

# Meeting #4 Agenda

Project: Transportation Electrification Infrastructure Needs Analysis (TEINA)

---

Subject: Advisory Group Meeting #4

---

Date/Time: Tuesday, May 11, 2021  
8:30 a.m. – 10:30 a.m.

---

Location: WebEx Link: [Click here](#)  
Meeting number (access code): 146 054 3643  
Meeting password: EYpfhnYC426  
Call-in Number: +1-408-418-9388

---

Invitees: **AG Members**

Amanda Pietz, ODOT  
Greg Alderson, PGE  
Thomas Ashley, Greenlots  
Philip Barnhart, Emerald Valley EV Assoc.  
Chris Chandler, Central Lincoln PUD  
Marie Dodds, AAA  
Judge Liz Farrar, Gilliam County  
Ingrid Fish, City of Portland  
Stu Green, City of Ashland  
Jamie Hall, General Motors  
Zach Henkin, Cadeo Group  
Joe Hull, Mid-State Electric Cooperative  
Juan Serpa Muñoz, Eugene Water and Electric Board  
Vee Paykar, Climate Solutions  
Cory Scott, PacifiCorp  
Jairaj Singh, Unite Oregon  
Charlie Tracy, Oregon Trail Electric Co-op  
Dexter Turner, OpConnect

**Project Team**

Mary Brazell, ODOT  
Zechariah Heck, ODOT  
Jessica Reichers, ODOE  
Wayne Kittelson, Kittelson and Associates  
Stacy Thomas, HDR  
Alexander Nelson, HDR  
Britta Gross, RMI  
Chris Nelder, RMI  
Lynn Daniels, RMI  
Shenshen Li, RMI  
Rhett Lawrence, Forth

---

## Meeting Purpose:

Review and discuss the **TEINA Draft Report**, including:

- Modeling results
- Policy recommendations
- Priorities for implementation

Time	Topic	Lead
8:30 a.m.	Welcome <ul style="list-style-type: none"> <li>• Welcome and team introductions</li> <li>• Agenda review</li> <li>• AG roll call</li> </ul>	Amanda Pietz
8:40 a.m.	Public Comment (second opportunity at 10:20 a.m.)	Amanda Pietz
8:45 a.m.	Implication of Modeling Results for Oregon <ul style="list-style-type: none"> <li>• Key findings</li> <li>• <i>AG questions/discussion</i></li> </ul>	Britta Gross, Chris Nelder & Shenshen Li
9:10 a.m.	Policy Recommendations and Priorities for Implementation <ul style="list-style-type: none"> <li>• <i>AG questions/discussion</i></li> </ul>	Rhett Lawrence & Amanda Pietz
10:10 a.m.	Other Draft Report Comments <ul style="list-style-type: none"> <li>• <i>AG discussion</i></li> </ul>	Amanda Pietz
10:20 a.m.	Public Comment	Amanda Pietz
10:25 a.m.	Next Steps	Amanda Pietz
10:30 a.m.	Adjourn	

Draft Final Report

# **Transportation Electrification Infrastructure Needs Assessment (TEINA)**

May 4, 2021

DRAFT

Draft Final Report

# Oregon's Transportation Electrification Infrastructure Needs Assessment (TEINA)

Prepared For:  
**Oregon Department of Transportation**  
355 Capital Street NE  
Salem, OR 97301-3871

Prepared By:  
**Kittelson & Associates, Inc.**  
851 SW 6<sup>th</sup> Avenue, Suite 600  
Portland, OR 97204

In Association With:  
**RMI (Primary Author)**  
**HDR, Inc.**  
**Forth Mobility**

Project No. 23021.027

May 4, 2021



DRAFT

## Contents

Table of Figures.....	iv
Table of Tables.....	iv
Acronyms Used.....	v
Foreword.....	vi
Executive Summary.....	1
Modeling Results.....	3
Policy Recommendations.....	5
Introduction.....	6
Scenario Overview.....	8
Modeling Analysis and Results.....	10
Approach and Assumptions.....	10
Model Optimization.....	10
Results.....	12
Urban LDV.....	14
Barriers that pose challenges to Urban LDV Charging.....	15
Rural LDV.....	15
Corridor LDV.....	17
Local commercial and industrial vehicles.....	19
Transit and school buses.....	20
Transportation Network Companies (TNCs).....	21
Long-haul trucking.....	23
Micro-mobility.....	24
Disadvantaged communities.....	25
Stakeholder Engagement.....	27
TEINA Policy Recommendations.....	31
Vision.....	31
Overall Infrastructure Goals:.....	31
Recommended Policies and Initiatives to Accomplish Infrastructure Goals:.....	31
Infrastructure Deployment Priority Actions.....	39
Conclusion.....	42

DRAFT

Appendices..... 44  
 END NOTES..... 45

### Table of Figures

Figure 1. Three Scenarios were modeled for Oregon..... 8  
 Figure 2. Venn Diagram of model optimization..... 10  
 Figure 3. Total number of chargers for Urban e-LDVs..... 15  
 Figure 4. Total number of chargers for Rural e-LDVs..... 16  
 Figure 5. Total number of chargers for Corridor e-LDVs after optimization ..... 18  
 Figure 6. Total number of chargers for local MD vehicles..... 19  
 Figure 7. Total number of chargers for e-buses..... 21  
 Figure 8. Total number of 150kW DCFCs for e-TNCs after optimization..... 22  
 Figure 9. Total number of chargers for Long-Haul Trucking..... 23  
 Figure 10. Reduction in number of required chargers due to Micro-Mobility..... 24  
 Figure 11. Additional chargers required for Disadvantaged Communities..... 26  
 Figure 12. Overall Infrastructure Goals..... 31  
 Figure 13. Key Infrastructure Implementation Priorities..... 39  
 Figure 14. Key stakeholders engaged in transportation electrification in Oregon..... 43

### Table of Tables

Table 1. Modeling methodology and assumptions by use case..... 11  
 Table 2. BAU scenario characteristics by target year..... 13  
 Table 3. Key takeaway messages from Listening Sessions..... 28  
 Table 4. Near-term priority policy initiatives..... 37  
 Table 5. Cross Reference: Illustration of How Equitable and Accessible EV Charging Goal and its associated Policy Goals address barriers to EV Charging Implementation ..... 38

DRAFT

## Acronyms Used

2019 Oregon Senate Bill 1044 (SB 1044) .....	1	Level 2 chargers (L2) .....	4
Americans with Disabilities Act (ADA).....	32	Light Duty Vehicles (LDV) .....	1
Black, Indigenous, and People of Color (BIPOC).....	32	Medium-duty vehicles (MD).....	2
Business As Usual (BAU) .....	12	Multi-Unit Dwelling (MUD).....	13
Consumer Owned Utilities (COUs).....	34	Oregon Department of Transportation (ODOT) .....	6
Direct Current Fast Charging (DCFC).....	12	Oregon Department of Energy (ODOE) .....	33
Electric Vehicle (EV).....	2	Portland General Electric PGE.....	vi
Electric Vehicle Service Equipment (EVSE) .....	32	Public Utility Commission (PUC) .....	33
Heavy Duty Commercial Vehicles (HD) .....	34	Transportation Electrification Infrastructure Needs Assessment (TEINA).....	1
High Occupancy Vehicle (HOV) .....	33	Transportation Network Companies (TNC) .....	2
Internal Combustion Engine (ICE) (ICE) .....	13	Vehicle Miles Traveled (VMT).....	23
Level 1 chargers (L1) .....	41	Zero Emission Vehicles (ZEV).....	1

DRAFT

## Foreword

This report was prepared for the Oregon Department of Transportation’s Climate Office under the guidance and direction of Mary Brazell (Agency Project Manager), Amanda Pietz (Climate Office Director), and Zechariah Heck. Collaborative support and guidance were also provided by the Oregon Department of Energy through Jessica Reichers and Rebecca Smith.

The consultant project team consisted of Wayne Kittelson (project manager), Susan Mah and Christopher Bame, Kittelson & Associates (prime contractor); Chris Nelder, Shenshen Li, Britta Gross and Lynn Daniels, Rocky Mountain Institute (RMI); Stacy Thomas and Alexander Nelson, HDR Inc.; and Rhett Lawrence, Jeanette Shaw, and Kelly Yearick, Forth.

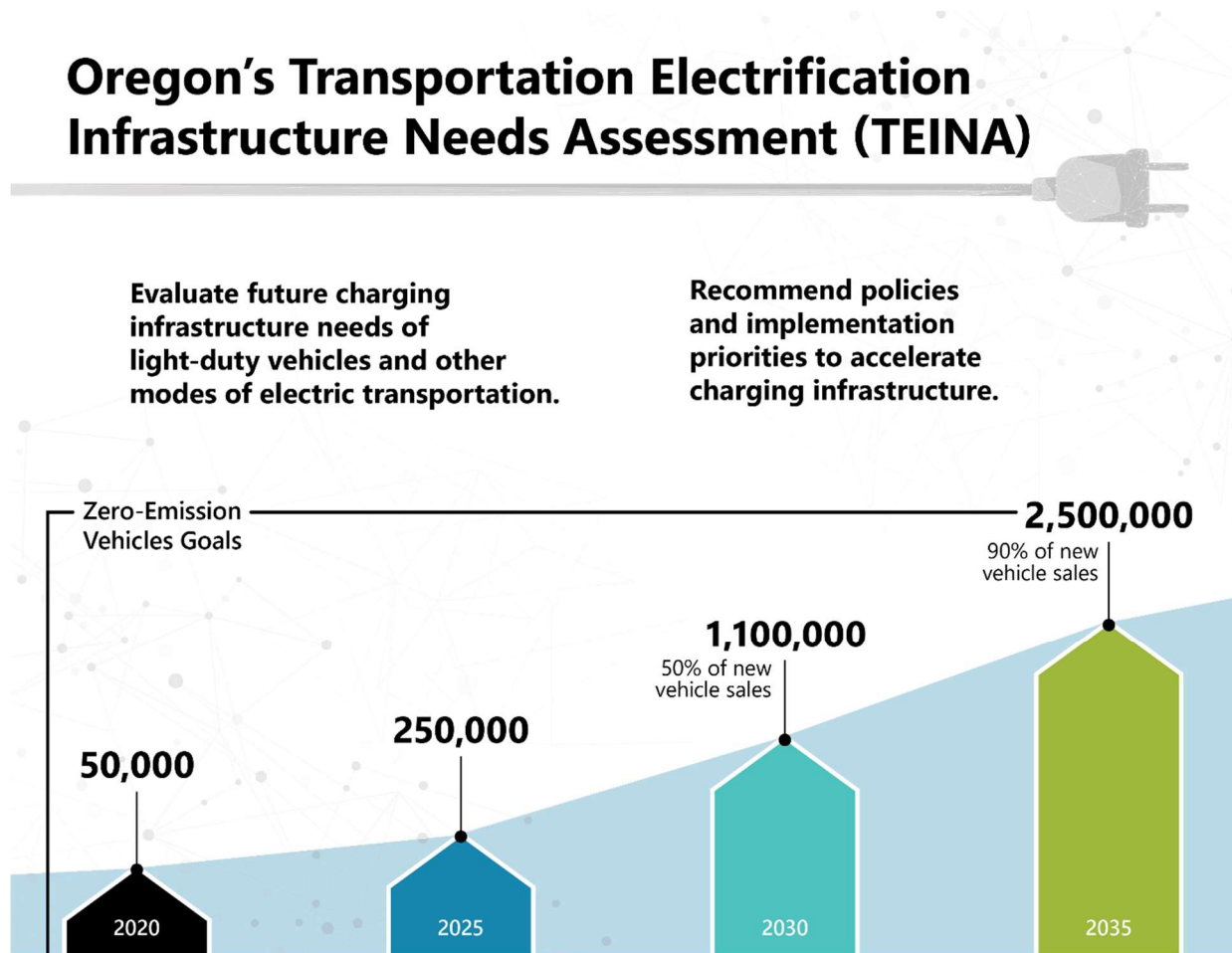
The project received additional guidance and support from an Advisory Group consisting of Greg Alderson, Portland General Electric (PGE); Tom Ashley, Greenlots; Phil Barnhart, Emerald Valley EV Association; Chris Chandler, Central Lincoln PUD; Marie Dodds, AAA Oregon; Judge Liz Farrar, Gilliam County; Ingrid Fish, City of Portland; Stu Green, City of Ashland; Jamie Hall, General Motors; Zach Henkin, Cadeo Group; Joe Hull, Mid-State Electric Co-op; Juan J Serpa Muñoz, Eugene Water and Electric Board; Vee Paykar, Climate Solutions; Cory Scott, Pacific Power; Jairaj Singh, Unite Oregon; Charlie Tracy, Oregon Trail Electric Co-op; and Dexter Turner, OpConnect.



DRAFT

## Executive Summary

The goal of Oregon's Transportation Electrification Infrastructure Needs Assessment (TEINA) study was to evaluate the likely future charging infrastructure needs of all modes of electric transportation. TEINA focuses on light duty vehicle (LDV) charging needs while also including transit, delivery, freight, and micro-mobility vehicles, during the modeling period of 2020–2035. The study is designed to evaluate charging infrastructure needs to meet the LDV goals articulated under 2019 Oregon Senate Bill 1044 (SB 1044) while also examining charging needs for other vehicle types and use cases. Additionally, the study recommends policies and implementation priorities required to accelerate infrastructure deployment, with special emphasis on the near-term to ensure Oregon sets an appropriate pace to achieve all of its midterm and longer-term milestones. Both the TEINA goals and Oregon’s SB 1044 Zero Emission Vehicles (ZEV) goals are reflected in the following graphic:



DRAFT

To achieve the vision of ubiquitous ZEV charging access, six overarching Electric Vehicle (EV) Infrastructure goals emerged from the TEINA study:



Support rapid deployment of EV charging infrastructure in homes, along travel corridors, at work and fleet depots, at travel destinations, and in multi-unit dwellings.



