



# Listening Sessions Summary

Oregon Department of Transportation Climate Office  
Project No. 23021.027

Transportation Electrification Infrastructure  
Needs Analysis (The TEINA Study)

April 30, 2021

Prepared by:  
Kittelson & Associates, Inc.

Project Team:  
Wayne Kittelson, P.E. (Project Manager)  
Rocky Mountain Institute  
Forth Mobility  
HDR Inc. (Primary Author)



*This page intentionally left blank*

## Contents

1	Introduction.....	1
2	Key Themes .....	2
	2.1 Upfront Costs .....	2
	2.2 Charging at Multi-Unit Dwellings.....	2
	2.3 Public Charging Network.....	2
	2.4 Public Charging User Experience .....	2
	2.5 Availability of Vehicles and Equipment .....	3
3	Listening Sessions .....	3
	3.1 Key Takeaways .....	3
	3.2 Listening Sessions Questions and Summary of Responses .....	4
	3.2.1 EV Drivers and Advocates .....	4
	3.2.2 Transit Agencies and Providers .....	6
	3.2.3 EV Service Providers .....	8
	3.2.4 Micro-Mobility Companies.....	10
	3.2.5 Rural Representatives.....	13
	3.2.6 Workplace Charging Venues .....	15
	3.2.7 TNC Drivers.....	16
	3.2.8 Freight/Delivery Representatives .....	17
	3.2.9 Historically Underserved Communities .....	19
	3.2.10 Developers, Property Managers, Multi-unit Dwelling Owners.....	20
	3.2.11 Farming/Ranching Representatives.....	22
	3.2.12 OEMs/EV Dealers .....	23

## Tables

Table 1.	Listening Session Details.....	1
Table 2.	Listening Session Key Takeaways .....	3

*This page intentionally left blank*

# 1 Introduction

The Oregon Department of Transportation Climate Office is working with state agencies, utilities, service providers, local jurisdictions, and other stakeholders on the Transportation Electrification Infrastructure Needs Analysis (TEINA). The study will identify charging infrastructure gaps, needs and opportunities statewide to support and accelerate zero-emissions vehicles (ZEV) adoption.

The study will suggest policies and actions that address charging needs for nine different use cases:

- Rural
- Corridor light-duty vehicles
- Urban
- Underserved communities
- Local commercial and industrial vehicles
- Transit and school buses
- Transportation network companies
- Long-haul trucking
- Micro-mobility

This memorandum summarizes twelve listening sessions conducted by the project team from January 2021 – February 2021, with approximately 70 different stakeholders.

Listening sessions gathered stakeholders’ perspectives on issues related to transportation electrification, including charging infrastructure and electric vehicle (EV) adoption in Oregon. This feedback will help inform the study’s recommended policies and actions.

Listening session topics, associated use case(s), dates, and number of participants in each session are included in Table 1.

**Table 1. Listening Session Details**

Group	Use Case(s)	Date	Participants
EV Drivers and Advocates	Corridor light-duty vehicles, urban, rural	January 25, 2021	6
Transit Agencies and Providers	Transit and school buses	January 25, 2021	6
EV Service Providers	All	January 27, 2021	8
Micro-mobility Company Representatives	Micro-mobility	January 28, 2021	10
Rural Representatives	Rural	February 1, 2021	7
Workplace Charging Venues	Local commercial and industrial vehicles	February 4, 2021	7
Transportation Networking Companies	Transportation network companies	February 4, 2021	2
Freight/Delivery Representatives	Local commercial and industrial vehicles, long-haul trucking	February 5, 2021	7
Historically Underserved Community Representatives	Underserved communities	February 9, 2021	2
Developers, Multi-unit Dwelling (MUD) Owners, Property Managers	Urban, rural, disadvantaged communities	February 10, 2021	7
Farming/Ranching Representatives	Rural, corridor light-duty vehicles (LDVs), local commercial and industrial vehicles	February 11, 2021	4
Original Equipment Manufacturers and EV Dealers	All	February 11, 2021	4

## 2 Key Themes

Five key themes emerged across all listening sessions.

### 2.1 Upfront Costs

Individuals, agencies, municipalities, and businesses must make a financial investment to adopt EVs. The cost associated with the vehicles, electrical upgrades, and chargers can be a barrier to adoption. For individuals who can charge at home on an existing outlet, savings may come immediately through good lease terms and fuel savings. For others like property managers or those who manage electric fleets, cost expended for electrical infrastructure upgrades and chargers may not have a positive return on investment in the foreseeable future. Incentives for vehicle and charger purchases and infrastructure upgrades play an important role in making EV adoption financially feasible. Incentives directed toward low-income communities are also important to cultivate and promote.

### 2.2 Charging at Multi-Unit Dwellings

Participants at every listening session stressed that widespread adoption of EVs is linked to providing at-home charging to residents of multi-unit dwellings. Residents need to experience the benefits of convenient, reliable, and affordable charging to spur adoption. Landlords and property owners of current developments face high infrastructure installation costs with limited options to recoup their investments. Building codes addressing new development will help EV-readiness over time, but retrofitting existing buildings remains a challenge. Access to workplace charging will continue to be important to EV drivers who live in multi-unit dwellings without at-home charging. Some participants emphasized workplace charging should not be considered the ultimate solution.

### 2.3 Public Charging Network

A functional statewide public charging network combined with well-defined, visible charging signage will create awareness of charging locations, make longer trips possible, help combat range anxiety, and accelerate EV adoption.

Participants raised the need to expand public charging options across the state. In urban areas, drivers often experience queues. Additional chargers are needed at convenient locations like grocery stores and outlying areas where people recreate. The distance between charging stations in rural areas makes traveling between communities challenging. Corridor and off-corridor charging options will make driving EVs for both personal and business use viable.

