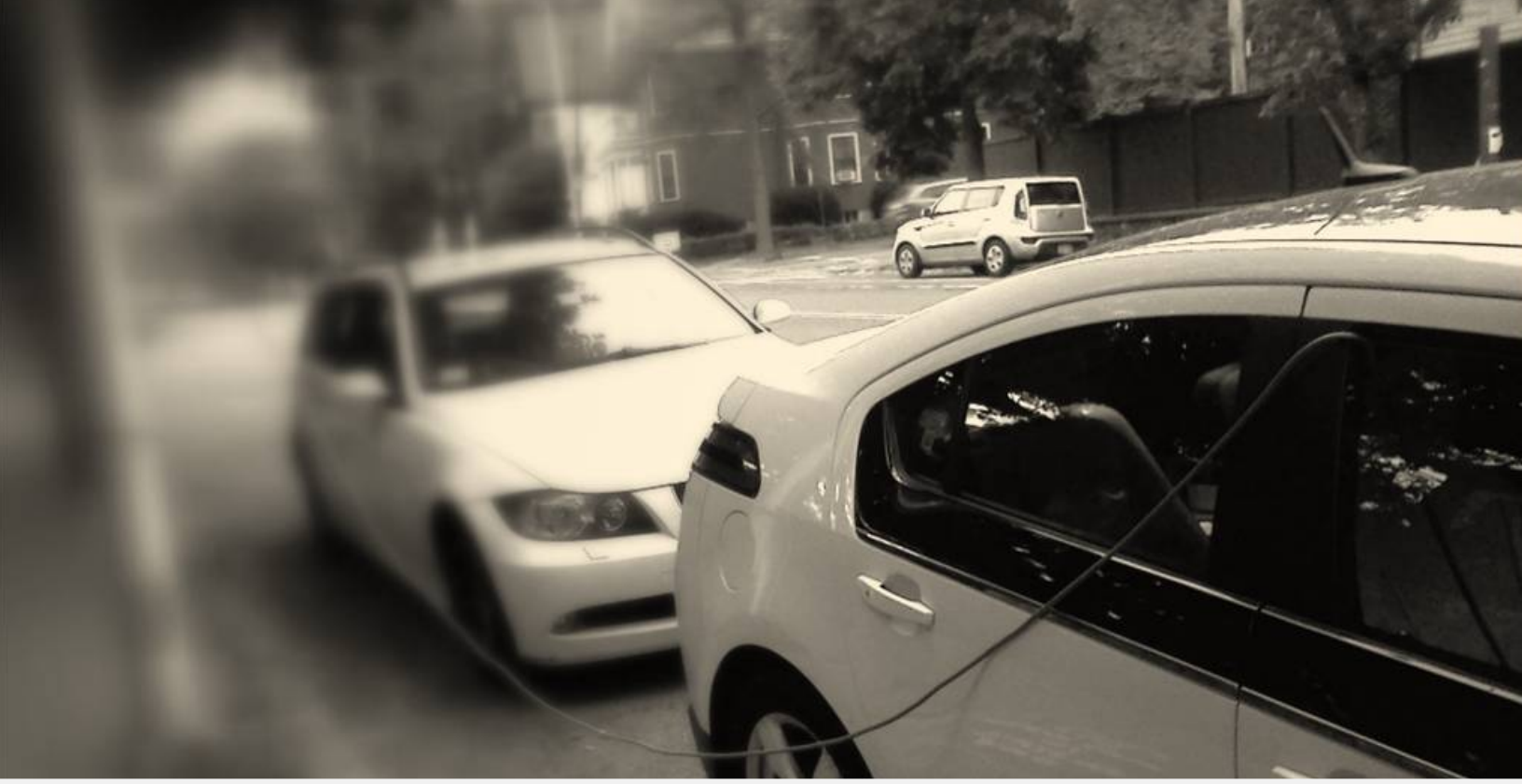

# Removing Barriers to Electric Vehicle Adoption by Increasing Access to Charging Infrastructure

**October 2014**

SEATTLE OFFICE OF
Sustainability & Environment

NELSON
NYGAARD

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Cover image adapted from John C. Briggs original

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## Terms

**AFV:** Alternative fuel vehicle

**CHAdeMO:** "CHArge de MOve," Trade name connector for direct current (DC) high-voltage electric vehicle charging

**DC:** Direct Current, seen as "DC/Fast Charge," a rapid charging EVSE

**EV:** Electric vehicle

**EREV:** Extended-range electric vehicle

**EVSE:** Electric vehicle supply equipment

**HEV:** Hybrid electric vehicle

**HOV:** High-occupancy vehicle

**OSE:** Seattle Office of Sustainability & Environment

**PEV:** Plug-in electric vehicle

**PHEV:** Plug-in hybrid electric vehicle

**SAE J1772:** North American standard for electric vehicle connectors, maintained by Society of Automotive Engineers

**SAE J1772-2009 Combo:** SAE-approved fast-charging combo protocol

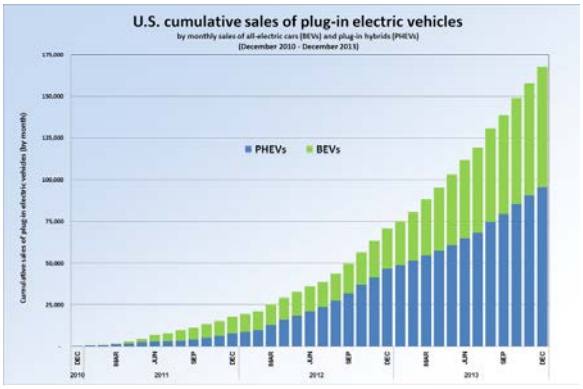
**SCL:** Seattle City Light

**ZEV:** Zero-emission vehicle

# 1 EXECUTIVE SUMMARY

## STUDY PURPOSE AND METHODOLOGY

Figure 1 Cumulative US Plug-in Vehicle Sales




Sales of plug-in electric vehicles continue an upward trend; a larger percentage of those vehicles are battery electric vehicles (BEV).

Electric Drive Transportation Association Electric Drive Sales Dashboard, via wikicommons

The City of Seattle began preparing for the arrival of electric vehicle (EV) in 2009. Fueled by public demand, government support, and increased availability, EV adoption continues an upward trend throughout the country. Washington State, and specifically the Seattle metropolitan area, has one of the highest EV adoption rates in the country.

EV users must charge their vehicles routinely. EVs currently offer a range of roughly one-third of a conventional internal combustion vehicle (ICE) and refueling an EV through electric charging takes more time than fueling an ICE car. While most current EV users access charging at home, usually in garages, there are potential EV adopters who lack access to reliable off-street parking for charging. These EV adopters own vehicles that are defined as "garage orphan EVs."

This study identifies the barriers faced by potential garage orphan EV owners and provides recommendations for equitable access to EV charging for residents in all housing types. Due to issues of curb space allocation, exclusive use, installation, maintenance, removal, and City liability for charging infrastructure installations in the public right-of-way, this study focuses on strategies for off-street charging accessible to residents without dedicated off-street parking and charging at home.

Figure 2 What defines an EV as a "Garage Orphan?"


The City describes electric vehicles with the following attributes as garage orphans EVs: Residents without access to off-street parking and those with off-street parking, but without reliable access to electricity. The vehicles that fit these attributes are deemed garage orphans.

It is important to understand the magnitude of the issue related to garage orphan EV owner households in Seattle. According to the 2009 American Household Survey for Seattle, Washington, 95.4% of all Seattle residents surveyed have some form of off-street parking available.[1] That does not mean that all garages guarantee access, assigned off-street parking, or that there are adequate power supplies available for charging. The following strategies may provide important parking access for owners of all types of vehicles.

The study's methodology began with academic and research findings drawn locally, nationally, and globally. This research highlights barriers, points to consumers'

[1] US Census Bureau, American Housing Survey, 2009, Table 1-6, SEA-1, Seattle, Washington, city. Accessible online: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

preference, and addresses needs for vehicle charging. A review of current and potential business models builds on research findings. Each business model has applications for locations outside the EV owner's home and considers both Level II and DC/Fast Charging options. Interviews with stakeholders build upon the background research that identifies the current situation, national best practices, and opportunities for accessible charging in Seattle.

## STAKEHOLDER OUTREACH

The stakeholders engaged in this project included a diverse mix of public agency representatives, private parking facility managers, commercial property owners, charging station (also known as electric vehicle supply equipment (EVSE)) subscription service providers, fleet managers, institutional representatives, EV advocates and owners, and an owner of a garage orphan EV. These stakeholders and others participated in a statewide and regional EV charging workshop in January 2014. A survey of workshop participants collected information about charging strategies.

## NEIGHBORHOOD TYPOLOGIES

To understand the local context and challenges faced by garage orphan EV owners, Chapter 5 provides three neighborhood typologies for Seattle. The neighborhoods of Capitol Hill and First Hill, South Lake Union, and Wallingford serve as representative neighborhoods to analyze context-sensitive solutions to accessing charging infrastructure for owners of garage orphan EVs. An overview of the neighborhoods' unique characteristics, such as population, density, housing mix, land uses, institutional uses, and available EVSEs provides a snapshot of the potential challenges and opportunities on the ground.

## STRATEGY DEVELOPMENT

The consultant team developed strategies for removing barriers to EV charging access in Seattle's neighborhoods based on information collected during the background research phase and through conversations with stakeholders. Identified strategies are highlighted in Figure 3 and detailed in Chapter 6.

Figure 3 Strategies and Strategy Summaries

| Strategy # | Strategy | Strategy Summary |
|---|---|---|
| 1 | Citywide Information Clearinghouse | *A one-stop web tool that calculates a number of metrics and makes recommendations to the potential EV buyer about vehicle and housing choices.* |
| 2 | After-hours Access to Private Lots | *a. Incentivize and encourage parking lot owners and management companies to allow paid access to managed and access-controlled lots, after hours for use of EVSE.*<br>*b. Develop a marketing campaign or web tool to better advertise the availability of these EVSE locations.*<br>*c. Encourage information and advertising opportunities for lot/garage owners/managers and for nearby residents.*<br>*d. Require conduit trenching with wire access when surface parking lots are resurfaced.* |
| 3 | After-hours Access to Institutional Properties | *Encourage the installation of EVSE and increase access to parking lots at institutions located within neighborhoods such as churches, community centers, schools, and universities.* |
| 4 | Adaptive Use of City-owned Property | *a. Utilize vacant and underused City properties with electrical service for interim or extended EVSE stations.*<br>*b. Develop Public Private Partnerships (PPP) with charging network providers to manage and maintain locations.*<br>*c. Prioritize EVSE uses of City-owned surplus property.* |

| Strategy # | Strategy | Strategy Summary |
|---|---|---|
| 5 | Neighborhood Peer-to-Peer Plug-sharing | *Provide guidance and support for neighborhood peer-to-peer plug-sharing.* |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | *Waive or reduce parking minimums in multifamily residential development zones that still have minimums in exchange for the installation of EVSE in parking facilities at the development.* |

The strategies identified above are applied to the three neighborhood typologies previously described and ranked according to their applicability for Level II charging. An additional layer of analysis considered the strategy's applicability to support DC/Fast Charging, a direct current connection to the power grid that requires a 480-volt source that can support a 125-amp current, usually in commercial or industrial areas. Considerations of likely power supplies and connections to the grid determine strategies appropriate for DC/Fast Charging.

The table below summarizes the ranking of the strategies detailed in Chapter 6.

Figure 4 Applicability of Strategies for Level II charging

| Strategy # | Strategy | Score: Capitol Hill/ First Hill (5-1) | Score: Wallingford (5-1) | Score: South Lake Union (5-1) | TOTAL | Top Three RANK |
|---|---|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | 4 | 4 | 3 | 11 | |
| 2 | After-hours Access to Private Lots | 5 | 5 | 4 | 14 | 1 |
| 3 | After-hours Access to Institutional Properties | 5 | 5 | 3 | 13 | 2 |
| 4 | Adaptive Use of City-owned Property | 3 | 3 | 4 | 10 | |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | 3 | 5 | 3 | 11 | |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | 3 | 2 | 3 | 8 | |

Rankings 5 through 1: 5= Very Good; 4= Good; 3= Fair; 2= Poor; 1=Unacceptable.

# RECOMMENDED STRATEGIES

The highest ranking strategies based on the methodology used and analysis done in this study are After-hours Access to Private Lots and After-hours Access to Institutional Properties.

## After-hours Access to Private Lots and After-hours Access to Institutional Properties

The two strategies of After-hours Access to Private Lots and After-hours Access to Institutional Properties ranked highly for many neighborhoods. These strategies apply to neighborhoods that have surface private and institutional parking lots that are not used through the night. Many

parking lots are vacant from 7:00 p.m.–7:00 a.m., creating opportunities to rent the empty parking spots to residents interested in access to charging. If installation of Level II EVSE is required, it may also benefit the daytime users of the parking area.

One emerging opportunity on private lots is the installation of Level II EVSE at food cart pods as an adaptive reuse of often-underused surface parking located throughout neighborhoods. As food carts grow in popularity in Seattle, there could be an opportunity to utilize the land they occupy for additional interim uses such as EV charging.

### Adaptive Use of City-owned Property: Top ranked Strategy for DC/Fast Charging

The top ranked strategy to encourage DC/Fast Charging access to people without off-street access to home-based charging was the adaptive use of City-owned property. City properties with clearly defined leases and sufficient electrical supply are ideal locations for DC/Fast Chargers.

Seattle City Light (SCL) substations with robust power service connections are City-owned locations. These sites would require limited trenching and other investments such as sidewalks and repaving. The lease terms should include the cost of equipment removal and site maintenance and landscaping. For the private partner, a lease with good terms and access to potential customers may be attractive.

## STUDY FINDINGS AND RECOMMENDATIONS

An important fact to consider moving forward is that according to the 2009 American Household Survey for Seattle, close to 96% of residents surveyed have some form of off-street parking available.[2] This does not mean that all garages guarantee access, assigned off-street parking, or that there are adequate power supplies available for EV charging. However, this gives a baseline that helps the City prioritize activities to encourage EV adoption among Seattle residents.

In addition to working on establishing public/private partnerships to implement the recommended strategies, the following near-term City actions could remove barriers to EV adoption:

- In light of the still largely untapped EV adoption potential by residents with dedicated off-street parking for charging, focus on:
    - Outreach and engagement to highlight the benefits of EVs, and
    - Making off-street parking sites EV ready, with efforts such as exploring feasibility of City provided incentives for installation of EVSE in resident's properties where possible.
- Where dedicated off-street parking is not available, help residents wishing to adopt EVs make connections to private lot charging and the existing publicly available EVSE network including infrastructure installed by the EV Project. Leverage the work being done by the State Joint Transportation Committee's by analyzing the results of the study of business models for financially sustainable EV charging networks.
- Continue to facilitate EV readiness in multi-family dwellings via code changes.
- Explore ways to remove barriers to DC/Fast Charging, such as exploring the possibility of removing demand charges for EVSE.

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[2] US Census Bureau, American Housing Survey, 2009, Table 1-6, SEA-1, Seattle, Washington, city. Accessible online: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

# 2 INTRODUCTION

## STUDY PURPOSE

The intention of the Removing Barriers to Electric Vehicle Adoption by Increasing Access to Charging Infrastructure Study (the "Study") is to identify the challenges faced by Seattle residents without off-street access to EV charging. The Study identifies the barriers faced nationally, regionally, and within Seattle. The study identifies the current business models for charging that support or hinder owners of "garage orphan" Electric Vehicles (EVs) who do not fit the typical profile of early adopters (access to a garage or other dedicated off-street parking with access to electricity). The study provides an overview of EV development and adoption in the United States and considers the existing conditions and barriers to EV adoption in three Seattle neighborhoods.

Due to issues of curb space allocation, exclusive use, installation, maintenance, removal, and City liability related to charging infrastructure installations in the public right-of-way, this study focuses on strategies for off-street charging accessible to residents without dedicated off-street parking and charging at home.

## CITY OF SEATTLE'S EFFORTS TO REMOVE BARRIERS TO ELECTRIC VEHICLE ADOPTION

The City of Seattle's goal is to facilitate widespread EV adoption. Since 2009, the City of Seattle has convened the Plug-in Ready Interdepartmental Team to work on a range of topics for coordinated EV policy. The efforts of this group include a streamlined permitting process for home and commercial installation of EV charging stations or Electric Vehicle Supply Equipment (EVSE); code changes to make it easier to install EVSE; regional coordination; a commitment to provide equitable access to EV adoption for residents; and, ongoing coordination with other municipalities, EV owners, and advocacy groups. These efforts to remove barriers to EV adoption formed the basis of the current study.

### OSE "Demand for Electric Vehicle Charging Stations" Study - May 2012

The City performed the Demand for EVSE Access for Garage Orphans study in May 2012. The study team mailed a survey to 6,000 households considered as likely owners of "garage orphan EVs" based on information from the City Assessor's Office. The term garage orphan refers to an EV whose owner or operator does not have access to a garage or other off-street parking, or, if the owner/operator has access to off-street parking, there is no or no reliable access to electricity. The term refers only to the vehicle.

Notable findings from this research include:

- Half of users of garage orphan EVs would use a public charging station (50%).
- Many potential users of garage orphan EVs are more likely to purchase an EV if they would have access to publicly available charging station within one mile (40%) of their homes.
- Location, cost, and availability/convenience are the biggest motivators for users of garage orphan EVs to use a public charging station.
- Location, security, availability/convenience, and cost are the biggest concerns with a public charging station.

### Demand for EVSE Policy Recommendation, November 2012[3]

After reviewing issues of ownership, curb space allocation, installation and maintenance, and equipment removal, the Office of Sustainability and Environment drafted a 2012 policy recommendation to address access to EVSE issues by prioritizing home charging and publicly available charging in private and institutional properties over right-of-way (ROW) charging. The policy recommendation focused on Level II and DC/Fast Charging options, considering the feasibility of ROW charging for the two charging options. The recommendation was not to pursue ROW charging, and the study found no clear path forward to guide ROW charging (and at the time there was no emerging path at the national level).

## STUDY METHODOLOGY

The methodology of the current study was developed to identify and test strategies to remove barriers to EV charging for people without access to off-street parking. Background research on EV use and charging business models contributed to the study's understanding of context appropriate charging models that serve EV users and offer a sustainable business model. Stakeholder interviews, a workshop, and an online survey informed the development of strategies applicable to Seattle neighborhoods. From these sources a set of strategies were developed.

A ranking was then applied to assess which strategies best fit the individual neighborhoods and across all three neighborhoods. The Opportunities and Challenges analysis identified the top ranked strategies through a five-point scale used to assess the applicability of the strategies. A five (5) on the scale represents a "Very Good" or very applicable strategy and a one (1) means an "Unacceptable" or not applicable strategy. An Opportunities and Challenges analysis identifies and ranks a strategy's pros and cons, considering applicability, cost performance, and impact.

***The Study was comprised of six major components:***

**Background Research.** *Performed background research including an overview of existing and potential business models found in the United States and internationally.*

**Stakeholder Interviews.** *Conducted more than a dozen 45-90 minute phone interviews (see Appendix B for a summary of findings and list of interview questions) and conversations with City of Seattle staff and other stakeholders.*

**Regional Workshop.** *Hosted a regional EV charging strategy workshop that brought 24 regional representatives together (See Appendix D for more details). Workshop participants discussed options to develop regional and local strategies to remove barriers to charging for owners of "garage orphan" EVs.*

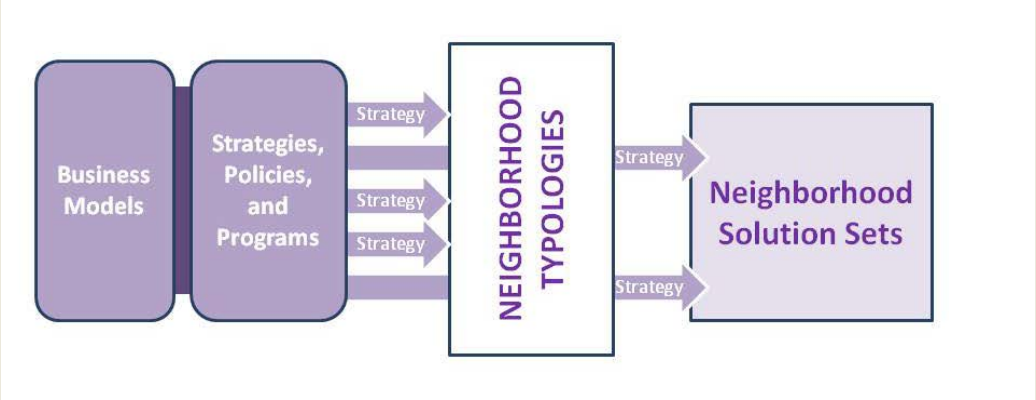
[3] Seattle Office of Sustainability, "Providing Access to EV Charging Infrastructure for 'Garage Orphans' in Seattle: Policy Recommendation, 11-26-12."

**Online Survey.** *Surveyed strategies and attitudes toward at-home, at-work, and other charging strategies administered to regional workshop participants, interviewees, and other regional and local representatives.*

**Neighborhood Typologies.** *Developed three neighborhood typologies that represent a variety of housing types and locations where people without off-street parking may live. National, regional, and local data, driving, parking, and potential EV charging patterns assessed.*

**Strategy Identification.** *Identified strategies to remove barriers to EV charging in the different neighborhood types. Considered DC/Fast Charging applicability based on neighborhood characteristics.*

Figure 5 Strategy Development Flow




The primary objective of the study is to identify strategies supported by business models that apply to unique neighborhoods in Seattle. Neighborhood Solution Sets are the result of developed business models and strategies that are filtered through three neighborhood typologies, illustrating the "fit" of the strategies.

## Study Overview

The Study Overview outlines the chapter structure and key components of the study

- **Chapter 1: Executive Summary.** *Provides a digest of the study, presenting the study's structure and findings.*
- **Chapter 2: Introduction**. *Introduces the study, EVs, and challenges for EV adoption.*
- **Chapter 3: Study Background and Research Findings.** *Presents key research related to EV adoption such as barriers to access and forecasts for future adoption.*
- **Chapter 4: Business Models For Electric Vehicle Charging At Third Places and Workplaces.** *Introduces publicly accessible EV charging business strategies that have emerged over the last decade. This section also introduces some of the nascent business models. This chapter includes specific examples of both successful and failed models.*
- **Chapter 5: Neighborhood Typologies.** *Establishes three neighborhood typologies for assessing strategies on the ground, based on the mix of housing, land uses, and available parking.*
- **Chapter 6: Garage Orphan Electric Vehicle Strategies.** *Summarizes challenges and opportunities to integrating electric vehicle supply equipment (EVSE) in the neighborhood typologies and recommends DC/Fast Charging and conventional (Level*

*II) charging strategies for the City of Seattle to pursue in different types of Seattle neighborhoods.*

- **Chapter 7: Appendices.**

# 3 STUDY BACKGROUND AND RESEARCH FINDINGS

The people of Seattle and the Puget Sound region are adopting electric vehicles (EVs) at a higher rate than almost any other region in the county.[4] Recent technological improvements, government incentives, and a growing desire for fuel efficiency have contributed to increasing consumer demand for EVs.

Many EV early adopters fit a profile of affluent, technological savvy, and those concerned about their environmental footprints. This self-selecting group most often also has access to off-street parking, in most cases a garage, where they can reliably charge their vehicles. However, some consumers do not have designated off-street parking for charging. Although the publicly available charging infrastructure is increasing in our region, these locations may not provide reliable charging options. Increased EV market penetration will require expanding charging options for those without access to off-street charging facilities at home.

## KEY RESEARCH FINDINGS

Drawn from national, regional, and local data, key research findings include academic, research institute, and federal research laboratory work related to barriers to EV adoption.

- EV users with home charging do not use public EVSE to the extent originally expected by research forecasters. As EV users become more comfortable with the technology, they most often accomplish all of their daily driving needs by charging at home.
- It is expected that most EV charging will continue to take place at home. Many EV adopters will choose to purchase or lease a vehicle based on available at-home charging. Initial efforts to install EVSE outside the home location focused on charging at "third places" such as parks, grocery stores, and along commercial strips. While those locations remain important, a great focus for non-home charging is at-work charging.
- Access to at-work charging provides the opportunity to expand the number of people that may choose to adopt EVs. Guaranteed at-work access may be a promising option for many users of garage orphan EVs.
- A failsafe charging business model does not exist. Regardless of the business model, there is limited economic profit at this time for EVSE entrepreneurs due to low electricity costs, especially in Seattle, which has one of the lowest energy costs in the nation.

[4] "EV" is term used for a variety of drivetrain types that include plug-in electric vehicles or battery electric vehicles (PEV or BEV), Plug-in Hybrid Electric Vehicles (PHEV), Extended-Range Electric Vehicles (EREV), and Neighborhood Electric Vehicles (NEV). For the purpose of clarity and consciousness, all of these types of electric vehicles will collectively be called EVs. This definition does not include hybrids such as a standard Toyota Prius. See overview of technology in 2-5.

- Despite the availability of EVs from major manufacturers, the abundance of charging models, and the increasing number of EV adopters, the EV industry is still nascent. Adoption remains limited, and it represents a small percentage of the total motor vehicle market.

# Electric Vehicle Background

## The Modern Electric Vehicle, an Overview

Over a century ago, some of the first cars to travel the streets were electric-powered. In the early days of motoring, EVs held many speed and distance records, and the first fleet of taxis in New York City were electric. With the wild popularity of Henry Ford's Model T, the entire automobile industry shifted toward internal combustion engines, with only seldom experiments with EVs continuing during the intervening century. Only recently have advancements in technology allowed EVs to be competitive with internal combustion automobiles based on range, cost, and ease of use.

| **Advantages of EVs** (compared to gasoline-powered vehicles) | **Disadvantages of EVs** (compared to gasoline-powered vehicles) |
|---|---|
| - Lower operating costs<br>- Reduced noise<br>- Zero tailpipe emissions<br>- Home fueling (if available)<br>- Smart grid support | - Limited range<br>- May be more expensive: upfront costs, batteries<br>- New technology: uncertain battery life<br>- Long fueling time<br>- Limited charging infrastructure available |

Automobiles produce one-third of the greenhouse gases in the United States, significantly contributing to global climate change.[5] Moreover, the demand for petroleum has become a serious economic drain for the Seattle region, the state, and the country. Since the oil embargo of 1973, the United States has spent about $12 trillion on crude oil imports. In Washington State, internal combustion engine vehicles require the import of billions of dollars of gasoline from outside the state and country, money that could otherwise remain in the region.