Ensure EV charging infrastructure is equitable and accessible to all Oregonians (including all communities, income levels, and geographic locations).



Ensure the public charging experience is user-friendly, convenient, safe, and consistent.



Ensure that EV charging offers all consumers and fleets the benefit of lower electric fueling costs.



Ensure utilities are positioned for rapid expansion of EV charging statewide. Utilities must plan for and supply increasing demands for electricity, while exploring resiliency in the event of power outages.



Develop foundational policies and provide resources to support community members, businesses, local governments, and tribes to build and benefit from a ZEV future, including educational and technical resources, EV-ready residential and commercial buildings, a skilled workforce, and increased support for micro-mobility solutions.

The study was primarily focused on the sizeable and thus critically important LDV sector, however a total of nine different use cases were modeled: Urban LDV, Rural LDV, Corridor LDV, Local commercial and industrial vehicles (also referred to as Medium-duty (MD) vehicles), Transit/school buses, Transportation Network Companies (TNC) such as Uber and Lyft, Long-haul trucking, Micro-mobility and the

DRAFT

specific infrastructure needs of Disadvantaged Communities. Broadly speaking, and as expected, the charging needs of the Urban and Rural LDV sectors are an order of magnitude greater than for the other transportation sectors (use cases). But across all sectors, there is an extraordinary need for charging infrastructure growth, not only by 2035, but also a significant near-term need for growth over the next four years.

### Modeling Results

**TEINA Results: Number of Chargers Needed (Business As Usual Scenario)**

	2020	2025	2030	2035
Urban LDV	2,000	8,000	39,000	84,000
Rural LDV	1,000	5,000	22,000	49,000
Corridor LDV	400	2,000	3,900	6,100
Local Commercial	10	371	949	1,836
Buses	15	893	3,318	7,407
TNC	0	23	193	216
Long-Haul Trucking	0	39	219	690
Disadvantaged Communities	100	600	2,700	6,000
<b>Total Number of Chargers</b>	<b>3,525</b>	<b>16,926</b>	<b>72,279</b>	<b>155,249</b>
<i>Increase Over 2020 Level</i>		<b>480%</b>	<b>2,050%</b>	<b>4,404%</b>

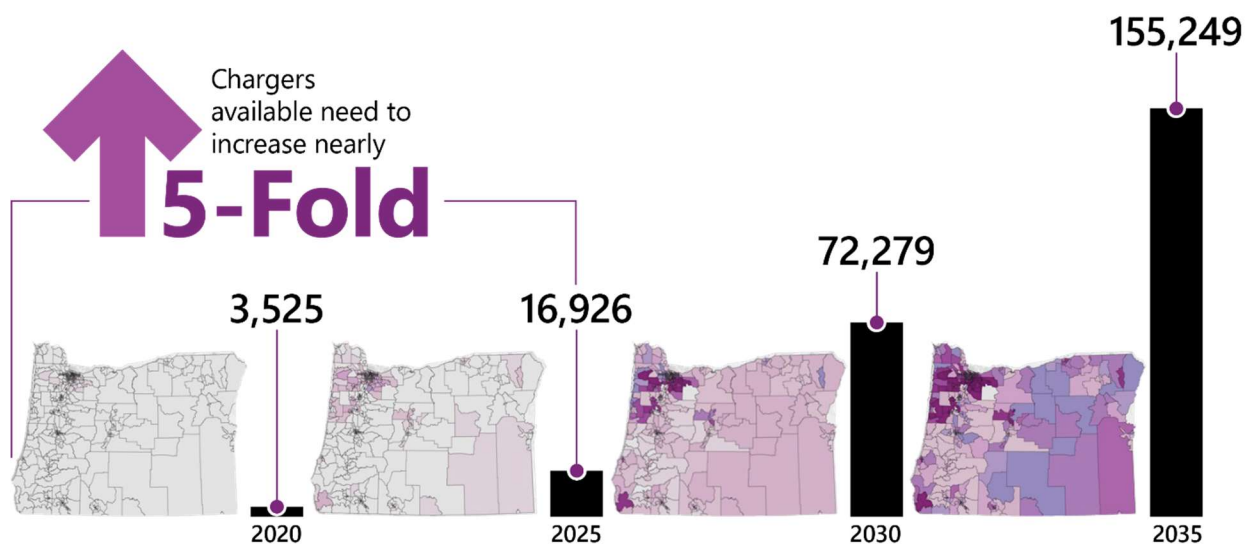
**TEINA Results: Light Duty Vehicle Chargers Needed, by Type of Charger (Business As Usual Scenario)**

	2025	2030	2035
Workplace Level 2	7,022	32,405	70,429
Public Level 2	4,472	20,611	44,785
Public DC Fast Charge (DCFC)	4,411	14,875	29,639

DRAFT

As shown in the first graphic above, in the optimized Business As Usual (BAU) scenario, 155,249 chargers will be required by 2035 — a 44-fold increase from 2020 levels. In order to meet just the light duty vehicle charging needs across all use cases (i.e., Urban, Rural, Corridor, TNC, and Disadvantaged Communities), the second table summarizes the need for Level 2 workplace charging, public Level 2, and public DC Fast Charge (DCFC) stations. These figures highlight the extraordinary growth in EV charging infrastructure required over the next 5, 10 and 15 years.

The analysis assumes that by 2035, 60% of Urban and Rural LDV charging is performed at home and takes into account the fact that a significant portion of Oregonians live in multi-unit dwellings (e.g., apartments, duplexes, townhomes) where access to convenient overnight on-site charging can be a challenge. The need for public charging grows exponentially from 2020 to 2035 and can be seen in the following heatmaps that show that available chargers across all use cases need to increase nearly five-fold just from 2020 to 2025.



*Growth in public chargers needed over the next 15 years to meet Oregon's 2035 goal.*

DRAFT

## Policy Recommendations

The near-term policy priorities are described in the following figure:

See [\[insert hyperlink to page\]](#) for full description of goals.

### Near-Term Priority Policy Initiatives



**ZEV Infrastructure Deployment Strategy – 2 to 5 year focus, including opportunities for targeted state investment** 1

**Target equity in charging** 2 4 5

- Ensure charging access for those eligible for Charge Ahead rebate.
- Incentivize workplace charging at employers, emphasizing women and minority-owned businesses and similar groups.
- Incentivize investment in charging deserts in rural areas.

**Update Oregon’s building codes and parking ordinances to make them Electric Vehicle ready** 6

**Develop and fund a statewide educational and technical assistance program for charging** 3 4 6

- Fact sheets, technical resource documents, and website content.
- Create proactive outreach program that is comprehensive, hands-on, and targets high priority markets.
- Serve as an initial point of contact, referring individuals to utilities and other resources.
- Provide guidelines and model processes for streamlining permitting.

**Lead by example: install charging at state buildings and offices, for employees and visitors** 2 5

Near-term infrastructure deployment priority actions target light duty vehicle charging needs, while supporting depot charging and planning for charging needs of local commercial and industrial vehicles and long-haul trucking.

DRAFT

## Introduction

Oregon is fast approaching an inflection point of zero emission vehicle (ZEV) adoption, driven by market forces, manufacturer commitments, technology improvements, and federal and state climate and EV policies. Recognizing the significant greenhouse gas benefits of EV adoption, the Oregon legislature passed SB 1044 which established ZEV adoption goals that would require 90% of new car sales be ZEVs by 2035. This extraordinary growth in electric vehicle adoption will create a fundamental, unprecedented shift in the way Oregonians fuel their vehicles. The current infrastructure for fueling vehicles is not adequate to support ZEVs, and a different type of infrastructure is required to meet this demand.

To guide this transition, Governor Kate Brown directed the Oregon Department of Transportation (ODOT) to conduct a Transportation Electrification Infrastructure Needs Assessment (TEINA) in Executive Order 20-04. Accordingly, ODOT hired a consultant team and formed advisory and focus groups to evaluate and highlight needs. Based on the TEINA research, stakeholder listening sessions, scenario development, and modeling of future electric fueling needs, it is clear that Oregon's existing foundation of EV charging infrastructure needs to exponentially grow over the next 15 years to drive - and supply - transportation electrification throughout Oregon.

Access to EV charging infrastructure is uniformly cited as one of the key barriers to EV adoption. Unlike current fueling infrastructure, electric charging infrastructure can, and should, be installed where people live, work, travel, and play. Critically important to instilling confidence among Oregon's EV drivers is a public network of EV charging along highway corridors and at travel destinations, workplaces, fleet depots, and for Oregonians living in multi-unit dwellings (apartments, duplexes, townhomes, often referred to as MUDs). Charging infrastructure is needed to support all Oregonians and the full spectrum of electric transportation, including light duty vehicles, electric transit and school buses, commercial and local delivery EVs, electric long-haul freight trucks, and electric bikes and scooters. Heightened private sector, public sector, and utility engagement will be critical to achieve the needed future ZEV charging infrastructure.

This report summarizes the results of the TEINA project, including the findings of the infrastructure needs assessment, policy recommendations and implementation priorities. The TEINA project was organized along five major task areas.

- **Existing Conditions:** Review, inventory and understand existing geographic and ZEV charger distribution characteristics in Oregon.
- **Literature Review:** Conduct a literature review to provide insights into how Oregon's situation compares with other efforts being undertaken across the country. In addition, an in-depth review of activities within three states (Colorado, New York, and

## DRAFT

California) that are providing national leadership in ZEV adoption was performed, to explore models for Oregon to emulate.

- **Stakeholder Engagement:** This project included an extensive stakeholder engagement process to solicit important project input regarding insights and activities being undertaken by the many different entities that are actively engaged in promoting the planning, design and implementation of transportation electrification infrastructure in Oregon. Input was received from several sources, including:
  - a 17-member Advisory Group that reviewed and critiqued activities and findings;
  - 12 separate Listening Sessions each of which focused on the concerns of representatives regarding ZEV adoption and charging for a particular use case; and
  - public comments, which were received throughout the life of the project via a website and as part of four public meetings.
- **Infrastructure Needs Assessment:** This effort represented the heart of the project and consists of the modeling analysis and findings regarding infrastructure needs in Oregon. Three bookend scenarios were used to establish a range of expected infrastructure needs across three target dates (2025, 2030, and 2035) for each of nine use cases (e.g., rural light duty vehicles, transit, etc.) as well as an optimized condition that considered all use cases in combination.
- **Policy Recommendations:** Policy recommendations and infrastructure deployment priorities were developed based on the information obtained during the study. The recommendations and infrastructure deployment priorities are presented in several different ways to enhance their usability, including:
  - in the context of overall infrastructure goals;
  - in accordance with infrastructure priorities and approach by major use case; and
  - as a list of top five recommended policy priorities to support Oregon's future plan for a ZEV charging infrastructure deployment strategy.

The main body of this report focuses on the results of the infrastructure needs assessment, the policy recommendations and the implementation priorities. Detailed findings relative to the existing conditions, literature review, stakeholder engagement, and the assumptions and methodology used in the infrastructure needs assessment, can be found in the Appendices (to be attached to the final version of this report).

The goal of Oregon's TEINA study was to evaluate the likely future charging infrastructure needs in order to ultimately achieve the state's ZEV adoption goals articulated under Oregon SB 1044 for the milestone years 2025, 2030, and 2035. Though the study focused largely on the sizeable and thus critically important light duty vehicle

DRAFT

(LDV) sector, a total of nine different use cases were modeled: Urban LDV, Rural LDV, Corridor LDV, Local commercial and industrial vehicles, Transit and school buses, Transportation network companies (TNCs) providing ridesharing services, Long-haul trucking, Micro-mobility, and the specific infrastructure needs of Disadvantaged Communities.

Broadly speaking, and as expected, the charging needs of the urban and rural LDV sector are an order of magnitude greater than for the other transportation sectors (use-cases). Across all sectors, there is an extraordinary need for charging infrastructure growth, not only by 2035, but also a significant near-term need for growth over the next four years.

### Scenario Overview

Three scenarios were used in this study to bracket the possible trajectories for the Oregon economy between 2020 and 2035 in light of the Covid-19 pandemic. All three scenarios were created to ultimately meet the ZEV objectives set out in SB 1044 by 2035. The scenarios contemplate a number of factors, such as overall economic vigor and activity, evolving technologies, consumer preferences, future policies, the changing cost of charging, potentially changing demographics, and the character of the economic recovery from the pandemic.

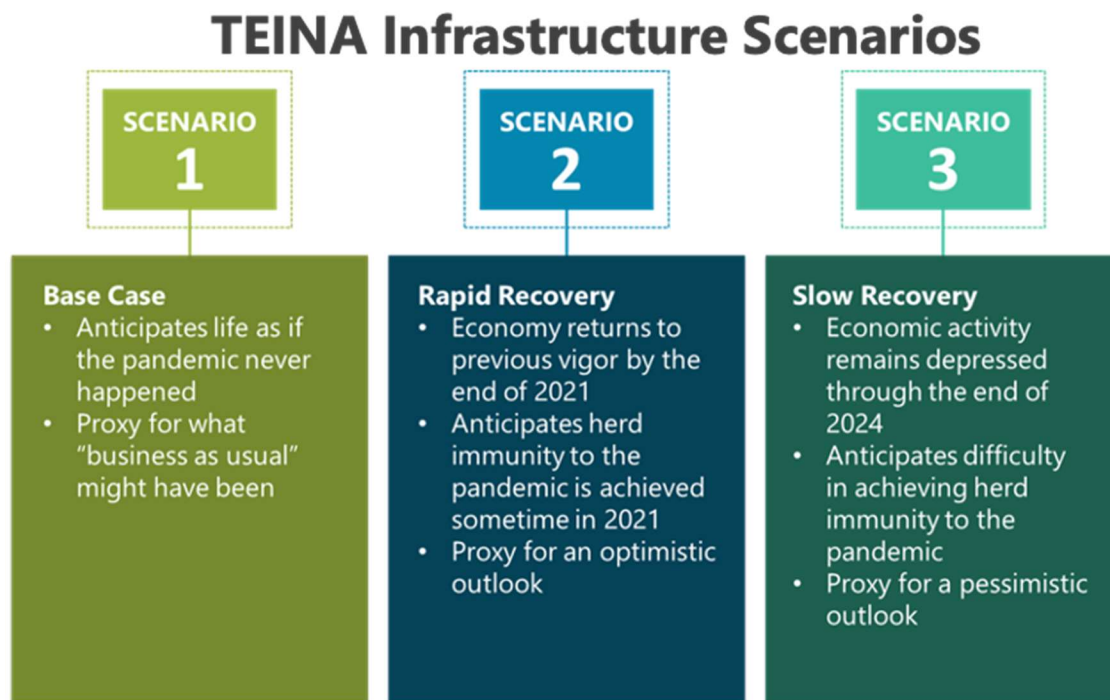


Figure 1. Three Scenarios were modeled for Oregon



DRAFT

A brief summary of each scenario follows. Complete scenario narratives are provided in the Appendix.

