119	29

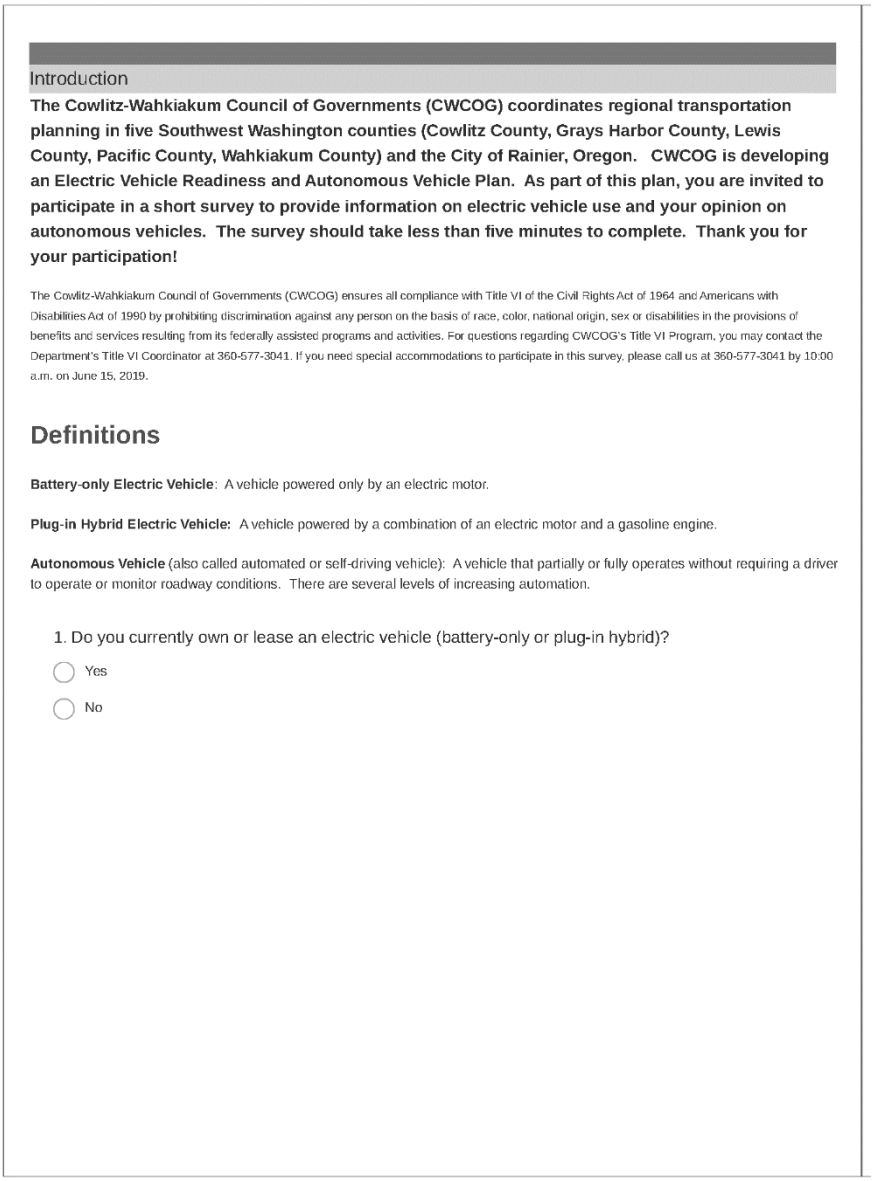
Kia	Niro Plug-in Hybrid	48/46/44	105	26
Kia	Optima Plug- In Hybrid	38/40/43	103	29
Mini	Cooper SE Countryman ALL4	28/27/27	65	12
Mitsubishi	Outlander PHEV	22/25/26	74	22
Porsche	Panamera 4 e-Hybrid	21/23/24	51	14
Porsche	Panamera 4 e-Hybrid Executive	21/23/24	51	14
Porsche	Panamera 4 e-Hybrid ST	21/23/24	51	14
Porsche	Panamera Turbo S e-Hybrid	19/20/22	48	14
Porsche	Panamera Turbo S e-Hybrid Executive	19/20/22	48	14
Porsche	Panaerma Turbo S e-Hybrid ST	19/20/22	48	14
Subaru	Crosstrek Hybrid AWD	36/35/35	90	21
Toyota	Prius Prime	55/54/53	133	25
Volvo	S60 AWD	29/31/34	74	22
Volvo	S90 AWD	26/29/33	71	21
Volvo	XC60 AWD	25/26/28	58	17
Volvo	XC90 AWD	24/25/27	58	17

Total Number of PHEVs Makes: 13

Total Number of PHEVs Models: 31

Appendix B Electric Vehicle and Emerging Technology Survey

CWCOG conducted a short, online survey via SurveyMonkey.com from April 10 to June 30, 2019. The survey was available in a hard-copy format upon request. In addition, the survey was translated into Spanish and also available upon request. This Electric Vehicle and Emerging Technology Survey was twelve (12) questions, but the respondents were asked to respond to either nine (9) or eleven (11) questions since the first question determined whether Question 2 or Questions 3 - 5 were answered. The remainder of this appendix are images of the paper version of the survey. Appendix C includes the survey results.



Introduction

The Cowlitz-Wahkiakum Council of Governments (CWCOG) coordinates regional transportation planning in five Southwest Washington counties (Cowlitz County, Grays Harbor County, Lewis County, Pacific County, Wahkiakum County) and the City of Rainier, Oregon. CWCOG is developing an Electric Vehicle Readiness and Autonomous Vehicle Plan. As part of this plan, you are invited to participate in a short survey to provide information on electric vehicle use and your opinion on autonomous vehicles. The survey should take less than five minutes to complete. Thank you for your participation!

The Cowlitz-Wahkiakum Council of Governments (CWCOG) ensures all compliance with Title VI of the Civil Rights Act of 1964 and Americans with Disabilities Act of 1990 by prohibiting discrimination against any person on the basis of race, color, national origin, sex or disabilities in the provisions of benefits and services resulting from its federally assisted programs and activities. For questions regarding CWCOG's Title VI Program, you may contact the Department's Title VI Coordinator at 360-577-3041. If you need special accommodations to participate in this survey, please call us at 360-577-3041 by 10:00 a.m. on June 15, 2019.

Definitions

Battery-only Electric Vehicle: A vehicle powered only by an electric motor.

Plug-in Hybrid Electric Vehicle: A vehicle powered by a combination of an electric motor and a gasoline engine.

Autonomous Vehicle (also called automated or self-driving vehicle): A vehicle that partially or fully operates without requiring a driver to operate or monitor roadway conditions. There are several levels of increasing automation.

1. Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

- ◯ Yes
- ◯ No

2. Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

- ◯ Yes
- ◯ No (explain below)

If you answered No, please explain.

3. In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

- ◯ Very likely
- ◯ Somewhat Likely
- ◯ Have no plans to purchase or lease a plug-in hybrid electric vehicle
- ◯ Somewhat Unlikely
- ◯ Very unlikely

4. In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

- ◯ Very likely
- ◯ Somewhat Likely
- ◯ Have no plans to purchase or lease a battery-only electric vehicle
- ◯ Somewhat Unlikely
- ◯ Very unlikely

5. What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)? (select all that apply)

- ☐ Sale or lease prices are too high.
- ☐ Miles per charge are insufficient to meet my needs.
- ☐ There are not enough public charging locations.
- ☐ More tax credits, or other incentives, are needed
- ☐ Other Reason(s) (Please explain)

6. When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself using one?

- ◯ No way!
- ◯ Only when I travel outside of my home community.
- ◯ On an occasional basis.
- ◯ On a daily or weekly basis.
- ◯ Not sure.

7. Where do you live? (please select one)

- ◯ Cowlitz County
- ◯ Grays Harbor County
- ◯ Lewis County
- ◯ Pacific County
- ◯ Wahkiakum County
- ◯ City of Rainier, Oregon
- ◯ In Washington, not in one of the five counties listed above
- ◯ In Oregon, outside of the City of Rainier
- ◯ Not in Washington or Oregon

The remaining questions are optional, but completing them is appreciated to help with Title VI compliance.

8. Age?

- ◯ 30 or younger
- ◯ 31-39
- ◯ 40-49
- ◯ 50-59
- ◯ 60-69
- ◯ 70 or older
- ◯ I prefer not to answer

9. What is your gender identification?

- ◯ Female
- ◯ Male
- ◯ Other
- ◯ I prefer not to answer

10. What is your race/ethnicity?

- ◯ White or Caucasian
- ◯ Black or African American
- ◯ Hispanic or Latino
- ◯ Asian or Asian American
- ◯ American Indian or Alaska Native
- ◯ Native Hawaiian or other Pacific Islander
- ◯ Other
- ◯ I prefer not to answer

11. What is your approximate, annual household income (before taxes)?

- ◯ Under $40,000
- ◯ $40,000 - $59,999
- ◯ $60,000 - $74,999
- ◯ $75,000 - $99,999
- ◯ Over $100,000
- ◯ I prefer not to answer

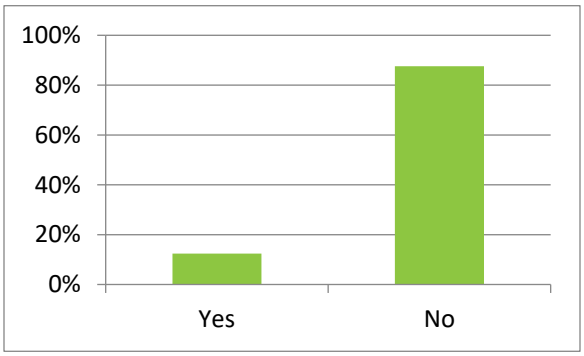
12. Please provide your email address below if you would like to be notified when the Electric Vehicle Readiness and Autonomous Vehicle Plan is available for public review or for future public participation opportunities regarding this plan.

Appendix C Electric Vehicle and Emerging Technology Survey - Results

All Responses

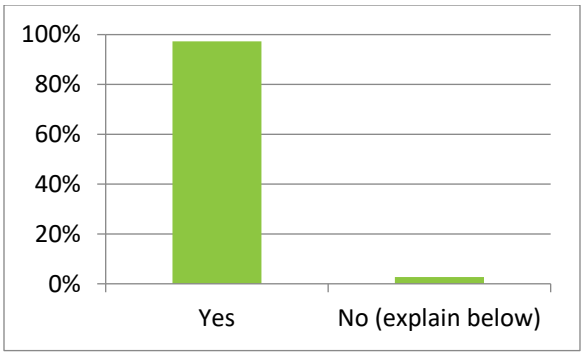
Question 1 – Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
Yes	12.42%	37
No	87.58%	261
	Answered	298
	Skipped	2



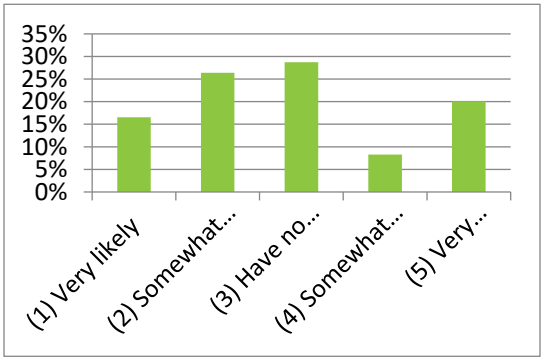
Question 2 – Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

Answer Choices	Responses	
Yes	97.30%	36
No (explain below)	2.70%	1
	Answered	37
	Skipped	263



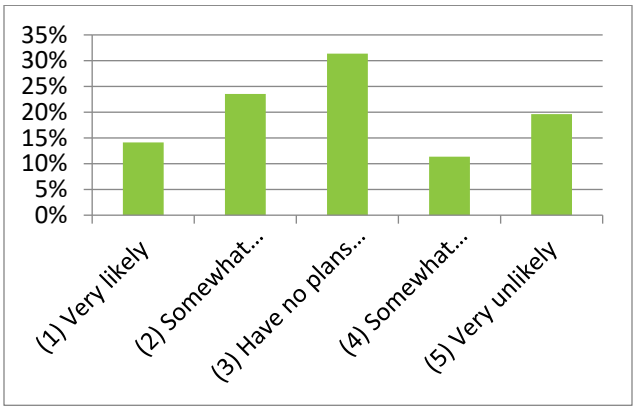
Question 3 – In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