Far from a panacea, EVs offer a stopgap effort to reduce vehicle emissions with zero mobile emissions and limited overall emissions due to Seattle's hydroelectric power sources and Seattle City Light's (SCL) carbon neutral status. EVs make better use of energy conversion than vehicles with an internal combustion engine and have no tailpipe emissions.

[5] Boschert, S. (2006). *Plug-in Hybrids: The cars that will recharge America*. Gabriola Island, BC, Canada: New Society Publishers.

Figure 6 Electric Vehicles —Today's Technology

Today's crop of EVs is the result of improved battery life, chassis lightening, regenerative braking, and other advanced technologies. Commercial vehicles have a range of up to 265 miles on a single charge. Full-size transit buses can complete existing routes on a single charge. In the years to come this number will likely increase as the price of batteries plummets.

**Plug-in Electric Vehicle or Battery Electric Vehicle (PEV or BEV)**

100% electric, these include highway capable EVs such as the Nissan LEAF, Ford Focus Electric, and Mitsubishi i-MiEV.


**Plug-in Hybrid Electric Vehicle (PHEV)**

EVs with the capacity to operate as 100% electric and include an auxiliary internal combustion engine that operates after battery life depletion. Vehicles include the Toyota Prius PHEV.

**Extended-Range Electric Vehicle (EREV)**

Battery EVs with a gasoline engine that functions as a generator for the battery to allow an extended range. EREVs include the Chevrolet VOLT.

**Neighborhood Electric Vehicle (NEV)**

Small, street-legal EVs with short operating ranges, usually under 40 miles. NEVs may not qualify for highway use. Example NEVs are the Global Electric Motorcars low-speed vehicles.

Sources: (top to bottom) flickr/autoviva.com; Wikimedia commons; flickr/NRMA New Cars; flickr/The US Army

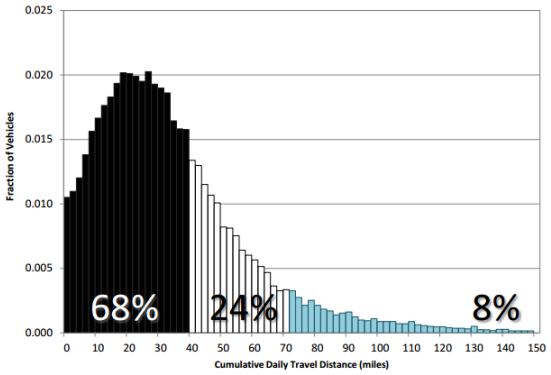
# Barriers to Electric Vehicle Adoption

Barriers to new technologies are manifold. Beyond affordability and other cost issues, there remain two primary barriers to EV adoption for the user: information barriers and access barriers.

## Information Barriers

Education and information about EVs is limited. Potential EV buyers have questions and concerns about safety, performance (e.g., battery range), and cost (e.g., utility bill increases). With few EVs in operation, consumers do not likely have a peer as a reference for information.

Figure 7 Cumulative Daily Travel Distance of US Commuters




Distribution of daily travel distance, United States
Source: FHWA, 2011. Adopted from NAS, 2013

Consumers often miscalculate the actual number of miles they drive daily, most often inflating their daily driving range needs. The perceived need for long-range travel weighs on people's decisions. Even though some municipalities provide information about possible cost savings by owning EVs, research has shown that 92% of people drive less than 70 miles per day, and in the Puget Sound area the average daily miles traveled per day per person is about 22 miles. Sixty-eight percent (68%) of drivers travel less than 40 miles per day. This is well within range of most EVs and within the full electric range of most PHEVs.

Initial studies of EV adoption found that new EV users suffered "range anxiety" and required nightly at-home charging for confident driving.[6] After gaining experience with EVs and having a variety of charging options (at-home, at-work, third places), many EV drivers adjust their driving habits and substantially reduce their range anxiety.

As EV adoption increases, knowledge-sharing will increase among peers. Car manufacturers that should be the driving force in breaking information barriers are likely hesitant because of direct competition with their existing offerings of internal-combustion vehicles.

## Access Barriers

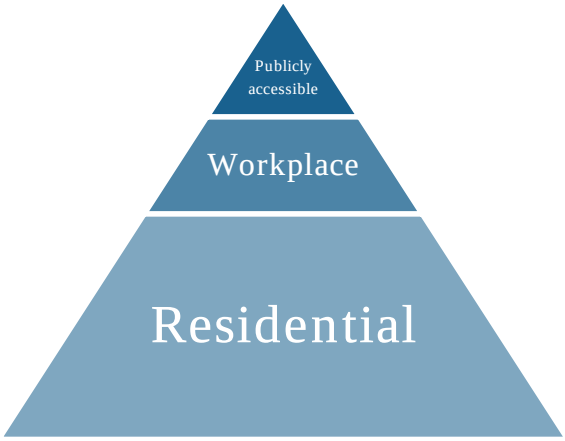
This section addresses access barriers to EV adoption for people without off-street parking for charging. This is an important barrier for EV adoption. For the purpose of this study, "equitable access" is defined as the choice to purchase an EV unfettered by one's home location and ability to reliably park and charge the EV off-street.

The EV Project, a national demonstration project funded by the federal government, found that 82% of charging events by participants took place at the home location. Other studies have found a rate as high as 90%. According to the 2011 American Housing Survey, most households in the United States, both single-family and multi-family homes, have access to a carport or a garage

[6] Hickman, 2011; Skippon & Garwood, 2011

(63%).[7] Furthermore, among the 37% of homes without access to garage or carport, 83% have off-street parking or a driveway available. This leaves about 6% of all households in the United States without off-street parking or a driveway. Most of these households are located in urban areas. For instance, in the Seattle-Tacoma--Everett metropolitan area, 74% of all homes have garages or carports.[8]

Figure 8 The Hierarchy of Charging




Hierarchy of Charging: Where Consumers Value Charging Access

Adapted from the Electric Power Research Institute's graphic

Issues related to limited proximity to electrical outlets must also be considered. Nationally, less than 40% of houses have parking within 10 feet of a 110/120V outlet and about 50% are within 25 feet.[9] A U.S. Energy Information Administration report finds that 44% of households have an outlet within 20 feet of parking.[10] Twenty feet is a considerable distance and is generally unacceptable for EV charging and unsupported by most EVSE.

A municipality may remove barriers to EV adoption through a variety of policy and program responses. Based on the municipality's policies, it may choose to designate on-street parking spaces for EVs and may provide on-street access to charging equipment. More commonly, municipalities may remove some of the more onerous permitting and installation barriers that may keep a property manager or homeowner from installing EVSE on private property during or after construction.

## Electric Vehicle Charging

EVs available today generally have far less range than conventional motor vehicles. Most current full EVs have a range of about 80-120 miles on a single charge. When surveyed, most EV users plug in their vehicles every night, safeguarding their potential driving range for the next day.

Figure 9 Electric Vehicle Supply Equipment Basics

| Charging Station Level | Typical Charging Time | Likely Location |
|---|---|---|
| Level I - (110 V) | 10–20 hours - (0-100%) | Household, workplace charging, parking garages, long-term and overnight lots |
| Level II - (220 V) | 3–6 hours - (0-100%) | Household, shopping centers, parking garages, third places, institutions |
| DC/Fast Charge -(480+ V) | 20–40 minutes (0-80%); about 1 hour to 100% | Commercial: shopping centers, publicly accessible locations with high customer turnover |

Based on a 24 kWh battery and charged from empty to full charge

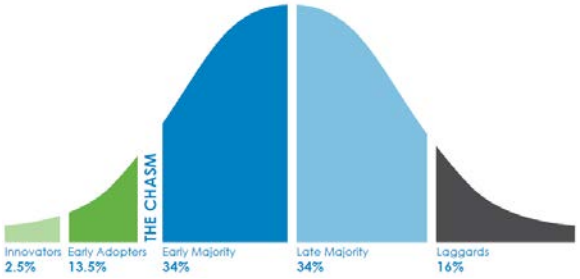
[7] US Census Bureau, American Household Survey, 2012

[8] Ibid.

[9] Axsen & Kurani, 2012

[10] Traut, et al., 2013

Figure 10 Roger's Innovation Adoption Curve




Early adopters often help identify critical needs for widespread adoption. The City of Seattle has already removed many barriers to early adoption, now the City is looking for policy options to eliminate additional obstructions.

Source: Business Oregon, 2013

The basic model of ownership requires near daily charging or easy access to routine charging. This has led to most early adopter having at-home, off-street parking available. Depending on the location of the charging equipment, how long the vehicle will be parked at the location, and the business model employed for charging, one of three charging types will be employed. Level I and Level II are the most common types of EVSE. Increasingly, more DC/Fast Chargers are being installed in commercial and high-use locations. Figure 9 explains the power capacity requirements and amount of time each level provides.

## CONSUMER PREFERENCE AND NEED

What are the unique needs of EV users and potential buyers? In 2009, researchers investigated new technology users' shift in understanding and adopting new motor vehicle technologies through an analysis of stated and revealed choice research. The authors found that an individual's perceived barriers are not fixed and may be influenced. Increased market penetration often results in a "neighbor effect" of adoption.[11] This means that as more people see neighbors and friends successfully adopting EVs, the fewer perceived barriers remain.

In other analyses of consumers' willingness to pay for alternative fuel vehicles, research has found that consumer preference and adoption is largely contingent on the cooperation and implementation of all major stakeholders including the energy providers and the equipment manufacturers.[12, 13]

Consumer's preference for EVs is influenced by factors that include availability of charging infrastructure, knowledge about the technology, perceived performance, and a host socioeconomic factors such as income and social attitudes.

Survey results suggest that EV drivers may be willing to pay more for added convenience. A survey of early adopters of new technology in New York City found that many current drivers are willing to change their behavior to accommodate EVs. Of the 21% identified as early adopters, more than half reported willingness to pay more to obtain an assigned spot with charging and more than half are willing to walk a greater distance to access charging.[14]

[11] Axsen, et al., 2009

[12] Eggers & Eggers, 2011

[13] Greene, 1997; Ewing & Sarigollu, 1998; Cao & Mokhtarian, 2004

[14] The City of New York, "PlaNYC, Exploring Electric Vehicle Adoption in New York City, January 2010." Accessed online: http://www.nyc.gov/html/om/pdf/2010/pr10_nyc_electric_vehicle_adoption_study.pdf

***Where Electric Vehicle Users Charge Their Vehicles***

An important consideration for many EV users is identifying where they will charge their vehicles. Availability of charging at home, at work, or in third places where the user travels all influence a consumer's preference for EVs.

- Home location. An EV owner can charge their vehicle overnight if parking is available and they are able to run a cord. For the potential consumer without home access to charging, this most common location is unavailable or not reliable.
- Work location. Work-based charging may be a dependable charging location for people without home access to charging. For consumers that primarily use their vehicles to travel to their work location, this may be the only consistent charging location necessary.
- Third places. Third places are locations in the community, other than home or work, that support charging of EVs. For people without home access to charging, third places represent one of the primary locations for charging. These places may provide access to fast charging events or overnight parking in nearby lots or garages.

# 4 BUSINESS MODELS FOR ELECTRIC VEHICLE CHARGING AT THIRD PLACES AND WORKPLACES

Many early adopters of EVs already meet certain criteria such as access to off-street parking. This results in roughly 80% to 90% of charging currently taking place at home for many users. Most other charging events take place at work locations with the fewest charging events taking place at third places (i.e., at commercial and retail locations, in public parking garages, and in the public ROW).

As EVs enter the mainstream and have higher rates of adoption, new business models will emerge to better support user needs. There are emerging business models to address the away-from-home charging needs of current EV owners. Business model structures have different arrangements of land ownership, leasing, and management. Between the release of the first mass-produced EVs and today, major changes have taken place in the EVSE market. However, initially supported and almost entirely subsidized by the federal government, most ventures around the country and the globe have gone out of business. Barriers to overcome include American consumers' resistance to subscription-based programs, the cost to install and maintain seldom-used EVSE, and the opportunity costs associated with setting aside land (including re-purposing parking spots in the ROW) or charging capacity for publicly accessible EVSE.

The following section will introduce the range of publicly accessible EV charging business strategies that have emerged over the last decade. This section also introduces some of the nascent business models and includes specific examples of both successful and failed models.

## CHARGING PROVIDED AS AMENITY MODEL

| Business Model | Charging provided as amenity/EVSE provided as charity |
|---|---|
| Concept | Private parking facility owners provide access to EVSE as an amenity to customers. Charging is provided free of charge. |
| Advantages | Attracts customers, used for LEED points, improves environmental image. |
| Advantages to people without home access to charging | If consistently and conveniently available, this would be a windfall: free charging near the home location. |
| Disadvantages | If popular, may be costly for property owner. If unpopular, may bind access to limited parking supply. |
| Disadvantages to people without home access to charging | Unlikely that a property owner will continue to provide access to charging free of charge. Not a reliable charging location. |
| Available in Seattle | Yes |
| Available in the Puget Sound region | Yes |

# STATION OWNER/OPERATOR MODEL

| Business Model | Station owner/operator |
|---|---|
| Concept | EVSE provided at a cost, charges users per charging episode, often through a subscription-based service plan. |
| Advantages | Reduces range anxiety, increases usability of EVs, insulates property owner from costs of installation, operation, and maintenance. |
| Advantages to people without home access to charging | If a property owner allows consistent access and the subscription rate is appropriate, this may satisfy the daily charging needs of many consumers. |
| Disadvantages | Difficult to turn a profit under current market conditions (EV saturate, available locations). May be abandoned if the market does not support the location. |
| Disadvantages to people without home access to charging | Consistent and dependable access to a location near the consumer's home is difficult to guarantee. Lack of guaranteed access introduces anxiety that may limit EV adoption. |
| Available in Seattle | Yes |
| Available in the Puget Sound region | Yes |

***CASE STUDY: NRG eVgo***

Billed as the first fully private, comprehensive EV "ecosystem," the NRG eVgo network does not suffer from the limitations and financial troubles of federally subsidized business models. A part of NRG Energy Incorporated, the NRG eVgo represents more than $150 million of investment from the parent company. Currently, the business model is limited to the NRG power networks in Texas, California, and the greater Washington, DC region.

Station owner/operator model NRG eVgo station in Texas

Source: Flickr user NRG eVgo

For non-home-based charging, NRG eVgo offers DC/Fast Charging "Freedom Stations" and Level II installations. These EVSE are aimed at multi-family, commercial office spaces, and retail properties. Freedom stations are installed and maintained free of charge for the property owners. The company works with property owners and managers to designate site locations, manage permitting, coordinate local utilities issues, install EVSE, distribute key fobs, and monitor and maintain equipment.

For installation, the company assesses the location based on a set of criteria that includes:

- Opportunity for retail engagement
- Proximity to major thoroughfares
- Visibility
- Easy ingress and egress
- Access to power
- Area crime reports

Similar to CarCharging and others, NRG eVgo's business model requires consumers to purchase a plan or to pay a onetime fee to access charging equipment. Currently, in California, the company offers an unlimited 60-day trial period for $7.95. This allows access to the network's Level II and DC/Fast EVSE. Unlimited Level II charging costs $29.95 per month, and DC/Fast Charging costs $9.95 per charge.


Federally funded ECOtality EVSE, many Blink EVSE remain underused in locations that do not support their use.

Source: Plugincars.com

***Case Study: ECOtality***

The EV Project (Blink) network was a federally subsidized network of EV supply equipment including DC/Fast charging and Level II EVSE.

Poorly analyzed siting led to an unsustainable business model once federal grant funding ran out. The infusion of federal money may have led to hasty installation without proper market assessment.

In 2013, ECOtality filed for bankruptcy with viable equipment shifting to become part of CarCharging's network and the Blink network supported temporarily by Nissan USA through a $1 million+ grant.

## MILEAGE OPERATOR MODEL/"BATTERIES NOT INCLUDED" MANUFACTURING

| Business Model | Mileage operators/ "Batteries not included" manufacturing |
|---|---|
| Concept | Removes the sunk cost of the battery from consumer, lowering overall vehicle costs. Bulk purchases of batteries drives down the cost for the consumer, reduces risk for the operator, and allows for faster introduction of new battery technologies. |
| Advantages | Lowers the cost of vehicles, reduces anxiety about battery failure, and allows for the deployment of new battery technologies. Convenient for consumers. |
| Advantages to people without home access to charging | If locations are found near the home location or along common routes, battery swapping may provide a principal means of EV charging. |
| Disadvantages | Business model unproven. Swapping stations may be land-intensive when located near residential locations. Current levels of EV adoption do not support a network. Widespread adoption of battery swapping would require industrywide battery standards. |
| Disadvantages to people without home access to charging | Available locations would take time to develop to a usable level for many people without home access. |
| Available in Seattle | No |
| Available in the Puget Sound region | No (but may be soon) |

Better Place battery swapping station pilot in Israel. The exchanges were slated to cost $500,000, less than half the cost of standard fueling station. Compact in design, they could be integrated with existing fueling stations space permited.
Source: Wikimedia Commons

***Case Study: Better Place***

***Mileage Operator Model***

Better Place is a defunct Israeli venture that proposed developing a network of battery-swapping stations where EV users could swap batteries in a matter of minutes. By making the battery swap time competitive with fueling a conventional car at a gas station, the business model decouples the battery from the vehicle. Based in California with their first deployments in Israel and Denmark, the company raised start-up capital and a great deal of media interest. In addition to the highly publicized battery swapping stations, Better Place owned and operated a network of conventional charging stations around the world.

The model relied on the adoption of the Renault Fluence Z.A. automobile; indeed, it was only compatible with that vehicle. When less than 1,500 Fluence Z.A.'s were deployed, Better Place's pilot markets failed, leading to bankruptcy.

The business model has many fans; especially attractive is the speed of recharging and the limited risk of battery failure, diminished capacity, and long-term replacement costs. For the operator, the purchase of a massive number of batteries will decrease their risk when some inevitably fail. For successful utilization of this model, a standardized battery platform, contact points, and ability to swap batteries among manufacturers would be necessary. It may also be necessary for governments or international standards organizations to intervene and mandate standardization.

## THE PROPRIETARY NETWORK MODEL

| Business Model | Proprietary network |
|---|---|
| Concept | The propriety network may have exclusive EVSE that is only compatible with certain equipment. This may be for exclusivity or because other charging protocols do not offer the necessary speed. |
| Advantages | If capital is available, one technology can lead the industry and accelerate technological advancement. |
| Advantages to people without home access to charging | It may provide some advantages for consumers that travel on highway locations near network nodes. |
| Disadvantages | Limits interoperability. Requires consumers to make purchase decision based on charging technology instead of cost. |
| Disadvantages to people without home access to charging | Unlikely that a consumer without home access to EVSE will be able to rely on the network for daily charging needs. |
| Available in Seattle | No |
| Available in the Puget Sound region | Yes |

***FastNed DC/Fast Charging Network***

***A regional fast charging network***

The Netherlands government has committed to installing more than 200 DC/Fast Chargers in the next two years. Dubbed the FastNed network, the government is installing one station every one to two miles along highways and major thoroughfares. The network will be commercial, and priced around €10 per charge. By their calculations, about 30,000 EVs will need to use the EVSE each week to break even in the endeavor. As of December 2013, four of the charging stations have been completed.

The technology firm ABB won a contract to supply the CHAdeMO, Combo 2, and Type 2 combination EVSE dubbed the ABB Terra 3-Plug.

ABB FastNed fast charging station

Source: ABB.com


Tesla SuperCharger, 90kw EVSE located in Gilroy, California.

Source: Flickr user jurvetson

***Case Study: Tesla SuperCharger Network***

***The Proprietary Network***

Tesla Motors has been challenging industry conventions since they started producing Tesla Roadsters. The latest innovation has been the support of long-distance driving along major travel corridors facilitated by vehicles with 200 to 265-mile ranges and a network of 480V DC/Fast chargers dubbed the SuperCharger Network.

The network is free for Tesla owners. The Supercharger is currently exclusive to specially equipped Model S cars because of the proprietary charging interface. These superchargers operate at 120kW, requiring an expensive on-board charger that allows 200 miles of range on 30-minutes of charge.

Each station has twelve charge points and plans are underway to install one battery swapping station at each location. The battery swapping elements may develop into the first successful mileage operator business model.

# SUMMARY OF BUSINESS MODELS

Figure 11 Summary of Electric Vehicle Supply Equipment Business Models

| Business Model | Charging provided as amenity/EVSE provided as charity | Station owner/operator | Mileage operators/"Batteries not included" manufacturing | Proprietary network |
|---|---|---|---|---|
| Concept | Private parking facility owners provide access to EVSE as an amenity to customers. Charging is provided free of charge. | EVSE provided as a cost, charges users per charging episode/session, often through a subscription-based service plan. | Removes the sunk cost of the battery from consumer. Bulk purchases of batteries drives down the cost for the consumer, reduces risk for the operator, and allows for faster introduction of new battery technologies. | The proprietary network may have exclusive EVSE that is only compatible with certain equipment. This may be for exclusivity or because other charging protocols do not offer the necessary speed. |
| Advantages | Attracts customers, used for LEED points, improves environmental image. | Reduces range anxiety, increases usability of EVs, insulates property owner from costs of installation and maintenance. | Lowers the cost of vehicles, reduces anxiety about battery failure, and allows for the deployment of new battery technologies. Convenient for consumers. | If capital is available, one technology can lead the industry and accelerate technological advancement. |
| Advantages to people without home access to charging | If consistently and conveniently available, this would be a windfall: free charging near the home location. | If a property owner allows consistent access and the subscription rate is appropriate, this may satisfy the daily charging needs of many consumers. | If locations are found near the home location or along common routes, swapping may provide a principal means of battery charging. | It may provide some advantages for consumers that travel on highway locations near network nodes.. |
| Disadvantages | If popular, may be costly for property owner. If unpopular, may bind access to limited parking supply. | Difficult to turn a profit. May be abandoned if the market does not support the location. | Business model unproven. Swapping stations may be land intensive when located near home locations. Current levels of EV adoption do not support a network. Widespread adoption of battery swapping would require industrywide battery standards. | Limits interoperability. Requires consumers to make market decisions based on charging technology instead of cost. |
| Disadvantages to people without home access to charging | Unlikely that a property owner will continue to provide access to charging free of charge. Not a reliable charging location. | Consistent and dependable access to a location near the consumer's home is difficult to guarantee. Introduces anxiety that may limit EV adoption. | Available locations would take time to develop to a usable level for many people without home access. | Unlikely that a consumer without home access to EVSE will be able to rely on the network for daily charging needs. |
| Available in Seattle | Yes | Yes | No | No |
| Available in the Puget Sound region | Yes | Yes | No (but may be soon) | Yes |

# 5 NEIGHBORHOOD TYPOLOGIES


Figure 12 Neighborhoods Profiled

## INTRODUCTION

Electric vehicle charging needs and potential garage orphan EV owners vary by neighborhood—largely based on land uses. This study examines the premise that some of the previously described business models are more appropriate in meeting the needs of individual neighborhoods.

Three neighborhoods were chosen to represent the diversity of neighborhoods in Seattle. Focused on residential at-home charging availability, the project team identified the following neighborhoods: First Hill and Capitol Hill, South Lake Union, and Wallingford. These neighborhoods have a mix of uses including apartments, single-family homes, commercial districts, and institutions. The Capitol Hill and First Hill neighborhoods were combined for geographic and comparability with the other neighborhoods.

This chapter introduces the demographic characteristics and some of the unique attributes of the neighborhoods. Although no neighborhood is the same, these were chosen because they share elements in common with other residential neighborhoods throughout the city. The next chapter presents strategies to match business models to each of the three neighborhoods.

Neighborhood solutions will be fit and tested against these neighborhood typologies. The three residential neighborhood typologies presented here are:

- Dense urban residential/commercial mix as illustrated by Capitol Hill/First Hill
- Redeveloping former industrial area as illustrated by South Lake Union
- Primary single-family residential area as illustrated by Wallingford

Please see Appendix B for a detailed look at each neighborhood profile.

# CAPITOL HILL AND FIRST HILL

The Capitol Hill and First Hill neighborhoods offer a mix of new and old housing, commercial, and institutional uses. For the study area, the southern portion of Capitol Hill and First Hill neighborhood represent an area with older homes built without driveways or garages, older apartments without off-street parking, as well as newer buildings and commercial uses.

Largely developed in its current form during the late 19th century and early 20th century, Seattle's First Hill and Capitol Hill still show their historic development patterns, illustrated by developments each with unique characteristics and housing patterns. The waves of development and redevelopment over the years have resulted in an eclectic mix.

First Hill is home to many of Seattle's state-of-the-art medical centers as well as a mix of businesses and dense residential housing. While borders are amorphous between adjacent neighborhoods, First Hill includes Harborview Medical Center, Swedish Medical Center, and the Virginia Mason Medical Center. Additional institutional uses include the Seattle University campus, the Frye Art Museum, St. James Cathedral, and others.