### **Scenario 1: Base Case or Business as Usual (BAU)**

Before the pandemic, EV adoption and charging infrastructure deployment in Oregon were proceeding well. In 2018, Oregon was ranked third in the union for EV market share, behind only California and Washington.<sup>1</sup> Therefore, it makes sense to consider what the trajectories of electrification might look like had the pandemic never happened. This scenario is used as a baseline for comparison to the other two scenarios, and as a proxy for what a “business as usual” outlook might have been.

### **Scenario 2: Rapid recovery**

The “rapid recovery” scenario assumes that one or more vaccines are widely deployed such that the overall U.S. economy quickly returns to its previous vigor by the end of 2021. This scenario serves as a proxy for an “optimistic” outlook.

### **Scenario 3: Slow recovery**

The “slow recovery” scenario imagines a future in which economic activity remains depressed through the end of 2024. As such, this scenario serves as a “pessimistic” outlook. Following 2024, economic activity quickly recovers to full vigor toward the end of the forecast period. A late, quick recovery is necessary in order to meet the objectives set out in SB 1044 by 2035, as all three of the scenarios are designed to do.

For report brevity, only the Business as Usual scenario results are shown, below. All results are available in the Appendix (to be provided in the final report).

DRAFT

## Modeling Analysis and Results

### Approach and Assumptions

A comprehensive analysis methodology was employed to estimate EV charger needs for each use case across three scenarios and for each of three target years (2025, 2030, and 2035). Table 1 provides an overview summary of the stepwise methodology followed to model each use case. It also summarizes key assumptions that underlie the analysis for each use case.

### Model Optimization

The modeling treated each use case individually, as if a dedicated set of chargers existed for each one. In reality, some chargers will be used by multiple use cases, so an optimization pass on the model results was performed to estimate how such sharing might reduce the total number of chargers needed in Oregon.

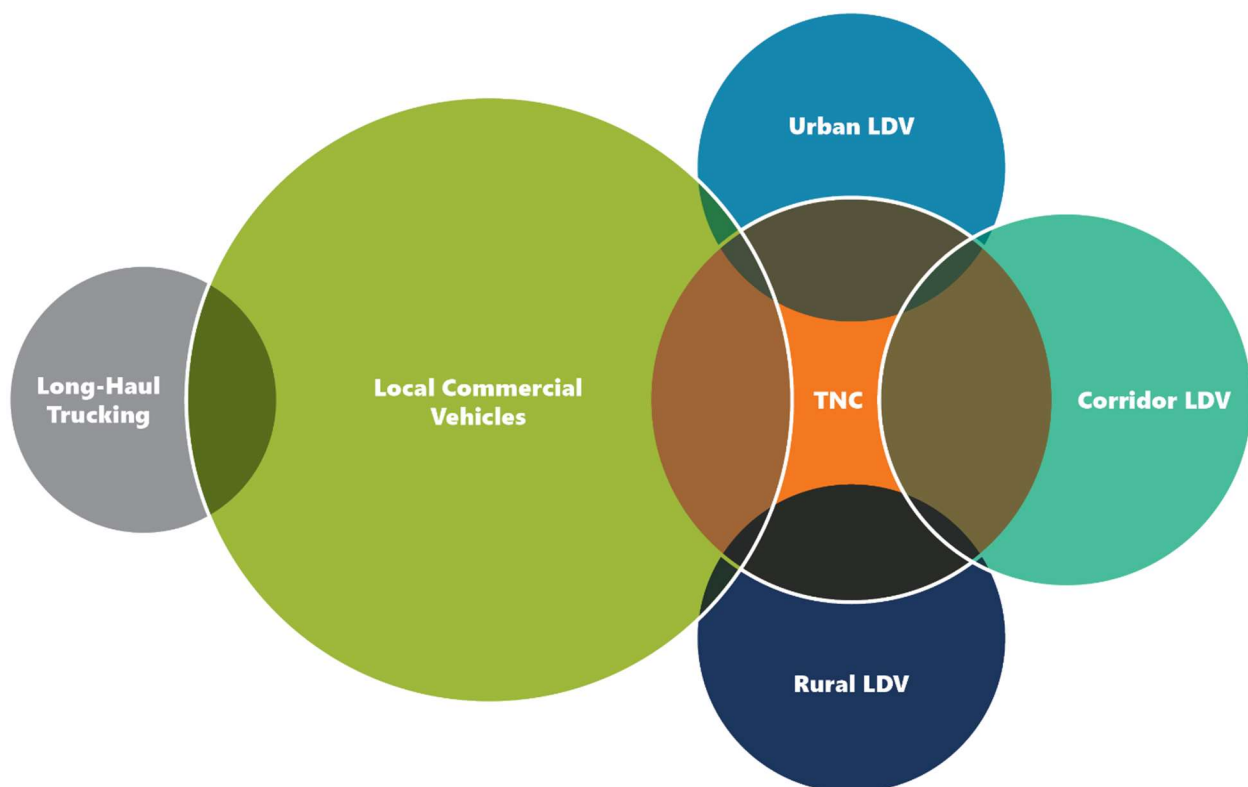


Figure 2. Venn Diagram of model optimization

Table 1. Modeling methodology and assumptions by use case.

Modeling Methodology by Use Case	Assumptions	Modeling Methodology by Use Case	Assumptions
<p><b>Urban Light Duty Vehicles (LDV)</b>  <b>Step 1:</b> Forecast the total number of LDV—both EVs and ICEs—throughout the modeling period.  <b>Step 2:</b> Using EV/ICE ratios and independent growth rates for EV and ICE, forecast the number of LDV statewide in each of the milestone years.  <b>Step 3:</b> Determine number of chargers needed by census tract to support EVs - workplace Level 2, public Level 2, and public DCFC chargers, based on six regression models derived from hundreds of runs of NREL's EVI-Pro Lite modeling tool. (Residential charging is factored into the NREL tool but is not separately modeled for this study)</p>	<p>No. Urban eLDV is 192,000 (2025), 888,000 (2030), 1,930,000 (2035); 90% of all LDV charging is at home in 2020, decreasing to 60% in 2035 as more workplace and public chargers are installed; DCFC power = 150kW</p>	<p><b>Transportation Network Companies</b>  <b>Step 1:</b> Forecast the TNC VMT in each county through 2035. Distributing the total statewide VMT per year across the counties, based on each county's share of the state population. To establish a 2019 baseline for the TNC VMT, perform a regression of TNC shares of VMT based on population density.  <b>Step 2:</b> Convert the TNC VMT into a # of TNC vehicles, based on the weighted average TNC VMT in California.  <b>Step 3:</b> Apply vehicle-to-charger ratios to the number of EVs from Step 2, to determine the number of chargers by county that will be needed for TNC EVs.</p>	<p>eTNC daily VMT is 93,000 (2025), 888,000 (2030), 1,258,000 (2035); For TNC drivers with no access to home charging, use vehicle-to-plug ratio of 33 EVs/plug; 22% of TNC drivers have access to home charging in 2025, 33% in 2030 and 44% in 2035; Public DCFC = 150 kW</p>
<p><b>Rural Light Duty Vehicles</b>  <b>Step 1:</b> Same as the urban use case  <b>Step 2:</b> Same as the urban use case, except applying a different EV/ICE ratio.  <b>Step 3:</b> Subtract the urban totals from the statewide totals to get the number of chargers needed in rural areas.</p>	<p>No. Rural eLDV is 58,000 (2025), 269,000 (2030), 585,000 (2035): Home charging assumptions same as for Urban LDV; DCFC power = 150kW</p>	<p><b>Long-Haul Trucking</b>  <b>Step 1:</b> Forecast the electric VMT for HDV (statewide, not just highways) in each of the milestone years based on the electric HDV sales projections used in the WCCTCI study.  <b>Step 2:</b> Calculate the energy required for the HDV VMT.  <b>Step 3:</b> Determine the energy needed to be provided en route by census tract as well as the number of 500 kW chargers to support the trucks (500kW is max charging rate for HDVs entering the market today)</p>	<p>Long-haul Freight daily VMT is 68,000 (2025), 289,000 (2030), 802,000 (2035); 0% eTruck sales in 2020 increase to 15% sales in 2035; 10% en route charging + 90% depot in 2020 (50% en route in 2035); 1/3 of VMT comes from out-of-state trucks</p>
<p><b>Corridor Light Duty Vehicles</b>  <b>Step 1:</b> Forecast the total number of LDV traveling these corridors for the milestone years by extrapolating from historical annual average daily traffic (AADT) data.  <b>Step 2:</b> Assume that every e-LDV traveling these corridors in Oregon, even if their trips originate and end in other adjacent states, will need to gain 30% more energy using corridor chargers in Oregon than is needed to finish their trips.  <b>Step 3:</b> Forecast the number of chargers needed in each 30-mile segment of each corridor, assuming charging is done using 150 kW public DCFC, to provide the amount of energy calculated in Step 2.</p>	<p>LDV average 68% share of traffic on all major corridors in the state (AADT extrapolation); 150 kW charging on all corridors over the period; 20% charger utilization rate in 2020 (35% in 2035) – i.e. the share of hours in a day the charger is in use</p>	<p><b>Micro-mobility</b>  <b>Step 1:</b> As a baseline, use the output of the Urban and Rural LDV use cases for LDV charger demand.  <b>Step 2:</b> Estimate how micromobility use might reduce the demand for LDV chargers for urban and rural areas separately, because we assume that micromobility is far more prevalent in urban areas.  <b>Step 3:</b> Apply the calculated reduction in demand for LDV chargers against the Urban and Rural LDV baseline to calculate the resulting need for LDV chargers under the micromobility use case.</p>	<p>Micromobility; Assumes 110V outlets at home, work, public destinations, Urban: 3% of trips in 2020 up to 25% in 2035, Rural: 0% of trips in 2020 up to 5% in 2035</p>
<p><b>Local Commercial and Industrial Vehicles</b>  <b>Step 1:</b> Forecast the electric VMT for MDV in each of the milestone years based on the projections used in the WCCTCI study.  <b>Step 2:</b> Calculate the energy required for the MDV VMT. To begin this calculation, we multiplied the vehicle's energy efficiency by the VMT.  <b>Step 3:</b> Forecast the chargers needed (assumed 350kW) in each census tract to provide the energy calculated in Step 2.</p>	<p>eMDV daily VMT is 567,000 (2025), 1,345,000 (2030), 2,351,000 (2035); 10% en route charging + 90% depot in 2020 (50% en route in 2035); 15% charger utilization rate in 2020 (30% in 2035); 21% of MDV are electric by 2035; DCFC power = 350 kW</p>	<p><b>Disadvantaged Communities</b>  <b>Step 1:</b> As a baseline, use the output of the Urban and Rural LDV use cases for LDV charger demand.  <b>Step 2:</b> Add an increment of all types of chargers to each of the disadvantaged communities to compensate for the bias in our model due to lower vehicle registrations in those communities.  <b>Step 3:</b> Adjust the number of chargers by charger type, in accordance with the narrative scenarios.</p>	<p>No. EVs 20% of total EVs in OR 86 "Opportunity Zones" nominated by Gov. Brown; 25% additional chargers for workplace, L2, DCFC; By 2035, no. chargers per capita equals non-disadvantaged communities</p>
<p><b>Transit and School Buses</b>  <b>Step 1:</b> Starting with the number of transit and school buses in the state, develop a forecast for the number of school buses (both EV and ICE) in each county, based on its share of the population and the transit agencies service areas.  <b>Step 2:</b> Forecast the number of e-buses needed through 2035 statewide, based on growth rate factors.  <b>Step 3:</b> Apply charger to transit bus ratios to determine the number of 60 kW DCFCs for transit buses, and charger to school bus ratios to determine the number of Level 2 chargers for school buses.</p>	<p>No. eTransit buses is 234 (2025), 874 (2030), 1,992 (2035); 75% of market by 2035 and 90% of new sales; 60 kW depot charging; 1:1 charger per Bus (growing to 2:1 after 2030); No. eSchool buses is 720 (2025), 2,832 (2030), 6,411 (2035); 75% of market by 2035 and 90% of new sales; Level 2 school bus charging; 1:1 charger per bus</p>		

DRAFT

The optimization modeling makes two assumptions:

1. The overall impact of sharing in each use case will be quite modest, because the modeling assumes that at some point, as the EV fleet grows, the utilization of chargers will be maximized, and so the hours of the day that chargers will not be in use will be fairly minimal.
2. As the EV fleet grows, the use of chargers by EVs in multiple use cases will increase.

Not all use cases will have potential overlap with other use cases, as shown in Figure 2. No overlap is expected in the following cases:

- Transit buses and school buses are expected to use dedicated chargers.
- Ultra-high speed Direct Current Fast Charging (DCFC) chargers for long-haul trucks won't likely be usable by anything else.
- Workplace L2 will likely be restricted to employee use.