Answer Choices	Responses	
(1) Very likely	16.54%	42
(2) Somewhat Likely	26.38%	67
(3) Have no plans to purchase or lease a plug-in hybrid electric vehicle	28.74%	73
(4) Somewhat Unlikely	8.27%	21
(5) Very unlikely	20.08%	51
	Answered	254
	Skipped	46



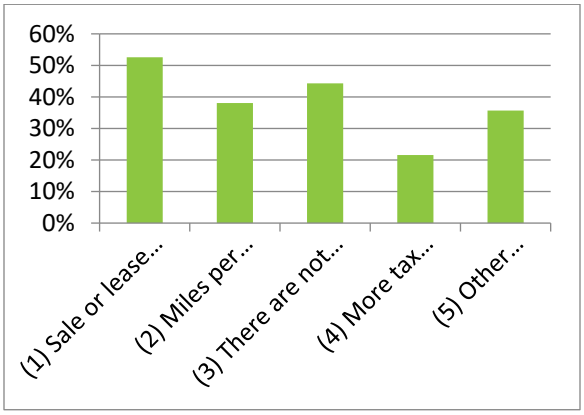
Question 4 – In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

Answer Choices	Responses	
(1) Very likely	14.12%	36
(2) Somewhat Likely	23.53%	60
(3) Have no plans to purchase or lease a battery-only electric vehicle	31.37%	80
(4) Somewhat Unlikely	11.37%	29
(5) Very unlikely	19.61%	50
	Answered	255
	Skipped	45



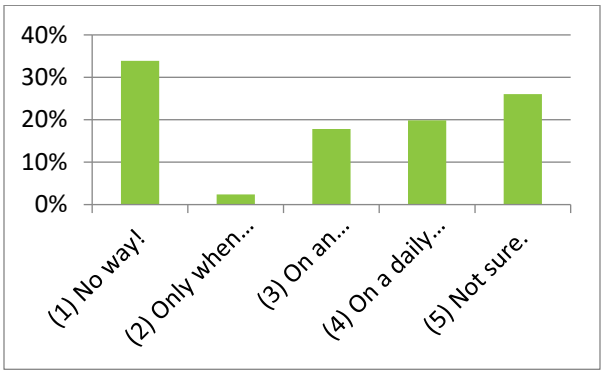
Question 5 – What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
(1) Sale or lease prices are too high.	52.55%	134
(2) Miles per charge are insufficient to meet my needs.	38.04%	97
(3) There are not enough public charging locations.	44.31%	113
(4) More tax credits, or other incentives, are needed	21.57%	55
(5) Other Reason(s) (Please explain)	35.69%	91
	Answered	255
	Skipped	45



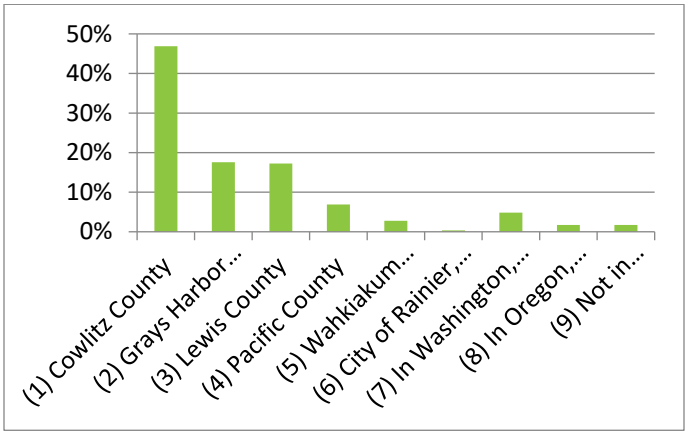
Question 6 – When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself driving one?

Answer Choices	Responses	
(1) No way!	33.90%	99
(2) Only when I travel outside of my home community.	2.40%	7
(3) On an occasional basis.	17.81%	52
(4) On a daily or weekly basis.	19.86%	58
(5) Not sure.	26.03%	76
	Answered	292
	Skipped	8



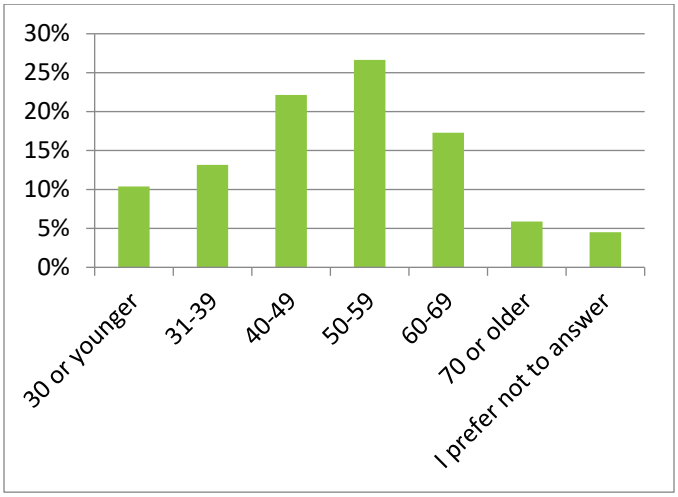
Question 7 – Where do you live?

Answer Choices	Responses	
(1) Cowlitz County	46.90%	136
(2) Grays Harbor County	17.59%	51
(3) Lewis County	17.24%	50
(4) Pacific County	6.90%	20
(5) Wahkiakum County	2.76%	8
(6) City of Rainier, OR	0.34%	1
(7) In Washington, not in one of the five counties listed above	4.83%	14
(8) In Oregon, outside of the City of Rainier	1.72%	5
(9) Not in Washington or Oregon	1.72%	5
	Answered	290
	Skipped	10



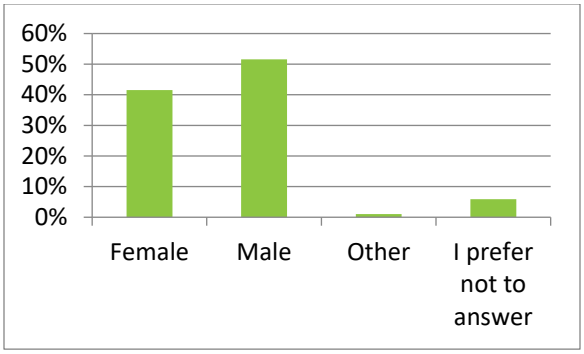
Question 8 – Age?

Answer Choices	Responses	
30 or younger	10.38%	30
31-39	13.15%	38
40-49	22.15%	64
50-59	26.64%	77
60-69	17.30%	50
70 or older	5.88%	17
I prefer not to answer	4.50%	13
	Answered	289
	Skipped	11



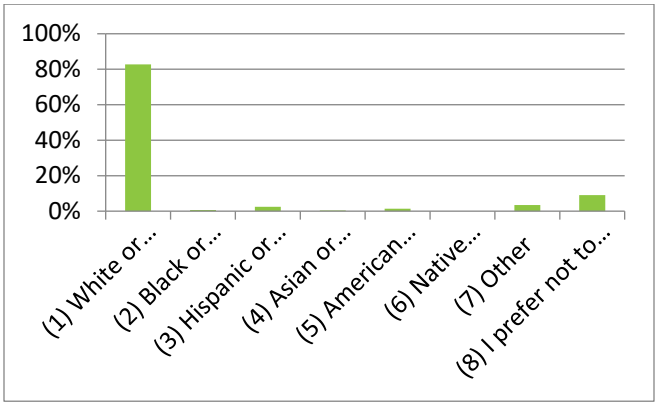
Question 9 – What is your gender identification?

Answer Choices	Responses	
Female	41.52%	120
Male	51.56%	149
Other	1.04%	3
I prefer not to answer	5.88%	17
	Answered	289
	Skipped	11



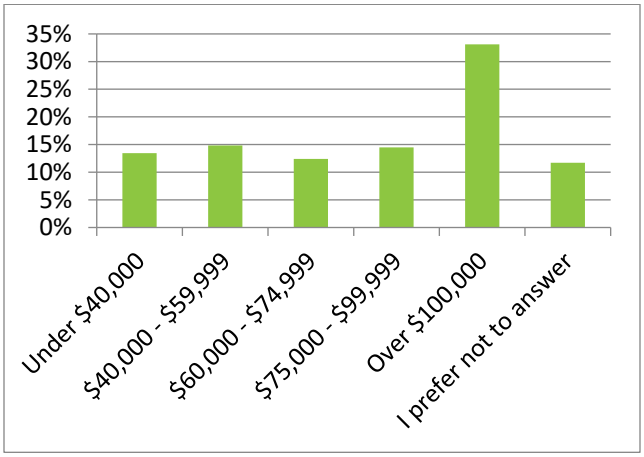
Question 10 – What is your race/ethnicity?

Answer Choices	Responses	
(1) White or Caucasian	82.70%	239
(2) Black or African American	0.69%	2
(3) Hispanic or Latino	2.42%	7
(4) Asian or Asian American	0.35%	1
(5) American Indian or Alaska Native	1.38%	4
(6) Native Hawaiian or other Pacific Islander	0.00%	0
(7) Other	3.46%	10
(8) I prefer not to answer	9.00%	26
	Answered	289
	Skipped	11



Question 11- What is your approximate, annual household income (before taxes)?

Answer Choices	Responses	
Under $40,000	13.45%	39
$40,000 - $59,999	14.83%	43
$60,000 - $74,999	12.41%	36
$75,000 - $99,999	14.48%	42
Over $100,000	33.10%	96
I prefer not to answer	11.72%	34
	Answered	290
	Skipped	10



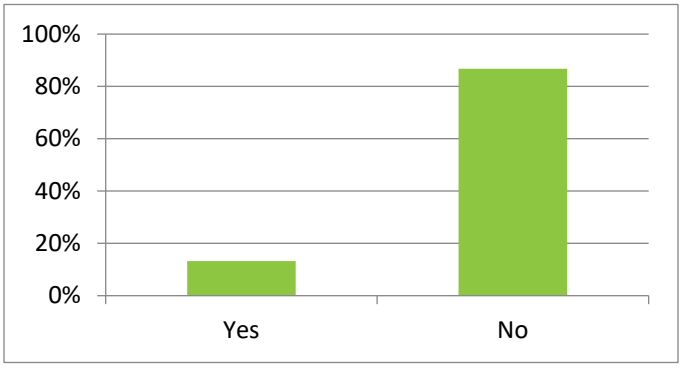
Question 12 – Please provide your email address below if you would like to be notified when the Electric Vehicle Readiness and Autonomous Vehicle Plan is available for public review or for future public participation opportunities regarding this plan.

There were seventy-seven (77) responses to this question. The emails collected through this question are on file with CWCOG.

Cowlitz County

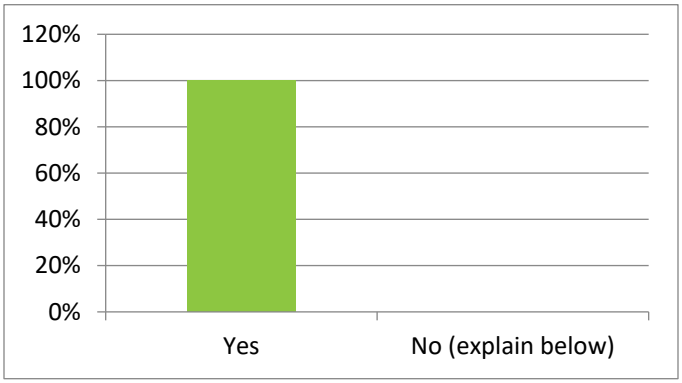
Question 1 – Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
Yes	13.24%	18
No	86.76%	118
	Answered	136
	Skipped	0