Capitol Hill contains nodes of and corridors of commercial activity along Broadway and Pike and Pine Streets with a variety of multifamily apartment complexes located adjacent to the commercial locations. Just off the main thoroughfares, the area features a mix of homes converted to apartments, duplexes, and single-family houses.

| | | | |
|---|---|---|---|
| Population | ▪ 30,895 people in the combined study area.<br>▪ 21,613 people per square mile, densest of case studies.<br>▪ See Figure 14. | Parking Supply | ▪ Many surface and structure parking lots.<br>▪ On-street parking largely by zone permit and paid on-street parking.<br>▪ See Figure 16. |
| Transportation | ▪ WalkScore: 97; TransitScore: 97<br>▪ Transit: bus service throughout neighborhood; First Hill streetcar and light rail connections under construction.<br>▪ Pedestrian and bicycle networks: excellent pedestrian permeability and a number of bicycle routes including physically separated facilities through the neighborhood. | Housing Mix | ▪ Capitol Hill and First Hill mix commercial and residential uses along major corridors.<br>▪ Many older stock apartment buildings throughout neighborhood, many without off-street parking or garages.<br>▪ Single-family residential neighborhoods dominate the eastern side of the study area while First Hill is predominately higher-density multifamily units.<br>▪ See Figure 17. |
| Electric Vehicle Supply Equipment | ▪ Most existing publicly accessible EVSE are located more than ¼ mile away from residential parts of neighborhood.<br>▪ Access to DC/ Fast Charging at Harvard Market.<br>▪ Good commercial and at-work access to charging.<br>▪ See Figure 15. | Institutional Uses | ▪ Many universities, schools, and hospitals located on the western and southern extents of the study area.<br>▪ Local schools located within the neighborhoods.<br>▪ See Figure 18. |

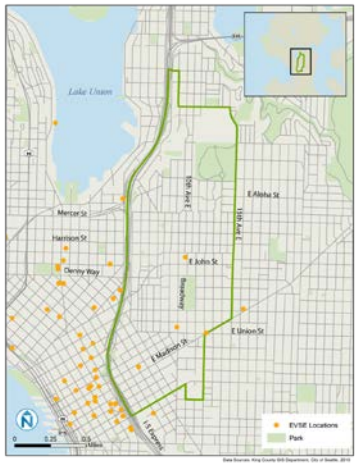



Figure 13 Capitol Hill and First Hill Study Area

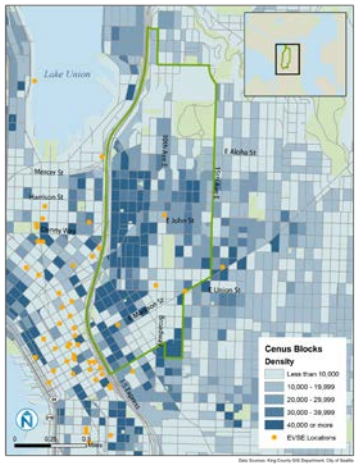



Figure 14 Capitol Hill/First Hill Population Density

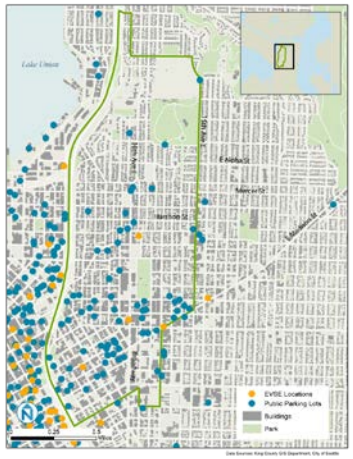



Figure 15 Capitol Hill/First Hill EVSE Locations


Figure 16 CH/FH Publicly-available Parking Lots


Figure 17 Capitol Hill/First Hill Land Uses


Figure 18 Capitol Hill/First Hill Institutions

# WALLINGFORD

A residential neighborhood with an older stock of single-family residential housing, Wallingford represents many Seattle neighborhoods with single-family homes clustered near walkable commercial corridors.

North 45th Avenue creates a vibrant commercial corridor cutting through the neighborhood. At the corner of N 45th Avenue and Wallingford Avenue, the converted school, Wallingford Center, and the QFC grocery store create the center of the neighborhood.

Just off the commercial corridors are a mix of older single-family homes, older stock apartments, and newer builds integrated into the neighborhood.

| | | | |
|---|---|---|---|
| Population | ▪ 15,759 people in the study area.<br>▪ 10,554 people per square mile, second densest and most residential study area.<br>▪ See Figure 26. | Parking Supply | ▪ Limited public parking available in neighborhood.<br>▪ On-street parking available free and without permit throughout the residential area of the neighborhood.<br>▪ Few apartment complexes without off-street parking and many older-stock single-family homes do not have off-street parking.<br>▪ See Figure 28. |
| Transportation | ▪ WalkScore:82, Seattle 25th most walkable neighborhood TransitScore: 59<br>▪ Limited transit connections concentrated along N 45th Ave.<br>▪ Automobile network concentrates traffic on N 45th Ave and Stone Way. Unique street patterns create difficult intersections.<br>▪ Pedestrian networks: good pedestrian permeability through neighborhoods. | Housing Mix | ▪ Most of the neighborhood is zoned and built out as single-family residential.<br>▪ A variety of multi-family homes and apartments are mixed throughout the neighborhood.<br>▪ Infill properties such as “skinny” homes are adding density to the neighborhood.<br>▪ See Figure 29. |
| Electric Vehicle Supply Equipment | ▪ Poorly served by publicly-available EVSE; available EVSE located at the edge of the neighborhood.<br>▪ No publicly-available DC/Fast Charging in study area.<br>▪ See Figure 27. | Institutions | ▪ Institutions such as neighborhood schools, churches, and community centers mixed throughout the neighborhood.<br>▪ All residential uses in the neighborhood are within walking distance of an institutional property.<br>▪ See Figure 30. |


Figure 19 Wallingford Study Area

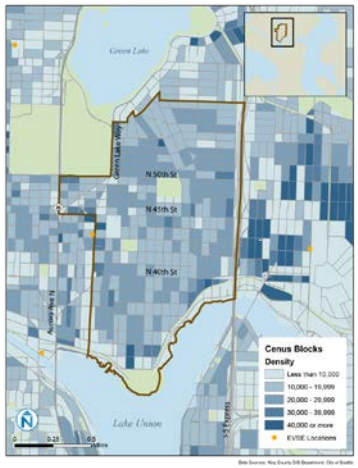



Figure 20 Wallingford Population Density


Figure 21 Wallingford EVSE Locations


Figure 22 Wallingford Publicly-available Parking Lots


Figure 23 Wallingford Land Uses


Figure 24 Wallingford Institutions

# SOUTH LAKE UNION

Rapidly growing and changing, the South Lake Union neighborhood represents a neighborhood in transition. As warehousing and industrial neighborhoods redevelop as high-tech and residential areas, much of the residential growth has been in higher density apartment buildings. Increasingly, these apartment complexes are decoupling parking from housing, utilizing unassigned spots, and building limited parking infrastructure. Residents without off-street or reliable access to charging interested in purchasing EVs may need special consideration for access.

In 2004, the City designated South Lake Union as one of Seattle's six urban centers. This designation identified the growth happening and planned in the neighborhood. Once a vibrant warehousing and industrial area, the neighborhood fell into neglect during the late 20th century. When a bid to redevelop the neighborhood as a large city park failed to be moved forward by the voters, much of the property in the neighborhood returned to the park proposer, Vulcan, Paul Allen's real estate firm.

Through zoning programs, the South Lake Union Urban Design Framework, and the South Lake Union Neighborhood Plan, the City and the community have provided capacity for up to 12,000 households and more than 20,000 new jobs.

| | | | |
|---|---|---|---|
| Population | ▪ 4,137 people located in the study area.<br>▪ 6,684 people per square mile, the least dense of the study areas.<br>▪ See Figure 20. | Parking Supply | ▪ Surface and structure parking lots, many surface lots are slated for redevelopment.<br>▪ Metered on-street parking.<br>▪ New-build apartments often have off-street parking and underground garages available.<br>▪ See Figure 22. |
| Transportation | ▪ WalkScore: 98<br>▪ TransitScore: 97<br>▪ Transit: bus service accessible neighborhood; South Lake Union streetcar.<br>▪ Pedestrian and bicycle networks: acceptable pedestrian permeability and a number of bicycle routes. | Housing Mix | ▪ Primary land use in neighborhood remains commercial.<br>▪ Majority of neighborhood zoned for mixed-use development, allowing for diverse uses.<br>▪ Housing is almost exclusively new-build mixed-use apartments with commercial uses on the ground floor.<br>▪ A small group of older-stock apartments is located along the eastern edge of the neighborhood.<br>▪ See Figure 23. |
| Electric Vehicle Supply Equipment | ▪ Limited number of publicly-available EVSE sites.<br>▪ Location of housing allows most residents to live within walking distance of a publicly-available EVSE.<br>▪ Good commercial and at-work access to charging.<br>▪ DC/Fast Charger available at the SLU Discovery Center.<br>▪ See Figure 21. | Institutions | ▪ Amazon campus is the primary commercial land use, considered institutional because of the campus layout.<br>▪ Cornish, Cortiva School of Massage, School of Visual Concepts, and other schools located in the neighborhood; many schools hold evening classes.<br>▪ See Figure 18. |


Figure 25 South Lake Union Study Area

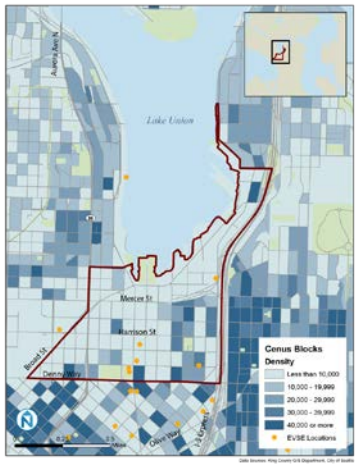



Figure 26 South Lake Union Population Density


Figure 27 South Lake Union EVSE Locations


Figure 28 SLU Publicly-available Parking Lots


Figure 29 South Lake Union Land Uses


Figure 30 South Lake Union Institutions

# 6 GARAGE ORPHAN ELECTRIC VEHICLE STRATEGIES

## STRATEGY DEVELOPMENT BACKGROUND

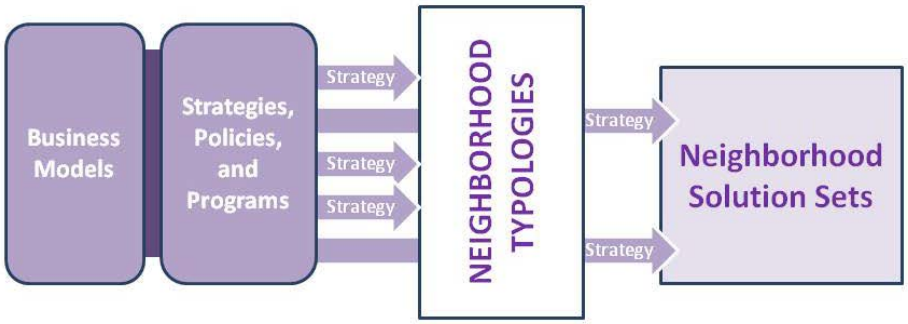
This chapter explores the challenges and opportunities with integrating electric vehicle supply equipment (EVSE) in the neighborhoods identified in Chapter 5. The chapter develops potential strategies for the City of Seattle to pursue and recommends two approaches to pursue in each neighborhood: 1) DC/Fast charging and 2) Level II charging for the three neighborhood typologies. Figure 33 illustrates the flow from business models through neighborhood typologies to the development of strategies that fit the neighborhood solution set.

The research team used the business models to develop and assess the applicability and feasibility of the strategies. Drawn from the business models a wide range of strategies were considered. This assessment found that given the available vehicle technology, land use demands of the models, and current interest in the models, the "charging as charity," "batteries not included manufacturing," and "mileage operator" models did not provide strategies applicable to Seattle at this time.

### Challenges and Opportunities Abound

Each strategy developed presents an overview of some of the challenges and opportunities inherent to the policy or program. All strategies to support the needs of people without access to off-street charging will require a great deal of coordination between the City of Seattle, developers, institutions, and residents to achieve success. If successful, the following strategies will also offer the benefit of absorbing other neighborhood parking needs and accommodating the parking demands of newly built apartment buildings with limited parking. Each of the strategy overviews explains the associated challenges and opportunities.

Figure 19 Neighborhood Solution Set Strategy Development Flow




Neighborhood solution sets are drawn first from connections between existing and future business models and applicable policies, programs, and strategies. A number of applicable strategies are developed and passed through the particularities of Seattle's neighborhood typologies. From this filtering, preferred strategies are developed that best fit a variety of Seattle neighborhoods.

**Access Strategies Fit to the Users**

Any strategy specifically intended for owners of EVs without off-street access to charging needs to consider the demographics of those without access. According to the 2009 American Household Survey for Seattle, Washington, 72.5% of all houses in the city include garages. Of those housing units surveyed without garages or carports, 83.5% of housing units have off-street parking included. In sum, 95.4% of all Seattle residents surveyed have some form of off-street parking available.[15] *That does not mean that all garages guarantee access, assigned off-street parking, or that there are adequate power supplies available for charging. The following strategies may provide important parking access for owners of all types of vehicles.*

## OVERVIEW OF STRATEGIES

Six strategies are presented below and summarized in a table at the end of the chapter. The strategies all represent low or no-cost options for the City; they are strategies that allow the City to use scarce resources to support residents, businesses, and other partners interested in expanding access to EVs.

The strategies present the background, local applicability, challenges, opportunities, and provide a basic road map to implementation. The strategies generally fall under one or more of the following categories: Information & Resources, Expanding Access to EVSE, and Facilitation. The three categories represent the type of support and partnership provided by the City.

[15] US Census Bureau, American Housing Survey, 2009, Table 1-6, SEA-1, Seattle, Washington, city. Accessible online: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

**STRATEGIES**

INFORMATION & RESOURCES

Strategy 1: Citywide Information Clearinghouse

*A one-stop web tool that calculates a number of metrics to make recommendations to the potential buyer about vehicle and housing choices.*

EXPANDING ACCESS TO EVSE

Strategy 2: After-hours Access to Private Lots

*a. Incentivize and encourage parking lot owners and management companies to allow paid access to managed and access-controlled lots, after hours for use of EVSE.*

*b. Develop a marketing campaign or web tool to better advertise the availability of these EVSE parking locations.*

*c. Encourage information and advertising opportunity for lot/garage owners/managers and for nearby residents.*

*d. Require conduit trenching with wire access when surface parking lots are resurfaced.*

Strategy 3: After-hours Access to Institutional Properties

*Encourage the installation of EVSE and increase access to parking lots at institutions located within neighborhoods such as churches, community centers, schools, and universities.*

Strategy 4: Adaptive Use of City-owned Property

*a. Utilize vacant and underused City properties with electrical service for interim or extended EVSE stations.*

*b. Develop Public Private Partnerships (PPP) with charging network providers to manage and maintain locations.*

*c. Prioritize EVSE uses of City-owned surplus property.*

Strategy 5: Neighborhood Peer-to-Peer Plug-sharing

*Provide guidance and support for neighborhood peer-to-peer plug-sharing.*

FACILITATION

Strategy 6: Minimum Parking Standard Reduction in Exchange for EVSE Installation

*Waive or reduce parking minimums in multifamily residential development zones that still have minimums in exchange for the installation of EVSE in parking facilities at the development.*

# Strategy 1: Citywide Information Clearinghouse

*A one-stop web tool that calculates a number of metrics to make recommendations to the potential buyer about vehicle and housing choices.*

## Background and Overview

Information about daily driving habits, the variety of charging options available nearby, and a host of other inputs could be developed into a web tool that calculates driving, at-work EVSE, neighborhood EVSE, and other considerations that may support the buyer's decision. Local advocate groups such as Seattle Electric Vehicle Association could host this web tool.

## Local Applicability

This strategy meets local needs by addressing an information gap that exists for many people considering purchasing an EV. For those who already own a garage orphan EV, a web tool may help them identify nearby locations where they can easily charge. This strategy is applicable to all neighborhoods.

## Challenges

- Maintaining up-to-date information could be difficult without the necessary resources. Requirements when permitting electrical work for EVSE installation will need to include sharing information to support updating the online database.
- Difficult to assess nuances of travel patterns and needs. While basic modeling from a travel calculator will demonstrate how often a buyer will need to charge a vehicle during routine travel, additional weekday and weekend use is common and, at times, unpredictable.
- Many web interfaces quickly become dated. To maintain an up-to-date and usable web interface the host will need to invest in routine software and programming updates to keep pace with advancements in technology.
- High-cost to maintain data and websites. The above challenges are compounded by budget constraints. This may require a partnership with private partners.

## Opportunities

- Established web-savvy advocates, such as the Seattle Electric Vehicle Association, may be willing to host and maintain the site.
- Partnerships are possible with user-maintained, peer-to-peer (P2P) sites such as Plugshare and CarStations.

## Roadmap to Implementation

### Pathways

1. Decide who would develop and host the website. A commitment to maintaining the site would be needed. P2P sites would need to host the calculator and allow for access and editing from hosting staff.
2. Develop open-source opportunities to funnel research and establish a back-end calculator with inputs including home and work locations, nearby publicly accessible EVSE, distance to work, additional daily driving needs (shopping, driving to school, other family commitments, etc.), and weekend transportation needs.
3. Establish how the host will collect and maintain data. Potential opportunities include:
    - Collecting a small fee during electrical installation permitting by the City for host to maintain database and website.
    - Allowing a lower-level of data authentication and allow user-generated, volunteered, and open-source information.
4. Advertise and get the tool into the hands of advocates, dealerships, and others interested in supporting EV adoption.

### Potential Host Costs

Web tools are a service and have dynamic costs. The costs to develop and maintain the web tool may be minimal if the primary investment is in developing the calculator to help people assess their driving needs. Once established, the host may be able to apply for grant funding from local,

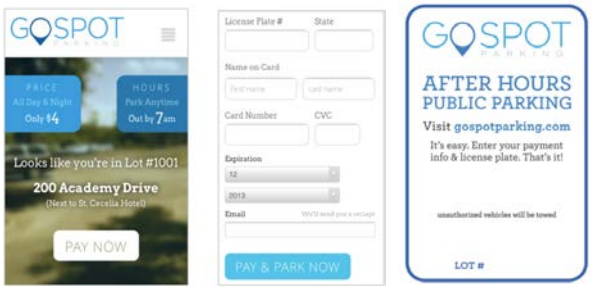
regional, or national agencies to help support the tool. Additional cost-sharing public-private partnerships are possible through the dealerships interested in promoting EV adoption.

## Strategy 2: After-hours Access to Private Lots

*Incentivize and encourage parking lot owners and management companies to allow paid access to managed and access-controlled lots, after hours for use of EVSE.*

### Background and Overview

Parking garages and surface parking lots exist throughout Seattle's neighborhoods and commercial districts. Off-street, commercial parking lots adjacent to residential areas are ideal candidates to host EVSE. Many access-controlled parking garages are only heavily used during regular business hours, or, generally, from 7:00 a.m. to 7:00 p.m. During other hours, these lots often remain empty, offering an opportunity for residential access to charging.


GoSpot after-hours parking management allows payment by smartphone, opening many small surface lots for residential and after-hours use.

Source: gospotparking.com

Many of these lots have restricted, access-limited parking or contracts with towing companies to remove vehicles after certain hours. Using smartphone-based parking applications like GoSpot, lot managers will be able to collect money for after-hours parking without fare collection infrastructure.

According to stakeholder interviews with representatives in the industry, many parking management companies and private lots allow after-hour use of access-controlled parking lots and garages. Often these are at a monthly rate and require the user to vacate the lot before regular business hours. Advertising at apartment complexes nearby is limited or non-existing, leaving a huge untapped market, especially if apartment building parking lots do not have EVSE.

Information campaigns, a maintained website similar to Strategy 1, and potential memoranda-of-understanding (MOUs) with parking providers to better utilize parking spaces at all hours may lead to EVSE installation at residential locations.

### Local Applicability

This strategy directly meets the needs of garage orphan EV users. Developing opportunities to increase access to controlled parking lots could create a revenue stream for the lot managers and solves the home-based charging challenge faced by some potential EV adopters. This strategy

applies to all neighborhoods in Seattle, but certain neighborhoods such as First Hill and Capitol Hill will have more private lots available, due to the existing land use mix.

## Challenges

- Information sharing remains a barrier. If a lot has an after-hours-only access plan and no one knows about it, it hurts the potential user and the lot. This is especially true for lots with available EVSE that charge for charging.
- Ensuring security. Security remains a concern both for the person accessing the lot or garage after hours and for garage managers and owners. For the customer, there is concern about using mostly empty lots at night; therefore, excellent lighting and a variety of crime prevention through environmental design (CPTED) elements should be employed to ensure security. In stakeholder interviews it was noted that lot managers' primary responsibility and concern is for the well-being of their tenants above offering access to others.
- Risk remains for costly installation of EVSE. It may only be feasible to profit from access to EVSE if the initial investment is made. This may require retrofitting, new electrical services, trenching, and running conduit. All of these upgrades may make access to EVSE cost prohibitive. With the right incentives and partnerships in place, it is possible for the City to encourage and develop private partnerships.

## Opportunities

- The business case for opening garages is clear when the cost and use of EVSE is not a factor. Using the lot for overnight, wall-socket, Level I charging may be possible at limited parking spaces.
- An assessment of total existing parking spots in a neighborhood may find that existing business hours-only lots can accommodate many conventional and electric vehicles. This assessment may lead to an overall reduction in district-wide parking minimums.
- Increased pedestrian activity developed by the EVSE users may result in a safer, better surveilled parking facility.
- Where electrical services are adequate, DC/Fast Charging should be encouraged (although Seattle City Light demand charges might apply thus making the operation of the EVSE more expensive). There may be a business case for lot owners and managers to install DC/Fast Chargers that allow customers to purchase a charge in 20 to 30 minutes while shopping.
- One emerging opportunity related to private lots is the installation of Level II EVSE at food cart pods as an adaptive reuse of often-underused land located throughout neighborhoods, especially where there is a commercial node or strip of largely underused surface parking. As food carts grow in popularity in Seattle, there could be the potential to better utilize the land they occupy for additional interim uses.

## Roadmap to Implementation

### Pathways

1. Determine if an incentive is needed for private lot owners and managers. For small lots near daytime offices and businesses, the owners may not be inclined to allow access or to invest in EVSE-ready infrastructure. In this case, an incentive may be needed.
    - Amend Seattle Municipal Code to SMC 23.54 to include parking lot standards for EVSE.
    - For other lots owners and managers requesting special use permits, like in Strategy 5, EVSE-ready infrastructure upgrades should be required for permitting.
    - Develop separate requirements and incentives for small lots with two to 40 spaces and for locations with more than 40 spaces.
2. Assess the incentive structure. If it is to be self-supporting, the incentive needs to be drawn from a revenue stream connected with EVs such as the permitting of EVSE installation. The City's role should be largely encouragement and information sharing.
3. Assess zoning requirements based on specific zone requirements (SMC 23.54.015).
4. Combine EVSE requirements with Green Parking Lot standards (SMC 23.47.016).
5. Require trenching and running conduit to designated spaces when a property owner resurfaces a parking lot.
6. Establish a means to share information about parking spaces available for after-hours parking. This City-hosted and moderated forum can be integrated into the web tools developed in Strategy 1. Removing the barriers to information at present is a priority for all strategies.
7. Develop a marketing campaign or web tool to better advertise the availability of these EVSE parking locations.
8. Encourage information and advertising opportunities for lot/garage owners/managers and for nearby residents.

### Potential City of Seattle Costs

This strategy can be implemented with limited public outlay. By encouraging garage orphan EV owners to request paid access at nearby residential private lots and by encouraging private lot owners and managers to open access to the lots that have EVSE, it is possible to reach a small number of users. With enough requests from EV owners, it is possible that lot owners and managers will find a business opportunity in providing access to charging.

To encourage more small surface lots to install EVSE and offer after-hours access to residents in the neighborhood, Seattle City Light (SCL) and the Department of Planning and Development (DPD) can offer vouchers for electrical contractors to evaluate services of properties, waive permitting fees, or other subsidies if the lot owners agree to a certain number of after-hours accessible EVSE by residents interested in renting the spot.

# Strategy 3: After-hours Access to Institutional Properties

The pay-to-park lot at Lowell Elementary School on Capitol Hill is often empty. Located within a residential neighborhood, it serves little community benefit as an underused lot.

Source: Google Streetview

*Encourage the installation of EVSE and increase access to parking lots at institutions located within neighborhoods such as churches, community centers, schools, and universities.*

## Background and Overview

Woven throughout Seattle's neighborhoods are institutions with surface parking lots that are used either during work hours or primarily for weekly events such as religious services. As Seattle's neighborhoods developed in the 19th and 20th centuries, schools and churches were located within walking distance of neighborhoods at a time when most students, faculty, and parishioners accessed the locations by foot. Over the years, most institutions added parking lots to accommodate demand for automobile parking. Today, many of the lots are underutilized and could serve as locations that can accommodate EVSE installation. Many of these lots have electrical services for street lamps and other uses. Using a subscription-based service such as the Station Owner/Operator model detailed in the study background and research findings chapter, Seattle can collaborate with private partners to install and maintain EVSE in certain parts of these lots.

## Local Applicability

There are churches, schools, and community centers within walking distance of many residents located throughout Seattle's neighborhoods. As the parking lots in many of these places remain underused throughout the week, this strategy would encourage neighborhood access throughout the city. At schools and other locations with day use, residential charging can be limited to after-hours (7:00 p.m.–7:00 a.m.). If EVSE charging subscription providers find the business model lucrative, this strategy has the great potential to increase walkable access to charging throughout Seattle's neighborhoods.

Many of these lots in residential areas are away from commercial strips, requiring a monthly rental or similar agreement from a garage orphan EV owner to ensure the investment.

## Challenges

- There are challenges from information sharing, property security, and cost risks associated with installation.
- The business case for installing EVSE is not clear. If the strategy requires public-private partnerships between Seattle schools and other public or non-profit institutions, the private partner operating the charging infrastructure will need to prove that the location can sustain the investment.
- There is a potential challenge of selling use of public or non-profit land for use exclusive EV use. If access to lots in residential areas is limited to EV owners, it may prove contentious to others wishing access to parking.

- Inverted block rate pricing utilizes tiered pricing for "blocks" of electricity. Operating EVSE may be cost prohibitive if the amount of electrical usage triggers demand charges that the institution or landowner cannot recoup.

## Opportunities

- There are similar opportunities to Strategy 2 (After-hours access to private lots). Potential for daytime revenue generation may increase financial feasibility.
- A variety of pricing and access schemes are possible. At locations with heavy daytime-use, such as schools and community centers, the business case may support providing charging at higher-rate during business hours and at a no-cost, or lower-cost, rate off-hours to subsidize public use of the property.
- There could be improved neighborhood access and utilization of "dead space." Many neighborhoods have small and medium-sized lots that remain open and unused throughout the evening or most weekdays. Installation and use of EVSE could revitalize these otherwise dead spaces.

## Roadmap to Implementation

### Pathways

1. Utilize approaches developed in Strategy 2.
    - Updates required to SMC 23.54: "Quantity and design standards for access, off-street parking, and solid waste storage."
2. Follow SMC 23.78: "Establishment of Criteria for Joint Use or Reuse of Schools" for use of school properties.
    - Assess and address challenges presented by the legal status of using land designated for public and non-profit use.
3. Develop a plan to encourage the installation of EVSE-ready infrastructure during resurfacing.