After optimization, it is estimated in 2035:

- 18% of estimated chargers for TNC drivers could be eliminated, without affecting the service level.
- 25% of corridor charging can be met by urban and rural LDV chargers.
- 10% of local commercial and industrial vehicle charging can be met by urban and rural LDV chargers.
- 5% of long-haul trucking charging can be met by leveraging local commercial and industrial chargers.

The full analysis and results of the optimizations are provided in the Appendix.

## Results

The modeling results for the base scenario, or Business As Usual (BAU) scenario, are below. The results for all scenarios can be found in the Appendix.

This BAU scenario is the baseline for comparison to the other two scenarios, and a proxy for what a business as usual outlook might have been. This scenario uses the ZEV adoption and charging infrastructure trends that existed before 2020 as a basis, and then applies a classic technology adoption S-curve to depict how those trends might have continued through 2035 had the pandemic never happened.

For example, if the economy reverts to the historical mean within two or three years, then the "rapid recovery" scenario would depict an unrealistically rapid economic recovery while the "slow recovery" scenario would depict an unrealistically slow economic recovery, and this scenario would offer a more accurate view of the future.

DRAFT

The BAU scenario is characterized in Table 2:

*Table 2. BAU scenario characteristics by target year.*

<p>2025</p>	<ul style="list-style-type: none"> <li>• EVs have reached sticker-price parity with ICE vehicles, driving a spike in consumer interest.</li> <li>• The market share for EVs is 8%, commensurate with the 2025 goal of SB 1044.</li> <li>• Public DCFC are now available within a 50-mile radius of anywhere in the state.</li> <li>• Charging networks have expanded significantly and Level 2 chargers are increasingly installed in public, workplace and Multi-Unit Dwelling (MUD) parking lots.</li> <li>• “Range anxiety” about the availability of charging stations isn’t really something anyone feels anxious about anymore.</li> <li>• In keeping with the SB 1044 targets, 250,000 ZEVs are registered in the state and 25% of new light-duty vehicles purchased or leased by state agencies are ZEVs. 95% of these vehicles are EVs with the remainder being hydrogen fuel cell vehicles.</li> </ul>
<p>2030</p>	<ul style="list-style-type: none"> <li>• The market share of EVs is over 30% and it’s obvious to all that EVs are the future.</li> <li>• Driven by the electrification trends in the urban areas and the significant price advantage that EVs now have over ICE vehicles, EV adoption spreads out from the urban cores to the rural areas of the state, led by electrified pickups and electrified farm equipment.</li> <li>• In keeping with the SB 1044 targets, 25% of registered vehicles and at least 50% of new vehicle sales are ZEVs.</li> <li>• All new LDV purchases or leases by state agencies are ZEVs. EVs make up 95% of these vehicles.</li> </ul>
<p>2035</p>	<ul style="list-style-type: none"> <li>• Gasoline stations have started disappearing from the state, making it less convenient and more expensive to own a personal Internal Combustion Engine (ICE) vehicle. Gasoline station coverage has largely shrunk toward the major highway corridors.</li> <li>• Rising state taxes on carbon-emitting fuels as part of the state’s overall climate policies, and a shrinking global oil industry also put upward pressure on gasoline and diesel prices. EVs have become dominant in all vehicle classes.</li> <li>• It is becoming clear to all that using ICE vehicles will become increasingly inconvenient, and much more expensive than EVs.</li> <li>• EVs account for 90% of new vehicle sales.</li> </ul>

DRAFT

## Urban LDV

Urban chargers serve a variety of drivers and use cases, making it feasible to provide charging services at a variety of power levels and charging session durations. This is important because providing power supply to urban charging sites can be costly, and EV charging loads at these sites should be managed as much as possible. Cost optimization also means using slower chargers whenever practical. Additionally, demographic analysis can provide insights into the local density of multi-unit dwellings (MUDs) vs single-family homes or the density of workplaces – both leading to an improved ability to more accurately size public charging stations. Urban stations are more likely to deliver less than a full charge in each charging session, as drivers plug in opportunistically to top up their vehicles while shopping or doing other things. A four-fold increase in urban public charging is required by 2025, including 4,800 workplace chargers, 2,800 public L2, and 880 DCFC.

- Home charging will represent 90% of all LDV charging in the near term, while decreasing over time to 60% in 2035 as more workplace and public charging becomes available, and as MUD residents represent a larger segment of the ZEV driver population. Encouraging and enabling home charging (especially with demand side management capability) for all urban dwellers will continue to be important throughout.
- Near term priority focus and support for workplace and urban DCFC charging hubs (addressing both Transportation Network Companies (TNCs) and MUDs), as well as depot charging for public and private fleets.

As shown in the chart below, a four-fold increase over 2020 levels in the total number of chargers would be needed in the BAU scenario to meet the urban LDV requirements by 2025, and a nearly 20-fold increase would be needed by 2030. Most of the needed chargers by 2030 would be workplace Level 2 and public Level 2 chargers.

However, DCFC chargers become a more significant part of the needed infrastructure by 2035, driven by two somewhat countervailing trends: a) increased consumer adoption of EVs, and b) more people choosing not to own vehicles and to use ridesharing services (TNCs) instead, because those services will rely on public DCFC.

Because public DCFC and public Level 2 chargers tend to be operated by private sector charging network operators or “site hosts” like big-box retailers, the deployment of these chargers will largely depend on the economics and requirements of operating those networks. This speaks to the importance of policy supports, like requiring buildings and lots to pre-wire for Level 2 chargers, or demand charge relief and advanced tariff designs that improve the economics of operating public DCFC networks. However, to achieve the required deployment of workplace Level 2 chargers,

DRAFT

public policy will likely need to take the form of incentives to encourage employers to install Level 2 chargers in their parking lots, and to encourage their employees to adopt EVs that use them. Note also that Oregon SB 1044 aimed to reach 50,000 registered ZEVs in Oregon by the end of 2020; actual adoption was short of that goal by a third, at 33,547. This illustrates the enormous challenges of mobilizing all critical actors at the same time to ensure the successful achievement of targets, including utilities, regulators, state agencies, infrastructure providers, the operators of fleets, and consumers themselves.

### Barriers that pose challenges to Urban LDV Charging

Lack of adequate wiring and right-size electrical conduit to meet charger needs	1 2 3 4 5 6
Inconsistent fees and/or rates for public charging	1 2 3 4 5 6
Low accessibility for residents of MUDs Limited workplace charging	1 2 3 4 5 6
Limited government planning or guidance for EV infrastructure needs	1 2 3 4 5 6

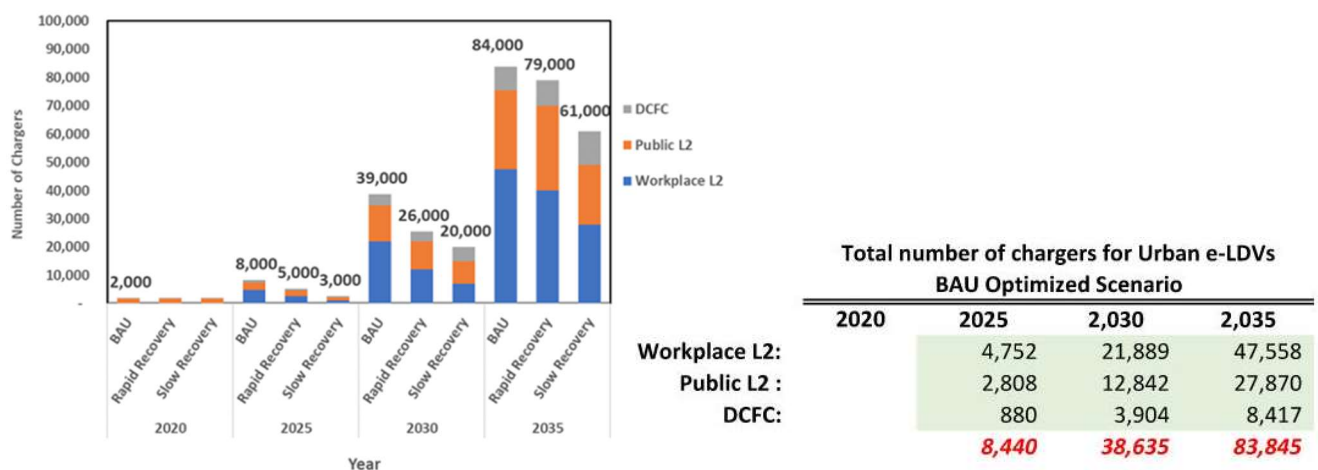


Figure 3. Total number of chargers for Urban e-LDVs

### Rural LDV

The needs of rural drivers often result in longer travel distances than urban drivers, with charging stations that are likewise more widely spaced. As a result, these charging

DRAFT

stations generally require larger power capacity to deliver a faster charge. Rural charging stations are often challenged to meet a wide variety of use cases, from long-distance travelers passing through, to farmers needing to charge up specialized farming equipment. Rural towns may have charging needs that differ from rural corridors.

- A five-fold increase in rural public charging is required by 2025, including 2,000 workplace chargers, 1,500 public L2, and 1,400 DCFC. Encouraging and enabling home charging, with demand side management capability, will continue to be important throughout.
- In the 2025 BAU case, roughly one quarter of all LDV EVs will be located in rural areas (58,000 of 250,000). Given longer distance travel in these areas (and recognizing the larger geographical area), the need for rural DCFC chargers in the next five years (1,400 by 2025) exceeds the need for DCFC in urban areas (880).

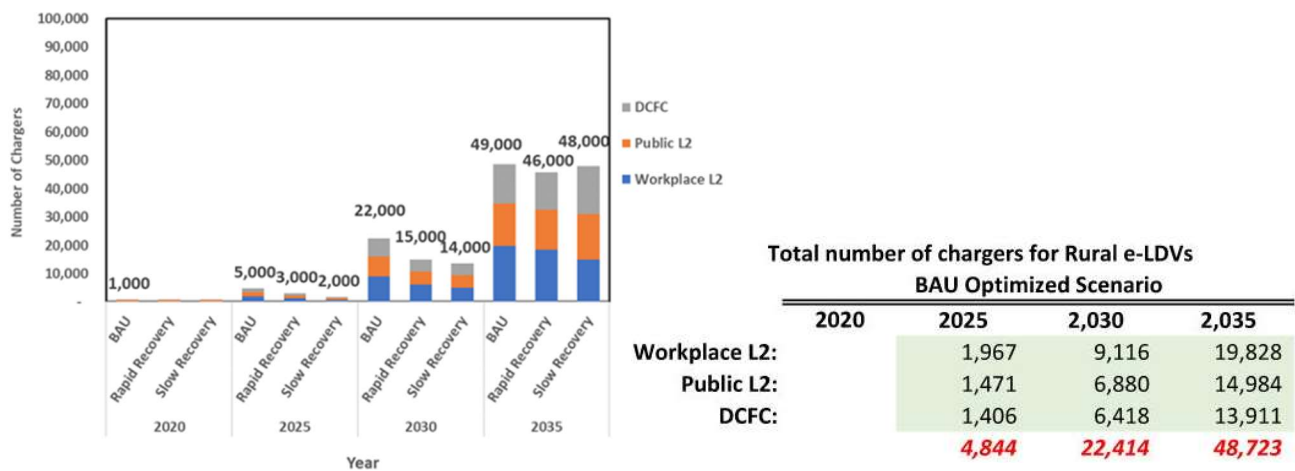


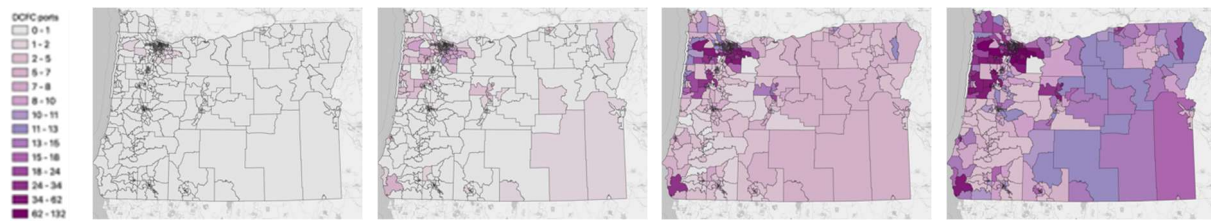
Figure 4. Total number of chargers for Rural e-LDVs



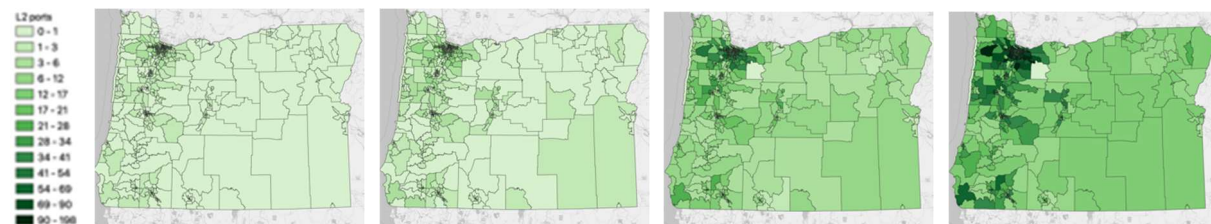
DRAFT

Urban & Rural LDV Use Cases Chargers Needed

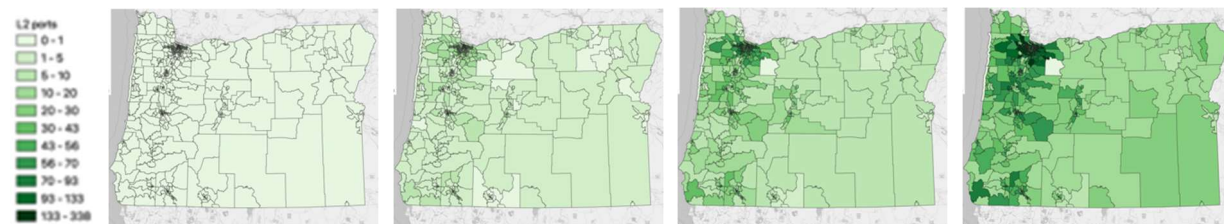
DCFC Chargers



L2 Chargers



Workplace Chargers



2020

2025

2030

2035

Corridor LDV

Today, charging stations along major corridors mostly serve long-distance travelers with light-duty vehicles who need a fast charge, so these charging stations are typically high-speed DCFC with large power requirements. LDV travelers also typically need access to amenities when they are stopped to recharge, so the availability of restaurants, convenience stores, and restrooms is important.