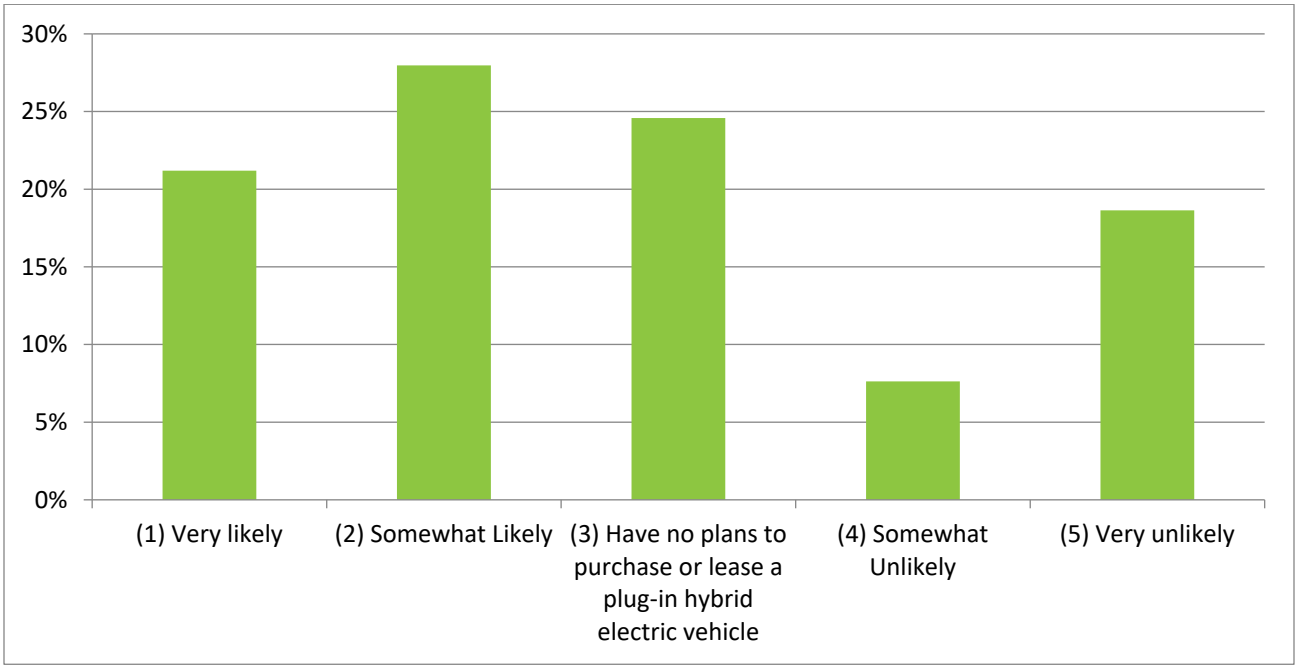
Question 2 – Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

Answer Choices	Responses	
Yes	100.00%	18
No	0.00%	0
	Answered	18
	Skipped	118



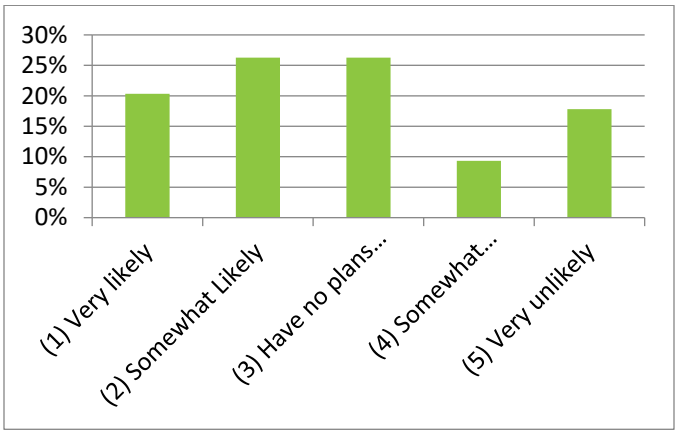
Question 3 – In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

Answer Choices	Responses	
(1) Very likely	21.19%	25
(2) Somewhat Likely	27.97%	33
(3) Have no plans to purchase or lease a plug-in hybrid electric vehicle	24.58%	29
(4) Somewhat Unlikely	7.63%	9
(5) Very unlikely	18.64%	22
	Answered	118
	Skipped	18



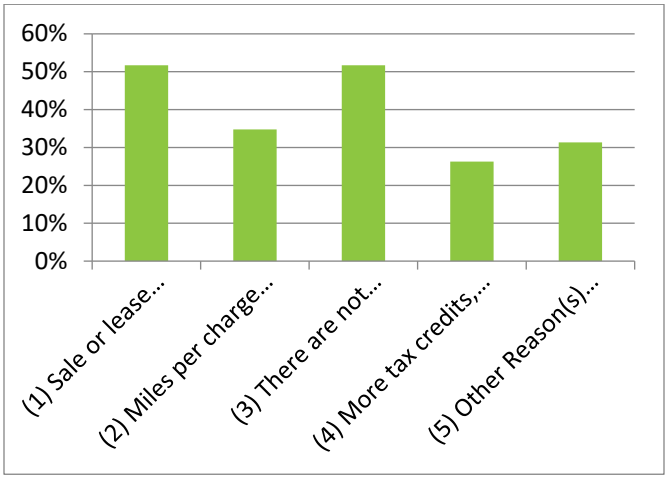
Question 4 – In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

Answer Choices	Responses	
(1) Very likely	20.34%	24
(2) Somewhat Likely	26.27%	31
(3) Have no plans to purchase or lease a battery-only electric vehicle	26.27%	31
(4) Somewhat Unlikely	9.32%	11
(5) Very unlikely	17.80%	21
	Answered	118
	Skipped	18



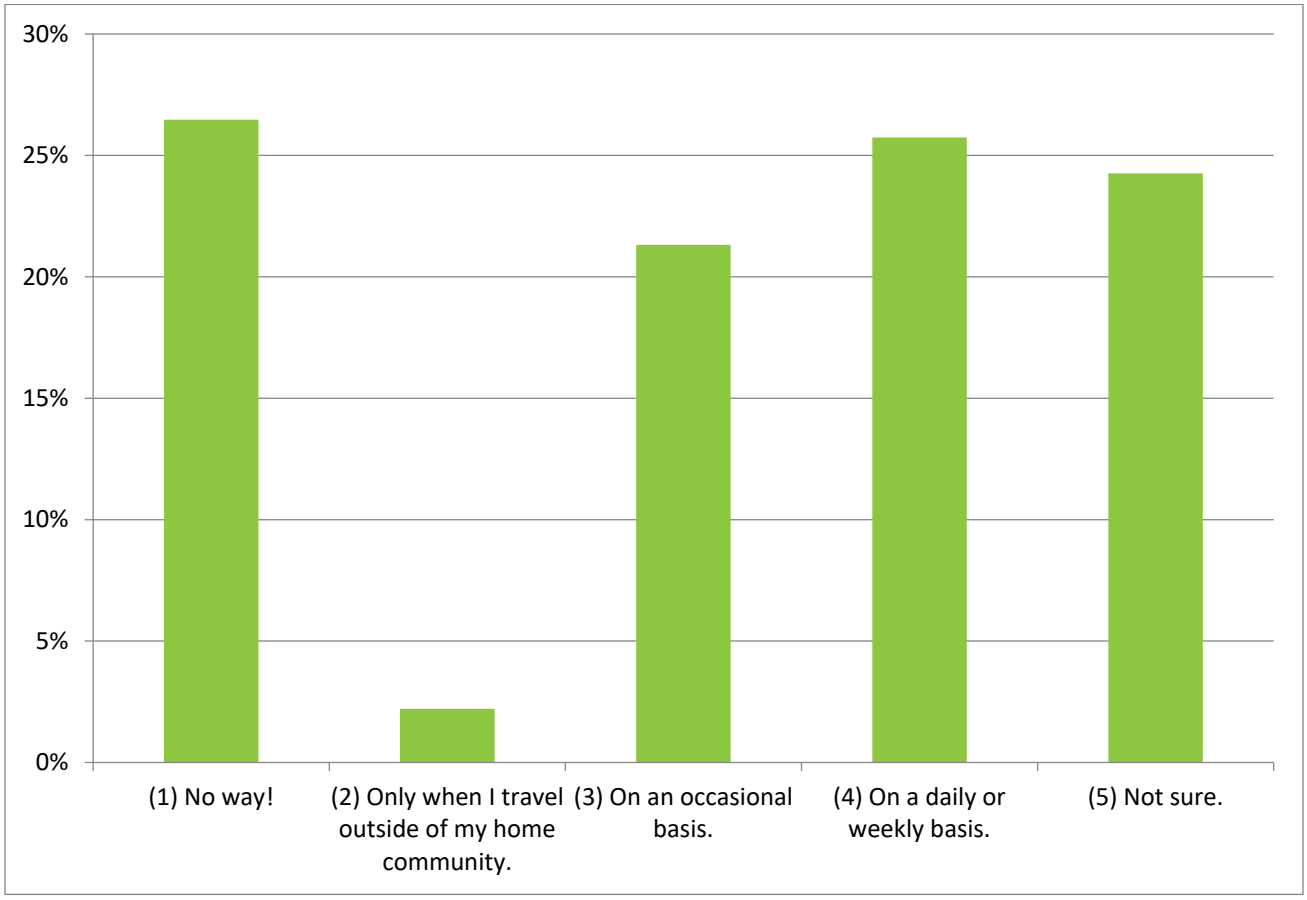
Question 5 – What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
(1) Sale or lease prices are too high.	51.69%	61
(2) Miles per charge are insufficient to meet my needs.	34.75%	41
(3) There are not enough public charging locations.	51.69%	61
(4) More tax credits, or other incentives, are needed	26.27%	31
(5) Other Reason(s) (Please explain)	31.36%	37
	Answered	118
	Skipped	18



Question 6 – When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself driving one?

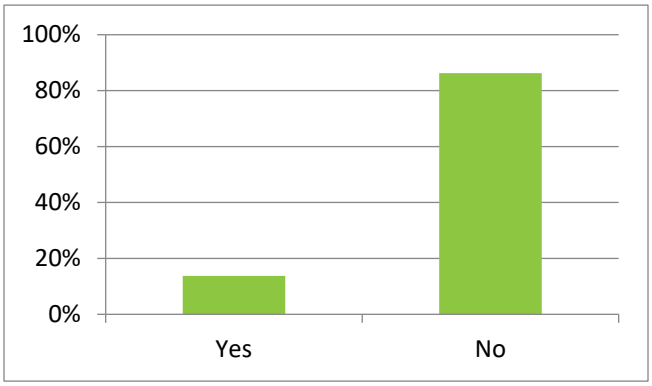
Answer Choices	Responses	
(1) No way!	26.47%	36
(2) Only when I travel outside of my home community.	2.21%	3
(3) On an occasional basis.	21.32%	29
(4) On a daily or weekly basis.	25.74%	35
(5) Not sure.	24.26%	33
	Answered	136
	Skipped	0



Grays Harbor County

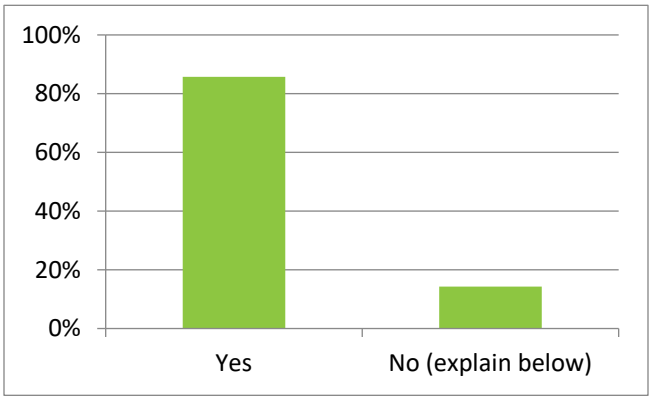
Question 1 – Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
Yes	13.73%	7
No	86.27%	44
	Answered	51
	Skipped	0