### Potential City of Seattle Costs

There are similar costs associated with Strategy 2. Waiving certain electric, paving, and design standards may incentivize installation of EVSE. It is imperative to establish that the waivers will not compromise community goals.

# Strategy 4 Adaptive Use of City-owned Property

Figure 20 Former SCL Substations

The old Bellevue Substation, located near South Lake Union and Capitol Hill, is currently a green space.

Source: Google Streetview

The decommissioned 157 Roy St. substation includes a barricaded driveway leading to a parking lot with space for 10+ cars.

Source: Google Streetview

Former Aurora Substation is located adjacent to a commercial strip and a residential neighborhood.

Source: Google Streetview

Old substation in SW Seattle with secured fencing and parking along fence-front.

Source: Google Streetview

## Strategy

a. *Utilize vacant and underused City properties with electrical service for interim or permanent EVSE installation.*
b. *Develop Public Private Partnerships (PPP) with charging network providers to manage and maintain locations.*
c. *Prioritize EVSE uses of City-owned surplus property.*

## Background and Overview

Throughout the City of Seattle there is a stock of City-held property that is underused or vacant. Some of these properties, like old Seattle City Light (SCL) substations, are ideal locations for off-street EVSE stations; they have excellent power service although might have limited connections, trenching, and conduit.

The City would require the private partner installing EVSE to maintain and landscape the property. By offering long-term leases, the City can signal its support to this effort.

Ideally, a charging network provider would enter in a PPP with the City to operate the EVSE, maintain the facilities, and provide customer service. Beyond offering a limited use permit for the

site, the City could also offer advertising and other marketing support tied to Strategy 1 (Citywide Information Clearinghouse).

The strategy is also applicable to decommissioned gas stations. If gas stations or other brownfield lots are maintained by the City because of abandonment or if the landowner is interested in trading use of the property in exchange for maintenance, a PPP may be established to allow a business to operate EVSE in exchange for maintenance of the property.

## Local Applicability

Vacant and underused public properties are located throughout the City making this strategy applicable to most all neighborhoods. Communities often find these locations to be eyesores that detract from property values and neighborhood aesthetics. Revitalizing and landscaping these properties through PPP will increase the sites' attractiveness.

## Challenges

- Balancing the City's development goals may result in unsatisfying predicaments for the nearby EV users using the properties' EVSE, the private partners, and the City for various reasons. Redevelopment of the parcels would follow the lease terms and may influence how attractive the business venture is to private partners.
- Identifying a private partner to operate the subscription-based EVSE may be challenged by market considerations like lease tenure and redevelopment pressure.

## Opportunities

- Through carefully executed PPP, the City may allow a limited or long-term use of the property in exchange for property maintenance and guaranteed infrastructure removal upon completion of the lease. Including provisions to renew the lease would encourage private partners.
- The private partner receives use of prime real estate, often in residential zones or adjacent to commercial strips.

## Roadmap to Implementation

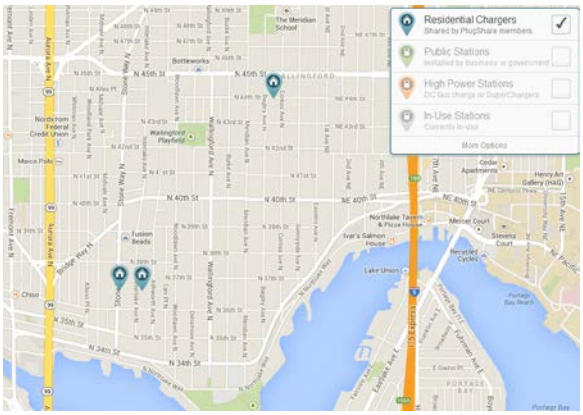
### Pathways

1. Establish a pilot program. A pilot program with interested private partners would serve as proof of concept. Entering into 10-year or longer leases would encourage more interest from the private market. Partners would place the cost of infrastructure in trust and contract to site upkeep.
2. Carefully contract with private partners to ensure maintenance of facilities and to protect community assets. Possibly include language allowing the City to break a lease if a better and higher use is identified for the property.

### Potential Costs to the City of Seattle

The City will need to run a pilot program to establish how public property is used by private entities. Protecting and maintaining the value of the City's assets must be prioritized. It will also be important to make sure that State Accountancy Act requirements are met.

# Strategy 5: Neighborhood Peer-to-peer Plug-sharing




Plugshare.com's Residential Chargers list private homeowners willing to share their EVSE with neighbors and travelers in need of a charge. The Wallingford study area has three participating households.

Source: Plugshare.com

*Provide guidance and support for neighborhood peer-to-peer plug-sharing.*

## Background and Overview

The peer-to-peer (P2P) economy is growing as more people become interested in sharing the benefits and the costs of their investments. Current P2P successes include AirBnB and Lyft, each with varying levels of success and regulation. In many neighborhoods, there is a mix of older stock homes with and without off-street parking as well as single-family homes mixed with apartment buildings, duplexes, and multiplexes. In these neighborhoods there is potential to develop the existing access to residential chargers. For those with shorter commutes or at-work access to charging, splitting home access may be an excellent solution. In some instances, a homeowner may offer a Level I charge for a neighbor while their EV charges at a higher rate in the garage. The myriad options for P2P charging can be supported in a similar way. The options can be hosted through a common interface and online information clearinghouses. Information about potential plug-sharing should be distributed and advocated by EV dealerships. This would build and collaborate with existing P2P sites such as PlugShare.com.

## Local Applicability

In neighborhoods with a mix of older stock homes and multifamily dwellings there are often many homes mixed into the neighborhood that have off-street parking, such as driveways and garages. Sharing this private resource and increasing the public knowledge of sharing opportunities is an excellent, low-cost means to increase access for many Seattle neighborhoods.

## Challenges

- Liability and security issues are present for the homeowners opening their doors to potential strangers. Security and safety issues are present for the garage orphan EV owner if they are entering a stranger's home. A potential solution would be to have a vetting form that provides background information for both the people offering a service and those using the service.
- Exchange of money is difficult to regulate. Similar to other P2P services such as AirBnB and Lyft, reporting the exchange of money and regulating use remains a problem.
- What the money is exchanged for is also a problem. The City must ensure it is not encouraging the re-sale of power by a non-utility, which is against the law. Any cost sharing must be donation-based for use of the property and/or access to the equipment.

### Opportunities

- Increase the confidence of finding parking and charging for garage orphan EV owners. If a relationship or co-charging (every other day or similar) charging pattern is set up it has the potential to greatly increase the adoption of EVs in certain neighborhoods.
- Community resilience and community development. It is possible to forge strong neighborhood relationships through the sharing economy.

### Roadmap to Implementation

#### Pathways

1. Connect with plugshare.com or other plug-sharing sites to establish sponsorship or relationship that will allow for enhanced screening and service in Seattle.
2. Provide public information online and through advertising about the benefits of opening up your garage or carport and sharing a charge with your neighbor.
3. Establish rules about the amount of money exchanged and the kind of reporting and background checks would be needed. Any donation-based exchange must be explicitly for the use of property and equipment, not for the power; reporting any money exchange is also required.

#### Potential Costs to the City of Seattle

Perhaps the lowest cost option among the various technological program strategies. Public information and general support for establishing neighborhood P2P plug-sharing should focus on reaching neighborhood groups and being integrated into local advertising and EV advocacy. A potential strategy to increase the connection between existing P2P resources would be provide sponsorship for an enhanced local Seattle version of plugshare.com or similar.

## Strategy 6: Minimum Parking Standard Reduction in Exchange for EVSE Installation

*Waive or reduce parking minimums in multifamily residential and commercial development zones that still have minimums in exchange for the installation of EVSE in parking facilities at the development. EVSE parking spaces will need to be for exclusive EV parking.*

### Background and Overview

The City of Seattle is a national leader in right-sizing available parking, especially in commercial and high-density residential areas with the highest levels of transit service. Yet, parking over-supply remains a cost to developers and, ultimately, to the City. This strategy builds upon existing King County's Right-Size Parking (RSP) project, an effort by the County to assess the active use of existing parking at many of Seattle's multifamily apartment complexes. With this project, the County developed the Right Size Parking Calculator.[16] Adding inputs to the calculator to assess lowering the amount of parking allowed through the provision of EVSE will move Seattle's nuanced parking requirements forward. A formula would be set to determine the reduction in

[16] King County Right Size Parking Calculator, accessed online: http://metro.kingcounty.gov/up/projects/right-size-parking/

overall parking spaces required for each EVSE-equipped space. EVSE-equipped parking spaces would need to be signed and regulated for EV parking only to ensure access.

An example formula would be to exchange two standard spaces for each EVSE-equipped space, increasing access to EVSE, lowering the development costs, and possibly reducing the total number of vehicles. To ensure use of EVSE and remove vehicles from the street, low-vehicle residential communities and commercial developments should be encouraged to allow others access to the parking structures.

## Local Applicability

Right-sizing parking is a Seattle community goal. By offering a finer grain assessment of needed parking and allowing parking requirements to be flexible based on encouragement of EV adoption, Seattle can better manage parking stock. Exchanging a higher number of standard parking spaces for EVSE-equipped spaces reduces absolute supply of parking while encouraging EV adoption.

The applicability of this strategy is limited by previous efforts to "right size" parking. New developments are currently built with generally appropriate number of parking spaces comparable to demand.

## Challenges

- There may be limited impact. Most neighborhoods near high-frequency transit and with higher densities already have lowered minimum or no minimums.
- There may be challenges to neighborhood compatibility and acceptance. There is often neighborhood pushback to low- and no-parking minimum developments because of increased on-street parking. The EVSE-equipped EV-only parking spaces would prioritize the available parking spaces for EV users.

## Opportunities

- Develop the King County Right-Size Parking (RSP) calculator into an assessment tool to lower the parking minimum. Based on the calculation the developer will provide fewer parking spots for non-EVs while increasing access to EVSE in spaces exclusively for EV use. The calculator will help assess the ideal parking to EVSE ratio.
- Installation of EVSE will cost much less than building additional parking spots. There is the potential that the housing costs will also be lower because of lower construction costs.

## Roadmap to Implementation

### Pathways

1. Determine the locations where this strategy will make an impact. This will require coordination with King County or for the City to develop a parking needs calculator.
2. If the impact is limited by the current development demand, establish a goal for the number of EVSE at new developments without requirements.
3. Consider increasing the amount of pre-wiring required at all building sites including commercial, lots, and residential properties. This will expand the current EV readiness building codes that are standard setting.

### Potential Costs to the City of Seattle

There is limited or no implementation cost carried by the City of Seattle. A potential cost may be updating the calculator and any associated hosting costs. These costs can be tied to Strategy 1.

# STRATEGY SUMMARY MATRIX

| Strategy # | Strategy | Strategy Summary | Challenges | Opportunities |
|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | *A one-stop web tool that calculates a number of metrics to make recommendations to the potential buyer about vehicle and housing choices.* | ▪ Maintaining up-to-date information is very difficult.<br>▪ Difficult to assess nuances of travel patterns and needs.<br>▪ Many web interfaces quickly become dated.<br>▪ Cost. May be difficult for partner nonprofit organization to maintain. | ▪ Many EV advocates have a strong web-presence and maintain existing sites.<br>▪ Partnerships are possible with user-maintained sites such as Plugshare and CarStations. |
| 2 | After-hours Access to Private Lots | *a. Incentivize and encourage parking lot owners and management companies to allow paid access to managed and access-controlled lots, after hours for use of EVSE.*<br>*b. Develop a marketing campaign or web tool to better advertise the availability of these EVSE parking locations.*<br>*c. Encourage information and advertising opportunity for lot/garage owners/managers and for nearby residents.*<br>*d. Require conduit trenching with wire access when surface parking lots are resurfaced.* | ▪ Information sharing remains a barrier.<br>▪ Ensuring security.<br>▪ Risk remains for costly installation of EVSE. | ▪ The business case for opening garages/lots is clear when the cost and use of EVSE is not a factor.<br>▪ Affiliated reduction in parking minimums possible.<br>▪ Increased pedestrian activity developed by the EVSE users may result in a safer, better surveilled parking facility.<br>▪ DC/Fast Charging potential. Where electrical services are adequate, DC/Fast Charging should be encouraged.<br>▪ Require trenching and running conduit to designated spaces when a property owner resurfaces a parking lot. |
| 3 | After-hours Access to Institutional Properties | *Encourage the installation of EVSE and increase access to parking lots at institutions located within neighborhoods such as churches, community centers, schools, and universities.* | ▪ Similar challenges to Strategy 2 with additional issues stemming from more residential locations and conflicts rising from public and non-profit control of land.<br>▪ Business case for installing EVSE is not clear.<br>▪ Potential challenge of selling exclusive use of public or non-profit land to EV owners. | ▪ Similar opportunities to Strategy 2. Potential for daytime revenue generation may increase financial feasibility.<br>▪ A variety of pricing and access schemes are possible.<br>▪ Improved neighborhood access and utilization of “dead space.” |
| 4 | Adaptive Use of City-owned Property | *a. Utilize vacant and underused City properties with electrical service for interim or extended EVSE stations.*<br>*b. Develop Public Private Partnerships (PPP) with charging network providers to manage and* | ▪ Balancing the City’s development goals may result in unsatisfying predicaments for the nearby EV owners using the properties’ EVSE, the private partners, and the City for various reasons. Potential delayed redevelopment, loss of revenue when redevelopment happens, and | ▪ Through carefully executed PPP, the City may allow use of the property in exchange for property maintenance and guaranteed infrastructure removal upon completion of the period or contract.<br>▪ In exchange, the private partner receives use of |

| Strategy # | Strategy | Strategy Summary | Challenges | Opportunities |
|---|---|---|---|---|
| | | *maintain locations.*<br>*c. Prioritize EVSE uses of City-owned surplus property.* | inability to charge one's vehicle.<br>▪ Market analysis will determine if a private partner finds the location suitable for a subscription-based charger. | prime real estate, often within residential zones or adjacent to commercial strips. |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | *Provide guidance and support for neighborhood peer-to-peer plug-sharing.* | ▪ Liability and security issues are present for the homeowners opening their doors to potential strangers.<br>▪ Security and safety issues are present for the garage orphan EV owner if they are entering a stranger's home.<br>▪ Exchange of money difficult to regulate. Similar to other P2P services such as AirBnB and Lyft, reporting the exchange of money and regulating use remains a problem.<br>▪ Illegal to re-sell power by a non-utility. | ▪ Cost savings realized by property owners and garage orphan EV owners.<br>▪ More available on-street parking during charging episodes.<br>▪ Reduced pressure for on-street access to EVSE.<br>▪ Community self-reliance; opportunities for neighborliness and connections to be made. |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | *Waive or reduce parking minimums in multifamily residential development zones that still have minimums in exchange for the installation of EVSE in parking facilities at the development.* | ▪ Limited impact. Most neighborhoods near high-frequency transit and with higher density already have lowered minimum or no minimums.<br>▪ Acceptability. There is often neighborhood pushback to low- and no-parking minimum developments because of increase on-street parking. | ▪ A calculator integrated with Strategy 1 will help assess the ideal parking to EVSE ratio.<br>▪ Installation of EVSE will cost much less than building additional parking spots. Potential that housing costs will also be lower because of lower construction costs. |

# APPLICABILITY OF STRATEGIES BY NEIGHBORHOOD: CAPITOL HILL/FIRST HILL – LEVEL II EVSE

| Strategy # | Strategy | Challenges: Capitol Hill/First Hill | Opportunities: Capitol Hill/ First Hill | Supports DC/Fast Charging? | Overall Fit to Neighborhood (Very Good, Good, Fair, Poor, Unacceptable) | Score (5-1) |
|---|---|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | ▪ There are few challenges that would restrict implementation in the neighborhood. | ▪ The existing density of publicly available Level II and DC/Fast Chargers in the district. | ▪ **Possible.** Many private lots located in residential and along commercial streets; web program should help identify hot spots for DC/Fast Charging. | Good | 4 |
| 2 | After-hours Access to Private Lots | ▪ Some of the lots are access controlled; key fobs and security checks may be needed. | ▪ Existing density of private lots supports increased access. | ▪ **Possible.** Private lots with access to service capacity should be identified. | Good | 5 |
| 3 | After-hours Access to Institutional Properties | ▪ Many of the public and institutional lots in residential areas are used throughout the day.<br>▪ Large institutions in the neighborhood are 18-hour locations: hospitals, universities, and community colleges. | ▪ The existing density of institutional properties supports increased access during off-hours. | ▪ **Possible.** Institutional lots with access to service capacity should be identified. | Good | 5 |
| 4 | Adaptive Use of City-owned Property | ▪ Few City-owned properties available in Capitol Hill/ First Hill. | ▪ Good interim use with cost-saving potential of maintenance and property values. | ▪ **Yes.** Many SCL properties have excellent utility service hook-ups and may be good candidate sites. | Fair | 3 |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | ▪ Difficult in First Hill and parts of Capitol Hill with apartments.<br>▪ Potential issues with re-sale of power. | ▪ Applicable to more residential parts on Capitol Hill. | ▪ **No.** Few if any P2P charging is possible as DC/Fast Chargers are cost prohibitive. | Fair | 3 |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | ▪ Neighborhood pushback: with pressures along commercial strips pinching residential parking supplies, further reductions may be problematic. | ▪ Developer support and potential to increase development by reducing construction costs. | ▪ **Not Likely**, but potential to further reduce parking requirements for DC/Fast Charger installations with public access. | Fair | 3 |

# APPLICABILITY OF STRATEGIES BY NEIGHBORHOOD: WALLINGFORD – LEVEL II EVSE

| Strategy # | Strategy | Challenges: Wallingford | Opportunities: Wallingford | Supports DC/Fast Charging? | Overall Fit to Neighborhood (Very Good, Good, Fair, Poor, Unacceptable) | Score (5-1) |
|---|---|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | ▪ There are few challenges that would restrict implementation in the neighborhood. | ▪ The existing density of publicly available Level II and DC/Fast Chargers in the area is an opportunity to inform potential users. | ▪ **Possible**. Many private lots located in residential and along commercial streets; web program should help identify hot spots for DC/Fast Charging. | Good | 4 |
| 2 | After-hours Access to Private Lots | ▪ Few large private lots in the neighborhood. | ▪ Smaller lots along commercial corridors such as restaurants and small shops may be ideal candidates. | ▪ **Not Likely**. Private lots with access to service capacity should be identified. | Very Good | 5 |
| 3 | After-hours Access to Institutional Properties | ▪ Most institutional properties are located in largely residential locations and may incur pushback from neighbors. | ▪ Depending on public reception, the large number of institutional properties close to homes may make the strategy more successful. | ▪ **Not Likely**. Institutional lots with access to service capacity should be identified. | Very Good | 5 |
| 4 | Adaptive Use of City-owned Property | ▪ Limited City-owned property available in neighborhood. | ▪ Good interim use with cost-saving potential of maintenance and property values. | ▪ **Yes**. Many SCL properties have excellent utility service hook-ups and may be good candidate sites. | Fair | 3 |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | ▪ There are few challenges that would restrict implementation in the neighborhood.<br>▪ Potential issues power resale. | ▪ Excellent potential with a higher number of single family residential homes in the neighborhood. | ▪ **No**. Few if any P2P charging is possible as DC/Fast Chargers are cost prohibitive. | Very Good | 5 |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | ▪ Limited number of large apartment complexes being built means there is limited applicability. | ▪ Future development along N 45th Street and Stone Way may benefit from strategy. | ▪ **Not Likely**, but potential to further reduce parking requirements for DC/Fast Charger installations with public access. | Poor | 2 |

# APPLICABILITY OF STRATEGIES BY NEIGHBORHOOD: SOUTH LAKE UNION – LEVEL II EVSE

| Strategy # | Strategy | Challenges: South Lake Union | Opportunities: South Lake Union | Supports DC/Fast Charging? | Overall Fit to Neighborhood (Very Good, Good, Fair, Poor, Unacceptable) | Score (5-1) |
|---|---|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | ▪ There are few challenges that would restrict implementation in the neighborhood. | ▪ Excellent neighborhood for a pilot of the clearinghouse as it is largely residential. | ▪ **Possible.** Potential locations along 45th Avenue may benefit from additional information. | Fair | 3 |
| 2 | After-hours Access to Private Lots | ▪ Large corporate lots located throughout neighborhood might hesitate to grant local access. | ▪ Stakeholder interview reveals that some large property owners are interested in expanding access.<br>▪ Many surface lots. | ▪ **Possible.** If private lots include DC/Fast Charging, which is possible in the future, there is potential for public access. | Good | 4 |
| 3 | After-hours Access to Institutional Properties | ▪ Few institutional properties located in the neighborhood. | ▪ A variety of institutions in SLU might be amicable to allowing access such as the five places of worship. | ▪ **Possible.** Institutional lots with access to service capacity should be identified. | Fair | 3 |
| 4 | Adaptive Use of City-owned Property | ▪ Few challenges to adaptive reuse likely unless stalling redevelopment on the site. | ▪ There are a few SCL properties in and near SLU that would be excellent candidate sites. | ▪ **Yes.** Many SCL properties have excellent utility service hook-ups and may be good candidate sites. | Good | 4 |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | ▪ There are few challenges that would restrict implementation in the neighborhood.<br>▪ Limited applicability in apartments.<br>▪ Potential issues with re-sale of power. | ▪ Limited opportunity in SLU. If apartments have assigned spots with EVSE, there is opportunity for plug-sharing. | ▪ **No.** Few if any P2P charging is possible as DC/Fast Chargers are cost prohibitive. | Fair | 3 |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | ▪ Neighborhood pushback: with pressures along commercial strips pinching residential parking supplies, further reductions may be problematic. | ▪ Developer support and potential to increase development by reducing construction costs.<br>▪ This will be most successful for commercial lots where developers might push for more parking. | ▪ **Not Likely**, but potential to further reduce parking requirements for DC/Fast Charger installations with public access. | Fair | 3 |

# APPLICABILITY OF STRATEGIES BY NEIGHBORHOOD: TOTALS - LEVEL II EVSE

| Strategy # | Strategy | Score: Capitol Hill/ First Hill (5-1) | Score: Wallingford (5-1) | Score: South Lake Union (5-1) | TOTAL | Top Three RANK |
|---|---|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | 4 | 4 | 3 | 11 | |
| 2 | After-hours Access to Private Lots | 5 | 5 | 4 | 14 | 1 |
| 3 | After-hours Access to Institutional Properties | 5 | 5 | 3 | 13 | 2 |
| 4 | Adaptive Use of City-owned Property | 3 | 3 | 4 | 10 | |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | 3 | 5 | 3 | 11 | |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | 3 | 2 | 3 | 8 | |

Rankings 5 through 1: 5= Very Good; 4= Good; 3= Fair; 2= Poor; 1=Unacceptable.

# APPLICABILITY OF STRATEGIES BY NEIGHBORHOOD: DC/FAST CHARGING

| Strategy # | Strategy | Supports DC/Fast Charging? Capitol Hill/ First Hill | Score: Capitol Hill/ First Hill (5-1) | Supports DC/Fast Charging? Wallingford | Score: Walling-ford (5-1) | Supports DC/Fast Charging? SLU | Score: South Lake Union (5-1) | TOTAL | Top Three RANK |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Citywide Information Clearinghouse | Possible | 3 | Possible | 3 | Possible | 3 | 9 | |
| 2 | After-hours Access to Private Lots | Possible | 4 | Not likely | 2 | Possible | 4 | 10 | 2 |
| 3 | After-hours Access to Institutional Properties | Possible | 3 | Not likely | 2 | Possible | 3 | 8 | |
| 4 | Adaptive Use of City-owned Property | Yes | 4 | Yes | 4 | Yes | 4 | 12 | 1 |
| 5 | Neighborhood Peer-to-Peer Plug-sharing | No | 1 | No | 1 | No | 1 | 3 | |
| 6 | Minimum Parking Standard Reduction in Exchange for EVSE Installation | Not likely | 2 | Not likely | 2 | Not likely | 2 | 6 | |

Rankings 4 through 1: 4= Yes; 3= Possible; 2= Not Likely.; 1= No.

# RECOMMENDED STRATEGIES

This section considers how the strategies developed from available businesses cases fit the neighborhood typologies profiled in Chapter 5. Based on an analysis of applicability, costs carried by the City, and likelihood of success, the strategies received a ranking from 1 to 5. A strategy with a ranking of 1 demonstrates low applicability, and a strategy with a ranking of 5 demonstrates a high applicability.

## Top Ranked Strategies – Level II EVSE

### Strategy 2 and Strategy 3: Encourage After-hours Access to Private Lots and Institutional Properties

Strategy 2 and Strategy 3 received the highest rankings for Level II charging and the second highest ranking for DC/Fast Charging. These strategies encourage after-hours access to private lots and institutional properties, taking advantage of underutilized parking supply. Both strategies are applicable in many neighborhoods, have potential to be successful, and largely require information sharing and encouragement.

## Top Ranked Strategies - DC/Fast Charging

### Strategy 4: Adaptive Use of City-owned Property

The top ranked strategy to encourage DC/Fast Charging access to people without off-street access to home charging was the adaptive use of City-owned property. Clearly defined leases of City property with excellent electrical supply are ideal locations for DC/Fast Chargers.

These properties are often at SCL substations with robust power service connections. Limited trenching and other investments such as sidewalks and repaving would be needed at these sites. The lease terms should include the cost of removal and site maintenance and landscaping. For the private partner, a lease with good terms and access to potential customers may be attractive.

# STUDY FINDINGS AND RECOMMENDATIONS

An important fact to consider moving forward is that according to the 2009 American Household Survey for Seattle, close to 96% of residents surveyed have some form of off-street parking available.[17] This does not mean that all garages guarantee access, assigned off-street parking, or that there are adequate power supplies available for EV charging. However, this gives a baseline that helps the City prioritize activities to encourage EV adoption among Seattle residents.