The heat maps below show the growth in electric LDV traffic along seven key highway corridors in Oregon over the period from 2020 to 2035. The corresponding bar graph shows that a **five-fold increase in publicly available DCFC charging is required along Oregon’s major highway corridors by 2025** (growing from 400 DCFC plugs today to 2000 in 2025); a 10-fold increase by 2030; and a 15-fold increase in DCFC infrastructure to reach 6,100 DCFC by 2035.

Key takeaways:

DRAFT

- A five-fold increase in publicly available DCFC charging is required by 2025.
- An overall near-term priority focus on Corridor LDV (including rural and key destinations) is needed. Begin by prioritizing the near-term buildout of highly-redundant SAE Combo DCFC on the West Coast Electric Highway (I-5, US 101, and other major roadways in Oregon).

To the extent practicable, consider a near-term goal of 25-50 mile max distance between charging stations on Oregon’s major highways (I-5, I-84, I-82, US 20, US 26, US 97, US 101) and 75-100 mile max distance between charging stations along remaining rural highways – eventually achieving a maximum of 25-mile station separation on all thoroughfares.

Chargers needed (DCFC) in the LDV Highway Corridor Use Case – 2020-2035

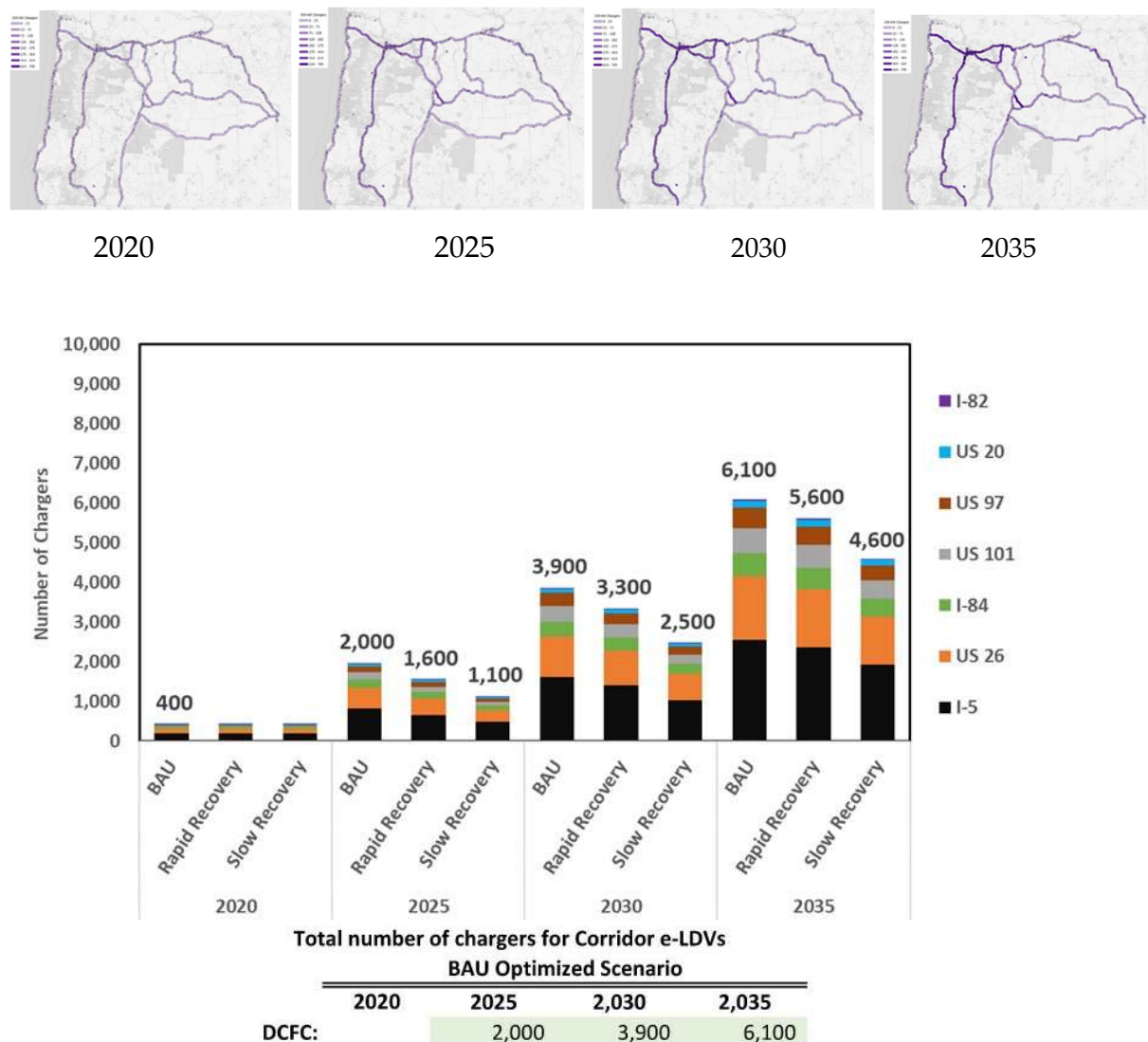


Figure 5. Total number of chargers for Corridor e-LDVs after optimization

DRAFT

## Local commercial and industrial vehicles

Assuming SB 1044 light-duty vehicle goals are met and vehicle manufacturers deliver a full range of suitable electric vehicles for all use cases, there will be a variety of EVs with commercial and industrial uses that require charging infrastructure. Charging needs for this use case will depend on the range of EV models that manufacturers bring to market, as well as the characteristics of improved battery capabilities and the charging requirements for these vehicles.

Key takeaways:

- Local medium-duty commercial fleet electrification is likely to significantly precede the electrification of longer-distance trucking fleets, particularly in urban delivery.
- It's expected that only 10% of commercial medium-duty fleet charging in the early years (2020-2025) will be served by public "en route" charging, which leaves a substantial need for 90% of charging to be served at private depots. This will grow to 50% depot and 50% public en route by 2035.
- Prioritize support for the early electrification of commercial fleets, including support for pilots and private depot charging infrastructure on private property. In 2025, commercial fleets will require an estimated 390 public chargers (350kW) or the equivalent (e.g., 2,730 @ 50kW public chargers to serve en route charging needs).

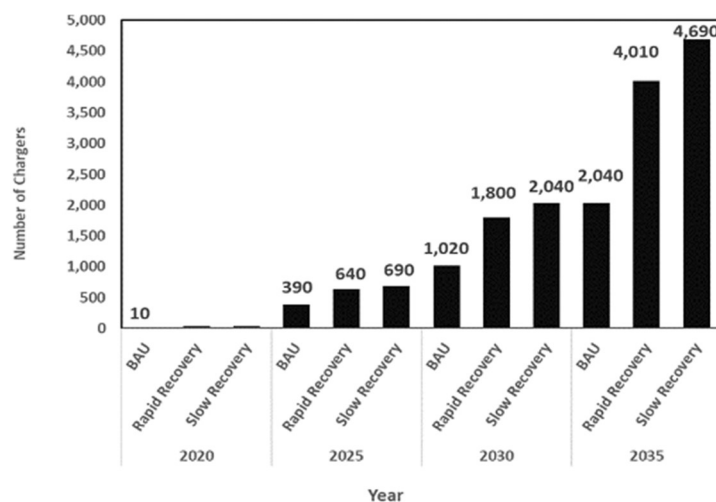
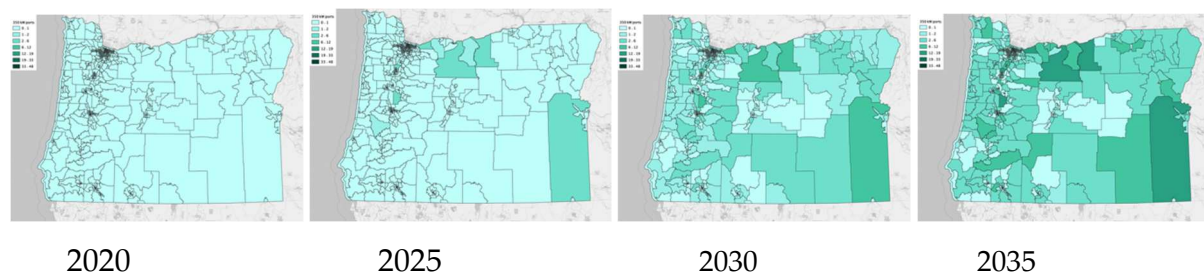


Figure 6. Total number of chargers for local MD vehicles.

DRAFT

Chargers needed (350 kW DCFC) in the Local Commercial MDV use case - 2020, 2025, 2030, 2035 (BAU):



## Transit and school buses

Transit buses are one of the types of vehicles most likely to rapidly electrify, and school buses are likely to begin electrifying quickly as well. Both types of buses are likely to be largely electrified fleetwide by 2035, which could add significant power demands to utility distribution systems, and warrant demand management strategies. Both transit buses and school buses have unique duty cycles, passenger needs, and capabilities that require their charging infrastructure needs to be separately modeled.

Key takeaways:

- By 2035, 75% of the bus market will be electrified and 90% of new sales will be eBuses.
- Three quarters of all transit buses in the state, and a vast majority of transit rides, are provided by three transit agencies (Tri-County Metropolitan Transportation District of Oregon also known as TriMet, serving Portland; Salem Area Mass Transit District; and Lane Transit District, serving Eugene).
- In the short term, expect virtually all charging to be at bus depots.
- Partnerships between public transportation agencies, the state, utilities, and others are needed to address total cost of operation and available funds.
- Educational and technical support to bus fleet operators is needed to accelerate the transition.

DRAFT

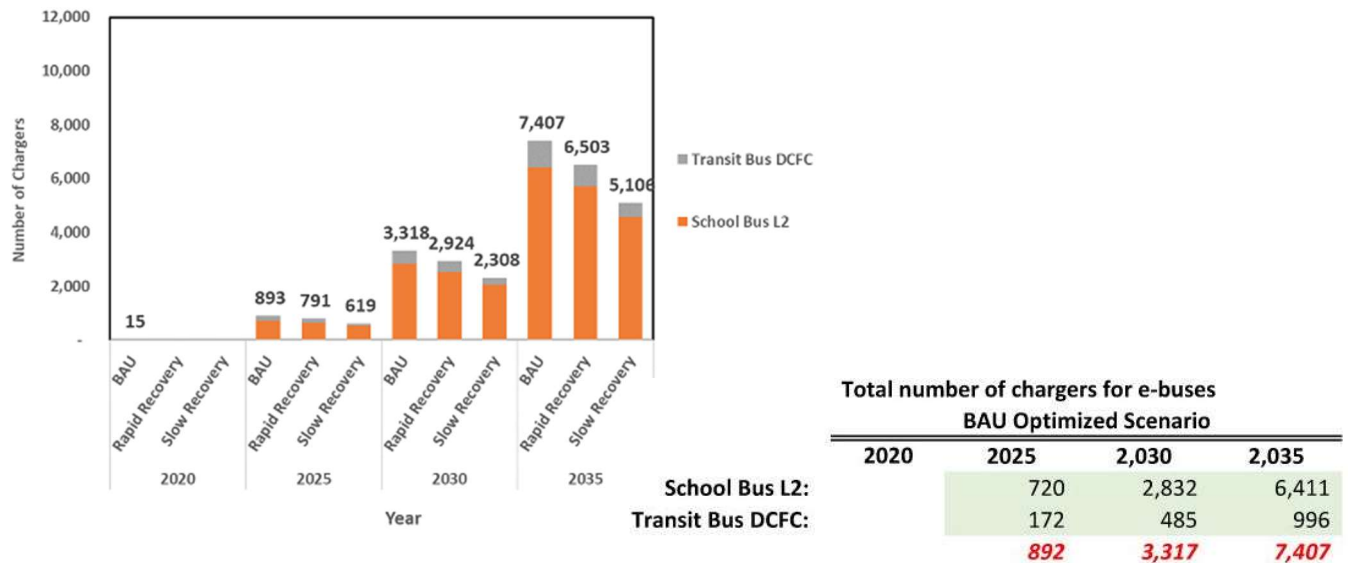
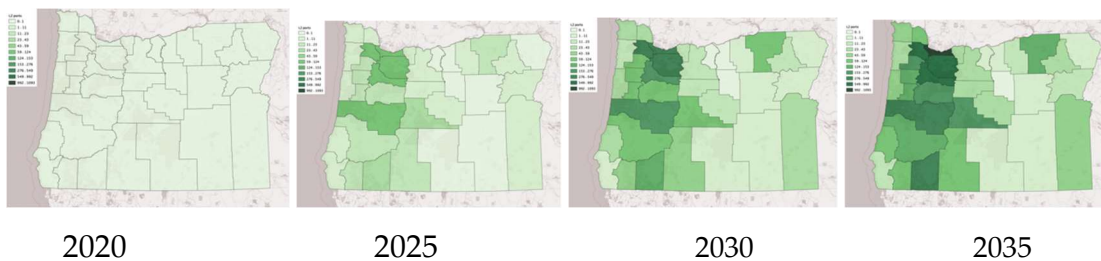
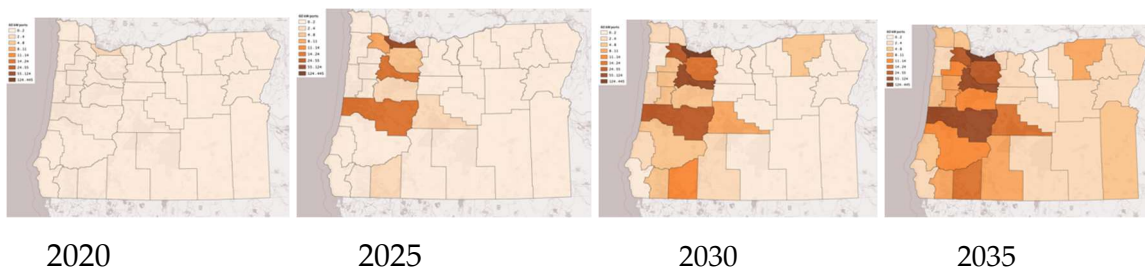


Figure 7. Total number of chargers for e-buses.