### 2.4 Public Charging User Experience

Creating a more positive and equitable user experience at public charging stations is important to many EV users. Ideally, charging stations are:

- Well maintained and reliable, like a gas station experience

- Safe and well-lit
- Interoperable and open access
- Located with other services, like bathrooms
- Following a code of conduct to avoid cars parked longer than needed
- Accepting credit cards to charge rather than relying solely on proprietary cards or smartphones apps
- Charging on a per kWh basis, as older vehicles charge more slowly

## 2.5 Availability of Vehicles and Equipment

Transit agencies, school districts, farmers, and freight operators are unable to exclusively adopt EVs now due to lack of or limited supply. When stock is readily available (many new vehicles are being piloted), these industries will have infrastructure costs, fleet vehicle costs, and charging logistics to weigh before making the decision to go electric. However, participants in these industries did see beneficial applications for electric vehicles and equipment, starting on a smaller scale.

# 3 Listening Sessions

## 3.1 Key Takeaways

Table 2 outlines the key takeaways from each of the twelve listening sessions.

**Table 2. Listening Session Key Takeaways**

Listening Session	Key Takeaways
EV Drivers and Advocates	<ul style="list-style-type: none"> <li>• <b>Address range anxiety</b> by installing clearer signage and engaging in greater public education.</li> <li>• Implement a <b>standardized charging/user experience</b> so that all users, regardless of EV type, will have the same experience while charging.</li> </ul>
Transit Agencies and Providers	<ul style="list-style-type: none"> <li>• There is a <b>lack of equipment</b> available for transit agencies.</li> <li>• The equipment and infrastructure that are currently available come at <b>high upfront costs</b>, so making investments becomes challenging.</li> </ul>
EV Service Providers	<ul style="list-style-type: none"> <li>• <b>Streamline permitting processes</b> so that chargers can be installed more expeditiously.</li> <li>• It is difficult to install chargers at MUDs.</li> </ul>
Micromobility Company Representatives	<ul style="list-style-type: none"> <li>• <b>Safe road conditions</b> are vital to micromobility adoption, so policies supporting road safety should be developed in conjunction with EV infrastructure.</li> <li>• People need <b>secure parking and storage</b> options for micromobility vehicles like e-bikes.</li> </ul>
Rural Representatives	<ul style="list-style-type: none"> <li>• EVs need to be able to <b>travel long distances</b> to be useful for rural environments where trips generally require greater distances than urban trips.</li> <li>• There are <b>not many EV trucks and SUVs</b> available, which are used more heavily in rural environments.</li> </ul>
Workplace Charging Venues	<ul style="list-style-type: none"> <li>• Keeping up with charging demand is challenging, but the <b>future need is uncertain</b> due to current work-at-home situations.</li> </ul>

Listening Session	Key Takeaways
	<ul style="list-style-type: none"> <li>• Many employees <b>use chargers longer than is needed</b>, thus precluding other employees from using the chargers.</li> </ul>
Transportation Networking Companies	<ul style="list-style-type: none"> <li>• There are frequently <b>issues at charging stations</b>, such as broken chargers, faulty card readers, and queues.</li> <li>• <b>More chargers are needed where people gather</b>, like retail, grocery stores, or recreation activities.</li> </ul>
Freight/Delivery Representatives	<ul style="list-style-type: none"> <li>• <b>Charging times and power capacity are challenging</b> for larger delivery vehicles, so electrified routes are generally kept to smaller more urban routes.</li> <li>• The equipment and infrastructure that are currently available come at <b>high upfront costs</b>, so making investments becomes challenging.</li> </ul>
Historically Underserved Community Representatives	<ul style="list-style-type: none"> <li>• Charging is not accessible for MUD residents.</li> <li>• Many communities would benefit from a <b>better understanding of EV cost savings, incentives, and climate benefits</b>.</li> </ul>
Developers, MUD Owners, Property Managers	<ul style="list-style-type: none"> <li>• Retrofitting buildings with EV charging infrastructure is generally <b>quite expensive</b>, as is installing new charging infrastructure.</li> <li>• <b>Developers need EV-ready incentives</b> to make EV infrastructure installation financially feasible.</li> </ul>
Farming/Ranching Representatives	<ul style="list-style-type: none"> <li>• Electric vehicles and farming equipment need to be <b>reliable</b> and have a <b>short charge time</b>.</li> <li>• <b>It is expensive to install charging infrastructure</b>, partly due to the fact of needing to run electrical utilities to the rural locations.</li> </ul>
Original Equipment Manufacturers and EV Dealers	<ul style="list-style-type: none"> <li>• Incentives and rebates are vital to increasing EV adoption.</li> <li>• <b>Address range anxiety</b> by installing clearer signage, engaging in greater public education, and equipping salespeople with proper knowledge about EV ranges.</li> </ul>

## 3.2 Listening Sessions Questions and Summary of Responses

Participants in twelve listening sessions were asked a unique series of questions. Questions and participant responses are summarized below.