In addition to working on establishing public/private partnerships to implement the recommended strategies, the following near-term City actions could remove barriers to EV adoption:

- In light of the still largely untapped EV adoption potential by residents with dedicated off-street parking for charging, focus on:

[17] US Census Bureau, American Housing Survey, 2009, Table 1-6, SEA-1, Seattle, Washington, city. Accessible online: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

  - Outreach and engagement to highlight the benefits of EVs, and
  - Making off-street parking sites EV ready, with efforts such as exploring feasibility of City provided incentives for installation of EVSE in resident's properties where possible.
- Where dedicated off-street parking is not available, help residents wishing to adopt EVs make connections to private lot charging and the existing publicly available EVSE network including infrastructure installed by the EV Project. Leverage the work being done by the State Joint Transportation Committee's by analyzing the results of the study of business models for financially sustainable EV charging networks.
- Continue to facilitate EV readiness in multi-family dwellings via code changes.
- Explore ways to remove barriers to DC/Fast Charging, such as exploring the possibility of removing demand charges for EVSE.

# 7 APPENDIXES

## APPENDIX A: BIBLIOGRAPHY

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# APPENDIX B: DETAILED NEIGHBORHOOD TYPOLOGIES

## Introduction


Figure 21 Neighborhoods Profiled

Electric Vehicle charging options and needs vary by neighborhood – largely based on land uses, socioeconomics, and demand. This study examines the premise that some of the previously described business models are more appropriate in meeting the needs of individual neighborhoods. Three neighborhoods were chosen to represent the diversity of neighborhoods in Seattle. Focused on residential at-home charging availability, the project team identified the following neighborhoods: First Hill and Capitol Hill, South Lake Union, and Wallingford. These neighborhoods have a mix of uses including apartments, single-family homes, commercial districts, and institutions. The First Hill and Capitol Hill neighborhoods were combined for geographic and comparability with the other neighborhoods.

This chapter introduces the demographic characteristics and some of the unique attributes of the neighborhoods. Although no neighborhood is the same, these were chosen because they share elements in common with other residential neighborhoods throughout the city. The next chapter presents strategies to match business models to each of the three neighborhoods.

Neighborhood solutions will be fit and tested against these neighborhood typologies. The three residential neighborhood typologies presented here are:

- Dense urban residential/commercial mix as illustrated by Capitol Hill/First Hill
- Redeveloping former industrial area as illustrated by South Lake Union
- Primary single-family residential area as illustrated by Wallingford.

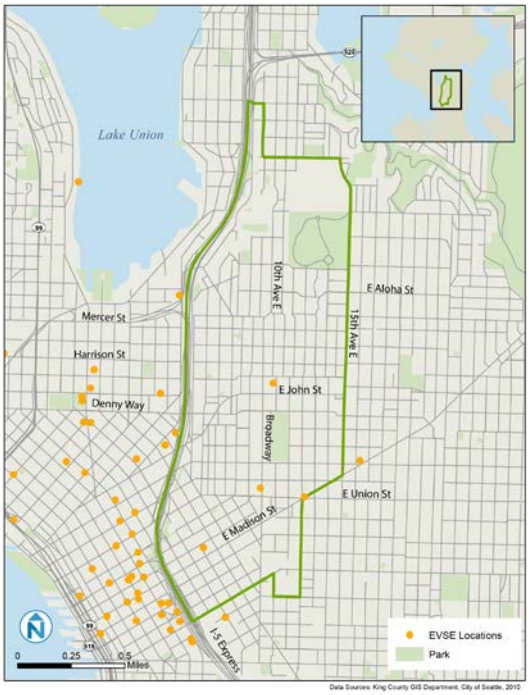



Figure 22 Capitol Hill and First Hill Study Area

# Capitol Hill and First Hill

## Neighborhood Introduction

A continuous ridge running behind downtown Seattle, the Capitol Hill and First Hill neighborhoods offer a mix of new and old housing, commercial, and institutions. For the study area, the southern portion of Capitol Hill and First Hill neighborhood were chosen to portray an area with older homes built without driveways or garages, older apartments without off-street parking, as well as newer buildings and commercial uses.

Largely developed in its current form during the late 19th century and early 20th century, Seattle's First Hill and Capitol Hill still show their historic development patterns, illustrated by developments each with unique characteristics and housing patterns. The waves of development and redevelopment over the decades have resulted in an eclectic mix.

First Hill is home to many of Seattle's state-of-the-art medical centers as well as an eclectic mix of businesses and dense residential housing. While borders are amorphous between adjacent neighborhoods, generally First Hill includes Harborview Medical Center, Swedish Medical Center, and the Virginia Mason Medical Center. Additional institutions include the Seattle University campus, the Frye Art Museum, St. James Cathedral, and others.

Capitol Hill contains nodes of and corridors of commercial activity along Broadway and Pike and Pine Streets with a variety of multifamily apartment complexes located adjacent to the commercial locations. Just off the main thoroughfares, the area features a mix of homes converted to apartments, duplexes, and single-family houses.

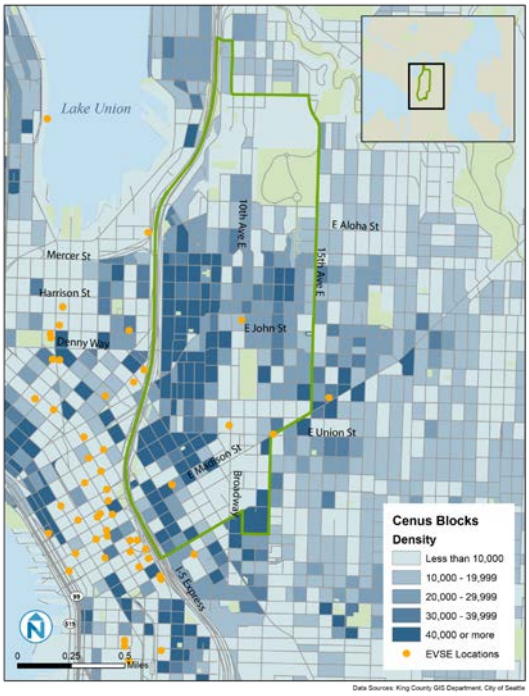



Figure 23 Capitol Hill/ First Hill Population Density

## Population

The most populous of the three study areas, the Capitol Hill/First Hill neighborhoods have a combined population of 30,895.[18] The study area is more than twice as dense in population as the other neighborhoods with 21,613 people per square mile. This density is achieved through multifamily apartment complexes located throughout. Figure 35 illustrates that the densest concentrations in the neighborhood are located on the western edge of the Capitol Hill neighborhood, between Broadway and Interstate 5.

## Transportation

Though these neighborhoods are the densest of the three study neighborhoods, there are many surface parking lots and parking garages. This is due to the large number of employers in the area, including large employees that receive visitors from throughout the region, such as the hospitals on First Hill.

[18] US Census, 2010.

Served by bus transit, in 2014/2015, the completion of the First Hill Streetcar line will better connect First Hill to downtown transportation including Link lightrail as well as Capitol Hill.

With a WalkScore and a TransitScore of 97[19] the neighborhood is considered highly walkable and well-served by transit. This high score is facilitated by excellent pedestrian permeability. There are a number of bicycle routes through the neighborhood. With the completion of the First Hill Streetcar, the transit, pedestrian, and bicycle networks will be strengthened.

### Electric Vehicle Supply Equipment

There are a limited number of publicly-available EVSE sites available in the Capitol Hill/First Hill neighborhoods. Figure 25 illustrates the locations of EVSE as of January 2014. The figure also shows buildings within a ¼ mile and within a ½ mile of the EVSE locations. It can be said that most residents within the study area are within walking distance of an existing publicly accessible charger. Located in commercial and mixed-use locations, most of the publicly available EVSE are more than a ¼ mile from purely residential zoning.


Figure 24 Capitol Hill/ First Hill EVSE Locations

[19] WalkScore is a composite score that calculates a neighborhood or city's pedestrian network, connectivity, and access to a host of attributes. Calculation accessed online: http://www.walkscore.com/WA/Seattle/First_Hill

## Parking

Many of the older stock of apartments and single-family homes do not have off-street access to parking. Some homes in single-family residential neighborhoods do not have driveways and car owners use curbside parking to accommodate home parking needs. Parts of the study area are included in the Seattle Department of Transportation's Restricted Parking Zone, Zone 4, Area 1 and Area 2. Parking restrictions are in effect Monday – Saturday 7:00 a.m. to 6:00 p.m. restricting on-street parking.

Figure 38 illustrates available publicly accessible parking lots in the study area. The allocation of parking lots is market-driven and located near commercial corridors and Downtown.

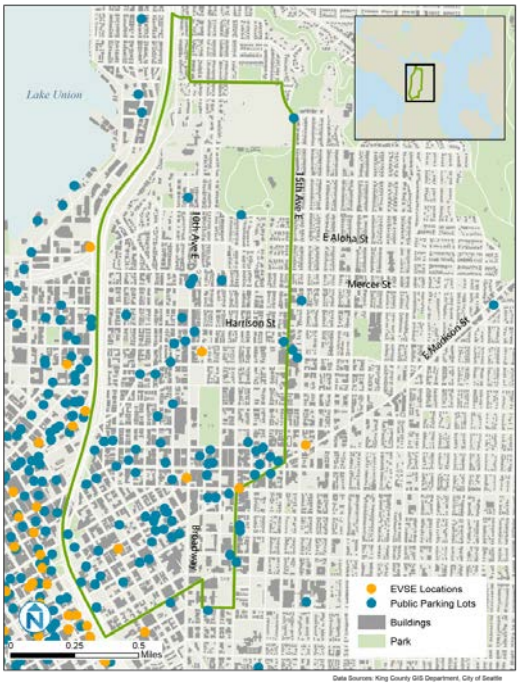



Figure 26 Capitol Hill/ First Hill Publicly-available Parking Lots

Figure 27 Sample Capitol Hill/ First Hill Parking Supply

Sample of First Hill Surface/Structure Parking

Sample of Capitol Hill Surface Parking

Image Source: Google Maps Engine/Earth


Figure 28 First Hill/Capitol Hill Land Uses

A publicly available Blink (ChargePoint) DC/Fast Charger is available at the Harvard Market, but as of March 2014, both DC/Fast Charging connections were offline and will remain so for an unknown amount of time. This highlights the need for reliable access to charging.

## Land Use

### Housing Mix

The Capitol Hill/First Hill study area's major uses are shown in . The mix of residential uses is illustrated in Figure 41 Typical residential uses in Capitol Hill/First Hill. The northern extent of the study area includes mostly residential uses; the middle section mixes commercial and apartment uses while the southern portion includes a variety of institutional and apartment uses. Many of these older apartments either have no off-street parking or have limited spaces, often without power supplies available.

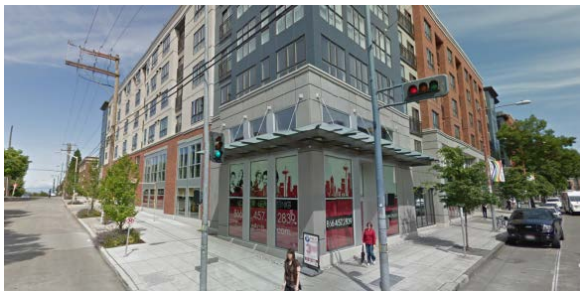
With few single-family homes, First Hill includes a variety of multifamily housing units ranging from early-20th century apartments to more modern high-rise apartments and condominium complexes. Many of these newer residences include belowground parking garages; older housing stock often lacks parking.

Figure 29 Typical residential uses in Capitol Hill/First Hill

Typical older stock apartment at 12th and E Republican on Capitol Hill.

Continuous curb block-face at 13th and E Newton. Houses do not have garages or off-street parking

Surface parking lots at Spring and Boylston Ave. Variety of apartment stock located nearby. Surface church lot located on right.



Modern mixed-use residential/commercial development at Broadway and E Republican. Parking garage does not include assigned parking.

All images: Google Maps

### Institutions

Institutions are located throughout the neighborhoods. These uses include places of worship, schools, universities, and medical uses such as hospitals. There are a number of parks and community centers located in the study areas. All housing units are located within a short walking distance to a mix of institutions. There are more than nine schools and 24 places of worship in the study area. Schools in the study area include Seattle University and Seattle Community College. In a phone interview with Seattle University staff, it was reported that they control ample parking that is often under-utilized or could be used for a variety of uses during off-peak hours. Most all of the schools and places of worship include some surface parking areas that see limited use during evening hours.


Figure 30 Capitol Hill/ First Hill Institutions


Figure 31 Wallingford Study Area

# Wallingford

## Neighborhood Introduction

A residential neighborhood with an older stock of single-family residential housing, Wallingford represents many Seattle neighborhoods clustered near walkable commercial corridors.

North 45th Avenue creates a vibrant commercial corridor cutting through the neighborhood. At the corner of N 45th Avenue and Wallingford Avenue the converted school, Wallingford Center, and the QFC grocery story create the center of the neighborhood.

Just off the commercial corridors are a mix of older single-family homes, older stock apartments, and newer builds integrated into the neighborhood.

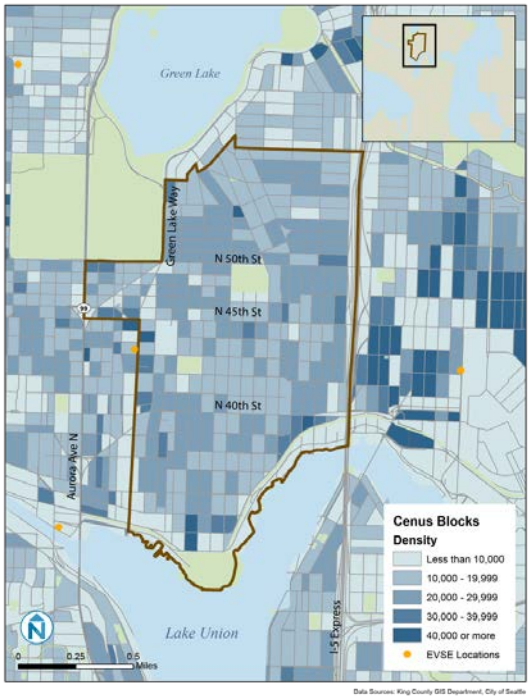



Figure 32 Wallingford Population Density

## Population

With medium densities of housing throughout the neighborhood, Wallingford is home to 15,759 residents with a population density of 10,554 people per square mile.[20]

## Transportation

The most residential of the three study areas, Wallingford was built along the axes of old streetcar lines. Buses have replaced streetcars in the neighborhood, but it remains well served by transit. Easily accessible by Aurora Avenue and Interstate-5, the two major roads west and east, respectively, also increase congestion on neighborhood arterials.

Wallingford was built out as a series of parcels by various developers. Some of the developers sought unique street patterns as evidenced in Tangletown in Wallingford. These angled intersections create congestion and difficult pedestrian and bicycle access. The persistent congestion along major corridors acts as an impediment to travel throughout the neighborhood.

[20] US Census, 2010.

Wallingford does not fare as well as the two other neighborhoods for pedestrian accessibility and transit connections. The WalkScore of 82 means Wallingford is Seattle's 25th most walkable neighborhood. The TransitScore of 59 leaves the neighborhood with the lowest Transit Score of the three study areas.

### Electric Vehicle Supply Equipment

Wallingford is poorly served by existing publicly-available EVSE. Most of the neighborhood is not located within a ½ mile of EVSE and fewer still within ¼ mile. Figure 27 shows where the EVSE are located at the edges of the neighborhood.

## Parking

Wallingford has limited publicly available parking. Most of the surface lots are reserved for customers and workers. Figure 28 highlights the limited supply of public parking in the neighborhoods. Figure 35 shows that parking supply is not as limited as the publicly available off-street parking map suggests. Taking a sample strip of commercial, institutional, and residential uses, the map highlights the location of surface lots, private and public. The graphic highlights the large amount of parking found within the neighborhood.


Figure 33 Wallingford EVSE Locations

Figure 34 Sample of Surface Lots, Wallingford

Image Source: Google Maps Engine/Earth

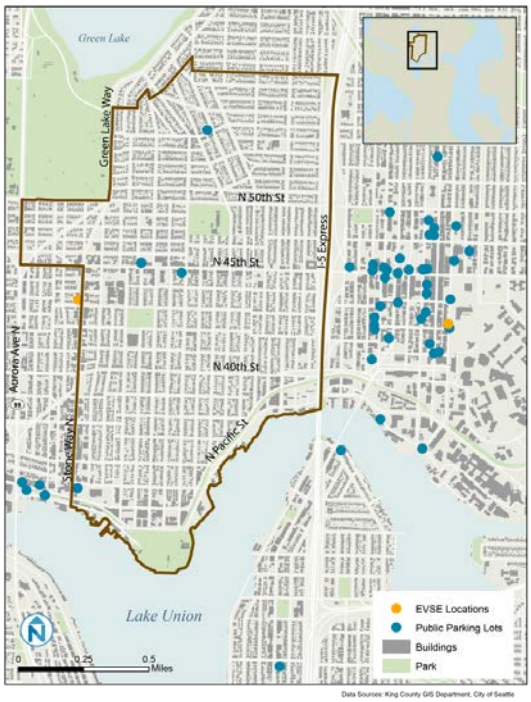



Figure 36 Wallingford Publicly-available Parking Lots


Figure 37 Wallingford Land Uses

## Land Use

The majority of Wallingford is zoned and built-out as single-family residential. There are a diversity of housing and age of housing within the neighborhood.

Beyond the commercial corridors mentioned above there are a number of small commercial nodes found within residential areas.

### Housing Mix

Though dominated by single-family housing, Wallingford also has a variety of multi-family and denser residential uses. Owners of older homes built on larger lots have been splitting their properties, leading to an increase in "skinny" homes on infill properties. Many of these infill homes do not have off-street access to parking. Larger apartment complexes have been built along major corridors in recent years. Older apartments, often 2-3 stories, built without dedicated off-street parking, are found throughout the neighborhood.

The variety of homes range from small bungalows, many without off-street parking, to new-build houses and townhouses, most with garages and parking strips.

Figure 38 Typical Residential Uses in Wallingford

Many of Wallingford's residential neighborhoods feature houses setback from the street without parking strips or garages.


The back lot at QFC is often under-utilized.

Dense apartment complexes are located along major corridors. Image from 43rd and Interlake Avenue N.

New infill housing increases the residential density in Wallingford. Much of this infill housing does not have off-street parking. Image from 55th and Kirkwood Place N.

All images: Google Maps

### Institutions

Institutions are located throughout the neighborhood. A few large schools have surface parking lots, as do a number of the churches integrated in the residential sections of the neighborhood. There are a number of parks and community centers located in the study area. All housing units are located within a short walking distance to a mix of institutions. As a predominantly residential neighborhood, Wallingford has a concentration of schools and places of worship. There are six schools and 11 places of worship in the study area. Most all of the schools and places of worship include some surface parking areas that see limited use during evening hours.

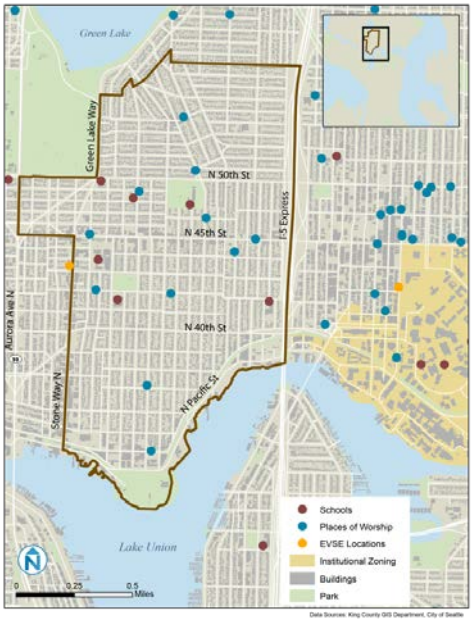



Figure 39 Wallingford Institutions


Figure 40 South Lake Union Study Area

# South Lake Union

## Neighborhood Introduction

Rapidly growing and changing, the South Lake Union neighborhood was chosen to represent neighborhoods in transition. As warehousing and industrial neighborhoods redevelop as high-tech and residential areas, much of the residential growth has been in higher density apartment buildings. Increasingly, these apartment complexes are decoupling parking from housing, utilizing unassigned spots, and building limited parking infrastructure. Residents without off-street or reliable access to charging interested in purchasing EVs may need special consideration for access.

In 2004, the City designated South Lake Union as one of Seattle's six Urban Centers. This designation identified the growth happening and planned in the neighborhood. Once a vibrant warehousing and industrial area, the neighborhood fell into neglect during the late 20th century. When a bid to redevelop the neighborhood as a large city park failed to be moved forward by the voters, much of the property in the neighborhood returned to the park proposer, Paul Allen's real estate firm, Vulcan.

Through zoning programs, the South Lake Union Urban Design Framework, and the South Lake Union Neighborhood Plan, the City and the community have provided capacity for up to 12,000 households and more than 20,000 new jobs.

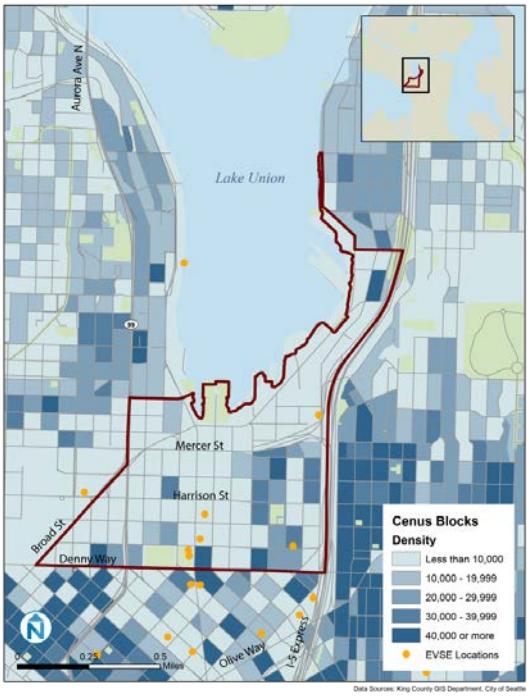



Figure 41 South Lake Union Population Density

## Population

The population density of South Lake Union is concentrated in the southern portion of the neighborhood. In 2010, the population of the neighborhood was 4,137.[21] Recent growth in the housing market has likely increased the population since 2010. The neighborhood's population density was 6,684 people per square mile in 2010.[22]

## Transportation

The South Lake Union Neighborhood has been re-stitched into the urban fabric in recent years with changes to the transportation pattern, an overhaul of Fairview Avenue/Eastlake Avenue, and continued refinements on Mercer Street. The South Lake Union Streetcar and multiple bus lines provide transit access to and throughout the neighborhood.

[21] US Census, 2010

[22] *Ibid.*

South Lake Union's WalkScore is 98 and the TransitScore is 97[23] indicating that the neighborhood is well served by transit and accessible for pedestrians with a variety of amenities within walking distance.

### Electric Vehicle Supply Equipment

There are a limited number of publicly-available EVSE sites available in the South Lake Union. Figure 21 illustrates the locations of EVSE as of January 2014. The Figure shows buildings within a ¼ mile and within a ½ mile of the EVSE locations. It can be said that most all residents within the study area are within walking distance of an existing publicly accessible charger.

The EVSE located at the South Lake Union Discovery Center includes a publicly available DC/Fast Charger. This EVSE is within ¼ mile of almost the entire neighborhood as illustrated in Figure 45 South Lake Union EVSE Locations.


Figure 42 South Lake Union EVSE Locations

[23] http://www.walkscore.com/WA/Seattle/First_Hill

## Parking

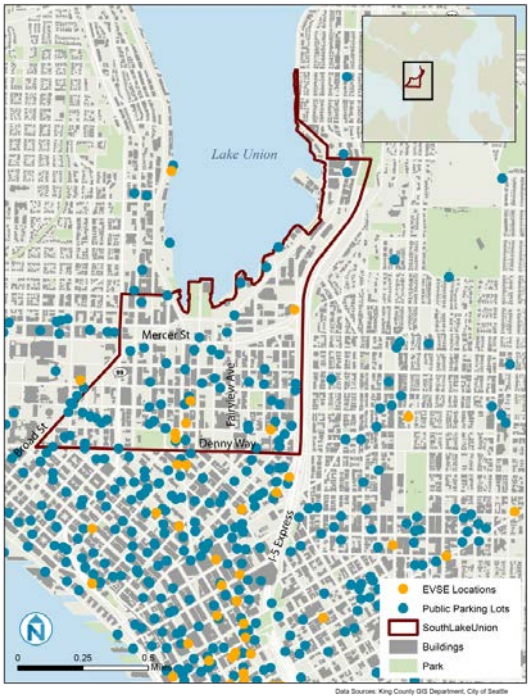



Figure 43 South Lake Union Publicly-available Parking Lots

Because South Lake Union's is undergoing continued redevelopment and its primary uses are commercial, there are a multitude of publicly available parking lots found in the neighborhood. Many of the lots are surface lots, paved areas where buildings were taken down during the neighborhoods years of disinvestment.

Figure 46 illustrates available publicly accessible parking lots in the study area. The allocation of parking lots is market-driven and located near commercial corridors and downtown.

Figure 44 Sample Surface Lot Coverage in South Lake Union

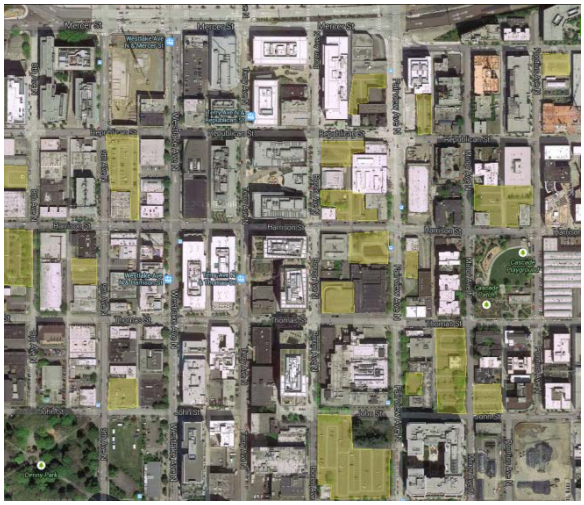


Image Source: Google Maps Engine/Earth

## Land Use

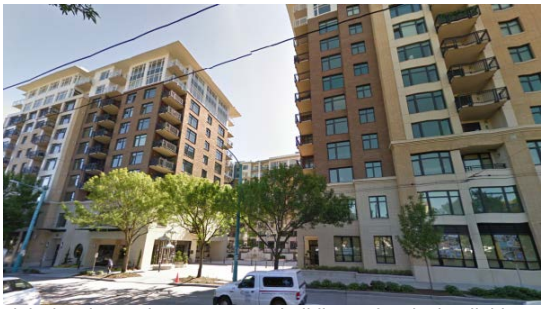
### Housing Mix

The majority of the South Lake Union neighborhood is zoned for mixed-use development. This allows for a diverse mix of uses, creating commercial nodes like the Amazon campus that integrate ground floor retail and have apartment housing located nearby. Many of the older workshops and warehouses that remain the neighborhood have been converted into new commercial uses. Residential uses are almost exclusively new-build modern apartments. There are some older stock apartments throughout the area, mostly along Eastlake Avenue near the Queen Anne neighborhood.