Chargers needed in the School Bus (L2) use case - 2020, 2025, 2030, 2035 (BAU):



Chargers needed in the Transit Bus (DCFC) use case - 2020, 2025, 2030, 2035 (BAU):



### Transportation Network Companies (TNCs)

TNCs offer a particular set of challenges to electrify their fleets. TNC drivers often live in communities that are distant from the areas where most of the demand is for TNC services. Most TNC drivers visit nearby airports at least once a day, if not many times a day. Full-time TNC drivers routinely drive 250-300 miles a day, necessitating conveniently located high-speed chargers so they can recharge with a minimum of down time. By 2035, it is possible that some of these services will use autonomous vehicles and become the preferred mode of travel for people who may become ex-drivers by 2035. However, it is unclear how demand from this sector will evolve.

DRAFT

Key takeaways:

- In 2025, it's estimated that 9% of TNC charging could be met by leveraging urban and rural LDV chargers, corridor LDV chargers, and the chargers installed for local commercial and industrial vehicles. By 2035, this could grow to 18%, while providing the same level of service. Thus, it's critical (and advantageous) to consider integrating the needs of TNC charging when planning urban DCFC charging.
- In 2025, an estimated 22% of TNC drivers will charge solely at home, and by 2035 44% will charge at home, reflecting increasing deployment of home chargers over the forecast period. This growing reliance and demand for home charging (generally much less costly than using public DCFC) -- especially with demand side management capability -- should be a near-term priority.

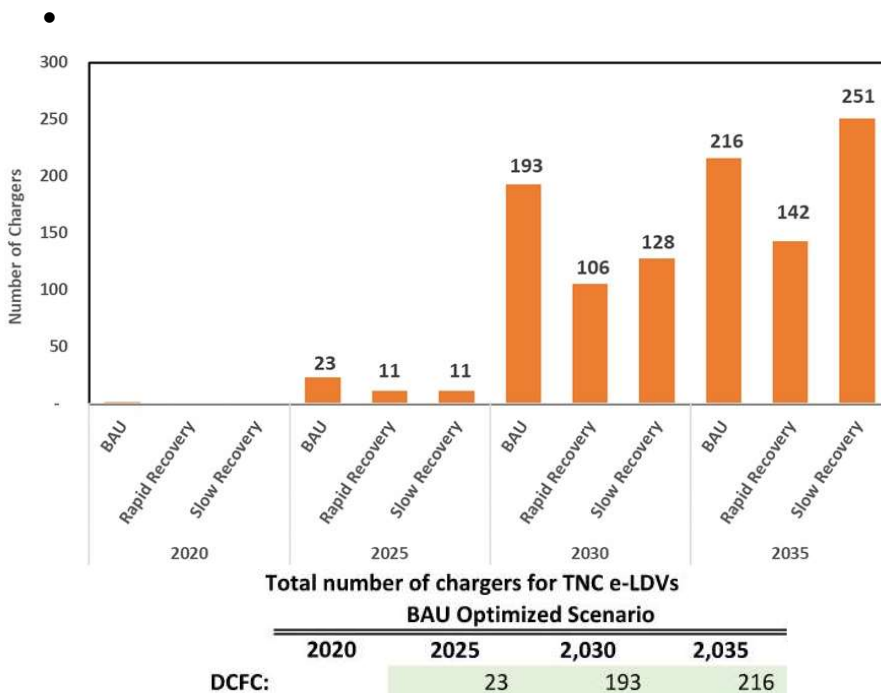
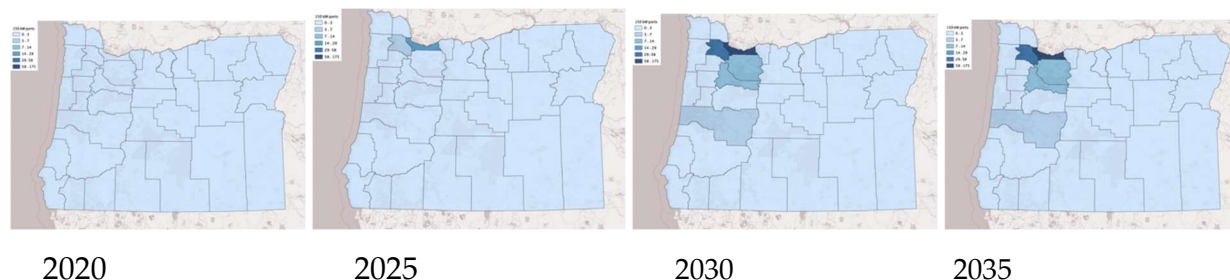


Figure 8. Total number of 150kW DCFCs for e-TNCs after optimization.

Chargers needed in the TNC (DCFC) use case - 2020, 2025, 2030, 2035 (BAU):



DRAFT

## Long-haul trucking

Long-haul trucking with Class 8 electric vehicles is still a nascent sector. That said, it is extremely likely that there will be significant numbers of electric trucks on the road over the modeling period, particularly now that the California Air Resources Board has passed a rule requiring most new trucks in the state be ZEVs by 2035. Oregon has signaled its intention to adopt a similar rule within two years. These vehicles require power supplies that are at least an order of magnitude larger per vehicle than some of today’s LDVs, and have very stringent requirements for duty cycles, dictated by federal rules governing driver working hours and the demands of the supply chains served.

Key takeaways:

- The heat maps indicate significant electrified long-haul growth really begins to appear after 2025, later than other sectors.
- One-third of long-haul trucking Vehicle Miles Traveled (VMT) comes from out-of-state, thus the demand for long-haul trucking charging based solely on trucks from California should form a core part of Oregon’s infrastructure planning strategy.

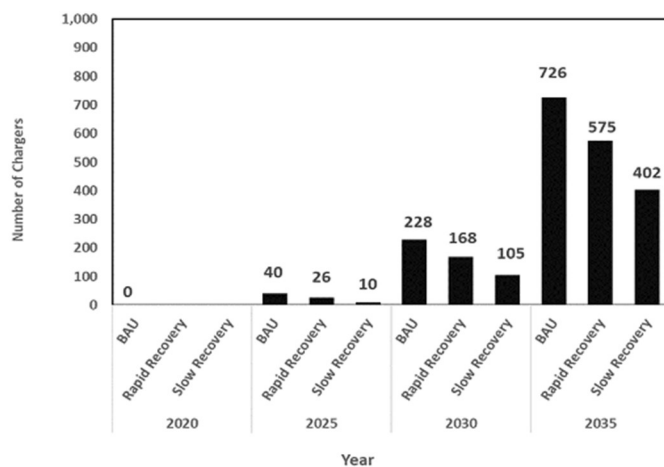
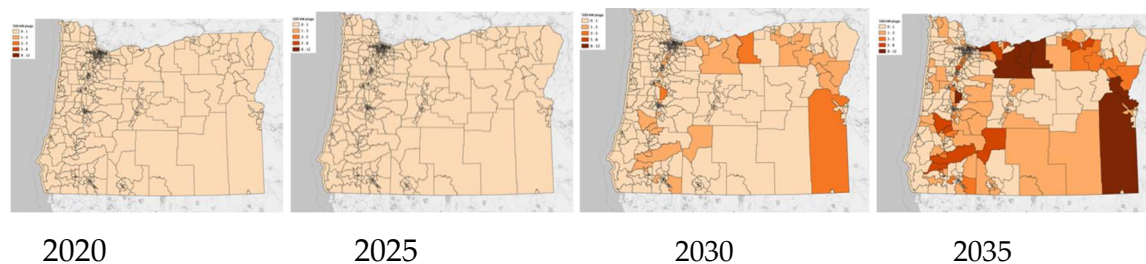


Figure 9. Total number of chargers for Long-Haul Trucking.

Chargers needed in the Long-Haul Trucking (DCFC) use case - 2020, 2025, 2030, 2035 (BAU):



DRAFT

## Micro-mobility

Micro-mobility is a rapidly growing sector, particularly as an adaptation strategy during the pandemic. Micro-mobility comprises a suite of electrified personal mobility devices, including bicycles, scooters, skateboards, one-wheels, unicycles, and more.

Key takeaways:

- The study assumes that micro-mobility will be far more prevalent in urban areas than in rural areas.
- Micro-mobility is expected to grow from 3% of urban trips in 2020 up to 25% in 2035; in rural areas micro-mobility is expected to grow more modestly from 0% of trips in 2020 up to 5% in 2035.
- The study assumes that micro-mobility is served by 110V outlets primarily at home locations, but that broader adoption will require a visible presence of charging opportunities at work locations and at public destinations, including parks, beaches, museums, etc.

The study assumed that a significant growth in micro-mobility (led largely by Portland’s long-term goal of meeting 25% of commuting trips with bikes) could offset VMT in the LDV sector (more so in the Urban LDV case than in the Rural LDV case). In 2035, micro-mobility accounts for 25% of urban trips and 5% of rural trips, resulting in the need for 9,400 fewer public chargers for the LDV sector (workplace, L2 public, DCFC) as shown in Figure 10.

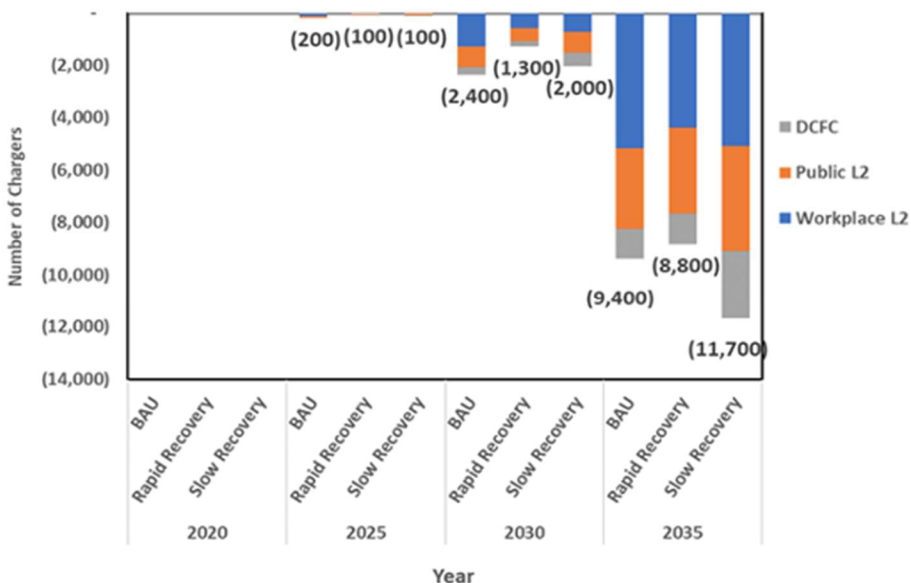


Figure 10. Reduction in number of required chargers due to Micro-Mobility.



DRAFT

## Disadvantaged communities

Drivers in disadvantaged communities are more likely to need fast charging stations for two reasons. First, these drivers often live in MUDs without dedicated parking where they can access a reliable slow charge overnight. Second, many drivers for transportation network companies (TNCs, like Uber and Lyft), live in these communities and TNC drivers need to be able to charge quickly in order to maximize their driving time. However, private charging networks often do not prioritize locations in disadvantaged communities for deployments. Thus, these charging stations may be candidates to be built and operated by utilities or other municipal agencies. Some MUDs may be reasonably anticipated to build overnight charging facilities on site for their residents, and those too need to be considered.

The modeling for disadvantaged communities essentially consists of adjustments to the Urban and Rural use cases.

Key takeaways:

- Analysis shows that vehicle registrations in Oregon are currently 26% lower in disadvantaged communities than non-disadvantaged communities. Because the model allocates chargers to counties or census tracts based on their share of vehicle registrations, it's inherently biased to allocate fewer chargers to disadvantaged communities.
- To compensate for this, the number of chargers in the disadvantaged communities was increased by various factors for each scenario. This also helps to compensate for the fact that residents in disadvantaged communities have less access to home charging, because many of them live in MUDs. Critically, with these adjustments, by 2035 the model results for disadvantaged communities obtains the same number of chargers per capita as in other non-disadvantaged communities, which levels the playing field and makes EVs more accessible.
- As a significant portion (~40%) of TNC trips begin or end in low-income communities, a key priority will be to plan for TNCs as anchor tenants of DCFC hubs in urban communities (2021 RMI report) to serve both TNC drivers and TNC customers.