### 3.2.1 EV Drivers and Advocates

**Question: What needs to happen to make EVs more accessible and functional for more Oregonians?**

- Expand **incentives** to purchase EVs.
- Significantly expand **charging at multi-unit dwellings (MUDs)**; adoption will not grow until MUD residents can conveniently and inexpensively charge at home.
- Address range anxiety:
  - A strong network of chargers coupled with a comprehensive **visible signage plan**
  - More **education and awareness** of the longer range of newer vehicles (compared to first generation EVs) and how it continues to improve
  - More charging **infrastructure along corridors in rural areas** between destinations
  - Infrastructure needed along **non-corridor** roadways

- Address charging anxiety and user experience:
  - **Standardize** the charging experience; like going to a gas station
  - EV charging signage should indicate the **charging types available** (Level 1, Level 2, Direct Current Fast Charging (DCFC)), or every charging station provide all three types of charging
  - Let people “**test charge**,” similar to taking a “test drive”
  - Use **universal form of payment** such as a credit card
  - Maintain chargers for **reliability**; currently, many are not maintained and therefore are not functional. The state could require reporting and tracking of infrastructure status to help resolve the issue
  - Address **charging etiquette** to reduce users leaving their cars plugged in at public charging stations
  - Use the Tesla charging experience as a model

**Question: What would make charging infrastructure equitable to everyone?**

- Providing **charging at multi-unit dwellings** is critical to ensure that people who do not own their home do not pay more.
- **Standardized rates and rate transparency:**
  - Treat charging providers more like utilities in order to provide **rate transparency**
  - **Charge on a per kWh basis** (volumetric) instead of by the time spent using the public charger
  - Cost and fees associated with each charging session need to be clear
- Require **payment in forms consistent across platforms** that does not depend on a bank account or smart phone.
- The current **proprietary charging networks** pose a barrier to access, if membership in a proprietary network is required for access / payment.
- Locate other services at charging stations such as e-bike charging, electrical outlets, and bathrooms.
- EV **incentives**, infrastructure incentives, and assistance with EV registration fees. (California’s Clean Cars for All program, through the California Air Resources Board, provides a good model.)
- Focus electrification on **specific community needs**; do not make assumptions.
  - Example: Vanpools or transit may be better than installing Level 2 chargers for communities that rely more heavily on transit than personal vehicles.

**Question: What are some challenges you see around charging infrastructure and getting it in the ground? Other EV-related challenges?**

- Expand **labor and workforce** through programs to get infrastructure installed and training programs for electricians and mechanics operating on light-duty-, medium-, and heavy-duty EVs. California has good programs.
- Update **building codes** to require installation of electrical conduit necessary to support chargers in the future.
- **Costs and profitability** are barriers to charging infrastructure installation; electric utility demand charges need to be addressed in ways that allow fair and reasonable electricity costs to consumers while utility needs are met .

### 3.2.2 Transit Agencies and Providers

**Question: What are the current barriers to adopting EVs for transit providers?**

- Lack of **available vehicles**:
  - Vans and cutaways are not readily available or do not serve the needs of disabled or elderly populations requiring ramps
  - Proterra and Cummins are both working on vehicle options; however, timing is unclear
  - Not all vehicles are approved to be purchased with Federal Transit Authority funds
- Vehicle **longevity and fuel diversity**.
  - Diesel vehicles last much longer than current electric transit vehicles at a fraction of the cost
  - Not implementing fuel diversity is “operationally irresponsible”
- **High upfront costs of vehicles and infrastructure installation**.
  - Cost of purchasing an electric transit vehicle is high
  - Cost of installing charging infrastructure is high, including utility upgrades and chargers
  - Only federal money is available right now, and there is not enough to go around
  - For providers that are not transit districts, funding is a big issue
- **Uncertainty** around the future of electrification for transit use.
  - Other **non-fossil fuel alternatives** may be more readily available or feasible, like hydrogen fuel cells
    - **Hybrid options** might be better than full electric
  - Vulnerable to **shifting priorities** after making large investment into infrastructure and equipment
- Charging **compatibility**. Committing to the same manufacturer for vehicles and chargers minimizes issues with maintenance and compatibility.

- **Trained technicians.** It is easy to train drivers; however, electric bus repair is more difficult. Currently repairs are dependent on manufacturers.

**Question: For transit providers with EVs, what form of charging infrastructure do you use?**

- Range of **charging models** discussed:
  - **Overnight depot charging** with rotations throughout the night for short range buses
  - **In-route charging**
  - **Sequential charging** system at the depot
  - **Inductive charging** is expensive. Not every bus can accept the technology, causing an interoperability issue
  - Smaller transit providers often do not own the property where vehicles are parked
  - For vehicles without routine route service, it is hard to standardize when traveling between communities with different utilities and service providers
- Charging is needed in **maintenance facilities** in addition to depots.

**Question: How do you identify which routes to electrify first?**

The group was split between prioritizing **equity/accessibility** and **geographic feasibility**. Feedback included:

- **Geographic feasibility**
  - Helpful to “stress test” the capabilities of electric buses during pilot programs along longer and hilly routes
  - Local routes close to the depot were best to allow unexpected charging when needed
  - Hills will hinder the capacity of electric buses until technology improves
- **Equity/accessibility**
  - Providing electric bus service to underserved communities can lower pollution and reduce noise
  - Equity will play a major role in the routes ultimately selected, a similar process to high-frequency route selection
  - One participant’s vision statement incorporates both a climate and equity lens to all work
  - As shuttle service is electrified, it will serve low-income communities
- Other considerations
  - **Range for large buses** is currently a problem for longer route vehicles
  - For smaller providers with limited routes, focus is on electrifying the **busiest routes**

### 3.2.3 EV Service Providers

**Question: What are the biggest gaps in EV charging infrastructure in Oregon today? What are the needs and the barriers?**

- US 20, US 26, and US 97 are known for infrastructure gaps.
- Coverage east of the Cascades is sparse; the westside has better coverage.
- Long-term alternatives to **demand-charge-based rates**:
  - Low utilization and high demand charges make it a challenge to fill the gaps in rural areas
  - Great Plains Institute (2019) report<sup>1</sup> addresses DC fast charging economics in rural areas
- **Load balancing and management.**
  - Amount of power needed for charging is an important consideration and can raise infrastructure cost
  - Software can help with load balancing, but that only addresses the current state of power v. future load growth
  - Load management and flexibility of charging units is important
- **Infrastructure costs.**
  - The cost for getting charging stations in the ground is not decreasing
  - Infrastructure installation is the highest cost, much higher than the charging units
- **User experience.**
  - **Unreliable charging** needs to be addressed before wider EV adoption
  - People need either **home charging** or a “refueling” experience that is reliable, comparable to going to a gas station
  - Solve the **interoperability** problem
- **Skilled and knowledgeable workforce.**
  - Many electricians do not understand how to install the chargers or pull the necessary permits
  - Installing EV charging infrastructure could become a great **jobs program and employment opportunity**
  - A good model for utilities to follow would be to establish a specific point of contact for EV service providers and have engineers dedicated to charger assistance