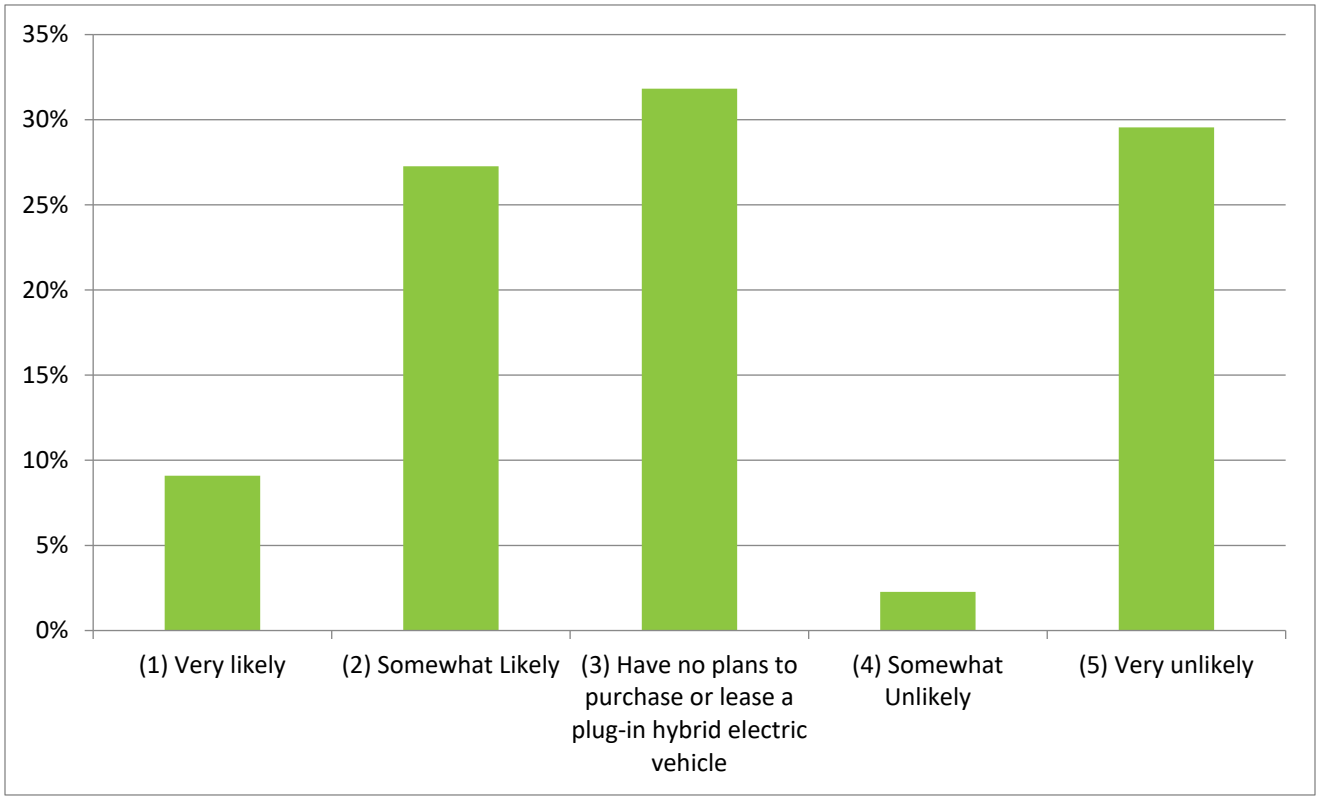
Question 2 – Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

Answer Choices	Responses	
Yes	85.71%	6
No	14.29%	1
	Answered	7
	Skipped	44



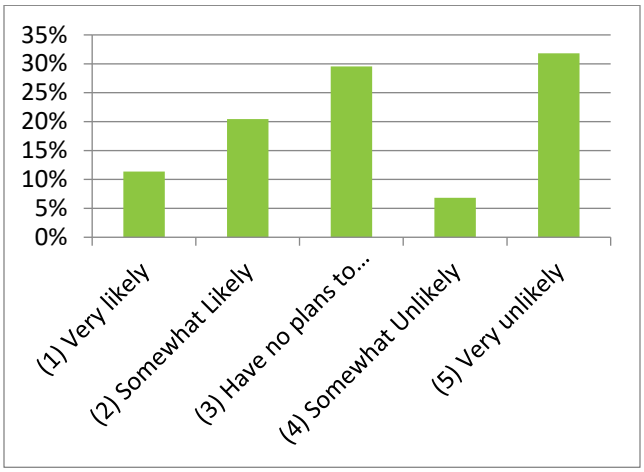
Question 3 – In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

Answer Choices	Responses	
(1) Very likely	9.09%	4
(2) Somewhat Likely	27.27%	12
(3) Have no plans to purchase or lease a plug-in hybrid electric vehicle	31.82%	14
(4) Somewhat Unlikely	2.27%	1
(5) Very unlikely	29.55%	13
	Answered	44
	Skipped	7



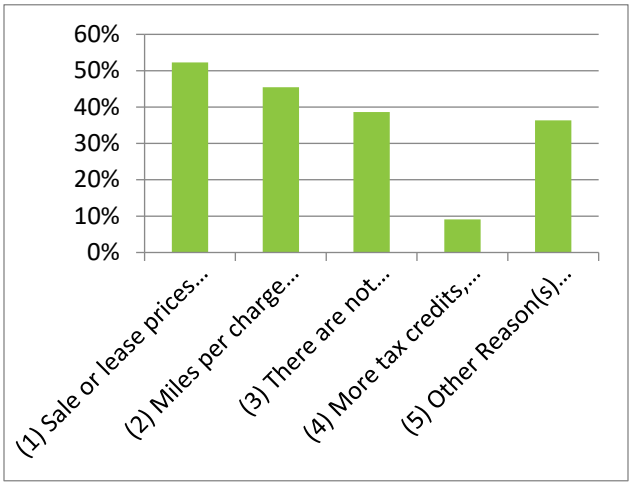
Question 4 – In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

Answer Choices	Responses	
(1) Very likely	11.36%	5
(2) Somewhat Likely	20.45%	9
(3) Have no plans to purchase or lease a battery-only electric vehicle	29.55%	13
(4) Somewhat Unlikely	6.82%	3
(5) Very unlikely	31.82%	14
	Answered	44
	Skipped	7



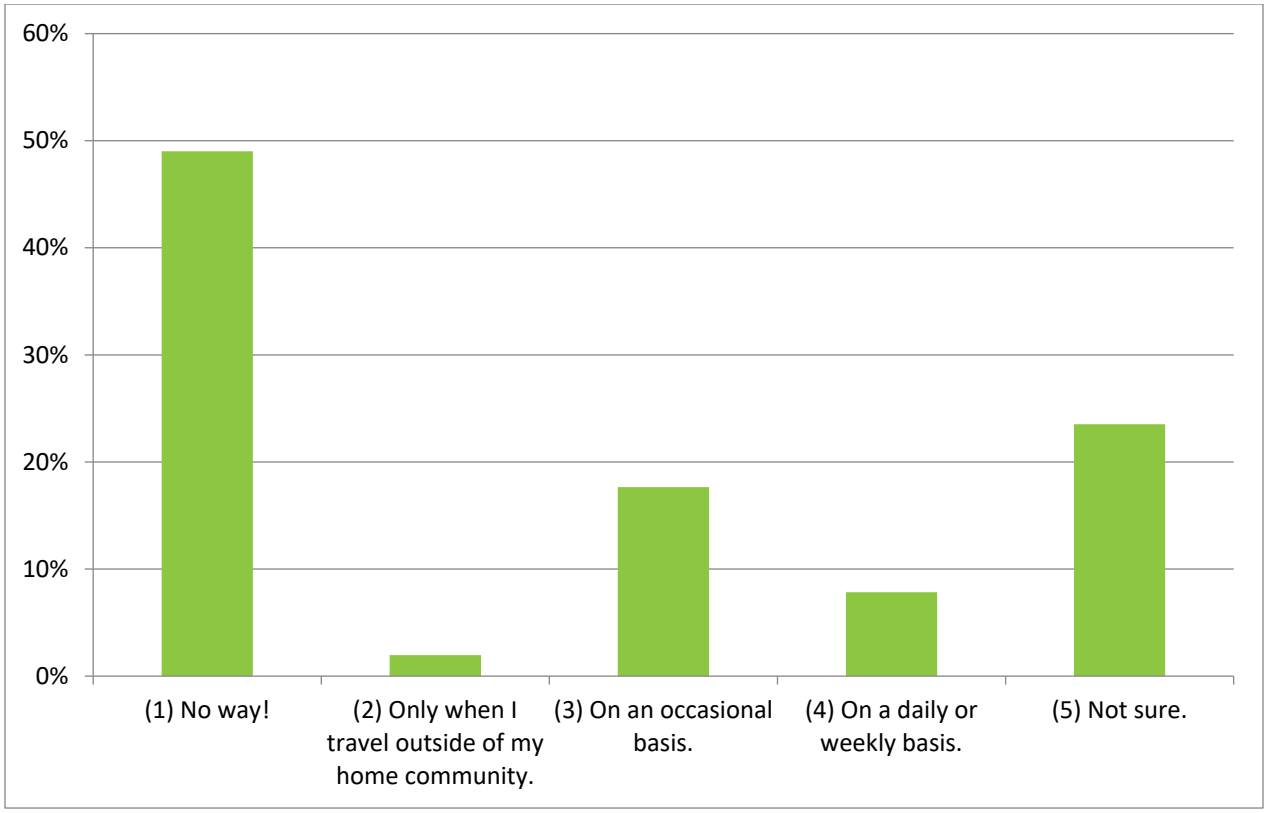
Question 5 – What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
(1) Sale or lease prices are too high.	52.27%	23
(2) Miles per charge are insufficient to meet my needs.	45.45%	20
(3) There are not enough public charging locations.	38.64%	17
(4) More tax credits, or other incentives, are needed	9.09%	4
(5) Other Reason(s) (Please explain)	36.36%	16
	Answered	44
	Skipped	7



Question 6 – When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself driving one?

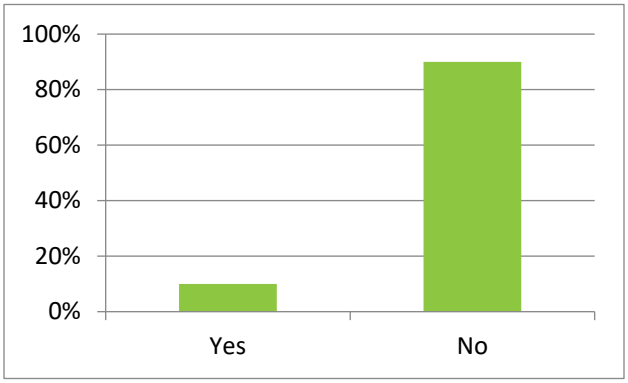
Answer Choices	Responses	
(1) No way!	49.02%	25
(2) Only when I travel outside of my home community.	1.96%	1
(3) On an occasional basis.	17.65%	9
(4) On a daily or weekly basis.	7.84%	4
(5) Not sure.	23.53%	12
	Answered	51
	Skipped	0



Lewis County

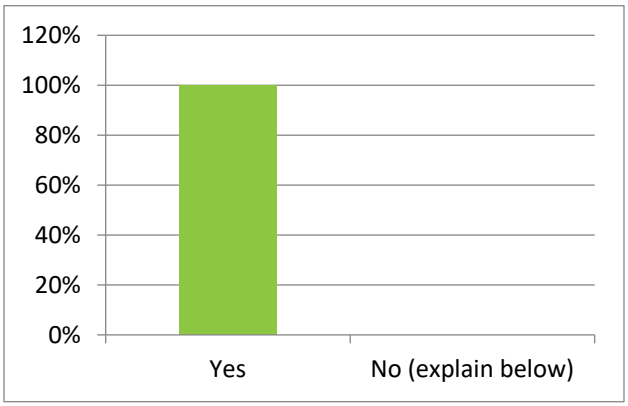
Question 1 – Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
Yes	10.00%	5
No	90.00%	45
	Answered	50
	Skipped	0



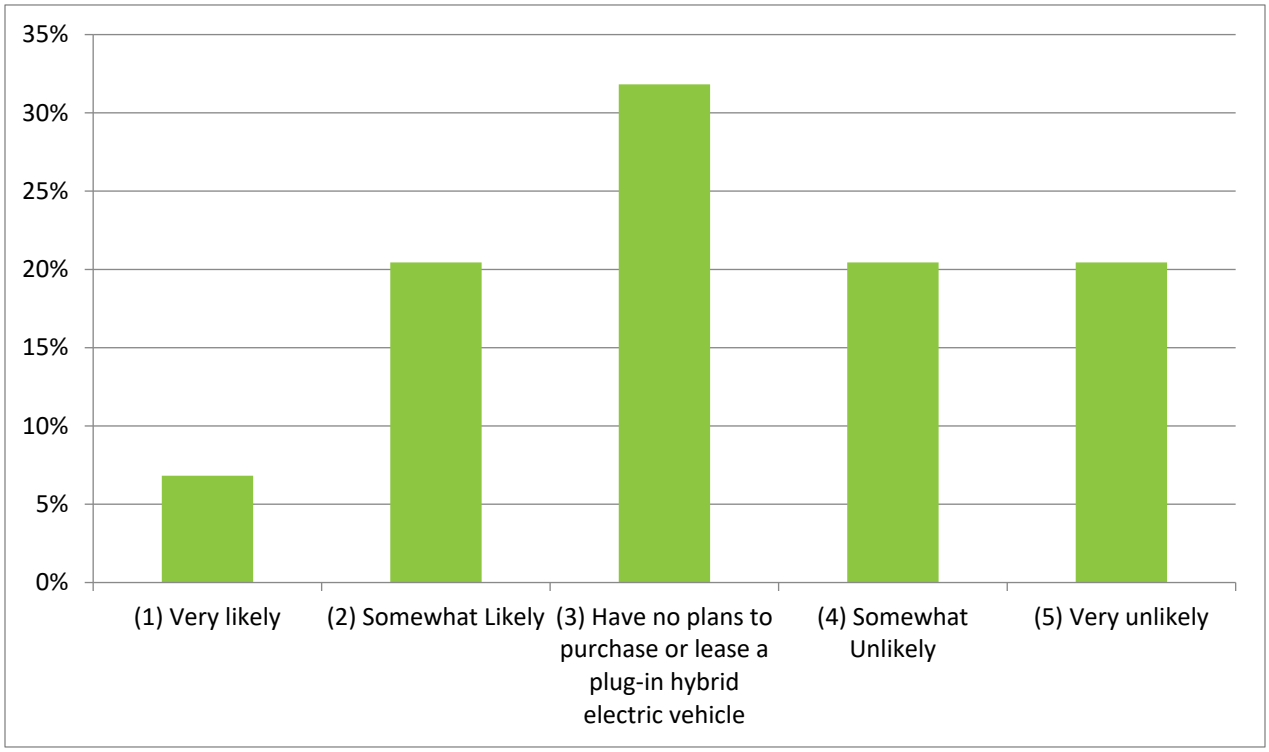
Question 2 – Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