DRAFT

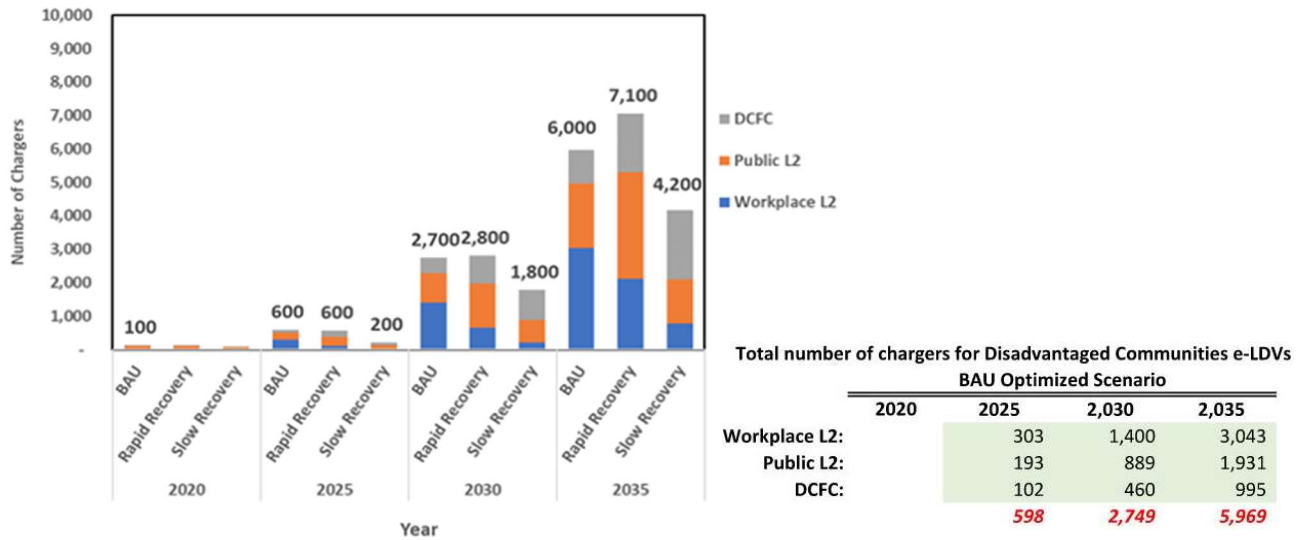
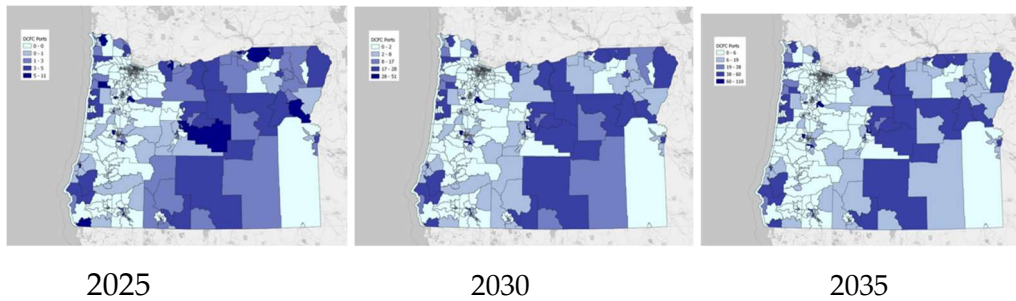
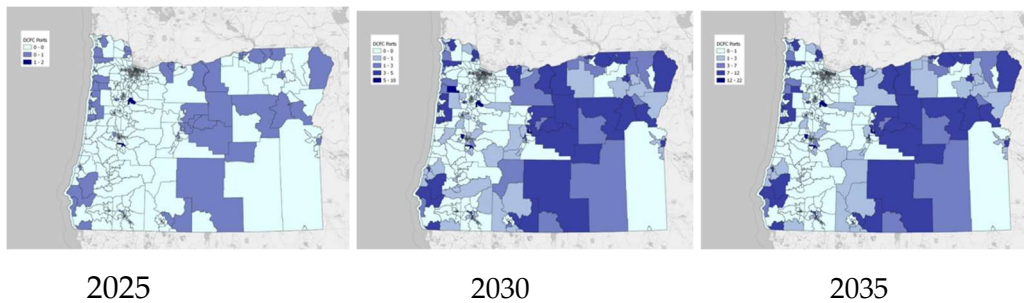


Figure 11. Chargers required for Disadvantaged Communities.

Total number of DCFC chargers needed in Disadvantaged Communities – including net additional chargers (BAU)



Net additional DCFC chargers required in Disadvantaged Communities (these chargers are included in the heat maps shown above) (BAU)



DRAFT

## Stakeholder Engagement

### Advisory Group Interviews and Listening Sessions

The project team held twelve virtual listening sessions in January and February to gather stakeholders' perspectives on issues related to transportation electrification, including charging infrastructure and EV adoption in Oregon. While the listening session participants provided a broad spectrum of input related to the goals of TEINA, there were five key themes that were shared across all or most of the listening sessions:

#### *Upfront Costs*

Individuals, agencies, municipalities, and businesses must make a financial investment to adopt EVs. The costs associated with purchasing 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 more affordable lease terms and lower fuel costs. 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 lower-income communities are also important to cultivate and promote.

#### *Charging at Multi-Unit Dwellings*

Participants at every listening session stressed widespread adoption of EVs is linked to providing at-home charging to residents of MUDs. 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, and community DC charging hubs may offer an alternative charging opportunity. 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 MUDs without at-home charging. Some participants emphasized workplace charging should not be considered the ultimate solution.

#### *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

DRAFT

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.

*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 gasoline 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

*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 consider before making the decision to go electric. However, participants in these industries did see beneficial applications for EVs and equipment, starting on a smaller scale.

In addition to the overall key themes, Table 3 highlights key takeaways from each individual listening session.

*Table 3. Key takeaway messages from Listening Sessions.*

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>

DRAFT

Listening Session

Key Takeaways

Transit Agencies and Providers

- There is a **lack of equipment** available for transit agencies.
- The equipment and infrastructure that are currently available come at **high upfront costs**, so making initial investments is challenging.

EV Service Providers

- **Streamline permitting processes** so that chargers can be installed more expeditiously.
- It is difficult to install chargers at MUDs.

Micro-mobility Company Representatives

- **Safe road conditions** are vital to micro-mobility adoption, so policies supporting road safety should be developed in conjunction with EV infrastructure.
- People need **secure parking and storage** options for micro-mobility vehicles like e-bikes.

Rural Representatives

- EVs need to be able to **travel long distances** to be useful for rural environments where trips generally require greater distances than urban trips.
- There are **not many EV trucks and Sport Utility Vehicles** available, which are used more heavily in rural environments.

Workplace Charging Venues

- Keeping up with charging demand is challenging, but the **future need is uncertain** due to current work-at-home situations.
- Many employees **use chargers longer than needed**, thus precluding other employees from using the chargers.

Transportation Networking Companies

- There are frequently **issues at charging stations**, such as broken chargers, faulty card readers, and queues.
- **More chargers are needed where people gather**, like retail, grocery stores, or recreation activities.

Freight/Delivery Representatives

- **Charging times and power capacity are challenging** for larger delivery vehicles, so electrified routes are generally kept to smaller more urban routes.

DRAFT

Listening Session

Key Takeaways

	<ul style="list-style-type: none"> <li>The equipment and infrastructure that are currently available come at <b>high upfront costs</b>, so making investments becomes challenging.</li> </ul>
<p>Historically Underserved Community Representatives</p>	<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</b> of EV cost savings, incentives, and climate benefits.</li> </ul>
<p>Developers, MUD Owners, Property Managers</p>	<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>
<p>Farming/Ranching Representatives</p>	<ul style="list-style-type: none"> <li>EVs 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 power to the rural locations.</li> </ul>
<p>Original Equipment Manufacturers and EV Dealers</p>	<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>

DRAFT

## TEINA Policy Recommendations

### Vision

In order to meet Oregon’s goals for EV adoption through 2035, expansive development of an EV fueling infrastructure is needed that provides Oregonians with confidence that EV charging is as ubiquitous and convenient as fueling with gasoline.

Six goals critical to the achievement of this vision were identified through the TEINA study. Recommended policies to support each goal are proposed below. To frame what’s needed next, EV charging infrastructure implementation priorities and approaches are highlighted in the subsequent chapter.

### Overall Infrastructure Goals:



Figure 12. Overall Infrastructure Goals.

### Recommended Policies and Initiatives to Accomplish Infrastructure Goals:



**Support rapid deployment of EV charging infrastructure in homes, along travel corridors, at work and fleet depots, at travel destinations, and in multi-unit dwellings.**

- a) Leveraging TEINA findings, develop a Statewide ZEV Charging Infrastructure Deployment Strategy (2 – 5 year horizon) that establishes near-term implementation actions and priorities to meet the state’s EV goals.
  - i) Prioritize actions by the ability to enable increased ZEV adoption (e.g., high residential density, near major employers, public transit access, rural and underserved communities)

DRAFT



**Ensure EV charging infrastructure is equitable and accessible to all Oregonians (including all communities, income levels, and geographic locations).**

- a) Adopt measures – using state-sponsored grants, low/no interest financing, Clean Fuels Program funding, utility guidance and incentives -- to increase EV charging investments in low-income, Black, Indigenous, and People of Color (BIPOC), rural, and disadvantaged communities.
- b) Set standards to guide EV charging investments defining “EV Charging Deserts” with geographic and other metrics to determine low-income, BIPOC, rural, and disadvantaged communities and needs.
- c) Investigate ways to coordinate and ensure charging access for those eligible for the Charge Ahead rebate.
- d) Lead by example and deploy Electric Vehicle Service Equipment (EVSE) at all state-owned properties, including state buildings and offices and state parks.
- e) Collaborate with federal agencies administering federally-owned lands in Oregon (e.g., national parks, national forests, interstate rest areas) to deploy EVSE.



**Ensure the public charging experience is user-friendly, convenient, safe, and consistent.**

- a) Lead a public process to identify EV charging needs and standards to create a more consistent EV charging experience; address all items of consistency, including transparency in rates, multiple payment methods, open access, roaming, interoperability, reliability, redundancy, resiliency, Americans with Disabilities Act (ADA) compliance, safety/lighting. Build upon standards proposed by the Western Governor’s Association’s EV Roadmap Initiative, REV West, Pacific Coast Collaborative, NESCAUM, Georgetown Climate Center and others.
- b) Engage with national, regional, and other multi-state actors, as well as private sector charging providers, to harmonize the EV charging experience. Leverage Governor Brown’s Western Governor’s Association EV Roadmap Initiative, and efforts of regional stakeholders.



DRAFT

- c) Require all incentive funding for infrastructure development to meet certain standards for user experience, including interoperability and reporting requirements.
- d) Ensure consistent signage and labeling for EV fueling.



#### **Ensure that EV charging offers all consumers the benefit of lower electric fueling costs.**

- a) Establish a working group of utilities and EV Service Providers (EVSP) led by ODOT, Oregon Department of Energy (ODOE), and Public Utility Commission (PUC) to identify the barriers and opportunities to address the cost of EV charging – including rate design, demand charges, and costs driven by the installation process; ensure these efforts consider rural communities, and the price-sensitivities of low-income communities and multi-unit dwelling (MUD) residents who may have no access to home charging and must rely on public charging. Explore best practices, convening experts to share insights, particularly highlighting successful strategies for COUs.
- b) Consider incentives that drive infrastructure development (both L2 and DCFC) across the entire transportation landscape, including at homes, MUDs, public and private fleets, businesses, and public charging locations. Such incentives might include grants, low/no interest financing, tax credits, Clean Fuels Program opportunities, on-bill financing, and non-financial incentives such as parking privileges, High Occupancy Vehicle (HOV) lane access, curbside loading/unloading privileges, and green zones.
- c) Explore tax breaks to incentivize employers to install charging infrastructure at workplaces, in turn encouraging employers to incentivize EV drivers.
- d) Encourage appropriate rates for distinct EV charging activities depending on charging profiles, charger types, and user groups. Utilities should be encouraged to explore, create, and pilot specific rate schedules for distinct types of EV charging. Convene work groups to identify and share best practices, with particular focus on COU success strategies.
- e) Pursue and leverage federal funding to implement EV charging deployment priorities.
- f) Ensure the installation of EV charging is efficient, cost-effective, and speedy. Consider convening a work group to identify rapid pathways to accomplish goals.

## DRAFT

- i) Ensure all state, local and utility processes involved in EVSE installations (e.g., site planning, permitting, and utility interconnects) are streamlined to reduce overall installation time and costs.
- ii) Measure, track, and report on best practices.
- g) Streamline EVSE permitting at local jurisdictions.
  - i) Develop and adopt streamlined permitting guidelines for EVSE installation permitting, with target timeframes.
  - ii) Develop and adopt “model” expedited and streamlined EVSE installation permitting processes (including website resources offering on-line electronic applications, checklists, and other information).



Ensure utilities are positioned for rapid expansion of EV charging statewide. Utilities must plan for and supply increasing demand for electricity as a transportation fuel and support the charging needs of electric light-duty, medium-duty, and heavy-duty vehicles and e-micro-mobility (exploring ways to incorporate resiliency in the event of power outages).

- (a) Utilities need to accelerate Make-Ready investments for LDV public charging (including urban hubs, corridors, workplace, MUDs, fleet depots, destinations) and plan to initiate Make Readies for Medium and Heavy-Duty (M/HD) Commercial Vehicle applications, including transit and school buses. Funding is key, and resources/mechanisms will need to be identified to support and fairly cover the costs of Make-Ready investments. The PUC and Consumer Owned Utilities (COUs) governance support, and incentives, are necessary.
- (b) Assess best practices and innovative rate designs and consider how best to create DCFC-specific rate schedules to mitigate the impact of demand charges to the deployment of DCFC stations. Share best practices of rate design principles that have met with success among COUs and IOUs.
- (c) Convene a workgroup of utilities and key stakeholders to identify optimal locations with available grid capacity for DCFC stations (including Travel Oregon among stakeholders). Plan for, and assess, the potential charging impacts on future grid capacity over the next 15 years when substantial EV adoption is underway. Develop recommendations to increase overall system resiliency as EV adoption takes off, potentially through battery storage or load management, and help mitigate the effects of power outages.