**Question: Is the lack of long-term solutions for a viable financial model a significant barrier?**

---

<sup>1</sup> [https://scripts.betterenergy.org/reports/GPI\\_DCFC\\_Analysis\\_July\\_2019.pdf](https://scripts.betterenergy.org/reports/GPI_DCFC_Analysis_July_2019.pdf)

- **Direct Current (DC) fast charger installation:**
  - There is **no business case** for a site owner to install a DC fast charger in most areas
  - It is currently not a successful long-term business model. Last year a participant paid the equivalent of \$5.69 per gallon for investment; this cannot be passed on to consumers
  - It is difficult to see a positive return on investment in the foreseeable future
  - **Utility Make-ready programs** for DC fast charging can be a big help, especially in rural areas
- Challenge to invest in states that do not **address demand charges**. Oregon needs to address this to attract investments. Maryland has a temporary program that can lead to longer term restructuring. New York is considering a bill.
- **Role of utilities:**
  - Utilities and EV services providers need to work together to develop a **shared responsibility model** where utilities are responsible for their side of the meter and EV service providers handle their side
  - Utilities are in the position to create **new profit centers**
  - Their role is variable depending on the state

**Question: What kind of charging do you find easiest/hardest to sell and install? Why?**

- **Commercial properties and new construction are easiest to sell/install.**
- Hardest to sell/install:
  - All charging is hard to sell and provides economic challenges
  - Harder to build in urban areas. Rural areas provide better topography and space, but can be a challenge with connectivity (ethernet, cell signals, etc.)
  - **Multi-unit dwellings:**
    - Condominiums
      - Selling chargers to condominiums is difficult because of the deeded parking spaces and limited panel capacity.
      - Some Homeowner Associations are attempting to un-deed the parking spaces.
      - Homeowner Associations are made up of volunteers, and decision-making can be a challenge.
    - Apartments
      - Generally, there are no driveways or garages to utilize at-home charging options.
      - When one apartment complex offers an amenity like charging, others will follow.
      - Need building code regulations that facilitate installation of charging infrastructure.

- Using common area parking has not been a success due to ADA space needs, etc.

**Question: When do potential sales slow down or fail?**

- Many sales slow or fail when people **receive the bid** for electrical installation.
- Bids include cost of running conduit, trenching, etc., and these items lead to **sticker shock**.

**Question: What programs or policies have you experienced that you feel did a good job of helping you install more charging?**

- **Helpful programs and policies:**
  - PG&E program in California
  - Charging Ahead program in Colorado
  - Do not shortchange future innovation/upgrade needs
  - Policies that build in cost-effectiveness and return on investment
  - Policies that are flexible in finding community-based solutions
  - Policies that have a clear purpose and are not overreaching
- Programs and policies that could be improved:
  - Streamline permit requirements and loosen zoning requirements regarding permissible charging locations
  - Reduce the amount of costly data that some grants and policies require in order to utilize their funds or incentives
  - California's requirements on reporting and pre-registration of chargers, etc. go too far and are slowing down the process. Do not replicate that in Oregon

**Question: How is your company addressing equity gaps in charging infrastructure? How can the state help improve equity gaps?**

- Need **credit card readers**; do not require smartphones.
- Have a **sponsorship program for education and outreach** to community-based organizations to improve awareness.
- The state and municipalities can help with **policies to provide affordable charging for everyone**.
- Putting a stronger focus on incorporating **vendors and installers that represent diverse communities**. Need to find a way to encourage this.

### 3.2.4 Micro-Mobility Companies

**Question: What types of locations or communities are best suited for e-mobility?**

- **Shared fleets** are best suited in areas with a larger population. Bend is the smallest city in Oregon that would accommodate shared fleets.
- **Privately owned equipment** is viable in both urban and rural areas.

- Adaptive mobility is also important to consider in this discussion.

**Question: How far do people typically travel on an e-bike and e-scooter?**

- E-bikes: 2-5 miles (and up to 10 miles roundtrip).
- E-scooters: 1-5-mile trips (often to/from public transportation).

**Question: What factors encourage and discourage e-mobility use and adoption?**

- **Safe road conditions** and infrastructure (bike/scooter lanes).
  - Streets need to be open and slow; surveys indicate this is the biggest component to increasing micro-mobility use
  - Scooter riders worry about cars and street conditions
- **Secure storage.**
  - **Transit hubs** with secure storage are becoming more widely adopted
  - E-bikes require **new storage solutions**; traditional bike storage often requires lifting bikes, and e-bikes are too heavy
- **High Costs.**
  - High electric bike costs (ownership) and annual membership fees (shared use) can be a barrier to many
  - **State and federal assistance** through incentives are needed to cover the **high costs of installing shared fleets**
  - The state should allow micro-mobility companies to apply for **energy credits** by showing a reduction in vehicle miles traveled to help offset high installation costs. Data from a Portland Bureau of Transportation (PBOT) study indicated that electric scooters have replaced about 38 percent of vehicle trips
  - Shared e-bikes are a feasible alternative to ownership for some in urban areas, but not where density is low

**Question: Where do micro-mobility users typically charge?**

- Private owners primarily charge at home or at their workplace.
- Shared fleets:
  - The industry seems to be moving toward **swappable batteries** which can be changed on the spot, rather than transporting scooters or bikes to and from a charging location
  - Swappable batteries have **reduced carbon footprints**, but currently have **safety issues** due to lack of protection
  - Bird makes batteries last longer by protecting them (and making them non-swappable)
  - Lime is looking at using the same batteries for their scooters and e-bikes

- A participant noted that the idea of having charging available in the public right-of-way does not currently have traction in the industry
- A participant shared the importance of ensuring that micro-mobility devices, their chargers, and storage are compatible with accessibility devices for people with disabilities.