Answer Choices	Responses	
Yes	100.00%	5
No	0.00%	0
	Answered	5
	Skipped	45



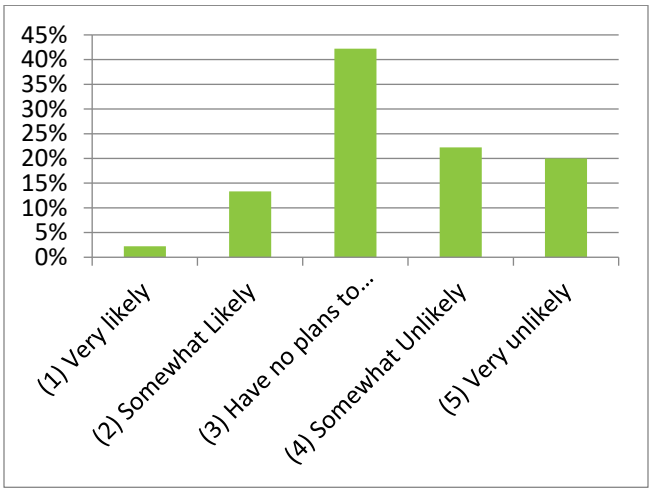
Question 3 – In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

Answer Choices	Responses	
(1) Very likely	6.82%	3
(2) Somewhat Likely	20.45%	9
(3) Have no plans to purchase or lease a plug-in hybrid electric vehicle	31.82%	14
(4) Somewhat Unlikely	20.45%	9
(5) Very unlikely	20.45%	9
	Answered	44
	Skipped	6



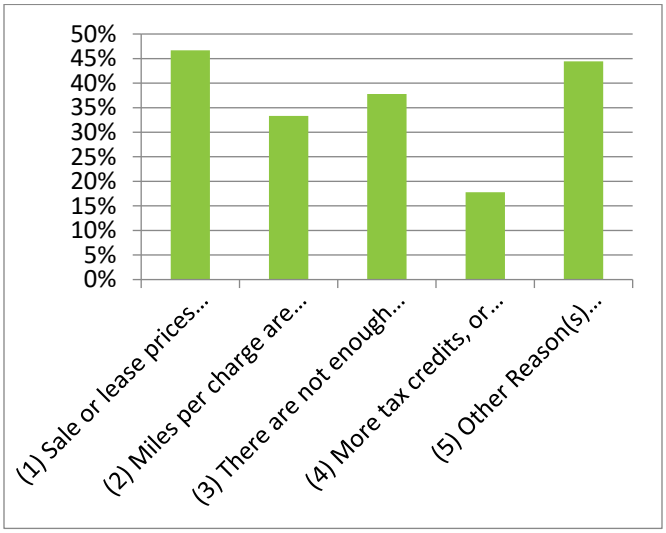
Question 4 – In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

Answer Choices	Responses	
(1) Very likely	2.22%	1
(2) Somewhat Likely	13.33%	6
(3) Have no plans to purchase or lease a battery-only electric vehicle	42.22%	19
(4) Somewhat Unlikely	22.22%	10
(5) Very unlikely	20.00%	9
	Answered	45
	Skipped	5



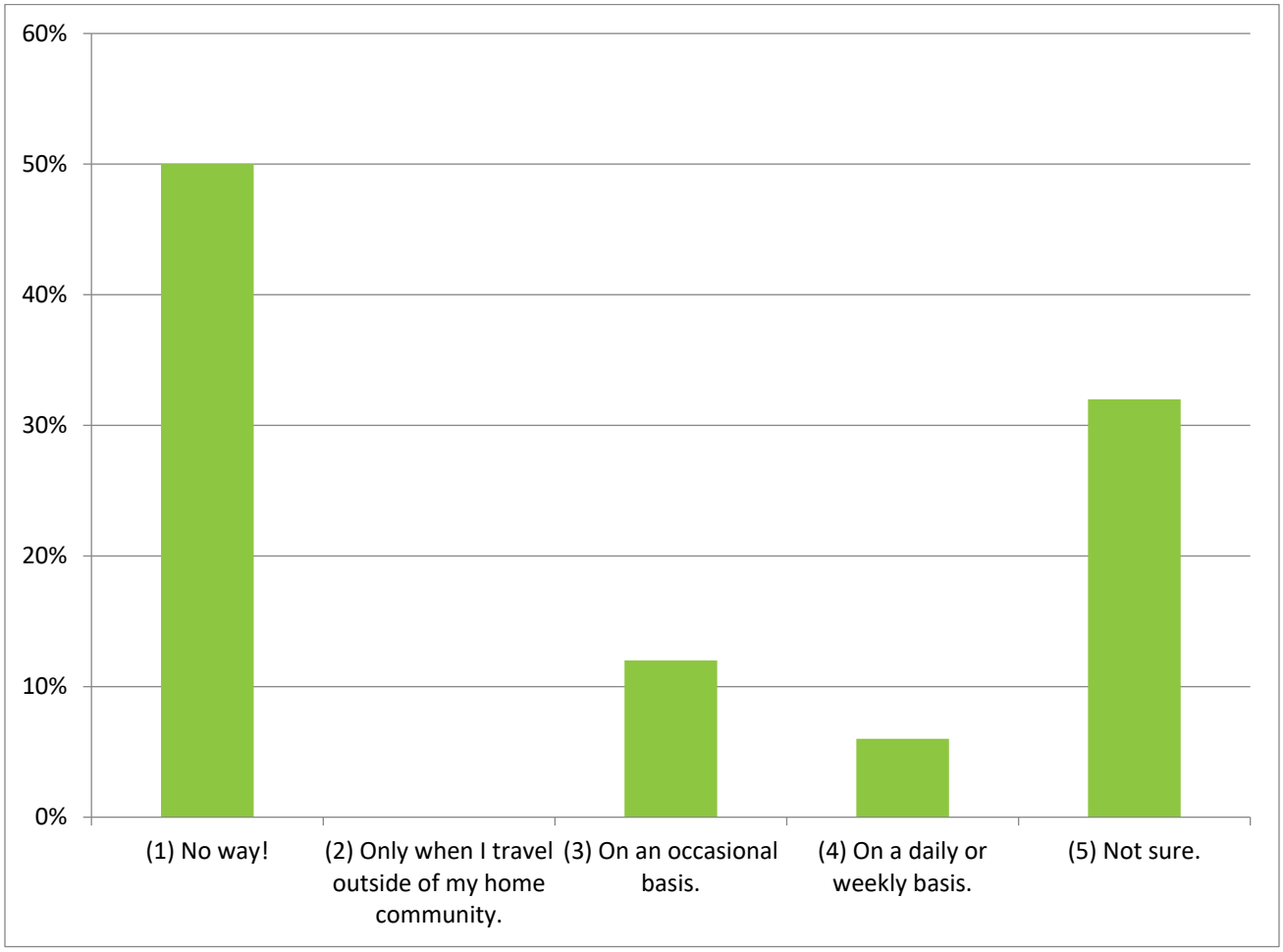
Question 5 – What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
(1) Sale or lease prices are too high.	46.67%	21
(2) Miles per charge are insufficient to meet my needs.	33.33%	15
(3) There are not enough public charging locations.	37.78%	17
(4) More tax credits, or other incentives, are needed	17.78%	8
(5) Other Reason(s) (Please explain)	44.44%	20
	Answered	45
	Skipped	5



Question 6 – When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself driving one?

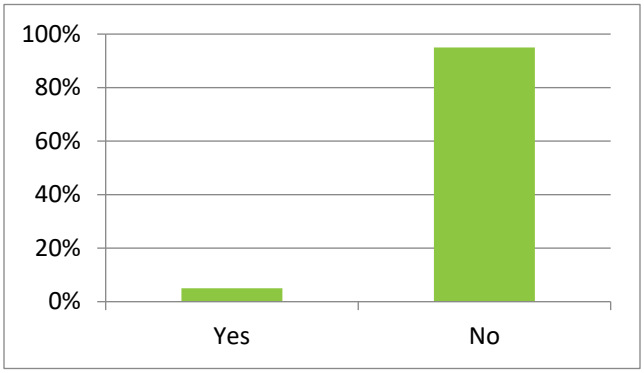
Answer Choices	Responses	
(1) No way!	50.00%	25
(2) Only when I travel outside of my home community.	0.00%	0
(3) On an occasional basis.	12.00%	6
(4) On a daily or weekly basis.	6.00%	3
(5) Not sure.	32.00%	16
	Answered	50
	Skipped	0



Pacific County

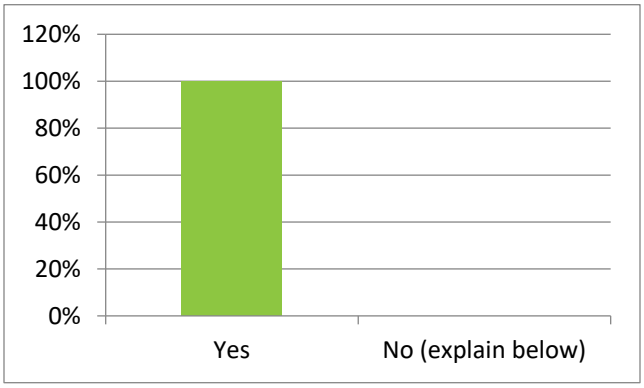
Question 1 – Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
Yes	5.00%	1
No	95.00%	19
	Answered	20
	Skipped	0



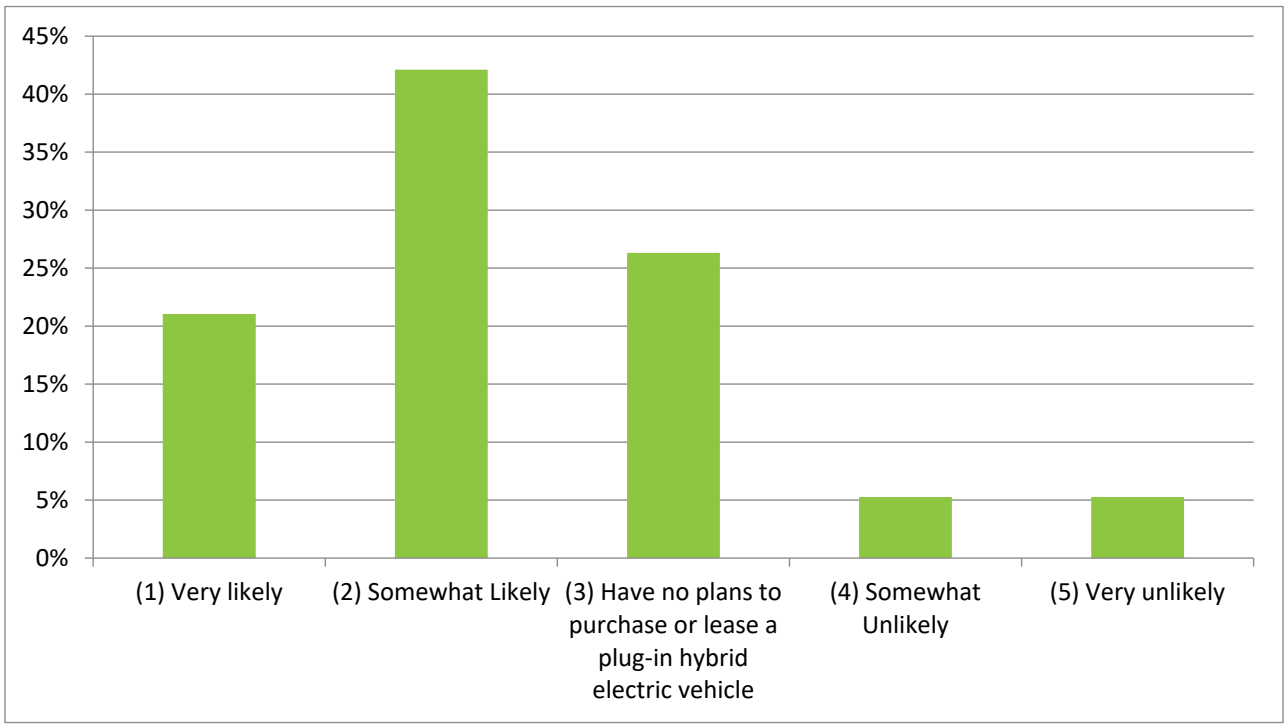
Question 2 – Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