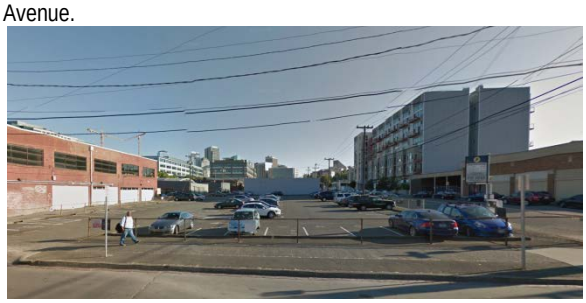

Figure 45 South Lake Union Land Uses

Figure 46 Typical residential uses in South Lake Union

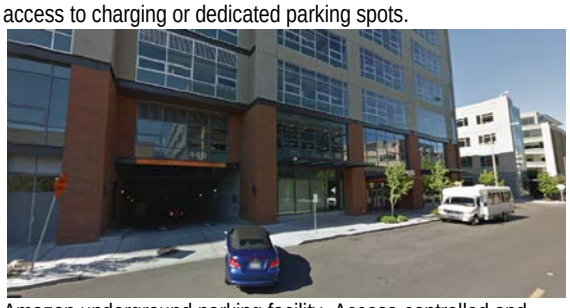
Older stock apartment without off-street parking along Eastlake Avenue.



High-density modern apartment buildings often lack reliable access to charging or dedicated parking spots.



Surface parking lots remain throughout the neighborhood but are being redeveloped quickly. The above lot is located at 9th Avenue N and Republican Street. The Tesla showroom is located to the left.



Amazon underground parking facility. Access-controlled and limited availability.

All images: Google Maps


Figure 47 South Lake Union Institutions

### Institutions

In the southern section of the neighborhood there are a few institutions. There is one school and five places of worship. Most all of the places of worship include some surface parking areas that see limited use during evening hours. The neighborhood hosts a number of professional schools, including Cornish, the Cortiva School of Massage, and the School of Visual Concepts. These schools often hold evening classes and have less predictable parking schedules.

# APPENDIX C: STATEWIDE AND REGIONAL ELECTRIC VEHICLE CHARGING STRATEGIES

## Introduction

Electric Vehicles have found a welcome home in Washington State. This section provides an overview of recent efforts by stakeholders around Washington State to encourage EV adoption. After providing a brief overview of state, regional, and local efforts to facilitate the use of EVs the document focuses on current efforts linked to a January 2014 workshop facilitated by the Seattle Office of Sustainability & Environment (OSE) to re-engage stakeholders around the region. After the workshop an online survey was administered to workshop participants and interested parties; the preliminary results of survey are summarized after a recap of the workshop proceedings.

## Brief History of Regional and Statewide Efforts to Facilitate EV Adoption

The following section offers a brief history of EV use and readiness in Washington State in general and the Puget Sound region in particular. In the 1980s and 1990s, a small number of limited production EVs were available in the Puget Sound region. Options included the Ford Escort-based Jet Electrica, the Renault LeCar, and the Commuter Vehicles Comuta-Car. In the late 2000s a wave of mass-marketed, mass-produced EVs were released due to demand and technological advances. The Tesla Roadster, Nissan LEAF, and Chevy Volt Plug-in Hybrid Electric Vehicle (PHEV) entered the market paired with aggressive government incentives and a strong federal program focused on installing EVSE at home and non-home locations. While the initial adoption of EVs has been slower than initially forecast, more manufacturers such as Mitsubishi, Honda, Ford, BMW/Mini, Fiat, Smart, and Cadillac have entered the market with plug-in electric vehicles (PEV).

The City of Seattle has been working on EV readiness since 2009. Collaborating with other regional governments, businesses, residents, and advocates, the City has made great strides in preparing for EV adoption. Seattle has made it more straightforward for EV users by streamlining the EVSE installation permitting process, making code changes, installing EVSE on City-owned property for City fleets and public charging, and educating the public about the benefits of EVs. The City is studying ways to increase equitable access to charging infrastructure.

### Seattle Electric Vehicle Association[24]

The advocates and enthusiasts of the Seattle Electric Vehicle Association (SEVA) dominated the early history of electric vehicles in the Puget Sound region. For more than 30 years, SEVA has worked to promote the development of EVs by manufacturers and the adoption of EVs by consumers. SEVA increased awareness of EVs through outreach events, car shows, rallies, and legislative pressure.

[24] http://www.seattleeva.org/wiki/Main_Page

## Washington State House Bill 1397: Clean Car Bill, 2005[25]

The Clean Car Bill, or Engrossed Substitute Bill 1397, holds Washington State to a similar standard as California for motor vehicles. A diverse group of lawmakers, environmental advocates, and those in the EV community championed this standard, higher than the national requirements. The Bill adopts higher-than-federal fuel economy standards similar to California's fuel economy standards. The Bill was passed on the provision that Oregon also adopted the higher standards. Later in 2005, Oregon and Montana also passed similar bills.

## Washington State Second Substitute House Bill 1481, 2009[26]

During the 2009 session of the Washington State Legislature, the House passed Second Substitute House Bill 1481 (2SHB 1481). The purpose of the Bill was to accelerate the adoption of EVs through a variety of measures. Through the bill, the Washington State Department of Commerce was to develop model ordinances appropriate for regional and local needs. This guidance directed the siting of EVSEs. A provision of the Bill required that cities in the Central Puget Sound, including Seattle, allow EVSEs and associated infrastructure as a use in all areas except those zoned residential, resource, or critical areas.

## Electric Vehicle Infrastructure Project and Technical Advisory Committee and Model Ordinance, 2010[27]

In response to the House Bill 1481 mandate, and using American Recovery and Reinvestment Act (ARRA) funds, a Technical Advisory Committee composed of local, regional, and state governments and agencies convened to increase access to EV infrastructure. This effort dovetailed with major automotive manufacturers entering the market with mass-produced EVs in the late 2000s. The Puget Sound Regional Council (PSRC), the Washington Department of Commerce, and local governments worked with the EV industry to ensure that cities and the region were ready for rapid adoption of EVs.

The Technical Advisory Committee and a consultant team developed a guide for local government with a model ordinance and model development regulations. The model ordinance has helped many local governments to adopt ordinances amending zoning codes, parking lot design guidelines, and parking enforcement codes.

## The EV Project, 2009[28]

In 2009, ECOtality North America was awarded $99.8 million from the American Recovery and Reinvestment Act of 2009 to launch the EV Project. In June 2010, the EV Project was granted an additional $15 million. Awarded and administered through the US Department of Energy (DOE), the EV Project was launched to deploy charging stations in major cities and metropolitan areas throughout the United States. This $115 million remains the largest amount given by the DOE for the deployment of EV infrastructure.

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[25] http://apps.leg.wa.gov/documents/billdocs/2005-06/Pdf/Bill%20Reports/House/1397-S.FBR.pdf

[26] http://apps.leg.wa.gov/documents/billdocs/2009-10/Pdf/Bill%20Reports/House/1481-S2%20HBR%20PL%2009.pdf

[27] http://www.psrc.org/assets/4325/EVI_full_report.pdf

[28] http://www.theevproject.com/overview.php

ECOtality collaborated with more than 60 companies and organizations including Chevrolet, Nissan, and other private companies as well as public partners including the State of Washington. Participants in the EV Project installed EVSE in residential and publicly-available locations. EVSE was deployed and installed at no cost to qualifying residential customers owning Nissan LEAF and Chevrolet Volt vehicles. The EV Project collected and analyzed data to characterize vehicle use. Data from publicly charging locations included trials on various revenue systems from commercial and public charge infrastructures. Today, the Idaho National Laboratory continues to collect and analyze this data.

In Washington State, The EV Project participated in the West Coast Electric Highway, and committed to deploying about 1,500 Level II EVSE for home installation. Initial plans were to install 17 or more DC/Fast Chargers in Washington. The actual number of residential and public EVSE installed in Washington ended up lower than projected. Nationally, the EV Project contributed a number of findings reports and the data found in research papers and findings that have guided the development of the nascent industry.

As of March 2013, ECOtality met the EV Project goal for residential charging units. ECOtality has since filed for bankruptcy, unable to make the Blink charging network profitable outside of the EV Project support. In October of 2013, the Car Charging Group purchased the Blink network.

## Washington State Plug-in Electric Vehicle Task Force and the Plug-in Electric Vehicle Readiness Plan for the State of Washington, 2011[29]

In 2011, the Washington departments of Commerce and Transportation organized a task force to address statewide electrified transportation needs. The Task Force "provided an opportunity to share challenges, information and ideas among a broad-based group, and to coordinate electric-vehicle-related activities."[30] The Task Force was composed of federal, state, regional, local staff, EV advocate groups, utilities, fleet managers, private companies, and related non-profits and organizations. The Task Force worked together for two years and arrived at the following key conclusions:

- Washington is at the forefront of EV deployment and should continue to lead.
- Members and stakeholders are ready to evolve the task force into entities that solidify and institutionalize progress.
- Increased manufacturer and company involvement is needed.
- PEV deployment is a long-term effort that requires sustained effort.

[29] http://www.wwcleancities.org/documents/EV_Readiness_Plan_WA.pdf

[30] http://www.commerce.wa.gov/Documents/PEV-Task-Force-Gov-Rpt-2013.pdf

State agencies/commissions
- Washington State Department of Commerce
- Washington State Department of Transportation
- Washington State Department of General Administration
- Washington State Department of Labor and Industries
- Washington State Department of Ecology
- Washington State Building Code Council
- Utilities and Transportation Commission
- Washington State Transportation Commission

Regional agencies
- Puget Sound Regional Council
- Puget Sound Clean Cities Coalition
- Puget Sound Clean Air Agency

Counties/Ports
- King County
- Snohomish County
- Port of Chelan County

Cities
- City of Seattle (including City Light)
- City of Tacoma
- City of Bellevue

Elected officials
- 1ST District Congressional Office
- Senator Cantwell's Office

Electric utilities
- Puget Sound Energy
- Avista

Research Institutions
- Pacific Northwest National Laboratory

Automobile manufacturers
- Nissan North America
- Ford Motor Company
- BMW

Non-profit organizations
- New Energy Solutions
- Climate Solutions
- Seattle Electric Vehicle Association

http://www.commerce.wa.gov/Documents/PEV-Task-Force-Gov-Rpt-2013.pdf

In early 2013, the PEV Task Force disbanded. With the ending of the Washington PEV Task Force and the winnowing of federal funding for EV charging infrastructure, the State continues to encourage EVs through a number of other initiatives. These initiatives include Washington's portion of the West Coast Green Highway, participation in the Center for Climate and Energy Solutions' PEV Dialogue Group, EV-ready Scenic Byways initiatives led by Plug-in North Central Washington, and community planning guidance at the local and regional level.

## Recent Washington State Bills: House Bill 1571, 2011;[31] Senate Bill 5099, 2013;[32] House Bill 1883, 2013/ Senate Bill 266;[33] Senate Bill 5849, 2013-14[34]

- House Bill 1571 was a victory for the nascent EV industry in 2011. The Bill limits regulations on EV battery charging facilities. The Bill prohibits the Utilities and Transportation Commission (UTC) from regulating special rates for EV battery charging stations offered by an entity not subject to the UTC.
- Fleet conversion represents a huge step forward for EV fleets in Washington State. State Senate Bill 5099 passed in 2013, requiring all local government fleet vehicles to be operated by biofuel or electricity by June of 2018 if reasonable substitutes are available.

[31] http://apps.leg.wa.gov/documents/billdocs/2011-12/Pdf/Bills/Session%20Laws/House/1571-S.SL.pdf
[32] http://apps.leg.wa.gov/documents/billdocs/2013-14/Pdf/Bills/Senate%20Bills/5099.pdf
[33] http://apps.leg.wa.gov/billinfo/summary.aspx?bill=1883&year=2013
[34] http://apps.leg.wa.gov/billinfo/summary.aspx?year=2013&bill=5849#documents

- A Bill seen as equitable by some as a penalty by others, Bill 1883 administers a $100 registration fee to EVs to compensate for the loss in gas tax revenue incurred by the State.
- Senate Bill 5849 institutes a $124 parking infraction for internal combustion engine vehicle owners parking in the parking spaces designated as EV charging stations (colloquially known as being ICE'd). The law applies to parking spaces indicated by green pavement markings.

## Current Regional Efforts

As efforts at the state and regional levels tapered on in late 2012, EV advocates including SEVA representatives continued to push at the local and state level for a variety of incentives and programs. The Washington Plug-in Electric Vehicle Task Force ceased regular meetings after releasing the February 2013 progress report, leaving coordination and information-sharing gaps at the state, regional, and local levels.

Currently, PSRC has stepped down from its role in EV readiness. King County Department of Transportation continues to lead a smaller regional effort that include siting EVSE at Park and Ride lots and King County Metropool EV rideshare program. Local governments, exemplified by Seattle's Plug-in Ready Interdepartmental Team, continue to work to support EV adoption through agency initiatives, incentive programs, code and standards, and education efforts.

A renewed regional effort is underway. The January 2014 Regional EV Charging Strategy Workshop hosted by Seattle's OSE included a request of participants to reconvene a regional working group to address regional and interregional EV charging needs. The following section details findings from the workshop.

## 2014 Regional/ Statewide EV Charging Strategy Workshop Overview

On January 21, 2014, OSE sponsored a half-day workshop. Appendix A contains the materials used to promote and facilitate the workshop. The purpose of the workshop was to rekindle a regional and statewide working group to address plug-in readiness and to offer support to affiliates through information sharing and collaboration. Additionally, the workshop collected information for an OSE study addressing the barriers to EV charging for people without off-street access to parking. The goals of the workshop were to kick-start a new conversation and renewed interest in regional collaboration, to inspire creative solutions for equitable access to charging throughout the region, and to assemble regional and local strategies. The workshop was successful in meeting these four goals.

The workshop began with a quick overview of the OSE study, presenting the challenges, the neighborhoods studied, and some example strategies that may address the needs of people without off-street parking. A longer introduction session that allowed participants to describe their interests in EVs, what they are currently working on, and any challenges they are confronting followed the presentation. This extended introduction better acquainted workshop participants with the breadth of interest and expertise in the room that could be drawn upon. Based on mutual interest, Sandra Pinto de Bader of OSE asked participants if they would be interested in renewing a statewide working group to address the breadth of topics and issues presented. The vast majority was in favor of this renewal and an agenda-setting conversation followed.

After a break that allowed for important networking, the conversation dug into the priorities for regional/statewide collaboration. The following topics were the main subjects of conversation:

- Policy Conflicts
- DC/Fast Charging Prioritization
- "Danger of barking up the wrong tree"
- "EV Everywhere"
- EVSE Deserts
- Automated Vehicles
- Adoption Rates
- Multifamily Homes
- Technology
- Marketing
- Regional first responders training
- Tax incentives
- EV taxis and fleet vehicles

These priorities will help form the working group's agenda for upcoming meetings. A work session followed this conversation. The participants were split into five groups. The groups answered questions related to the OSE barriers to charging study and some regional/statewide issues. Each team responded to the following challenges: 1) develop strategies to facilitate charging from people without access to home charging, 2) develop strategies for regional connectivity, and 3) develop strategies that support regional cooperation.

Teams conferred amongst themselves and the exercise spurred some excellent conversation and ideas. Appendix B provides detailed responses from this exercise. For challenge 1, teams developed strategies such as increased access to DC/Fast Charging in neighborhoods, access to institutional properties, and recommendations to focus on at-work charging. Recommendations included better understand the market, increasing incentives for building owners, and establishing mobile charging. One group mentioned induction charging while one participant noted that induction charging could fry small animals such as pets and would be unlikely in residential neighborhoods.

Most teams addressed challenges 2 and 3, Regional connectivity and regional cooperation, together. Teams developed strategies including:

- Incentives to bring advocates and other groups together collaboratively.
- Better regional data gathering and intergovernmental information sharing.
- Efforts to establish charging etiquette for regional charging points that may develop lines.

The workshop concluded with each team reporting their strategies, a word of thanks for participation, and a reminder that OSE would be following-up with them to establish the statewide/regional working group.

## Regional/ Statewide EV Charging Strategy Workshop Findings

In summary, the following themes came out of the team work sessions and the general group discussions:

- Participants noted the need to share information, both within the regional working group and with the public. Working group information sharing should include code/regulation best practices and data summaries for use in promoting EVs to public and policy makers.
- Participants had a desire to focus on workplace solutions. Most groups developed strategies for people without home access to charging that included workplace solutions.
- Multiple participants are working on fleet solutions to expand use of EVs in private and public fleets. The Nissan LEAF fleet lease plan was of interest to many participants.
- Participants see value in the network aspect of the working group; there was a desire for additional voices and for the working group to serve as a networking opportunity for best practices and new developments to be heard.
- A number of participants alluded to missing pieces of policy coherence. Policy coherence entails the promotion of mutually reinforcing policy actions across all departments and governmental entities to ensure synergistic achievement that aligns and builds toward goals. Workshop participants noted issues in the use and meaning of the terms "access" and "equitable." Participants also mentioned the policy incoherence between stated emissions reduction actions and vehicle miles traveled (VMT) reduction actions.

## Preliminary Online Survey Results

After the workshop, all participants who expressed an interest in further participation with the group, and initial invitees who were not able to attend, were sent a follow-up survey. In addition to following up on interest in a future working group, survey logic, allowed those who were unable to attend to workshop the opportunity to provide input on the workshop topics. The survey questions are found in Appendix C. Survey recipients were encouraged to send the survey to their colleagues interested in EVs. All survey responses were anonymous. The follow is a summary of the preliminary results collected between February 3, 2014 and February 11, 2014.

### Preliminary Online Survey Findings

The following key themes emerged from the survey responses:

- "Residential access to charging for people without off-street parking" was the top ranked subject that survey participants thought the statewide EV working group should work on, followed by "building codes and standards related to EVs and EVSE" and "At-work charging strategies."
- Most survey respondents thought the statewide group should be called a "working group," that the working group should meet quarterly, and that the working group should have an online presence.
- When asked to rank the top strategies to facilitate charging for EV users without off-street access to charging, the top-ranked choice was to provide "At-work charging strategies to facilitate away-from-home charging." The second and third ranked choices were "Plug-

sharing strategies with neighbors" and "Afterhours access to private parking lots and garages such as commercial buildings, hospitals, and other institutions."

## Detailed Responses

A total of 16 responses have been collected. Exactly half of the respondents participated in the Charging Strategy Workshop. The eight respondents that participated in the workshop represent one-third of total workshop participants. Eighty-percent of respondents replied that they would be interested in participating in the formation of a Washington State EV Readiness working group. There was no demographic information collected.

A few open response questions solicited thoughts not captured in other survey questions and the two ranking exercises:

### What issues related to EVs interest you the most?

| Open Response |
|---|
| Education and Outreach. LOVE doing shows and exhibits and interacting with the public. |
| Benefits to public agencies, and use of public dollars. |

### What challenges have you faced and what kind of support do you need to facilitate EV adoption?

| Open Response |
|---|
| We NEED to concentrate working with EV Dealers. Many of them do not hold the same passion for increased EV Sales as we do. Profit margins are low, very little chance for Service Profits, and much more customer education and Salesmanship needed to close a sale. |
| "Gift of public funds" issues; EV is low priority and seen as an above-and-beyond project; mandate from City or State to install stations and/or future mandate |

### What opportunities do you see at the local, regional, state, or federal level for increased EV adoption?

| Open Response |
|---|
| If the State of Washington had the same over-arching environmental regulations as California and Oregon the manufacturers such as VW, GM, Honda, Fiat would have to bring their products to Washington State also. Presently one must buy many of these products Out Of State, and have them brought back to Washington State. |

### What subjects should the working group address?

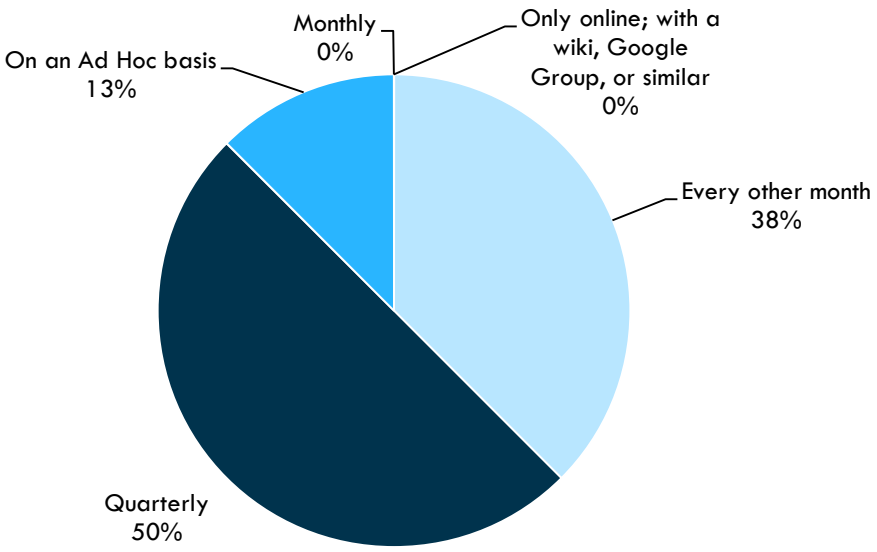
Participants ranked ten subjects from one through ten, with one representing their highest priority. By far, the most popular subject for the EV Readiness working group was "Residential access to charging for people without off-street parking." It is possible that survey bias was present based on the OSE study on residential access to charging for people without off-street parking. The subjects below represent the aggregate rankings, with one being the top ranked and 10 being the lowest ranked subjects.

| Subject | Rank |
|---|---|
| Residential access to charging for people without off-street parking | 1 |
| Building codes and standards related to EVs and EVSE | 2 |
| At-work charging strategies | 3 |
| Marketing and public information needs for increased EV adoption | 4 |
| EVSE siting criteria | 5 |
| Access to charging in "third places," non-home- or work-based charging | 6 |
| DC/Fast Charging implementation | 7 |
| Fleet conversion to EVs | 8 |
| EVSE compatibility, standards, and protocols | 9 |
| EV technological improvements | 10 |

Two follow-up questions with open-ended responses were asked: "what other subjects should the working group address?" and "Where would you like to see an increase in regional and statewide collaboration?" One respondent answered both questions, answering the first, "The potential middle-class market who could stand to benefit from the emission and cost reductions; and the second, "Incentives for middle-income families and individuals to participate and benefit from the technology and reduced pollution." One additional respondent replied to the latter question, noting, "I guess the answer would be more collaboration between existing stakeholders and Government agencies."

### How often do you think the working group should meet?

Respondents that indicated that they were interested in participating in the working group were asked how often they would like the group to meet. Half of respondents thought the group should meet quarterly. The next most popular frequency was "Every other month," with about one-third of the respondents. Thirteen-percent of respondents thought the group should meet on an Ad Hoc basis and no respondents felt the group should be online only or meet monthly.




**What do you think this group should be called?**

**In the past, Washington State convened an EV task force, a point that workshop participants noted to highlight the different meanings that the words "working group" and "task force" have. Generally, it was felt that "working group" was a better term for a group meeting to address a variety of subjects related to EV readiness and adoption. Are you interested in participating in an online working group through a wiki, Google Group, or similar?**

Most all respondents are technologically savvy, as evidenced by their completion of the online survey. Because respondents and potential EV Readiness working group participants have busy schedules and live in disparate parts of the state, a workshop participant suggested that the group engage online through a wiki or other online community message board.

Survey participants interested in participating in the EV Readiness working group answered if they would be interested in an online working group using such technology. The majority (71%) were interested in an online working group while 29% were not interested. In light of the lack of interest in having the working group meet only through an online medium, the majority interest in an online working group in addition to in-person meeting demonstrates that there is still value in real-time interaction between working group members.

**What other strategies do you think are important for OSE to pursue to increase the opportunities for EV adoption for people without off-street access to charging?**

While the primary objective of the online survey was to collect workshop participant's priorities for a statewide working group, survey respondents answered a few questions about strategies to facilitate access to charging for people without home access to off-street parking. Respondents were queried about the subject because it was a key part of the January workshop.

Survey respondents ranked seven strategies from one through seven, with one as their top-ranked strategy and seven as their lowest-ranked strategy. The most popular strategy was "At-work

charging strategies to facilitate away-from-home charging." "Plug-sharing with neighbors" and "After hour access to private parking lots and garages such as commercial buildings, hospitals, and other institutions" were the second and third ranked choices, respectively.

| Strategy | Rank |
|---|---|
| At-work charging strategies to facilitate away-from-home charging. | 1 |
| Plug-sharing strategies with neighbors. | 2 |
| Afterhours access to private parking lots and garages such as commercial buildings, hospitals, and other institutions. | 3 |
| Private-public partnerships to install and operate EVSE on unused publicly-owned property such as Seattle City Light substations. | 4 |
| Afterhours access to publicly-owned off-street lots such as schools, public buildings, or fire stations. | 5 |
| Focus on DC/Fast Charging access and battery swapping strategies such as Tesla's SuperChargers in residential applications. | 6 |
| Increasing the number of Level II and DC/Fast Chargers at "third places" such as grocery stores and retail. | 7 |

**What other strategies do you think are important for OSE to pursue to increase the opportunities for EV adoption for people without off-street access to charging?**

This open response question gathered four responses. Each comment draws attention to an important subject of inquiry.

*Follow-up to response 1:* The proliferation of gas stations provided by the private market offers limited lessons for the propagation of EVSE. Because EVs have such a small market share at this time and an explosion in adoption like the Ford Model T is unlikely, the spread of EVSE following a gas station model is unlikely.