**Question: What policies could help expand micro-mobility?**

- Clarity around **who pays for the infrastructure** and who pays for the electricity (PUCs will not let utilities give electricity away for free).
- New requirements around providing specific space for e-bikes like traditional bike parking.
- The state could help shared micro-mobility companies apply for energy credits.<sup>2</sup>
- For multi-unit dwellings, **storage is an issue**. Need enough space to place e-bikes and larger cargo bikes.
- **Policies supporting safety**.
- Building code changes to **improve design conditions for e-mobility**; these changes can also create improvements for people with disabilities.
- State goals for e-bikes like those for light-duty vehicles.

**Question: What type of public infrastructure is needed to support privately owned e-bikes?**

- 110v outlets.
- Most riders do not carry their chargers with them, requiring specific plugs because they are not standardized.
- Universal batteries (and thus chargers) would help the battery capacity issue, but manufacturers have expressed little interest.
- It takes about 0.5 kWh to charge an e-bike; e-bikes cannot rapid charge.

**Question: Anything else you would like the team to consider?**

- Private companies can donate charging ports to create an “airport cell phone charging” experience at locations in the city.
- Move in the direction of equity, universal use, and reducing traffic congestion and fossil fuel use.
- Positive legislation is occurring around incentives in other states, but more is needed.
- Consider battery recycling as part of the overall strategy.
- Seek legislative interest in directing the PUC to allow utilities to make infrastructure investments.

---

<sup>2</sup> <https://trec.pdx.edu/news/can-incentivizing-e-bikes-support-ghg-goals-launching-new-ev-incentive-cost-and-impact-tool>

### 3.2.5 Rural Representatives

**Question: What needs to happen so that EVs are successful and functional in your area?**

- **Ability to travel long distances.**
  - Vehicles with **long range batteries or mid-route charging stations**
  - When only one charger at a station, people can wait hours to charge if it is in use. Need more stations running with **multiple chargers per station**
  - Rural communities experience **areas with no charging stations** or only Tesla charging stations
    - Example: There is not any Combined Charging System in Corvallis so people that travel between Newport and I-5 via Corvallis in non-Leaf vehicles are challenged
    - Example: No charging on US 97 between Bend and Klamath Falls
  - DC fast charging along corridors like I-5 is critical
  - Need dependable stations with service support
- **Safe charging stations** in terms of locations and conditions.
- **Education and awareness.**
  - Provide opportunities to drive and experience EVs
  - Engage community leaders to help promote
- **Multi-unit dwelling charging stations.**
  - Provide charging for low- and moderate-income individuals. Rural areas will have many used EVs for sale in the future
  - Workplace charging may help fill a gap while inadequate charging at MUDs, but it should not be considered a solution

**Question: What are the average total miles per day you want to be able to travel?**

- A minimum of 300 miles is needed. 90 miles per day or 15,000-20,000 miles per year is not uncommon.
- In Lincoln County, there is a huge travel range, from over 50 miles per day to under ten.
- Rural drivers can benefit significantly from electrification and fuel cost savings.
- Housing in rural areas is more likely to be single-family, providing the benefits of at-home charging.
- For a commuter transit service, the challenge is not how far, but the fact that routes are run 3-4 times per day. The fleet would need to double in size to allow one to charge while the other is operating.

**Question: What is the general ratio of cars to SUVs and trucks in your area?**

- All participants said vehicles in rural communities are **mostly trucks and SUVs**.
  - Currently, no electric trucks are available and limited electric SUVs are available
  - With General Motors announcing the phase out of internal combustion engine vehicles, it is likely that electric trucks will be available for sale soon
- Some rural residents have smaller vehicles as second cars used for commuting.

**Question: Are you worried about the growth of transportation electrification in any way?**

- **Utility capacity.**
  - Potential electric utility capacity issues exist in central and eastern Oregon
  - Putting all the region's energy needs into one basket is risky and may not be a sustainable option for some communities
- **Reliability of infrastructure.**
  - Current infrastructure on West Coast Electric Highway (WCEH) is in bad repair and undependable
  - Tesla offers the best charging support, which not everyone can afford
- **Charging at multi-unit dwellings.**
  - Have at least one Level 2 charging space available at all MUDs
  - Level 2 chargers are a much lower investment than DC fast chargers
  - Landlords need to manage and monitor the Level 2 chargers to recoup costs
- **State-run charging.**
  - Address EV service providers' profitability issues by operating at the state level
  - ODOT should buy back the Webasto WCEH chargers and start operating them

**Question: Who would you turn to for advice about purchasing an EV?**

- Forth knows the industry and brings excitement
- Oregon Transit Facebook Group
- Smart Energy Group
- Ride and Drive events
- EV owners and peers
- Some participants shared their dealership experiences and indicated there is incorrect information being shared about EVs and sometimes salespeople dissuade interested customers from purchasing EVs.