Answer Choices	Responses	
Yes	100.00%	1
No	0.00%	0
	Answered	1
	Skipped	19



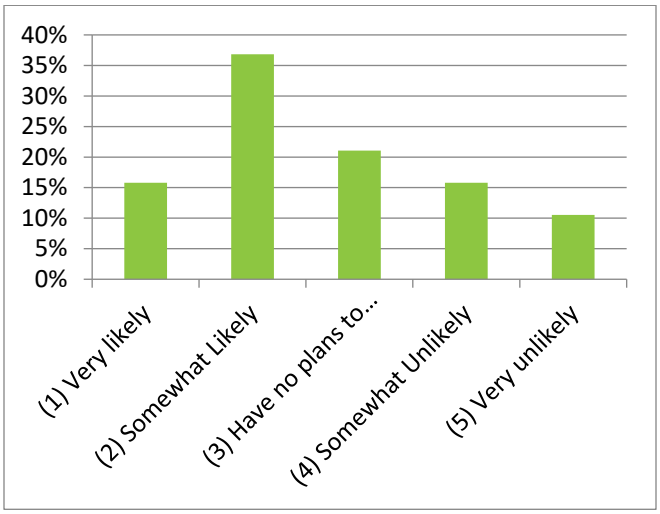
Question 3 – In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

Answer Choices	Responses	
(1) Very likely	21.05%	4
(2) Somewhat Likely	42.11%	8
(3) Have no plans to purchase or lease a plug-in hybrid electric vehicle	26.32%	5
(4) Somewhat Unlikely	5.26%	1
(5) Very unlikely	5.26%	1
	Answered	19
	Skipped	1



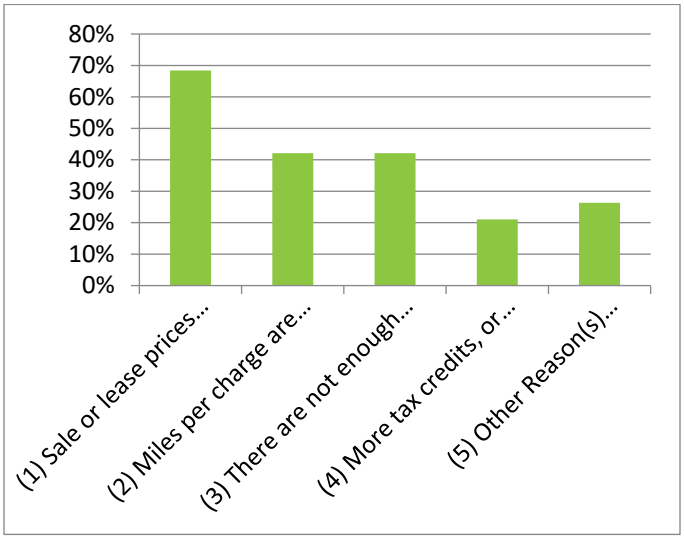
Question 4 – In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

Answer Choices	Responses	
(1) Very likely	15.79%	3
(2) Somewhat Likely	36.84%	7
(3) Have no plans to purchase or lease a battery-only electric vehicle	21.05%	4
(4) Somewhat Unlikely	15.79%	3
(5) Very unlikely	10.53%	2
	Answered	19
	Skipped	1



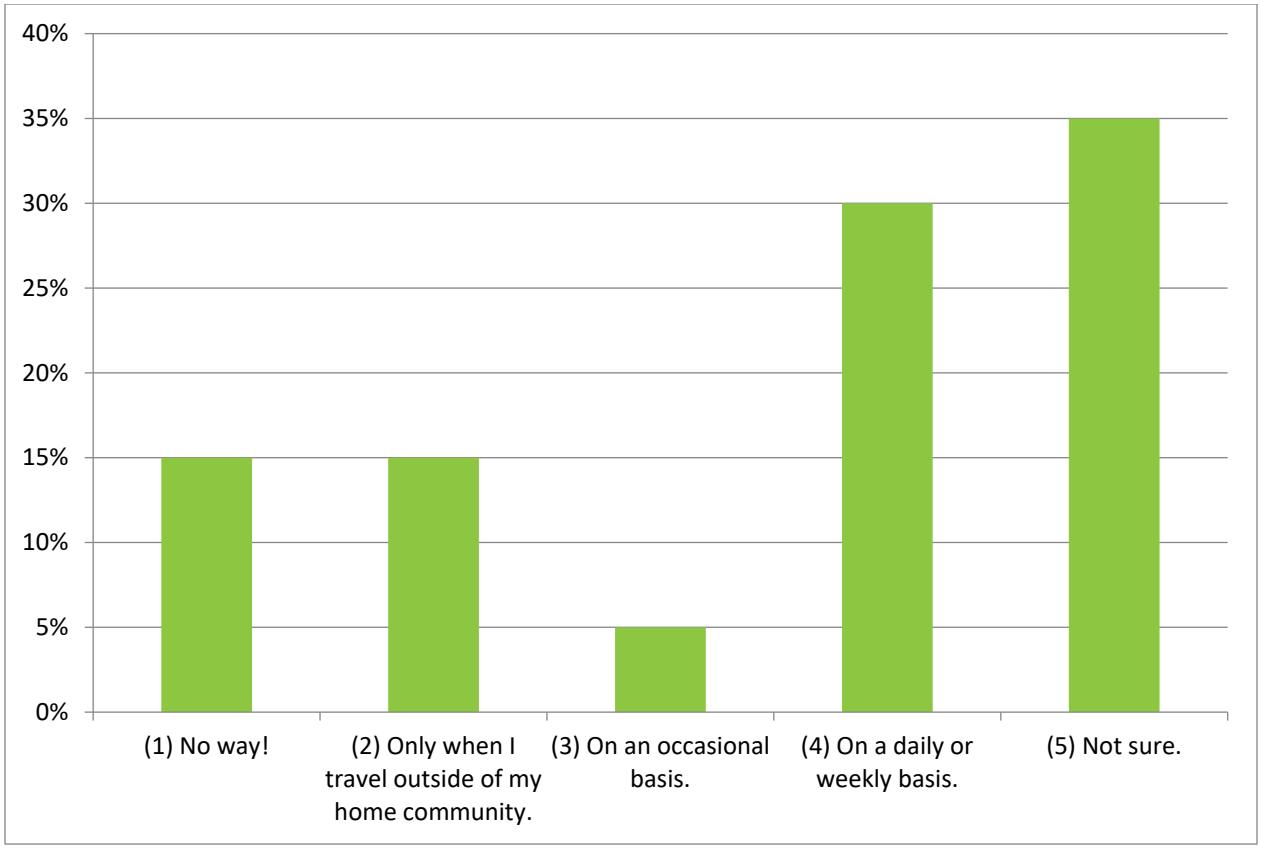
Question 5 – What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
(1) Sale or lease prices are too high.	68.42%	13
(2) Miles per charge are insufficient to meet my needs.	42.11%	8
(3) There are not enough public charging locations.	42.11%	8
(4) More tax credits, or other incentives, are needed	21.05%	4
(5) Other Reason(s) (Please explain)	26.32%	5
	Answered	19
	Skipped	1



Question 6 – When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself driving one?

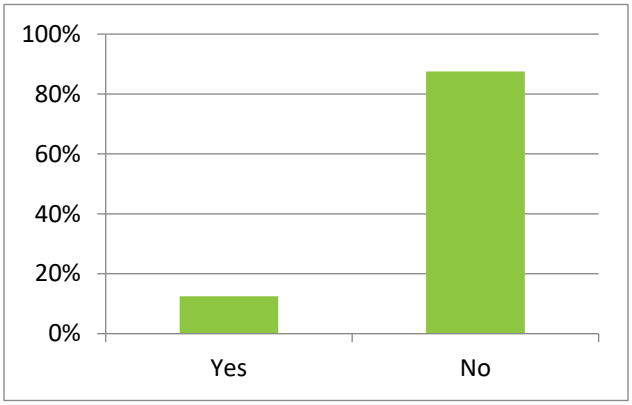
Answer Choices	Responses	
(1) No way!	15.00%	3
(2) Only when I travel outside of my home community.	15.00%	3
(3) On an occasional basis.	5.00%	1
(4) On a daily or weekly basis.	30.00%	6
(5) Not sure.	35.00%	7
	Answered	20
	Skipped	0



Wahkiakum County

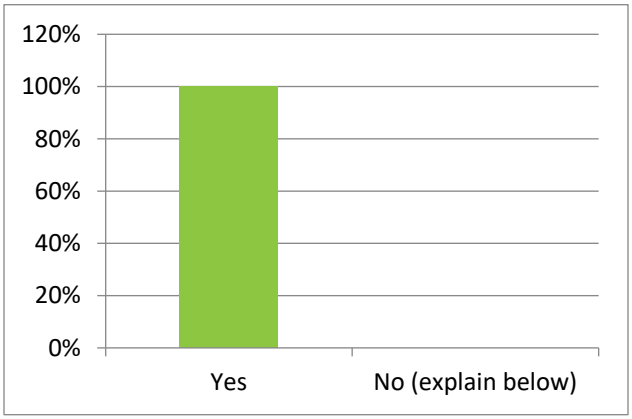
Question 1 – Do you currently own or lease an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
Yes	12.50%	1
No	87.50%	7
	Answered	8
	Skipped	0



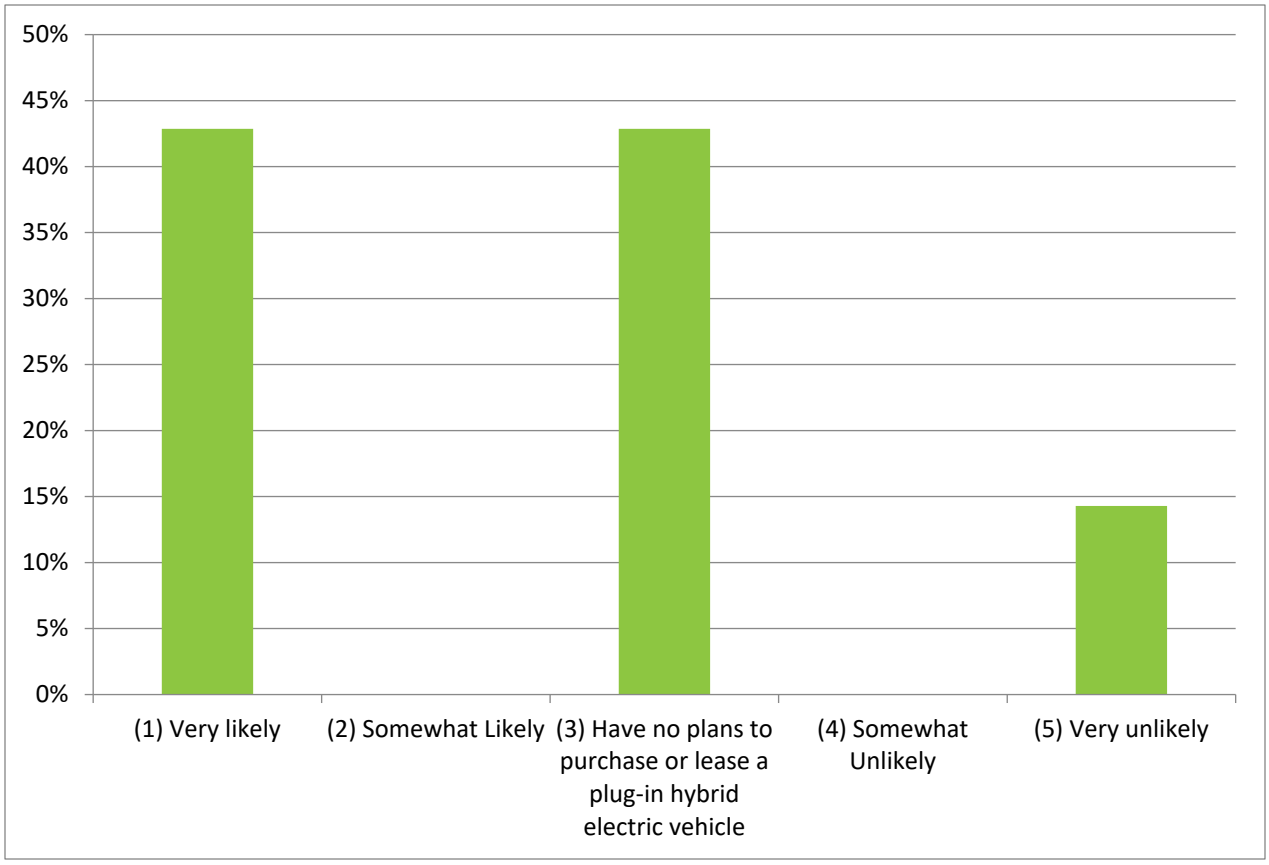
Question 2 – Would you purchase or lease an electric vehicle (battery-only or plug-in hybrid) again?