*Follow-up to response 2:* The comment about self-driving vehicles highlights the rapidly changing tendencies of the EV market at this time. A volatile market reduces entrepreneurs' willingness to invest in a technology if current investments are not likely to turn short-term profits.

*Follow-up to response 3:* The education needs for building developers is an important subject that warrants inclusion in the list of strategies to increase access to charging for EV users without off-street access to charging.

*Follow-up to response 4:* The final comment draws sharp focus to the issues surrounding terminology (access and equity) and the vast numbers of barriers that people face not captured by the study. Through incoherent policies within one jurisdiction or between jurisdictions, it is possible that emission benefits can end up being pitted against VMT reduction benefits via conflicting policies.

The full responses below:

| Open Response |
|---|
| 1. How/why/when did gasoline stations become so prominent? Can we draw lessons from the history of gasoline stations? |
| 2. If (when?) self-driving vehicles gain acceptance, the location of charging stations may cease to matter. |
| 3. More outreach to building developers, condo associations, apartment management to be pro-active and provide templates and ways of getting conduit or full installation in. |
| 4. It would be helpful to gain clarity on whose barriers we are working to remove. The implicit assumption was that we are trying to merely increase access for those who already have resources to consider the technology and be a part of the market. Please consider who is NOT in the room when you are making decisions and planning around "access" issues. |

## Next Steps for Regional/Statewide Engagement

Based on conversations that took place during the January workshop and responses to the online survey, recommended next steps for regional engagement includes:

- Follow-up with all survey respondents and workshop participants to establish a first meeting of the statewide working group.
- Establish an online Google Group or Wiki to start a discussion forum. Working group ground rules and agenda setting may be accomplished through this medium.
- Set the agenda for the first working group meeting. Recommended topics for the first meeting are residential access to charging for people without off-street parking, building codes and standards, and at-work charging strategies.
- Convene the working group.
- Because at-work strategies were stressed by many workshop participants during their individual introductions, during the group exercise, and through the online survey in both the working group and the OSE study rankings, it is recommended to move the topic to the front of the agenda.
- Workshop participants noted a desire for continued regional and statewide collaboration. Many participants were a part of a number of state and regional taskforces and advisory groups that disbanded for a number of reasons. A goal of the initial meeting should be a commitment to continued collaboration and conversation, and an examination of why the previous Task Force disbanded.
- EV readiness and adoption are vast topics that attract varied interest and levels of specialization. Regional engagement should allow for sub-groups to collaborate independently of the main working group.
- Set rough dates for each meeting in the coming year. Consider an annual conference that brings a wider group of interested parties that may be colleagues or tangentially connected to EV adoption.

# APPENDIX D: BUSINESS MODELS FOR ELECTRIC VEHICLE CHARGING AT THIRD PLACES AND WORKPLACES

## Charging Provided as Amenity Model

**Concept:** Private parking facility owners provide access to EVSE as an amenity to customers. Charging is provided free of charge, but parking may incur costs.

**Overview:** Providing charging as an amenity is an option that was exercised at the earliest stages of modern EV deployment. In this model, a property owner such as a retailer or an apartment complex manager purchases the EVSE, obtains proper permitting, and pays for the installation of the EVSE. Most often, these are accessible without cost to the user.

**Advantages:** The advantages of this arrangement are to businesses attracting customers and to customers accessing free charging. Primarily offered to attract business, to attain a "green" image, or for LEED credits.

**Current limitations:** As EVs become more popular, the financial incentive of providing this type of attraction may diminish, but for relatively little investment, the provider can gain patronage and esteem. With the current limited adoption of EVs, it may not be financially viable or responsible to reserve a parking spot for limited use by EV users. Unless DC/Fast charging is installed, level I or level II charging might not provide meaningful charging due to usually short visit times.

**Available in Seattle?** Yes. Free charging locations found throughout the city.

**Available in the Puget Sound region?** Yes.

**Applicability for people without home access to charging:** Not a viable option for daily charging needs, this model is best for charging at "third places" such as shopping centers. If a large number of people utilize these locations for daily charging needs or access the parking after business hours, the property owner/manager will need to charge for parking or utilize a subscription-based service. See station owner/operator model.

## Station Owner/Operator Model

**Concept:** Contracting with a property owner, a charging station supplier installs EVSE on property as an amenity and charges users per charging episode, often through a subscription-based service plan.

**Overview:** The most common business model that has offered mixed success is the owner/operator model. There are two variations of this model. In the first, a property owner contracts with a charging station supplier. The supplier permits, installs, and owns the charging infrastructure. The property owner offers access to the EVSE without cost to the customers and tenants. In the second, and more common variation of this model, includes the same contracting with a service provider, but the charging is subscription-based and not free of charge.

In the first case, the property owner pays for power but is insulated from permitting, installation, and maintenance costs. In the second case, the owner/operator contractor monitors energy use and compensates the owner for the energy while keeping a profit.

**Advantages:** For the consumer, proprietary websites and smart phone applications allow for easy wayfinding to EVSE locations. Some applications allow for interoperability with other

systems. Simple membership card access works well for consistent charging in-network. For the commercial property owner or manager, the model limits the financial investments. Existence of EVSE is cited as a sales point or amenity for condominium, shared use garages, and other locations. A strong network with a good reputation will attract users to location.

**Current limitations:** At this time, there is limited profitability. The owner/operator monitors total energy use at the EVSE and compensates property owners according to use. To gain widespread acceptance, consumers must be able to use a single payment type at most all infrastructure and not be tied to a single company's network.

Economic sustainability remains an issue. ECOtality's demise is evidence of the importance of siting EVSE in profitable (well-used) locations and the dangers of the limited profitability of the model. If not properly accounted for, the limited profitability of the model will lead to failure.

Carefully sited locations will be chosen for maximum revenue generation; this will preclude most residential areas or remote areas where charging would be needed in dire circumstances.

Without agreements in place or money placed in trust, a failed charging location may result in abandoned/stranded hardware, an expensive eyesore to remove.

**Available in Seattle?** Yes. This is the most common business model for charging. Subscription-based services found throughout the city.

**Available in the Puget Sound region?** Yes.

**Applicability for people without home access to charging:** This may be the best model for people without home access. Through a subscription service or by paying for the use garages or lots after business hours it is possible to provide consistent charging opportunities. Pricing will need to properly compensate the property owner through parking pricing or the subscription company. Also, the cost must be priced appropriately for consumers' daily use (often "third place" charging is priced high because of the convenience function).

## Mileage Operator Model

**Concept:** This business model removes the sunk cost of the battery from consumer. Bulk purchases of batteries drives down the cost for the consumer, reduces risk for the operator, and allows for faster introduction of new battery technologies.

**Overview:** Mileage operators buy massive amounts of batteries and electricity, thus keeping their ownership costs insulated from customers. They offer simple monthly subscriptions to their customers and help create a straightforward experience for the consumer. This business model may involve decoupling the initial purchase of the vehicle from the battery at the dealership or entail battery swapping stations throughout communities. Currently, there are no successful mileage operations.

This model was tested by the Better Place network in Israel. Limitations due to market penetration, saturation of infrastructure, and shortcomings of the available "swappable" vehicles all led to the company's bankruptcy.

Tesla has built its vehicles to be compatible with battery swapping technology for future adoption as they pursue building a battery swap network. At this time no swap stations are in operation.

**Advantages:** Battery technology is rapidly developing. Each year, battery capacity and reliability increases. Mileage operators remove consumer trepidation about battery failure, replacement cost, and technological obsolescence.

**Current limitations:** The business model is untested and requires massive initial capital outlays for batteries and battery swapping stations. The business model may not appeal to the current consumer base.

Developing a robust network of battery-swapping stations along major corridors cannot be supported by the current levels of EV users. The start-up and operating costs are likely cost prohibitive for the near future.

**Available in Seattle?** No.

**Available in the Puget Sound region?** Soon. A Tesla SuperCharger station is currently in Burlington, north of Mt. Vernon. Intended for highway travel, this location will include battery swapping soon.

**Applicability for people without home access to charging:** Depending on the development and speed of battery swapping service stations, this may be a solution for some consumers without off-street access to charging. If time and cost competitive, the consumer can make daily or near daily swaps for charged batteries. Today, the model is not a realistic option.

## "Batteries Not Included" Manufacturing

**Concept:** Similar and contingent on battery operator business models, "batteries not included" manufacturing would decouple the costs of batteries from the vehicle, lowering risk and potentially costs to consumers.

**Overview:** An untested business model is the mass manufacture of EVs without batteries. This subscription service would require an operator to own the batteries that are leased at a flat rate to the consumer. The consumer would charge or swap batteries at any location with the operator paying all fees. This model may be successful if the cost of batteries drops along with the cost of producing a battery-ready EV. If the subscription costs are less than the monthly price of gasoline, this model may be an attractive option for consumers.

**Advantages:** Lower manufacturing cost and lower cost of vehicles for customers. Allows new battery technologies to be developed and deployed. Improves standardization throughout the industry.

**Current limitations:** At this time, there is limited demand or almost no manufacturing interest in this business model.

**Available in Seattle?** No.

**Available in the Puget Sound region?** No.

**Applicability for people without home access to charging:** As a future model, this may be successfully coupled with the mileage operator model, providing local access to similar to neighborhood-based and adjacent gas stations.

## The Proprietary Network Model

**Concept:** An iteration of the station owner/operator model, the propriety network may have exclusive EVSE that is only compatible with certain equipment. This may be for exclusivity or because other charging protocols do not offer the necessary speed.

**Overview:** Developing new specialized technology requires specialized variations of successful business models tailored to customer demands and expectations. A proprietary network would allow exclusive access to certain charging infrastructure such as Tesla SuperCharger network.

**Advantages:** A successful network will shift the EVSE market, drawing other manufacturers to adopt the protocols and function of the proprietary network.

If successful, the company operating the network will attract more consumers and investment, further expanding the network and increasing network density.

**Current limitations:** The budding industry and technology needs standardization and interoperability, not exclusivity.

**Available in Seattle?** No.

**Available in the Puget Sound region?** Yes. The above mention SuperCharger site in Burlington is a part of Tesla's proprietary network.

**Applicability for people without home access to charging:** Depends on the course of development of the network. If a DC/Fast charging network was cost competitive and located in convenient locations adjacent to neighborhoods, this model may provide options for people without home access to charging. Today, the model is not a realistic option.

# APPENDIX E: STAKEHOLDER INTERVIEW QUESTIONS AND SUMMARY

## Overview

Stakeholder interviews were conducted with more than 15 individuals representing electric vehicle (EV) advocacy organizations, commercial property owners and managers, institutional staff, city and county staff, and an owner of a "garage orphan" electric vehicle. The interviews were conducted to solicit electric vehicle experts' opinions on ways to increase access to electric vehicle supply equipment (EVSE) for people without off-street access to charging.

Each stakeholder was apprised of the OSE study and the challenge faced by the City to provide equitable access to charging for all people that wish to use an EV. A review of the City's, region's, and state's efforts to encourage EV adoption was provided. Interviews were fluid but each stakeholder was prompted with a number of questions designed to elicit suggestions for removing barriers to EV adoption for people without off-street access to charging.

Questions included technical, policy, program, and financial-based questions. Legal liability, access issues, and public information were discussed. Interviews were organized in a 45-60-minute format conducted by phone. Most interviews (83%) were one-on-one with a project team member. One interview was a conference call with the Seattle Plug-in Ready Interdepartmental Team and another included two staff representatives from one institution. In addition to the phone interviews, stakeholder information was collected through email conversations, stakeholder input collected during a Workshop in January 2014, and information collected in the Statewide/Regional EV Charging Survey that followed the Workshop.

This information informs the business model case studies, neighborhood typologies and priorities, and the development of the charging strategies.

## Stakeholder Interviewees

| # | Stakeholder | Organization |
|---|---|---|
| 1 | Harold de los Reyes | ImPark |
| 2 | Kevin Huther | LAZ Parking Management |
| 3 | Seattle University Staff | Seattle University Facilities and Transportation/Parking Services |
| 4 | *Anonymous* | Microsoft Employee and owner of a Garage Orphan EV |
| 5 | Wes Edwards | King County |
| 6 | City of Seattle Staff | Seattle Plug-In Ready Team |
| 7 | *Anonymous* | Sales Director of Charging Network Provider |
| 8 | Steven Lough | SEVA President |

| # | Stakeholder | Organization |
|---|---|---|
| 9 | Jeff Finn | Plug-in America Board/ SEVA Political Liaison |
| 10 | Dan Langdon | Seattle City Light |
| 11 | John Schoettler | Amazon Global Real Estate |
| 12 | Markus Feichtinger | Simple |

## Key Takeaways from Stakeholder Comments

Summarized observations preserve anonymity due to confidentiality issues.

### Stakeholder-Generated Solutions

Stakeholders were identified and contacted to discuss the challenge faced by the City of Seattle: how to provide equitable access to EV charging for people without off-street access to charging infrastructure.

Each interview included prompts to solicit new solutions to remove barriers to EV adoption for people without off-street access to charging. Most solutions focused on strategies to increase deployment of EV more generally.

Specific solutions discussed during the phone conversations include:

- Improve after-hours access to access-controlled private parking lots and garages.
- Develop a clearinghouse of Seattle parking lots that agree to rent of parking spots with charging infrastructure available.
- Deploy a concerted public information campaign about the daily (or weekly) charging needs of EVs.
- Improve access to DC/Fast Charging. This solution was noted as a primary charging source for users of “garage orphan” EVs.
- Decouple parking from housing for new builds so available parking spots could be rented on the open market.
- Encourage increased peer-to-peer (P2P) plug sharing. Improve opportunities and incentives for plug sharing in neighborhoods. A stakeholder suggested that the City hosts this service.
- Temporary utilization of brownfields with available electric supply to serve as charging locations, subsidized by the City.

### Top Priorities Voiced by Stakeholders

Certain comments came up from many stakeholders. Above any solution related to removing barriers to EV charging for people without off-street access to charging, stakeholders noted the following priorities.

1. **At-home Charging**
   - Overwhelming, stakeholders shared that most charging, for the near future, will take place at home. Businesses affiliated with EV charging and parking do not see an immediate market need for "garage orphan" EVs.
2. **Workplace Charging**
   - At-work charging was brought up as a priority. Many stakeholders thought that increasing guaranteed, reliable access to EVSE at work would allow some people living in housing without off-street access to charging the ability to do all their charging at work.
   - When asked about strategies to remove barriers to EV adoption, at-work charging was cited also as a way to increase adoption for all drivers, especially people with longer driving commutes.
3. **"Psychological Tools" for Public Information**
   - It was noted by EV advocates and by government representatives, that information and marketing remain limited. The public is not aware of the number of miles that they drive or how many miles an EV can travel on a single charge.
   - There needs to be better information shared about the amount of charging required for typical daily use. A vehicle like the Nissan LEAF may operate for 3-4 days, or more, based on typical use, without being charged. Consumers need to be educated about how much they currently drive and EVs' current range.
   - There needs to be better information about the available range of EVs. Looking at the Tesla Type S and others, the range of EVs is going to extend dramatically, similar to an internal combustion engine (ICE) vehicle.
   - In a study cited, 80% of respondents admitted limited or no knowledge about EVs, how they work, and how they are charged.
4. **Publicly accessible DC/Fast Charging EVSE**
   - When asked about strategies that may facilitate charging options for people without access to off-street parking or reliable access to charging, stakeholders often noted that widely-available DC/Fast Charging may be a solution.

## General Observations

### Business Case

- One parking facility manager and the Network Provider noted that there was no clear viable business case or business plan for facilitating the needs of "garage orphan" EV users.
- Increase the number of "dumb chargers," non-networked EVSE that could be connected to a smart phone application that allows clear knowledge about costs and availability of EVSE.

### Granting Access to Access-controlled Facilities

- Noted by a number of facility managers and owners, with the right incentive, it is possible provide access to access-controlled lots. There was a variety of interest in this idea including:

  - Selling access including badges and security clearance.
  - Better advertising availability of EVSE spots for rent.
  - Sell and allow access to private lots during limited hours. The most commonly noted time period was 7:00 p.m. through 7:00 a.m. Fines or towing would be required for enforcement.

**Building Codes and Requirements**

- A few stakeholders noted that the City's priority should be to make future residential, commercial, and mixed-use locations EV-ready.
- Conduit should be run to all parking spots and the electrical systems should be robust enough to allow the addition of a panel of electric meters for individual EVSE installation.

**Liability**

- Who carries the liability was an important topic covered in conversations. The City of Seattle carries its own liability, is a limited liability organization, and would need to contract liability independently. A few arrangements were hypothesized including a co-op arrangement, public-private partnerships, or limited access. It was noted that the City is risk averse.
- Commercial parking lot management companies either carry their own insurance or are covered by the property owner's insurance.

**Owner of a "Garage Orphan" EV - Key Takeaways**

- The owner of the "garage orphan" EV noted that he would not purchase or rent a house/apartment by choice that did not have reliable access to charging. Living situation dictates his current charging.
- Noted that he would never recommend purchasing an EV without reliable at-home charging availability.
- Runs cord from house to the street where he parks. Because of limited use, the vehicle is often parked away from the house without a plug.
- Noted an interest in the King County EV carpool program that focuses on at-work charging and requires employers to provide a guaranteed EVSE-equipped parking spot for the vehicle.

**City of Seattle Staff - Key Takeaways**

- A number of public-private partnership opportunities are available and need to be pursued. Thoughts related to PPP included City to provide:
  - Permits.
  - Reassurance of policy.
  - Potential tax credits or tax breaks.
- A key concern about PPP and granting private use of public land includes liability issues:
  - As noted above, the City is risk averse and would need to insulate liability.

- In certain locations, the infrastructure is in place to support the installation of stations. Only limited existing facilities could hold these stations.
- Generally, installation is very expensive to retrofit because of trenching and other construction costs. City staff wondered if there was something that needed to be subsidized to help cover the construction costs.
- Demand for parking at many City properties, such as Fire Stations, is very high.
- Many City-controlled lots are necessarily closed to protect the facilities and people working there.
- Generally, there was a worry about moving too fast or "betting" on the wrong technology. It was noted and reiterated that the City is technology agnostic.
- There was general interest in pilot projects and using a multiphase approach to test policy. Consensus was formed around the idea that the City should be tying innovative approaches as pilot projects; if the pilots are successful, the City can institutionalize the policy or program.

# Stakeholder Interview Guide

## Seattle Office of Sustainability and Environment

## Removing Barriers to EV Adoption

## Stakeholder Interview Questions

Stakeholder(s)_____

Organization(s) _____

Interviewer(s) _____

Date _____

To help interviewees prepare for the interview, they will be provided with an EV charging "one-pager" prior to the interview that will include an overview of the Removing Barriers to EV Adoption study including the concept of a garage orphan EV and various charging models.

**General questions (all interviewees)**

1. What is your position/ title?
2. What is your experience with electric vehicles (EVs)? EV charging patterns/ types/ and models? Have you worked with different charging equipment and service providers?
3. Where do you think electric vehicle charging equipment should be located? Where is the demand (e.g. at home, at work, in 'third places,' other)?
4. Have you been involved in charging pattern/habits studies?
    a. What role does EV charging play in your employees/staff/customers' lives?
    b. Is there a current demand for EV charging? Where?
5. How do you/ have you respond/ed or support/ed these needs?
6. Have you formally studied EV charging needs in different environments/neighborhoods? (downtown, residential neighborhoods, business/industrial areas).
    a. What are some of the different needs by location?
    b. What are some of the consumer preferences by location or charging type?
7. Are there current government programs or initiatives (local, regional, state, or federal; grant driven) supporting your efforts?
8. Would special incentives for providers that can improve access by people without access to garages motivate installation?

**NGO/ government representative questions**

1. Is planning for/ developing policy related to EV charging a part of your job?
    a. What is your professional experience with EV charging?

2. In your work have you discussed/ considered EV charging for people without access to home charging?
    a. If yes, what have you asked these people?
    b. What have you considered as viable alternatives to home charging?
    c. Has there been a formal assessment of people's needs?
    d. What initiatives/ incentives could best reach these groups?
3. How is permitting supported/hindered by current legislation?
4. Are there conversations about different charging types to support? (e.g., Type I, Type II, SAE J1772 - 2013 combo, DC/fast chargers, etc.). Have there been considerations to what type should be supported at a regional or municipal level?
5. What regional communication has taken place to facilitate longer regional trips, especially longer range commutes?
6. What initiatives/ focus has been placed on Multi-family communities, retailers, condos and home owners' associations, workplace and commercial office buildings, others?
    a. Any consideration of off peak hour charging in commercial lots for residential use.
7. Have there been considerations of programs that target the above uses by people without single family homes/ home access to chargers?

**Service Providers/property owner/institutions**

1. What is your business? (property owner, NGO, government)
2. Does your property currently have an EV charger (EVSE)?
3. Do you see a demand or parking capacity for EV charging equipment to be installed?
    a. If yes, what is your basis for thinking so (study, customer/employee demand, etc.)?
    b. If no, under what circumstances would you consider installing an EV charger in your parking lot/garage? What incentives would motivate a purchase/installation?

<u>If you have installed a charger:</u>

1. What level of charger did you install/ what level are you interested in installing?
    a. How did you chose what level to install (price, performance, trenching/electric, others?)
    b. Have they been successful?
2. Did you receive a building permit? Was it a smooth process?
3. How long did it take to receive permit approval? What could be improved about the process?
4. Who physically installed the charger? How did you determine the placement and location of the charger?
5. Did you (or building/property management) have to upgrade the building's electrical capacity?
    a. What were the costs?
    b. What were the cost/benefit considerations?
6. Did you receive or apply for any incentives or tax rebates? What incentive is needed to encourage off-street charging?
7. Did you utilize any federal or local incentive programs?

8. What type of incentives were you looking for?
9. How do you manage the payment for the use of the charging station?

**Additional (all interviewees)**

1. How can we better facilitate the charging needs of people without home access?
2. How can we better network regional charging needs?
3. Anything additional to share about:
    a. Charging patterns for people without access to garages?
    b. Regional garage orphan EV charging?

# APPENDIX F: REGIONAL EV CHARGING STRATEGY WORKSHOP MATERIAL

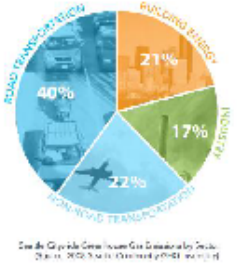
## Workshop Handout

## REMOVING BARRIERS TO ELECTRIC VEHICLE ADOPTION IN SEATTLE

### SEATTLE ENCOURAGES ELECTRIC VEHICLE ADOPTION

**The cars and trucks on Seattle's road make up 40% of our citywide carbon footprint. They are the single largest source of emissions.**

Electric vehicles (EVs) adoption is an important part of the City of Seattle's efforts to reduce greenhouse gases from cars and trucks on Seattle's roads. EVs are part of a two-pronged strategy to reduce our citywide transportation footprint. The first part is to offer more and better transportation choices so that residents can walk, bike, or take transit. The second part is to improve motor vehicle efficiency so that the remaining cars and trucks on Seattle roads have a smaller greenhouse gas impact. Powered by clean energy from Seattle City Light, EVs in Seattle are a more efficient alternative to gasoline-powered cars.




### SMART SOLUTIONS TO BARRIERS TO EV ADOPTION ARE NEEDED

**There a number of barriers to increasing the number of EVs in Seattle. Many people do not have access to a garage or other off-street locations to charge their electric vehicles.**

**Yet, there about eight parking spots for every car in the United States. Some of them must have access to charging.**

The City of Seattle is currently performing a study to determine ways to remove barriers to EV adoption for people without home charging locations. The study focuses on the aspects of where and how to charge EVs.

The *where* will address options for locating chargers at a variety of public and private locations off the public right-of-way to provide access at the neighborhood level. Options may include churches, universities, schools, hospitals, businesses with daytime uses...anywhere there might be under-utilized parking spots available with chargers. Other locations may include managed and access-controlled parking structures and lots. The *how* will address the technologies available and viable business models.

The "Removing Barriers to Electric Vehicle Adoption by Increasing Access to Charging Infrastructure" Study analyzes the existing and future business models; highlights the unique challenges found in three of Seattle's neighborhood types: Wallingford, Capitol Hill/First Hill, and South Lake Union; and develops strategies that may help reduce or remove the barriers to accessible charging.

## Workshop Invite


**WHAT**
A discussion about the future of regional electric vehicle (EV) charging strategies. This workshop will facilitate a conversation about policies that support and expand current charging strategies at home, at work, and in publicly-accessible places.

**WHEN**
January 21, 2014. 8:00 a.m. – Noon.

**WHERE**
At the Seattle Municipal Tower, Room 4050-4060. 700 5th Ave., Seattle, WA 98124.

**WHO**
YOU! This conversation will bring together regional representatives from various sectors including local and regional governments, private employers, EV industry, and advocates.

**WHY**
To explore innovative strategies to increase access to EV charging for all people interested in owning electric vehicles through coordinated home, work, and publicly-accessible charging policies to meet regional travel and charging needs.