### 3.2.6 Workplace Charging Venues

**Question: What needs to happen to spur EV adoption through workplace charging?**

- Keeping up with demand is the big issue for employers who provide workplace charging.
  - Employees assume it is free or inexpensive to install more infrastructure
  - Employees **overstaying their time at chargers** is a problem; current measures to encourage employees to move cars only marginally successful
  - Dedicated two parking spaces for one charging port
  - One participant located chargers in the middle of the parking lot to charge four cars with one port, but not meeting demand; and issues with people not moving
  - At home charging at MUDs would certainly lower workplace charging demand
- Small companies that do not own their office space but want to provide charging rely on flexible landlords.
- Charging is expanding to serve electric fleet and not just employees.

**Question: How can charging access be equitably provided?**

- Used EVs have a much lower range, so making charging available at work is important, especially until MUDs provide charging more widely.
- Envoy (electric car sharing service) is putting vehicles at low-income properties.
- **Charging as a service**; looking for vendors who bundle hardware/software/fuel into one monthly cost to electrify fleets.
- Fleet switching allows employees to drive to work and switch to their electric fleet vehicle.
- PGE has **time of use rates**, with overnight rates being the lowest. Utilities should work with businesses to pair renewables during the day for lower rates.

**Question: What are the barriers to adding more charges?**

- **High cost** of installing new infrastructure; state incentives would help.
- **Utility rates** affect the cost of charging. They are often the highest during the day when people charge their EVs at work.
- **Parking logistics and etiquette**; most employers do not have the capacity to monitor and enforce **charging codes of conduct**.

**Question: Do you provide charging for e-mobility? Do you charge for it?**

- There is **increased interest** among employees around e-mobility.
- Most participants provide **secured bike storage** rooms with **electrical outlets** and do not charge for electricity use.

- Promoting e-bikes is a good option since EVs still contribute to traffic congestion.

**Question: What concerns you about charging infrastructure needs over the next 15 years?**

- The **uncertainty about employee behaviors and infrastructure needs post COVID-19**. For example, the need for more chargers at workplaces may greatly reduce if many people continue to work from home long-term.
- **Infrastructure costs** will remain an issue as EV adoption increases.
- Fleet management.
- **Equity** around access to the infrastructure.

### 3.2.7 TNC Drivers

**Question: What are the advantages of driving an EV?**

- **Fuel cost savings.**
  - Before driving an EV, one driver spent about \$300 per week on gas. They now subscribe to PGE's Greenlots program, which only requires a low monthly fee to use DC fast chargers throughout the Portland metro area.
- **Decreased Maintenance.**

**Question: What issues do you experience as an EV driver?**

- **Faulty card readers.**
  - Chargers need to accept credit cards through platforms like tap to pay or Apple Pay because sometimes credit card readers are not functional
- **Broken chargers.**
  - People mishandle the charger connectors or leave them on the ground after they have finished charging. This can break the charger connectors and leave them unusable
  - A station can be out of order for a month, which does not happen with gas stations
- **Safety** while charging.
  - Charging stations that are hidden or out-of-the-way can be unsafe, especially at night. They should be in visible, well-lit locations
- Charging **wait times.**
  - There are often waits at Portland Electric Avenue, often caused by people who leave their cars for hours after they are done charging
  - Free charging can have a negative outcome; it does not motivate people to move their car once charging is complete, creating queues and wait times

**Question: How many miles do you drive per day and how low do you let the charge go before you start to prioritize charging?**

- Before COVID-19, one driver drove 300 miles per day but currently drives about 200 miles per day. Range is reduced in the winter because the battery is less efficient in the cold.
- Do not like to go under 40 miles before recharging.
- Both participants fast charge 3-5 times per day.

**Question: In your observations, how long does it typically take to repair broken chargers? What typically breaks?**

- **Heavy usage** is a precursor to break downs; break down causes vary.
  - One charger would not take payment, but drivers could still charge their cars
  - Some chargers appear to have communication errors that could be related to software
  - Downtown chargers often have broken clips/connectors that will not plug into the car
  - Holsters can be broken and laying on the ground

**Question: Where are additional charging stations needed?**

- In and around downtown Portland.
- Grocery stores, libraries, retail locations and tourist attractions in outlying areas.
- Where people begin and end their trips (suburbs and downtown, for example).
- Apartment buildings. If you expect people to get into EVs, charging needs to happen where they live and currently this is a barrier.

**Question: What are the priority charging infrastructure needs or barriers over the next 15 years?**

- **More chargers in high-use areas.** Can often wait up to an hour to charge downtown.
- **Fast chargers** needed along corridors and in outlying areas in order to reliably travel, recreate outdoors, etc.
- Make public charging affordable.
- **Increase at-home charging at MUDs.**
- **Serve equity communities,** not just the wealthy.

### 3.2.8 Freight/Delivery Representatives

**Question: What EVs or electric equipment do you have?**

- Forklifts and yard tractors
- No heavy-duty trucks are commercially available today, but are being piloted

- Shared staff vehicles
- Daimler is deploying eCascadia and step vans
- Portland International Airport
  - Current passenger bus fleet from the parking areas to the terminal is CNG, transitioning to RNG. Looking to transition to electric
  - Interested in working with airport partners on electrifying ground transportation vehicles

**Question: What are the barriers and needs for going electric?**

- **Charging and power capacity.**
  - Supporting large fleets will require a lot of power capacity. Utilities need to **plan long-term** to ensure the power is available when needed
  - Light- and medium-duty electric vehicles that operate during the day are best suited for electrification. They can charge in the depot and at night instead of charging mid-trip
  - Electrify classes 1-6 first; other fuels may be better for other classes
- **High cost of vehicles and infrastructure.**
  - Challenging for freight/delivery companies to **invest in the infrastructure** (vehicles, chargers, and any other upgrades) on their own
  - **Retrofitting** existing operations with the needed utilities is complex and costly
  - **Cost of ownership** is difficult for agencies like school districts looking to transition to electric buses. The miles driven, and thus the **cost savings per mile**, do not accumulate to enough savings to make the switch feasible
  - Freight companies may opt to **lease electric trucks or utilize a shared equipment** model rather than purchasing
  - Many trucking companies in Oregon are **independently owned and operated** by people from diverse backgrounds who many not have the resources to invest in electric trucks and chargers
  - **Supply and incentives** drive vehicle purchases. The Oregon credit is expiring and will limit ability to purchase vehicles
- **Long duration of utility upgrades.**
  - Fleet managers need to schedule appropriate installation times (**18-24 months**) with the **proper power level**. For example, planned upgrades may accommodate five trucks, but adding one more truck will trigger another upgrade
- **Streamline permits** for charging units.<sup>3</sup>