Answer Choices	Responses	
Yes	100.00%	1
No	0.00%	0
	Answered	1
	Skipped	7



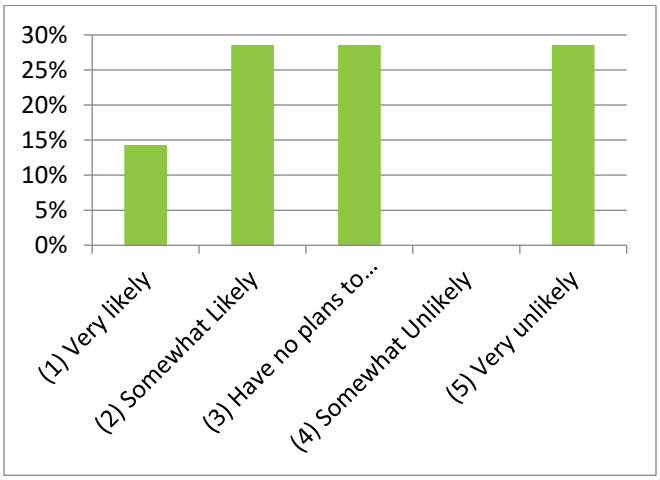
Question 3 – In the next five to ten years are you likely to purchase or lease a plug-in hybrid electric vehicle?

Answer Choices	Responses	
(1) Very likely	42.86%	3
(2) Somewhat Likely	0.00%	0
(3) Have no plans to purchase or lease a plug-in hybrid electric vehicle	42.86%	3
(4) Somewhat Unlikely	0.00%	0
(5) Very unlikely	14.29%	1
	Answered	7
	Skipped	1



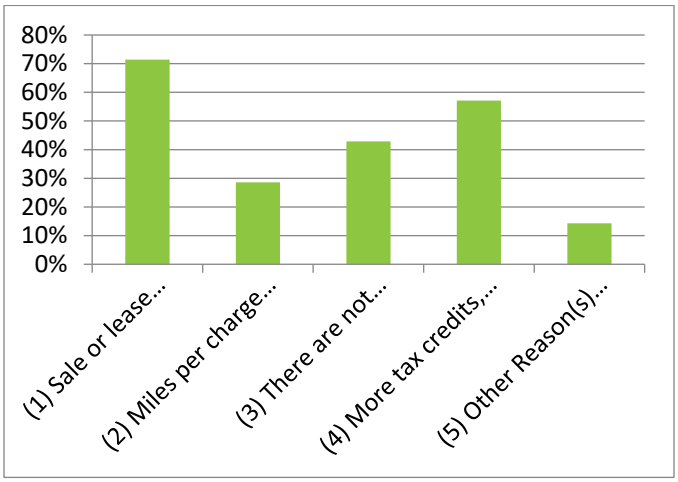
Question 4 – In the next five to ten years are you likely to purchase or lease a battery-only electric vehicle?

Answer Choices	Responses	
(1) Very likely	14.29%	1
(2) Somewhat Likely	28.57%	2
(3) Have no plans to purchase or lease a battery-only electric vehicle	28.57%	2
(4) Somewhat Unlikely	0.00%	0
(5) Very unlikely	28.57%	2
	Answered	7
	Skipped	1



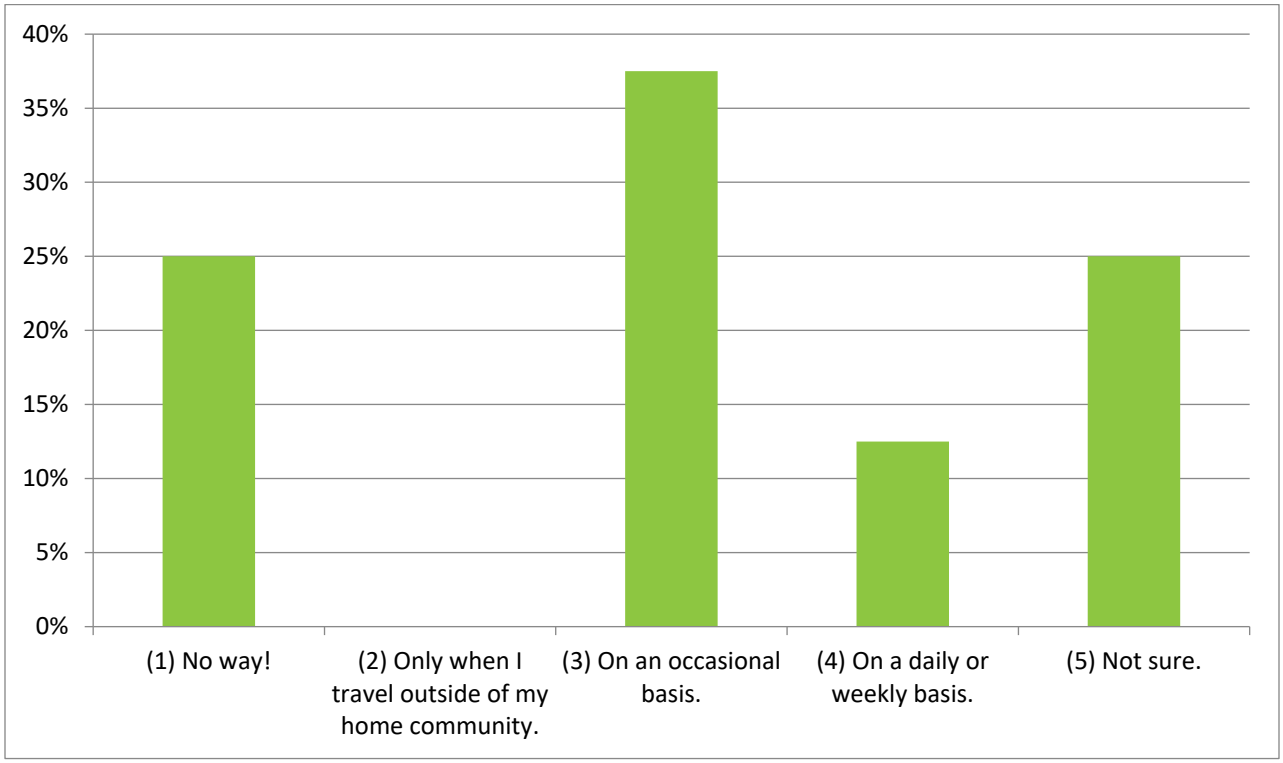
Question 5 – What is preventing you from purchasing or leasing an electric vehicle (battery-only or plug-in hybrid)?

Answer Choices	Responses	
(1) Sale or lease prices are too high.	71.43%	5
(2) Miles per charge are insufficient to meet my needs.	28.57%	2
(3) There are not enough public charging locations.	42.86%	3
(4) More tax credits, or other incentives, are needed	57.14%	4
(5) Other Reason(s) (Please explain)	14.29%	1
	Answered	7
	Skipped	1



Question 6 – When fully autonomous vehicles (vehicles that drive us instead of us driving them) are available in the future, do you see yourself driving one?

Answer Choices	Responses	
(1) No way!	25.00%	2
(2) Only when I travel outside of my home community.	0.00%	0
(3) On an occasional basis.	37.50%	3
(4) On a daily or weekly basis.	12.50%	1
(5) Not sure.	25.00%	2
	Answered	8
	Skipped	0



Appendix D Freight Stakeholders Connected and Autonomous Vehicle Technology Survey

CWCOG conducted a short, online survey via SurveyMonkey.com from October 28, 2019 to January 17, 2020. The survey was available in a hard-copy format upon request. This Connected and Autonomous Vehicle Technology Survey asked respondents to answer six (6) questions. The remainder of this appendix includes images of the paper version of the survey. Appendix E includes the survey results.

Freight Stakeholders
Connected and Autonomous Vehicle Technology Survey

Section A – Background

The Cowlitz-Wahkiakum Council of Governments (CWCOG) is working on an Electric Vehicle Readiness and Connected and Autonomous Vehicle Plan for its metropolitan and regional transportation planning programs serving the geographic area of Longview-Kelso, WA and Rainier, OR as well as the five counties of Cowlitz, Grays Harbor, Lewis, Pacific, and Wahkiakum. The primary purpose of this work is to develop a guide for local agencies, stakeholders, and others as an initial framework for future planning and coordination concerning electric vehicles and connected and autonomous vehicles.

The freight industry in our region will likely experience the impact of connected and autonomous vehicles first. As such CWCOG is using this survey to gather feedback from freight stakeholders (private business, elected officials, local agency staff, and state and federal government) regarding this emerging technology.

To learn more about the technology and possible freight impacts, please refer to a presentation by Transpo Group at CWCOG's recent Freight Stakeholders meeting here, https://www.dropbox.com/s/7xls41uet24gy79/TranspoPresentation.pdf?dl=0. Below are a few key definitions.

- **Connected Vehicle:** Communicates with nearby vehicles and infrastructure with human control.
- **Autonomous Vehicle:** Operates in isolation from other vehicles with use of an internal sensor with minimal human assistance.
- **Connected & Autonomous Vehicle:** Combines features of both a connected and autonomous vehicle.

Thank you for taking a few minutes of your time to complete this survey! Your feedback is important. The survey is also available online at this link (www.surveymonkey.com/r/CAVFreightSurvey).

Section B – Who you represent

1. Please provide the zip code of the business or agency you represent. For businesses or agencies with multiple locations, please use the one where you do your work. _____

2. Please select the best description for the business or agency you represent.
   a. Private Trucking Business
   b. Port District
   c. Private Business with Significant Third-Party Trucking Activity
   d. Private Business without Significant Third-Party Trucking Activity
   e. City or County Government
   f. State or Federal Government
   g. Other (please specify): _____

IF YOUR ANSWER TO QUESTION 2 WAS (a), (b), (c), or (d) PLEASE COMPLETE SECTIONS 'C1' AND 'D'.
IF YOUR ANSWER TO QUESTION 2 WAS (e) or (g) PLEASE COMPLETE SECTIONS 'C2' AND 'D'.
IF YOUR ANSWER TO QUESTION 2 WAS (f) PLEASE COMPLETE SECTIONS 'C3' AND 'D'.

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Section C1 – Connected and Autonomous Vehicle Impacts

For the next two questions, please take a moment and think about connected and autonomous vehicle technology and how it may impact your business or agency and/or the freight industry in the future.

3. On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Concerned', what is the level of ***worry*** or ***concern*** you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

	1	2	3	4	5	Not Sure
Travel is easier and reinforces sprawl and the need for new roads.						
Travel is easier and vehicle miles traveled increases.						
Overall the transportation system for all users including motor vehicles, trucks, bicycles, and pedestrians becomes less safe.						
Connected and autonomous vehicles sharing the road with human-operated vehicles creates more legal issues to address.						
Public health and the environment are negatively impacted due to more emissions from increasing vehicle miles traveled and with some vehicles still being powered by gasoline.						
The loss of jobs for truck drivers.						
The shortage of truck parking is still an issue with more trucks on the road.						