**PLEASE RSVP by contacting**
Sandra Pinto de Bader at (206) 684-3194, or
Sandra.Pinto_de_Bader@seattle.gov

**Charging at home, work, and publicly-accessible places**


eVgo publicly-accessible solar-supported electric vehicle charging equipment
*Source: NRG eVgo*

**Regional Strategies for Regional Travel Patterns**

Example publicly-accessible regional charging network being developed by King County
*Source: King County*

# Regional Electric Vehicle Charging Strategy Workshop Agenda

**January 21, 2014**

**Seattle Municipal Tower, Rooms 4050/4060**

Facilitated by:

Sandra Pinto de Bader, Seattle Office of Sustainability and Environment, Sandra.Pinto_de_Bader@seattle.gov

Scott Chapman, Nelson\Nygaard Consulting Associates Inc., schapman@nelsonnygaard.com

Colin Rowan, Nelson\Nygaard Consulting Associates Inc., crowan@nelsonnygaard.com

## Agenda

| | |
|---|---|
| 8:15-8:20 | **Welcome** |
| 8:20-8:25 | **Overview of the workshop, workshop goals, and Seattle Office of Sustainability & Environment's previous work**<br>*Sandra Pinto de Bader, Seattle Office of Sustainability and Environment* |
| 8:25-8:35 | **Overview of the study and initial findings**<br>*Nelson\Nygaard staff* |
| 8:35-10:00 | **Introductions, challenges, and opportunities** |
| 9:55-10:00 | **Opportunities for future collaboration**<br>*Sandra Pinto de Bader* |
| 10:00-10:15 | **BREAK** |
| 10:15-11:00 | **Regional priorities discussion**<br>Facilitated discussion to help establish regional priorities and future collaboration |
| 11:00-11:45 | **Strategy develop exercise**<br>Break out into smaller working groups |
| 11:45-11:55 | **Strategy develop exercise debrief** |
| 11:55-12:00 | **Parting words** |

# APPENDIX G: REGIONAL EV CHARGING STRATEGY WORKSHOP NOTES

## M E M O R A N D U M

To: Sandra Pinto de Bader

From: Nelson\Nygaard Project Team

Date: February 28, 2014

Subject: Regional Electric Vehicle Workshop Notes

## Attendees

| Name | Organization | E-Mail |
|---|---|---|
| Martin Birnie | Seattle Public Schools | mhbirnie@seattleschools.org |
| Andrea Breault | Standard Parking | abreault@spplus.com |
| Tonia Buell | WSDOT | buellt@wsdot.wa.gov |
| Michelle Caulfield | Seattle Office of Sustainability & Env. | Michelle.caulfield@seattle.gov |
| Harold de los Reyes | Impark | hdelosreyes@impark.com |
| Jeff Doyle | WSDOT | doylej@wsdot.wa.gov |
| Lisa Dulude | Snohomish County | Lisa.Dulude@snoco.org |
| Jeff Finn | Plug-in America | jfinn@pluginamerica.org |
| Jim Francfort | Idaho National Lab | James.francfort@inl.gov |
| Mike Grady | NOAA | Michael.Grady@noaa.gov |
| Daniel Heldring | CBRS – Microsoft | v.daheld@microsoft.com |
| Avi Jacobson | WA State Housing Finance Commission | Avi.jacobson@wshfc.org |
| Duane Jonlin | Seattle Department of Planning & Dev. | Duane.jonlin@seattle.gov |
| Ron Johnston Rodriguez | Plug-in North Central Washington | rjr@applecapital.net |
| Joe McGrath | City of Redmond | jlmcgrath@redomond.gov |
| Stephanie Meyn | Western Washington Clean Cities Coalition | Stephaniem@pscleanair.org |
| Patti Miller-Crowley | WA Commerce | patti.miller-crowley@commerce.wa.gov |
| John Niles | CATES | jniles@alum.mit.edu |
| Dan O'Shea | ChargePoint | dan.oshea@chargepoint.com |
| Jason Phillips | Seattle Finance & Administrative Services | Jason.phillips@seattle.gov |
| Sandra Pinto de Bader | Seattle Office of Sustainability & Env. | Sandra.Pinto_de_Bader@seattle.gov |
| Michael Roy | City of Redmond | mcroy@redomond.gov |
| Eric Smith | Semaconnect | Eric.smith@semaconnect.com |
| Mark Schiller | Seattle EV Association | Mark.schiller@stanfordalumni.org |
| Tania Tam Park | Puget Sound Clean Air Agency | taniap@pscleanair.org |

## Workshop Findings

- Participants noted the need to share information, both within the regional working group and with the public. Working group information sharing should include code/regulation best practices and data summaries for use in promoting EVs to public and policy makers.
- Participants had a desire to focus on workplace solutions. Most groups developed strategies for people without home access to charging that included workplace solutions.
- Multiple participants are working on fleet solutions to expand use of EVs in private and public fleets. The Nissan LEAF fleet lease plan was of interest to many participants.
- Participants see value in the network aspect of the working group; there was a desire for additional voices to be brought in and for the working group to serve as a networking opportunity for best practices and new developments to be heard.

## Introductions

Participants were asked to share what was new with their organizations; what they have been working on; what they were most interested in discussing during the workshop; and what issues they were most excited to tackle in the coming year. Each participant was given three minutes for comments and engagement during the break was encouraged.

### John Niles – Center for Advanced Transportation and Energy Solutions

**Current projects**

- Working with a group from the University of Washington and a group from the University of Michigan to develop broad integrated solutions for the future of mobility. They focus on autonomous vehicles.

**Workshop discussion**

- Interested to develop electric vehicle's relationship to transit.
- Interested to talk about people's driving cycles and behaviors.

**Exciting issues**

- Believes that air pollution is the most dangerous aspect of a city; kills more people than automobile crashes, yearly.

### Tonia Buell - WSDOT

**Current projects**

- Working with project partners on the West Coast Electric Highway, focusing on "range confidence."
- Working on strengthening the region's DC/fast charging network.
- Workplace charging is Tonia's top subject of interest and what she has been studying.

**Workshop discussion**

- Interested in messaging and campaigning to build range confidence. Highway range from Everett to Olympia and out to Spokane.
- Workplace charging.

**Exciting issues**

- Of note, Tonia is excited about the WSDOT Secretary, Lynn Peterson, adopting an EV for the fleet.

### Jeff Doyle - WSDOT

**Current projects**

- Include working on a Department of Energy-sponsored research project to learn about where and how people are charging their vehicles around the world.
- $5 million allocated for extending the West Coast Electric Highway.
- Working on a Vehicle Miles Travelled option.

## Duane Jonlin – Seattle DPD

**Current projects**

- What is needed for building codes and regulations for electric vehicle readiness?

**Workshop discussion**

- Look at what will be needed a few years out.
- Make sure buildings are able to handle energy loads.
- How electric utilities will shift loads and harness the smart grid capabilities of EVs.

## Mark Schiller – Seattle Electric Vehicle Association

**Current projects**

- Looking for help on some new legislation: zero emission fleet requirements for 2025.
- EV infrastructure specifications and code at the state level for multi-family units and single-family units.
- Public outreach about EVs.

**Workshop discussion**

- How to get rid of annual $100 tab fee.

**Exciting issues**

- In favor of the VMT tax and interested in SEVA supporting legislation.
- Expansion of public outreach.

## Jeff Finn – Plug-in America

**Current projects**

- State-level legislative lobbying.
- Board Secretary for Plug-In America; working on tax credits and National Plug-In Day events.

**Exciting issues**

- Getting the rest of the DOE-sponsored EV Project EVSEs in the ground. The project is not over and there are 4,500 EVSE yet to install.

## Jim Frankfort – Idaho National Lab

**Current projects**

- Currently mining 150 million miles of data.
- Still working on the data from the EV Project. He noted that the project is "not dead yet."

**Workshop discussion**

- Who is using DC/Fast Chargers and where?

## Stephanie Meyn – Puget Sound Clean Air Agency

**Current projects**

- Working with a DoE coalition collecting fleet data and working on fleet solutions.
- Transitioning to workplace charging focus including the Nissan workplace program.

**Workshop discussion**

- What can we do in this region for workplace solutions?
- Would like to serve as an information broker.
- Would like to have a great guidebook or case studies with regional examples.

## Patti Miller-Crowley – Washington State Department of Commerce

**Current projects**

- Staff support for taskforce.
- Alternative fuels program.
- Local government siting of EVSE.

**Workshop discussion**
- Interested in electricity rates.
- Energy service contracting issues.

**Exciting issues**
- Interested in having LEED certification "mandate" charging.

## Ron Johnston-Rodriquez – Plug-in North Central Washington

**Current projects**
- Private sector effort to raise funds to promote tourism. Group composed of hotels, retail, and restaurants all working with Clipper Creek. The group gives retailers a $2,000 EVSE.

**Workshop discussion**
- Wanting to answer the question: should we be focused on PHEV? Electric snowmobiles? Electric jet skis?

## Daniel Heldring – CBRE/ Microsoft

**Current projects**
- Microsoft charging stations are in high demand- working to meet the demand on the Microsoft campus and keep pace with future demand.
- Challenge to confront: there are 600 registered EV drivers and not enough EVSE.

**Workshop discussion**
- Attending to offer some perspective from a large employer.

## Avi Jacobson – Washington State Housing Finance Commission

**Current projects**
- Working on finance programs to make capital available for programs that support electric vehicle infrastructure.
- Interested in re-purposing capital bonds.
- Interested in driving solar connection to the grid.

## Mike Roy – City of Redmond Fleet Manager

**Current projects**
- Working toward a 100% EV fleet by 2018.
- On the American Public Works Association Board; including EV fleet adoption to agenda.

**Workshop discussion**
- Interested in fleet adoption of EVs.

**Exciting issues**
- Nissan LEAF fleet lease program.
- VMT tax issues and how EVs fit into that tax.

## Jason Phillips – Seattle FAS

**Current projects**
- Workplace charging assessments.

**Workshop discussion**
- Looking for input related to maxed-out chargers without additional power supply available.

**Exciting issues**
- Providing access to charging at fire stations.
- What infrastructure upgrade needs are required?
- What are our options if an upgrade is not possible- what can we do with our current stock electrical supply?

## Michelle Caulfield – Seattle OSE

**Workshop discussion**

- Interested in the challenges of behavior change.
- How we can make smart and wise investments for the future?

**Exciting issues**

- Ways to help grow the industry.

## Lisa Dulude – Snohomish County

**Current projects**

- Trying to determine how to site EVSE - when they are placed in County parks.
- They have been vandalized including sliced wires.
- Also noted that the park-based EVSE were successful.

**Workshop discussion**

- Interested in training/information about charging.
- Promoting greater use by County employees.

**Exciting issues**

- Issue of concern: now that ARRA money has dried up, what is the future for EVSE?

## Martin Birnie – Seattle Public Schools – Maintenance General Foreman

**Current projects**

- Increase EVSE at SPS and increased. ????

**Exciting issues**

- Very interested in workplace charging. Particularly interested in workplace charging at Seattle Public Schools.
- Seattle Public Schools fleet turnover: interested in the LEAF lease program.

## Tania Tam Park – Puget Sound Clean Air Agency

**Current projects**

- Working on issues of diversity and inclusion for people in multi-family homes- looking at disproportionate impacts from transportation and air pollution for certain communities.

**Workshop discussion**

- At workshop to learn.
- Interested in talking about equity issues and disproportional impacts to low-income people.

## Harold de los Reyes – Impark

**Current projects**

- Managing garages with a variety of owners; some are interested in increasing EV access. Most property owners want to use EVSE as a marketing tool.

**Workshop discussion**

- Harold is still interested in finding a viable business model for business owners and EV users.

## Andrea Breault – Standard Parking

**Current projects**

- Interested in user behavior and what EV users' priorities are.

**Workshop discussion**

- User behavior.
- Access and security controls.
- How parking taxes will influence barriers (new barriers/remove barriers).

### Eric Smith – SemaConnect

**Current projects**

- Working with building owners and managers to install SemaConnect in commercial locations.
- Working to increase the number of test drive opportunities.

**Workshop discussion**

- How to increase consumer exposure to electric vehicles.
- How to increase workplace charging.

**Exciting issues**

- Thinks that building managers and other property managers should have an EV that they drive to help them better understand the market.
- Thinks that workplace charging is an exciting place to try new ideas: "employee of the month" can get a company EV to drive and park at a well-located charger for the month.

### Dan O'Shea – ChargePoint

**Current projects**

- Upgrading ChargePoint software- smart charging infrastructure.
- Actively engaged in addressing barriers.
- Better understanding the 'attach rate" of chargers. How long a charger sits without a vehicle connection and how many charging episodes a single EVSE provides- the higher the better the EVSE is sited.

**Exciting issues**

- Reality is that people need to plug where they sleep.
- Interested in workplace charging- noted that people will charge where they sleep and work ("like cats").

### Joe McGrath – Redmond Fire Department

**Workshop discussion**

- Expand use in City fleets, including Fire Department leadership and administration.

**Exciting issues**

- Optimistic about fleet turnover of fire support vehicles.

### Mike Grady – NOAA/ City Council, Mercer Island

**Current projects**

- Working with Steve Marshall of Center for Advanced Transportation and Energy Solutions (CATES), working on Autonomous Vehicles.
- Ideas include autonomous vehicles that cycle people between transit park-and-rides and their homes. Looking at electric vehicles as a part of first and last mile challenges.

**Workshop discussion**

- Autonomous vehicles. Talk about avoided costs of not building parking lots for additional vehicles.

**Exciting issues**

- Autonomous vehicles.
- Fleet conversions to EVs and alternative fuel vehicles. Looking at federal government and other governments to make investments in alternative fuel fleets.
- Major manufacturers excited about autonomous vehicles and Volvo is investing heavily.

## Who is missing?

- Commercial Real Estate
- Electric vehicle manufacturers
- Electrician's representative/ electric code experts

- Seattle City Light

## Regional Priorities

Participants were asked about their priorities for a regional taskforce. Pressing issues that participants believed useful for a regional conversation where discussed. The follow-up survey uses many of these topics to help set an agenda for subsequent meetings.

### Incentive Tax

Get more companies to turnover existing fleets.

School bus fleets and other heavy uses of gasoline.

Potential for general fee/tax to support EV infrastructure (paid by all residents).

### Policy Conflicts

Conflict can be stereotyped as emissions reductions versus congestion mitigation. A task force needs to work through these.

It is necessary to have increased policy coherence (especially regarding parking and HOV incentives). This will allow for easier adoption of electric vehicles.

### Fast Charging Prioritization

Some in the room thought that a regional group would be the ideal vehicle to push for more publicly-available fast chargers.

### "Danger of barking up the wrong tree"

There are technological and investment risks of betting on the wrong type of charging protocol, the wrong type of vehicle, and perhaps for any type of personal vehicles. Region needs a good technology roadmap that acknowledges risk avoidance concerns.

### EV Everywhere

More needs to be done to learn about users and what they need. This research would look at how EVs are used and more about who the current and future users may be.

### EVSE Deserts

Locate neighborhoods that have limited access to publicly-available charging. It is necessary to understand the needs of residents in these areas and to develop ways for them to have increased access to EVSE. Possibility exists to focus incentives, subsidies, etc. in these targeted areas.

### Automated Vehicles

General diffusion of knowledge is needed to better support autonomous vehicle adoption and understanding.

### Adoption Rates

Necessary to study the rates of adoption at places such as Seattle School District, community colleges, and other large employers. This will allow for more access to charging at these locations

based on demand; necessary to track when and how these EVSE are being used and when to increase after-hours access to the charging infrastructure.

Need to gather input on the segment that is "almost ready to use EVs" and facilitate their change in behavior.

### Multifamily Homes

Important for a regional group to help condo owners and others. Better use of grid-connected or smart grid technology. This while helping condos and multifamily units get through high demand peak hours by putting power back into the grid.

### Technology

The regional group should have a technology mandate that will allow it to serve as a sounding board. The group can field technology questions and develop online help for members.

Clarify capability, benefits and practicality of 2-way charging that recharges the grid during peak loads. Stay on top of similar innovations.

Ideas around mobile charging solutions (the AAA truck equivalent –tried in Phoenix, although it uses a gas generator)

### Marketing

Need new and improved marketing messages for EV adoption. More about opportunities and moving forward; less about barriers.

The available and developing charging network was also noted as needing marketing.

### Regional first responders training

Many fire departments have not been trained to deal with EVs and they do not know what to do in the event of an emergency. Offering training with the manufacturers will allow first responders, tow truck operators, and others to more safely deal with electric vehicles that have been collisions or are on fire.

### Information Resources

A single regional online list of links that are helpful to members such as regulations and codes (building development, parking management etc.), EVSE mandates, EV usage, EVSE turnover rates, vendor news. This could work as a code collaborative.

A list of churches and interested institutional third-party sites was also noted as being useful.

### Taxis

Expanding the use of EVs in taxi fleets should be evaluated.

## Strategy Development Exercise

Participants were split into groups of about five people. Each group worked together to develop strategies to help facilitate charging for people without access to home charging, strategies that address increased regional connectivity, and ways to support regional cooperation.

## Group 1

### Access to home charging

- There needs to be better understanding of the data.
- Better understanding of market needed.
- Need to understand if workplace charging strategies are a better option for people without home access to charging.
- Need to understand how the public charging network facilitates the needs of people without access to home charging.

### Regional Connectivity

- Better policies and incentives for corporate sustainability.
- Better policies and codes for conduit sleeves in garages for early preparation.
- Places that have a higher turnover have an issue with lines forming. Should there be a percentage of load protocol for people waiting?

## Group 2

### Access to home charging

- More DC Fast Chargers are needed in neighborhoods.
- There needs to be standardized workplace charging. A way that each employer that offers their employees parking must also offer a certain percentage of those spots for EVs with EVSE available. These can be revenue generating opportunities for employers if they un-bundle the costs of parking and charge all employees to park.
- There need to be more building owner incentives available to increase the number of EVSE available.
- Right-of-way suggestion: More Car2Go models where zoning and permitting allow electric vehicles to access charging while parked.
- Interested in installing more EVSE in churches, especially Level II.
- Increase access to P2P charging with in-garage Level II.
- Increase access to mobile charging. In Arizona, AAA can come and give you an emergency charge. This might be an option for people parked on the street if the technology existed.
- City initiatives to raise more awareness.

## Group 3

### Access to home charging

- Increase access at churches, parks, and lodgings.
- Workplace charging must be pursued as an important option.
- Need to find the right incentives for multifamily units.
- Mobile charging also mentioned.
- Park-and-ride access to charging needs to be increased.
- Look into the possibilities of induction charging.

- Using INRIX and other mobility tracking methods to better understand the travel patterns and travel needs of local users. What neighborhood connectivity needs do they have?

**Regional Cooperation**

- Incentives are needed for all transportation advocates and groups to come together to work for regional cooperation and collaboration.

## Group 4

**Access to home charging**

- Study where people have charging stations and further incentivize in locations where people do not have current infrastructure. This would be a more focused approach.
- Plugshare-type charging with City incentives to allow for multiple Level II access in two car garages.
- Better incentivize employers based on the number of EVSE they have available.
- Need to better use those locations that serve multiple groups.
  - Depot model
  - Churches
  - Grocery stores
- Look at those places where people already go.

## Group 5

**Access to home charging**

- More education is needed to disseminate information about the 500+ EVSE currently available, statewide.
- Better share existing home infrastructure, especially those that have Level II EVSE at home.
- Develop ways for more people to test drive EVs.
- More community charging in places without high use. Find more opportunities for charging in public housing and other off-street public locations.

**Regional Connectivity**

- More carpooling with EVs. Find ways to increase the use of EVs through workplace or regional tax incentives.
- Better regional data gathering is needed.

**Regional Cooperation**

- Need to get emergency first responders into the EV "family." Support vehicles and other emergency response vehicles need to be electric to meet the 2018 alternative fuel fleet goals.
- Intergovernmental sharing needed to help government vehicles to travel from one city to the next.

# APPENDIX H: WASHINGTON STATE EV CHARGING STRATEGY SURVEY QUESTIONS

The following represents the survey language and paths presented to survey respondents.

*Thank you for participating in this Washington State Electric Vehicle (EV) Readiness survey.*

*This survey is a follow-up to a City of Seattle hosted workshop that took place on January 21. One of the workshop's goals was to discuss the formation of a regional EV working group to tackle pressing issues related to facilitating increased EV adoption in the Puget Sound and throughout Washington State.*

*The workshop also discussed a Seattle Office of Sustainability & Environment's (OSE) study that is developing strategies to remove barriers to EV adoption faced by people without access to off-street parking for EV charging.*

*Thank you for your participation in this survey. Responses will be kept anonymous. The survey should take about 5 minutes. Please forward this survey link to contacts or people in your organization interested in EV adoption strategies.*

*Best,*

*Sandra Pinto de Bader*

*Seattle Office of Sustainability & Environment*

*Did you participate in the Regional Electric Vehicle Workshop on January 21?*

-Yes/No

*Thank you for participating in the Regional EV Workshop on January 21. Participants were very engaged and contributed great ideas for regional collaboration. Do you wish to participate in the formation of the Washington State Electric Vehicle Readiness working group?*

-Yes/ No

*Thank you for your interest in a regional EV working group. Please provide your name, affiliation, and email address so we can contact you.*

-Name/ Affiliation/ Email Address

*As a regional working group comes together, we would like to ask you a few questions about what you would like to get from working with the group and what issues you would like the group to address. During the workshop we noted a number of topics people would like the working group to address. What topics do you think should be included as the first agenda items? Please rank from highest to lowest the subjects you think the working group should first deal with. The list will re-order itself as you rank the subjects…*

-EVSE siting criteria

-Building codes and standards related to EVs and EVSE

-EV technological improvements

-Residential access to charging for people without off-street parking

-At-work charging strategies
-Fleet conversion to EVs
-EVSE compatibility, standards, and protocols
-Access to charging in "third places." Non home- or work-based charging
-DC/Fast Charging implementation
-Marketing and public information needs for increased EV adoption

*What other subjects should the working group address?*

*How often do you think the working group should meet?*

-Monthly
-Every other month
- Quarterly
-On an Ad Hoc basis
-Only online; with a wiki, Google Group, or similar

*What do you think this group should be called?*

-A working group
-A task force
-A committee
-Other (please specify)

*Are you also interested in participating in an online working group through a wiki, Google Group, or similar?*

-Yes/ No

*During the introductions, we shared what EV topics we have been working on and recent successes, challenges, and opportunities. Would you like to share any additional thoughts about these topics? OSE is developing strategies to remove barriers to EV adoption for people without off- street access to charging. During the course of the workshop we collected people's top recommendations. Please rank the strategies from highest to lowest. The list will re-order itself as you rank your top strategies. Please remember, these are strategies you believe to be most useful, reliable, and practical for principal charging needs:*

-Plug-sharing strategies with neighbors.
-After-hours access to private parking lots and garages such as commercial buildings, hospitals, and other institutions.
-After-hours access to publicly-owned, off-street lots such as schools, public buildings, or fire stations.
-Private-public partnerships to install and operate EVSE on unused publicly-owned property such as Seattle City Light substations.

-At-work charging strategies to facilitate away-from-home charging.

-Focus on DC/Fast Charging access and battery swapping strategies such as Tesla's SuperChargers in residential applications.

-Increasing the number of Level II and DC/Fast Chargers at "third places" such as grocery stores and retail.

*What other strategies do you think are important for OSE to pursue to increase the opportunities for EV adoption for people without off-street access to charging? Please share any additional thoughts you have about ways to remove barriers or increase access...*

**For non-workshop participants**

*On January 21, OSE held a half-day workshop that explored some of the current EV "hot topics" in local communities, regionally, and throughout Washington State. You have received this survey because you either were invited but couldn't attend the workshop or because we asked our participants to share the survey with colleagues and contacts that might be interested in the topic of EV adoption. Please answer the following questions to help us understand your interests and point of view. During the introductions at the workshop we shared what EV topics participants have been working on and recent successes, challenges, and opportunities. Please share…*

- What issues related to EVs you have been working on?

- What topics related to EVs interest you the most?

- What challenges have you faced and what kind of support do you need to facilitate EV adoption?

- What opportunities do you see at the local, regional, state, or federal level for increased EV adoption?

*OSE is developing strategies to remove barriers to EV adoption for people without off- street access to EV charging. During the course of the workshop we collected people's top recommendations. We would like to add your voice to this topic. Please rank the strategies from highest to lowest. The list will re-order itself as you rank your top strategies. Please remember, these are strategies you believe to be most useful, reliable, and practical for principal charging needs:*

-Plug-sharing strategies with neighbors.

-After-hours access to private parking lots and garages such as commercial buildings, hospitals, and other institutions.

-After-hours access to publicly-owned, off-street lots such as schools, public buildings, or fire stations.

-Private/public partnerships to install and operate Electric Vehicle Supply Equipment (EVSE) on unused publicly-owned property such as Seattle City Light substations.

-At-work charging strategies to facilitate away from home charging.

-Focus on DC Fast Charging access and battery swapping strategies such as Tesla's SuperChargers in residential applications.

-Increasing the number of Level II and DC/Fast Chargers at "third places" such as grocery stores and retail.

*Please share any additional thoughts you have about ways to remove barriers to EV adoption for people without off-street access to parking or other strategies.*

*An important component of the meeting was establishing a renewed effort for regional and statewide collaboration. During the workshop participants were asked if there was interest in restarting a regional or statewide EV working group. Would you be interested in joining a regional or statewide EV working group?*

-Yes/No

*Thank you for your interest in a regional EV working group. Please provide your name, affiliation, and email address so we can contact you.*

- Name/ Affiliation/ Email Address

*As a regional working group comes together, we would like to ask you a few questions about what you would like to get from working with the group and what issues you would like to group to address. What topics do you think should be included as the first agenda items? Please rank the subjects from highest to lowest you think the working group should first deal with. The list will re-order itself as you rank your top strategies….*

-EVSE siting criteria.
-Building codes and standards related to EVs and EVSE.
-EV technological improvements.
-Residential access to charging for people without off-street parking.
-At-work charging strategies
-Fleet adoption of EVs
-EVSE compatibility, standards, and protocols.
-Access to charging in "third places." Non home- or work-based charging.
-DC Fast Charging implementation,
-Marketing and public information needs for increased EV adoption,

*What other subjects do you think are important for the group to address?*

*How often do you think the working group should meet?*

-Monthly
-Every other month
-Quarterly
-On an Ad Hoc basis
-Only online; with a wiki, Google Group, or similar

*What do you think this group should be called?*

-A working group
-A task force
-A committee
-Other (please specify)

*Are you also interested in participating in an online working group through a wiki, Google Group, or similar?*

-Yes/ No

Where would you like to see an increase in regional and statewide collaboration?

*While we understand you do not wish to participate in a regional working group, what issues do you think a regional working group should undertake? Please rank from highest to lowest the subjects you think the working group should first deal with. The list will re-order itself as you rank the subjects…*

-EVSE siting criteria.
-Building codes and standards related to EVs and EVSE.
-EV technological improvements.
-Residential access to charging for people without off-street parking.
-At-work charging strategies.
-EVSE compatibility.
-Access to charging in "third places." Non-home or work-based charging.
-DC Fast Charging implementation.
-Marketing and public information needs for increased EV adoption.

Thank you for your time. If you are interested in joining the regional working group later, please contact Sandra Pinto de Bader at the Seattle Office of Sustainability & Environment at Sandra.Pinto_de_Bader@seattle.gov or 206-684-3194