---

<sup>3</sup> See RMI article: <https://rmi.org/insight/reducing-ev-charging-infrastructure-costs/>

- Design rates that **incentivize certain charging times**, like charging at night.
- **More complex logistics.**
  - Current trucking logistics are challenging; charging requirements will increase the complexity
  - Until there is infrastructure available that can support **quick and easy charging**, electrification does not seem feasible
- Corridor charging gaps.
- Other more suitable alternative fuel options, like hydrogen fuel cells.
- Lack of charging infrastructure for independent owner operators.
  - Look for shared charging opportunities
  - Engage truck stops
  - City/state shared pilot programs

### 3.2.9 Historically Underserved Communities

**Question: How much awareness is there about EVs and their benefits in your community? What are your ideas for increasing awareness?**

- Current awareness and perception of EVs:
  - Currently there is **not widespread understanding** of the capabilities of EVs, including fuel cost savings and the distance EVs can travel on a single charge
  - EVs are not seen as an affordable solution; **not considered mainstream or accessible**
  - **EVs are perceived as luxury items**
- Increasing awareness in the community:
  - **Peer-to-peer connection** will be most effective; engage **community ambassadors** and liaisons
  - Community-based education and awareness campaign. **Co-create messaging with community members and provide information in-language** to avoid the language barriers that exist today
  - Providing **ride-share EVs and a charging station at local churches** could familiarize the community with EVs and the charging
  - NAACP's new solar project is a good opportunity for **ride & drive events** and educational opportunities

**Question: What are the potential barriers to EV in your community?**

- **Vehicle cost and financing.**
  - Purchase will be more realistic when used models are more available at reduced costs

- Access to resources including fair financing terms can be a barrier
- **Charging access and cost.**
  - Homeownership can be low among some disadvantaged communities. Less access to dedicated parking (garages or driveway) and **reduced access to charging at home** are barriers
  - **Multi-unit dwellings need to have enough charging infrastructure to enable to disadvantaged communities to adopt EVs.** It is expensive to install charging infrastructure and may not happen quickly. Public charging does not result in the fuel cost savings

### 3.2.10 Developers, Property Managers, Multi-unit Dwelling Owners

*Some property manager participants noted that they are EV advocates and the EV charging features they provide to tenants should not be considered typical.*

**Question: Do you provide parking for residents?**

- Many participants have parking for residents.
- Participant with multiple apartment complexes has a parking spot of varying types for each unit.
  - If a tenant buys an EV, they will get charging; generally, 110v with 240v at some locations
  - Charging is currently free but may transition to a monthly charge or paid meter usage
  - To meet code, developers must install infrastructure that could handle the maximum demand, which is “overkill sizing;” utilities may give credits to offset cost
- Participant with condo development has deeded spaces.
  - Has conduit and electrical service to charge at 240v
  - No conduit for guest parking
  - Line-extension fee to charger is expensive. Utility does not have the ability to split the costs between the developer and homeowners’ association/owners
  - Submetering is not economical
- Participant with apartment complex has all parking spaces wired with 110v and conduit for at least 240v.
  - Parking is additional cost; EV spaces are discounted according to daily mileage
  - OpConnect chargers verify and differentiate between billings
  - 110v chargers cannot be monitored but are turned off when not in use
  - Working with electric utility to figure out meter and submeter layout (separate meter for parking/charging for each tenant).

- Condominium complex participant has deeded parking.
  - 240v conduit is very expensive (\$3,000 per space). A large investment for low energy use. Need to find option to share capital costs among multiple users
  - Cyberswitch (similar to OpConnect) unit shares a dedicated 240v circuit to serve four cars

**Question: If residents request EV charging, what is your concern?**

- **Utility requirements and high costs of installing infrastructure.**
- Difficulty **sharing infrastructure capital costs** among multiple users.
- **Retrofitting complexity and costs.**
  - Existing apartments may not have the utility capacity or physical infrastructure needed to install chargers
  - Installing completely new parking areas with new conduits, wiring, and panels costs less than current retrofit options
  - Retrofitting challenges need to be solved because MUDs tenants' ability to charge at home is critical to accelerating EV adoption
- **Metering/charging tenants.**
  - When discussing perceived concerns among other apartment owners, many participants mentioned the ability to meter charging use and bill tenants:
    - Meters are expensive, as is the cost of using a third-party billing company. The cost of billing can be as much as the electricity usage, so developers often pay the electricity costs
  - General planning concerns:
    - The gas station of the future is people's garages. Tenants in multi-unit dwellings should be provided a unique charging spot rather than a shared charging option
    - Need to create a demand for chargers at multi-unit dwellings. MUD owners need to be collaborative partners, or it will be difficult for tenants to own EVs
    - The demand for charging is growing among condominium buyers and current owners
    - Size electrical panels to accommodate chargers and run the conduit and wire later

**Question: How do tenants charge their e-bikes or e-scooters?**

- Bike rooms have outlets. Bill at a flat rate to those who park there.
- Energy cost is quite low, so a monthly charge is the preferred method.
- Looking to evaluate charging patterns.