4. On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Hopeful', what is the level of ***hope*** you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

	1	2	3	4	5	Not Sure
The transportation system is safer with fatal and serious injury crashes significantly reduced.						
Traffic efficiency is improved and travel times are more reliable.						
Traffic efficiency is improved with connected and autonomous vehicle technology allowing trucks to travel mostly at night.						
Reduced vehicle emissions lead to an improved environment and better public health.						
Increased efficiencies mean reduced labor costs.						
Truck driver jobs are not lost, but replaced with other tasks.						
Mandatory rest breaks are reduced since the job of a truck driver involves new tasks not requiring as many breaks.						
With less mandatory breaks required, the need for short-term truck parking is reduced and the current truck parking shortage is less of an issue.						

Section C2 – Connected and Autonomous Vehicle Impacts

For the next two questions, please take a moment and think about connected and autonomous vehicle technology and how it may impact your agency and/or the freight industry in the future.

3. On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Concerned', what is the level of ***worry*** or ***concern*** you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

	1	2	3	4	5	Not Sure
Travel is easier and reinforces sprawl and the need for new roads.						
Travel is easier and vehicle miles traveled increases.						
Overall the transportation system is less safe for motor vehicles and trucks.						
Overall the transportation system is less safe for bicycles and pedestrians.						
Public health and the environment are negatively impacted due to more emissions from increasing vehicle miles traveled and with some vehicles still being powered by gasoline.						
The ease of mobility reduces the demand for public transit and negatively impacts the budget of transit agencies.						
The cost of connected and autonomous vehicles is too high and access to the technology is not an option for lower income communities.						
Expensive new traffic signals, signs, road striping, or other improvements end up being needed to accommodate connected and autonomous vehicles.						
Connected and autonomous vehicles sharing the road with human-operated vehicles creates more legal issues to address.						

4. On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Hopeful', what is the level of ***hope*** you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

	1	2	3	4	5	Not Sure
The transportation system is safer with fatal and serious injury crashes significantly reduced.						
Traffic efficiency is improved and travel times are more reliable.						
Traffic efficiency is improved with connected and autonomous vehicle technology allowing trucks to travel mostly at night.						
Reduced vehicle emissions lead to an improved environment and better public health.						
Connected and autonomous vehicles as a shared service improves transportation for people who do not own a vehicle.						

Section C3 – Connected and Autonomous Vehicle Impacts

For the next two questions, please take a moment to think about your ***worries*** or ***concerns*** and ***hopes*** concerning connected and autonomous vehicle technology and possible impacts to the freight industry in the future.

3. What are your top three (3) ***worries*** or ***concerns*** about how connected and autonomous vehicle technology may impact the freight industry in the next 20 years.

4. What are your top three (3) ***hopes*** about how connected and autonomous vehicle technology may impact the freight industry in the next 20 years.

Section D – Wrap Up

5. Please use the space below to share with us any other worries, concerns, or hopes you have regarding connected and autonomous vehicle technology.

6. (Optional Question) Please provide your contact information to stay informed about upcoming freight-related meetings or current topics, and to receive updates on the *Electric Vehicle Readiness and Connected and Autonomous Vehicle Plan*.

   Name: _____

   Business/Agency Name: _____

   Email: _____

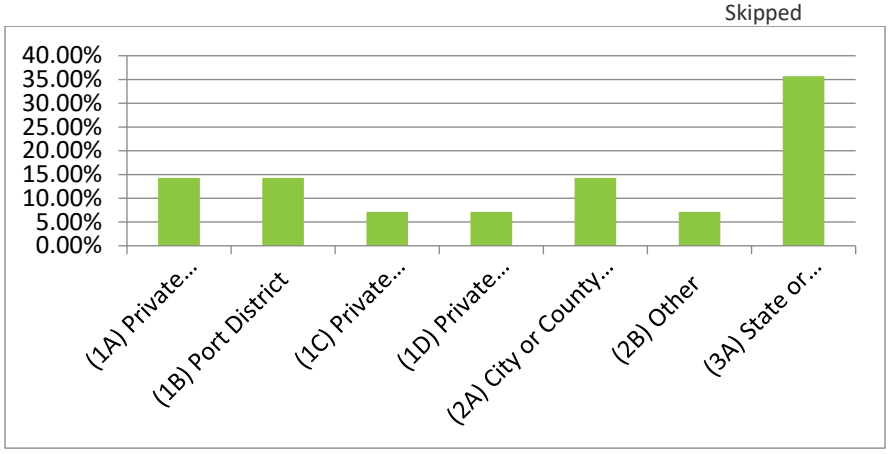
Appendix E Freight Stakeholders Connected and Autonomous Vehicle Technology Survey - Results

Question 1: Please provide the zip code of the business or agency you represent. For businesses or agencies with multiple locations, please use the one where you do your work.

Zip Code	Largest Incorporated City Associated with Zip Code	County	Number of Responses
98626	Kelso, WA	Cowlitz	3
98632	Longview, WA	Cowlitz	3
98674	Woodland, WA	Cowlitz	1
98557	McCleary, WA	Grays Harbor	1
98612	Cathlamet, WA	Wahkiakum	1
98043	Mountlake Terrace, WA	Snohomish	1
98682	Vancouver, WA	Clark	2
		Answered	12
		Skipped	2

Question 2: Please select the best description for the business or agency you represent.

Answer Choices	Responses	
(1A) Private Trucking Business	14.29%	2
(1B) Port District	14.29%	2
(1C) Private Business with Significant Third-Party Trucking Activity	7.14%	1
(1D) Private Business without Significant Third-Party Trucking Activity	7.14%	1
(2A) City or County Government	14.29%	2
(2B) Other	7.14%	1
(3A) State or Federal Government	35.71%	5
	Answered	14
	Skipped	0



Depending on the Question 2 answer, one of three versions of Questions 3 and 4 was asked. A Question 2 response of 1A, 1B, 1C, or 1D then presented the following version of Questions 3 and 4.

Question 3: On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Concerned', what is the level of worry or concern you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

Answer Choices	Responses (Level of Concern – 1 to 5)						
	1	2	3	4	5	Not Sure	Total
Travel is easier and reinforces sprawl and the need for new roads.	0	1	2	1	1	0	5
Travel is easier and vehicle miles traveled increases.	1	1	1	1	1	0	5
Overall the transportation system for all users including motor vehicles, trucks, bicycles, and pedestrians becomes less safe.	1	2	0	0	2	0	5
Connected and autonomous vehicles sharing the road with human-operated vehicles creates more legal issues to address.	0	2	1	0	2	0	5
Public health and the environment are negatively impacted due to more emissions from increasing vehicle miles traveled and with some vehicles still being powered by gasoline.	2	2	0	1	0	0	5
The loss of jobs for truck drivers.	0	1	2	1	1	0	5
The shortage of truck parking is still an issue with more trucks on the road.	0	0	3	1	1	0	5
						Answered	5
						Skipped	1

Question 4: On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Hopeful', what is the level of hope you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

Answer Choices	Responses (Level of Hope – 1 to 5)						
	1	2	3	4	5	Not Sure	Total
The transportation system is safer with fatal and serious injury crashes significantly reduced.	0	0	1	3	1	0	5
Traffic efficiency is improved and travel times are more reliable.	0	1	1	2	1	0	5
Traffic efficiency is improved with connected and autonomous vehicle technology allowing trucks to travel mostly at night.	1	0	1	1	2	0	5
Reduced vehicle emissions lead to an improved environment and better public health.	0	1	1	2	1	0	5
Increased efficiencies mean reduced labor costs.	0	0	1	3	1	0	5
Truck driver jobs are not lost, but replaced with other tasks.	0	0	1	3	1	0	5
Mandatory rest breaks are reduced since the job of a truck driver involves new tasks not requiring as many breaks.	0	1	1	2	1	0	5
With less mandatory breaks required, the need for short-term truck parking is reduced and the current truck parking shortage is less of an issue.	0	1	2	1	1	0	5
						Answered	5
						Skipped	1

Depending on the Question 2 answer, one of three versions of Questions 3 and 4 was asked. A Question 2 response of 2A or 2B then presented the following version of Questions 3 and 4.

Question 3: On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Concerned', what is the level of worry or concern you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

Answer Choices	Responses (Level of Concern – 1 to 5)						
	1	2	3	4	5	Not Sure	Total
Travel is easier and reinforces sprawl and the need for new roads.	0	1	0	2	0	0	3
Travel is easier and vehicle miles traveled increases.	1	0	0	2	0	0	3
Overall the transportation system is less safe for motor vehicles and trucks.	0	0	2	0	1	0	3
Overall the transportation system is less safe for bicycles and pedestrians.	0	0	1	2	0	0	3
Public health and the environment are negatively impacted due to the manufacturing process to build connected and autonomous vehicles.	1	1	1	0	0	0	3
The ease of mobility reduces the demand for public transit and negatively impacts the budget of transit agencies.	2	0	0	1	0	0	3
The cost of connected and autonomous vehicles is too high and access to the technology is not an option for lower income communities.	1	1	0	0	1	0	3
Expensive new traffic signals, signs, road striping, or other improvements end up being needed to accommodate connected and autonomous vehicles.	0	0	0	1	2	0	3
Connected and autonomous vehicles sharing the road with human-operated vehicles creates more legal issues to address.	0	0	1	1	1	0	3
						Answered	3
						Skipped	0

Question 4: On a scale of 1 to 5 where 1 is 'None' and 5 is 'Very Hopeful', what is the level of hope you have about each of the following scenarios happening in the next 20 years as connected and autonomous vehicle technology becomes more common.

Answer Choices	Responses (Level of Hope – 1 to 5)						
	1	2	3	4	5	Not Sure	Total
The transportation system is safer with fatal and serious injury crashes significantly reduced.	0	0	0	2	1	0	3
Traffic efficiency is improved and travel times are more reliable.	0	0	0	2	1	0	3
Traffic efficiency is improved with connected and autonomous vehicle technology allowing trucks to travel mostly at night.	0	0	1	1	1	0	3
Reduced vehicle emissions lead to an improved environment and better public health.	0	1	1	1	0	0	3
Connected and autonomous vehicles as a shared service improves transportation for people who do not own a vehicle.	0	1	0	2	0	0	3
						Answered	3
						Skipped	0

Depending on the Question 2 answer, one of three versions of Questions 3 and 4 was asked. A Question 2 response of 3A then presented the following open-ended version of Questions 3 and 4. Below these versions of Questions 3 and 4 are individual responses written in.

Question 3: What are your top three (3) worries or concerns about how connected and autonomous vehicle technology may impact the freight industry in the next 20 years?

Out of five people taking the survey and being presented this version of Question 3, three people provided a response. Below are the couple of worries or concerns provided as a response.

- Safety of Malfunctioning Systems
- Security of Systems
- Lack of Participation Industry-wide
- General Safety

Question 4: What are your top three (3) hopes about how connected and autonomous vehicle technology may impact the freight industry in the next 20 years?

Out of five people taking the survey and being presented this version of Question 4, two people provided a response. Below are the hopes provided as a response.

- Reduction in crashes
- Increased reliability of the Roadway System
- Reduced Congestion

Question 5: Please use the space below to share with us any other worries, concerns, or hopes you have regarding connected and autonomous vehicle technology.

The table below lists the four people who shared other worries, concerns, or hopes. These responses were not edited from what was typed by the person responding.

Additional Worries, Concerns, or Hopes Shared
Adoption of these new technologies are allowed to proceed organically in order to allow the necessary time to develop the supporting infrastructure and systems for autonomous vehicle integration.
The amount of vehicles on the road is in itself very dangerous and not environmentally safe.
It appears that the industry is having a hard time agreeing on a single communication wavelength to standardize
I believe we are still a long way from fully autonomous vehicles and even then there may still be a driver in the truck, except in certain circumstances. Freight volumes will grow over the next two decades requiring more vehicles to travel on the roads. We need to continues to expand our highway infrastructure to accommodate the amount of traffic that will be on the highways. Expecting autonomous vehicles to solve the infrastructure capacity issues is extremely naïve and will greatly diminish our way of life if we do nothing.

Question 6: (Optional Question) Please provide your contact information to stay informed about upcoming freight-related meetings or current topics, and to receive updates on the Electric Vehicle Readiness and Connected and Autonomous Vehicle Plan.

Four of the people responding to the survey provided their contact information. The individual responses to this question are on file at the CWCOG offices and not included here.