**Question: How could you speed EV adoption, focusing on MUDs?**

- **EV-ready incentives and support.**

- For most landlords, installing chargers and needed infrastructure is a financial decision; incentives can make it feasible
- Qualify multi-unit dwellings for Oregon Clean Fuels program credits
- Provide line-extension credits; costs absorbed by the utility instead of developers
- Provide state-implemented tiered incentives, such as one incentive for sites that are EV charger capable and another for sites that have already installed chargers
- Once EV charger readiness is required in building codes, incentives will not be available. Incentives exist to exceed requirements, not to meet them
- **EV-ready building codes.**
  - Currently there is an amendment for new residential construction to support Level 2 charging (scheduled for adoption October 2022), with a commercial amendment to follow
  - Making new development EV-ready requires a much smaller investment than retrofitting existing development
  - These requirements will add costs to new development and may result in less parking
  - EV-ready building codes should differentiate between MUDs and single-family dwellings
- **Access to knowledgeable electrical contractors.**
- Level 1 and 2 charging meet most needs, are cost-effective, and have less impact on the grid; DC fast charging is not economical.
- Provide Level 1 charging at tenant parking spots with a DC fast charging hub in the urban center.
- Strategically **incentivize** condominiums and apartments to make EV charging more accessible.
- Start a group of MUD owners and managers to **exchange EV charging best practices, information, and ideas.**
- Get MUDs to **harvest clean fuel credits.**
- Landlords and managers need to **recover costs and generate revenue.**

### 3.2.11 Farming/Ranching Representatives

***Question: What gaps need to be filled to support electric adoption? Has anyone adopted electric equipment or vehicles yet?***

- Many participants do not have any electric farming/ranching vehicles or equipment but are researching options. Some had personal EVs.
- Once EV trucks and ample infrastructure are available, the industry will make the switch.

- Equipment **reliability and charging time** is crucial.
  - Many farmers have a home operation and lease farming property elsewhere. They transport fuel tanks to their sites for equipment refueling; something they could not do with chargers
  - Overnight charging is not a worry but stopping to charge vehicles or equipment during the day is a concern
  - Not being able to fix equipment yourself is a concern, and servicing may be difficult
- **Cost-effectiveness issues.**
  - Due to the cyclical demand of farming equipment, the high costs do not pencil out for farmers who may only use it a few weeks each year
  - High speed chargers are expensive
  - The agriculture community is excited about the shift to electric, but the numbers must make sense

**Question: Are there advantages to going electric that you see for farming/ranching if costs pencil out?**

- Self-sufficiency.
- Potentially better efficiency.
- Lower carbon emissions than other fuel sources. However, transportation from the farm also needs to be considered. Most emissions produced from agriculture-related activity are from the transportation of goods, not the farming itself.

**Question: What type of farming do you see as a good fit for electrification?**

- Agricultural equipment varies drastically between what is used on eastern Oregon farms and Willamette Valley farms.
- Nurseries and farms with **high density, high value crops** like vineyards, blueberries, and hazelnuts are probably the best fit for electric equipment in the near-term. Wheat is down the list because it requires much larger equipment.

### 3.2.12 OEMs/EV Dealers

*Participants representing dealers noted that they are fully committed to EVs and may not represent typical dealers.*

**Question: What kind of charging would do the most to enable faster and easier sales of electric vehicles?**

- **All charging types are needed.** People will go on a road trip one week and have a short commute the next week. DC fast chargers are important on corridors and in urban areas; Level 2 at workplaces, etc.
- Plan for the future: Level 1 chargers meet a lot of today's needs, but as vehicles get bigger and heavier that will no longer be the case.

**Question: What complaints or questions about charging do you hear most from customers?**

- The majority of EV customers have done their homework and are very knowledgeable about charging.
- Most customers have some level of **range anxiety**.
- Most charging questions are from customers who become curious about EVs once they are at the dealership.
  - Questions cover **charging locations**; the **different charging levels**; **how far they can drive on a charge**; and **how long it takes to fully charge**
  - Most EVs have access to manufacturer apps that provide onboard concierge services. Dealers also provide area charging maps and suggest other established apps
  - Most common post-sale comments are about **charging stations that are not working**.
- Concerns include the **cost of EVs** relative to internal combustion engine vehicles and charging accessibility for apartment dwellers or people who park on the street.

**Question: What has been the level of investment needed to pivot to electric?**

- OEM participant said there is a strong commitment to converting the fleet to electric.
- It is not ideal to **train a specialist** for one product line because it is expensive.
- **Infrastructure**. Rural dealer purchased a DC fast charger to stay informed on how they work and lets customers experience it. Investment in the future.

**Question: What is the industry doing or what can others do to create awareness and accelerate adoption?**

- Approaches range from Super Bowl advertisements to local Ride and Drive events.
- Ride and Drive events are a lot of work with low rate of return.
- Dealers use EVs for courtesy cars to let maintenance customers try them.
- **Incentives** are currently the biggest drivers in increasing EV adoption. There should not be an MSRP cap so that all vehicles are eligible.
- **State fleet purchases** can make a big difference and shows support of EV adoption.
- **Early adopters** are wonderful marketers to their friends, family, and co-workers.
- **Social media** and other lifestyle marketing.
- **Rebates** are a big reason people purchase EVs. After factoring in the existing incentives, leases on EVs are often cheaper than their internal combustion engine counterparts.

**Question: What equity issues do you see and how can barriers be overcome?**

- **Charging access for multi-unit dwellings**, which can include low-income residents, is the biggest challenge and barrier to EV adoption.
- Create **incentives for low-income communities**. The incentive should include the cost of the vehicle and the at-home charger.
- California may allocate a portion of their subsidies to the purchase of used EVs for qualified low-income applicants. Unused funds would be applied to infrastructure investments.