DRAFT

- (d) Explore and develop programs that support EV adoption while supporting utility grid management needs, reduce GHG emissions from the transportation sector, and balance charging demand needs.



Develop foundational policies and provide resources to support citizens, businesses, local governments, tribes and communities build and benefit from a ZEV future.

- (a) Ensure educational and technical resources are available to support all stakeholder groups seeking to pursue EV charging and installation.
  - (i) Develop and fund a statewide educational and technical assistance program for charging:
    - 1. Create factsheets, technical resource documents, and website content, with separate, targeted materials for unique audiences.
    - 2. Create a proactive outreach program that is comprehensive, hands-on, and targets high priority/underserved markets.
    - 3. Serve as an initial point of contact, referring individuals to utilities and other resources.
  - (b) Ensure EV charging is available in new residential and commercial buildings, existing buildings are upgraded, and parking sites become increasingly EV ready. Adopt EV ready building codes and parking ordinances, enabling local jurisdictions to adopt more stringent reach codes.
    - 1. Building Codes Division to establish EV charging requirements for new structures and make recommendations about how to phase in requirements to retrofit existing buildings.
    - 2. Provide model code language to local jurisdictions (urban and rural) to set more stringent and enforceable building EV requirements and EV parking ordinances.
    - 3. Ensure effective enforcement mechanisms.
  - (c) Grow a skilled, local workforce to build EV infrastructure and expand economic opportunities stemming from EV infrastructure expansion, leveraging community colleges to ensure broad geographic coverage.
    - 1. Assess best practices in EV workforce development to guide investments.
    - 2. Focus investment in community college programs and other venues to build needed workforce skills.

DRAFT

## (d) Encourage public charging options for electric micro-mobility

1. Encourage addition of 110-volt outlets at public charging stations, especially if charging sites are supported via public funding.
2. Encourage State and local jurisdictions to collaborate to develop public-private partnerships, advancing opportunities for charging for electric bikes and scooters.
3. Study how best to encourage e-bike, e-scooter, e-commerce trike adoption, exploring charging in the context of a broader evaluation of actions needed to support adoption of these electric mobility modes. Aspects to be considered include micro-mobility infrastructure needs, more industry standardization, commercial technology solutions for payment, and connections to mass transit.

The sea change needed in EV charging infrastructure will require the broad mix of policies outlined above. Of particular note are several near-term policies that are deemed priority initiatives, highlighted in Table 4.

DRAFT

Table 4. Near-term priority policy initiatives.

See [insert hyperlink to page] for full description of goals.

### Near-Term Priority Policy Initiatives



<p><b>ZEV Infrastructure Deployment Strategy – 2 to 5 year focus, including opportunities for targeted state investment</b></p>	
<p><b>Target equity in charging</b></p> <ul style="list-style-type: none"> <li>• Ensure charging access for those eligible for Charge Ahead rebate.</li> <li>• Incentivize workplace charging at employers, emphasizing women and minority-owned businesses and similar groups.</li> <li>• Incentivize investment in charging deserts in rural areas.</li> </ul>	
<p><b>Update Oregon’s building codes and parking ordinances to make them Electric Vehicle ready</b></p>	
<p><b>Develop and fund a statewide educational and technical assistance program for charging</b></p> <ul style="list-style-type: none"> <li>• Fact sheets, technical resource documents, and website content.</li> <li>• Create proactive outreach program that is comprehensive, hands-on, and targets high priority markets.</li> <li>• Serve as an initial point of contact, referring individuals to utilities and other resources.</li> <li>• Provide guidelines and model processes for streamlining permitting.</li> </ul>	
<p><b>Lead by example: install charging at state buildings and offices, for employees and visitors</b></p>	

To help readers map how the results of the TEINA study, and the corresponding barriers to adoption, are addressed by the policies proposed, Table 5 provides a cross-reference illuminating how Infrastructure Goals (and their corresponding policies) address barriers (identified by use case). This table highlights how specific policies target barriers that pose challenges for individual use case charging adoption.

DRAFT

Table 5. Cross Reference: Illustration of How Equitable and Accessible EV Charging Goal and its associated Policy Goals address barriers to EV Charging

Policy Goal: **Ensure electric vehicle charging infrastructure is equitable and accessible to all Oregonians (including all communities, income levels, and geographic locations)**

	Adopt measures to increase electric vehicle charging investments in low-income, BIPOC, rural, and other disadvantaged communities	Set standards to guide electric vehicle charging investments to address charging deserts	Lead-by-example and deploy electric vehicle chargers at all state-owned properties	Collaborate with federal agencies administering federally-owned lands in Oregon to deploy electric vehicle chargers
<b>Light Duty Vehicles (LDV) Use Case</b>				
Lack of existing electric conduiting to meet chargers needs				
Inconsistent fees and/or rates for public charging	X			
Limited MUD charging	X	X		
Limited workplace charging		X		
Limited updates to government programs that affect charger development	X			
Limited government planning for LDV charging needs	X	X	X	
<b>LDV - Rural Use Case</b>				
Limited areas that can support power requirements				X
Inconsistent fees and/or rates for public charging	X			
Increased need for DCFC		X		X
Increased need for multi-use-case charging	X	X		
Increased need for travel destination charging		X		X
Potential cost impacts due to demand charges				
Limited updates to government programs that affect charger development				
Limited government planning for LDV charging needs			X	
<b>LDV - Corridor Use Case</b>				
Limited areas that can support power requirements				X
Locations must be safe and near to amenities		X		X
Inconsistent fees and/or rates for public charging	X			
Demand charges that reduce cost effectiveness				
Low initial charger utilization	X	X		X
Multiple platforms, charger types, and payment systems	X	X		
<b>Local Commercial and Industrial Use Case</b>				
Electrification will require upgrades to enable charging				
Fleet operations staff need training on maintaining EVs				
Need for publicly available charging for MD/HD		X		
Significant up-front costs				
Uncertainty about plug-type compatibility for public chargers		X		
Limited government planning for MD/HD charging needs		X	X	
Potential for cost impacts due to demand charges				
<b>Transit and School Buses Use Case</b>				
Electrification will require upgrades to enable charging				
Significant up-front costs	X			
Potential for cost impacts due to demand charges				
Fleet operations staff need training on maintaining EVs				
<b>Transportation Network Companies Use Case</b>				
Barrier list still to be copied into table.				
<b>Long-Haul Trucking Use Case</b>				
Barrier list still to be copied into table.				
<b>Micro-Mobility Use Case</b>				
Barrier list still to be copied into table.				

DRAFT

## Infrastructure Deployment Priority Actions

The TEINA study can help illuminate where to focus EV charging deployment efforts. An overall near-term priority focus is needed to deploy EV charging across a broad spectrum of light duty EV use cases: Corridor LDV charging (including Rural and key destinations), Rural LDV charging, and Urban LDV (including TNC and MUD charging). Additionally, support for fleet conversion to EVs is needed by encouraging private fleet depot charging for light-duty fleets, pilots of medium-duty/local commercial and delivery vehicle private depot charging, and pilots of long-haul truck private depot charging. Planning and support for longer-term public charging needs for medium and heavy-duty ZEV public charging should be initiated.

Building on the policy recommendations above, this chapter outlines a number of key infrastructure implementation priorities that are needed to create a robust statewide charging network. Infrastructure deployment strategies are aggregated into broad use cases, based on those identified in this report.

### Key Infrastructure Implementation Priorities



Figure 13. Key Infrastructure Implementation Priorities.

### CORRIDOR LONG DISTANCE TRAVEL

- Expand Oregon’s Corridor DCFC network across all federal and state highways, considering Rural and BIPOC access to long-distance travel.
  - Phase 1 short-term (as practicable):
    - Ensure 25-50 mile max distance between charging stations: I-5, I-84, I-82, Highway 20, US 26, US 97, US 101
    - Ensure 75-100 mile max distance between charging stations along remaining rural highways
  - Phase 2 mid-term (as practicable):
    - Ensure 15-25 mile max distance between charging stations: I-5, I-84, I-82, Highway 20, US 26, US 97, US 101

## DRAFT

- Ensure 25–50-mile max distance between charging stations along remaining rural highways. Ideally locate stations within 0.2 miles of highway exit (max 0.5 miles).
- Prioritize the near-term completion of the West Coast Electric Highway, encouraging installation of highly-redundant SAE Combo DCFC chargers for LDVs at each site (minimum 2 DCFC, goal of 4-8 DCFC, as consistent with TEINA results).

**RURAL**

- Address Rural Charging Deserts by prioritizing rural corridor, tourism, destination, and public L2 charging.
  - Prioritize DCFC on key corridors supporting tourism and key destinations, as well as travel between rural communities.
  - Address low utilization and how to overcome this business case challenge (convening workgroups with utilities, EVSPs, state agencies, and other stakeholders to address rates, streamlining of permitting, demand charges, Make Readies, other strategies).
  - Refine definition of Charging Deserts to guide priority installations.
- Focus on Level 2 chargers within rural communities and at key tourism sites/destinations:
  - Promote ‘charge and shop’ in support of local tourism.
  - Locate public chargers on federal, state, county, and city property, with existing power capacity to accommodate charging infrastructure. In particular, focus on low-income, BIPOC, and disadvantaged communities and equitable access to public charging by residents of MUDs.

**URBAN**

- Address Urban Charging Deserts by prioritizing urban DCFC “hubs” that serve multiple use-cases, including TNCs, MUDs, and other residents without access to reliable, overnight charging; co-locate multiple charging stations together to promote awareness and ensure better availability, redundancy, and reliability of the charging sites. Study and develop incentives for utility/Clean Fuel Programs/state programs:
  - Plan for TNCs as anchor tenants of DCFC hubs: TNCs can drive much-needed station utilization and significantly improve station economics. Furthermore, a significant portion of TNC trips begin or end in low-income communities, so locate DCFC directly within these communities (and consider proximity to high-density MUDs).



## DRAFT

- Consider and address the cost to charge at a public DCFC charging site vs. charging at “home” (assuming residential electricity rates) for the residents of MUDs or low-income, BIPOC, and disadvantaged communities. Options for addressing costs may include special utility rates or programs, pre-paid cards funded by public/NGOs with state oversight.
- Consider shared L1 and L2 “community” charging sites that provide a more affordable longer-duration charging alternative for residents without access to reliable, overnight charging at home, including MUD residents (including micro-mobility needs). Consider school and church parking lots, urban plazas, and other day-use parking lots with overnight capability, as well as right-of-way charging on utility poles and street lights.
- Locate L2 and DCFC public chargers on federal, state, county, and city property with existing power capacity to accommodate charging infrastructure; consider in particular low-income, BIPOC, and disadvantaged communities.
- Prioritize workplace charging at large and women/minority-owned employers; develop and distribute technical guidance for employers; consider tax incentives and other incentives to encourage employer investment.

**FLEET CHARGING: PRIVATE AND PUBLIC LDV, MEDIUM and HEAVY-DUTY**

## Local Commercial &amp; Delivery

- In the short-term, study and develop incentives/utility programs/Clean Fuels Programs that focus on larger urban fleets with shorter route distances; expect much of this charging will be at private fleet depots; survey public and private fleets to determine the need, for public charging in the near-, mid-, to long-term.
- In the short-term, begin to plan for shorter-range regional Medium/Heavy- duty trucking between major urban centers along key corridors via working groups with utilities, state agencies; survey private fleets to determine the need for public charging, and time frame.

## Transit and School Buses

- In the short-term, expect much of this charging will be at fleet depots; study and develop incentives/utility programs/Clean Fuel Programs that support transit and school bus transition to electric vehicles; survey public transit and school fleets to determine the need, if any, for public charging in the near-, mid-, to long-term.
- Broker partnerships between public transportation agencies and utilities (and potentially EVSPs) to enable planning and installation of transit fleet electrification, with particular attention on total cost of operation, available funds, and the need for resiliency in the event of power outages.

## DRAFT

- Produce and provide educational and technical resources to transit and school bus fleet operators to ensure they have access to the information required to electrify their fleets, install charging infrastructure, leverage available financial incentives (federal, state, local, utility).

## Long-Haul Trucking

- In the short term, continue to watch the market evolve and work with manufacturers and freight carriers on timelines for long-haul trucking deployment, particularly between major urban centers.
- In the mid-term, study and develop incentives/utility programs/Clean Fuel Programs to initiate a Medium/Heavy-Duty WCEH on major corridors to build out fast-charge stations along Oregon's Interstate Highways (I-5 and I-84).

## LDV Fleet

- Empower public and private LDV fleets to accelerate adoption of ZEVs by incentivizing private fleet charging, via utility programs, Clean Fuels Programs, and other mechanisms.
  - Ensure that charging meets standards for interoperability and user experience.
  - Encourage opportunities, where feasible, for fleet charging to be accessible on weekends or during daytime for workplace charging, community charging access.
  - Encourage opportunities for redundancy, resiliency, and renewable power

## Conclusion

Exponential growth of EV chargers throughout Oregon is needed to meet the ZEV adoption goals set forth in SB 1044. There is no magic wand to solve the challenges of Oregon's electric transportation infrastructure deployment. This effort will require a vigorous set of targeted approaches for different vehicle use cases in different parts of the state.

In addition, this isn't a challenge that can be overcome by a single actor or entity. As the saying goes, it will take a village to achieve the deployment goals outlined in this report.

As shown in Figure 14, a broad spectrum of key stakeholders will be needed to make Oregon EV ready, including state agencies, the Oregon legislature, utilities and their governing bodies, private sector charging providers, Tribal governments, and other advocates and interested parties across the state. All relevant stakeholders will need to take focused actions and coordinate with each other to build a robust statewide

DRAFT

charging network and rapidly deploy the EV charging infrastructure needed to push transportation in Oregon toward an electric and zero-emission future.

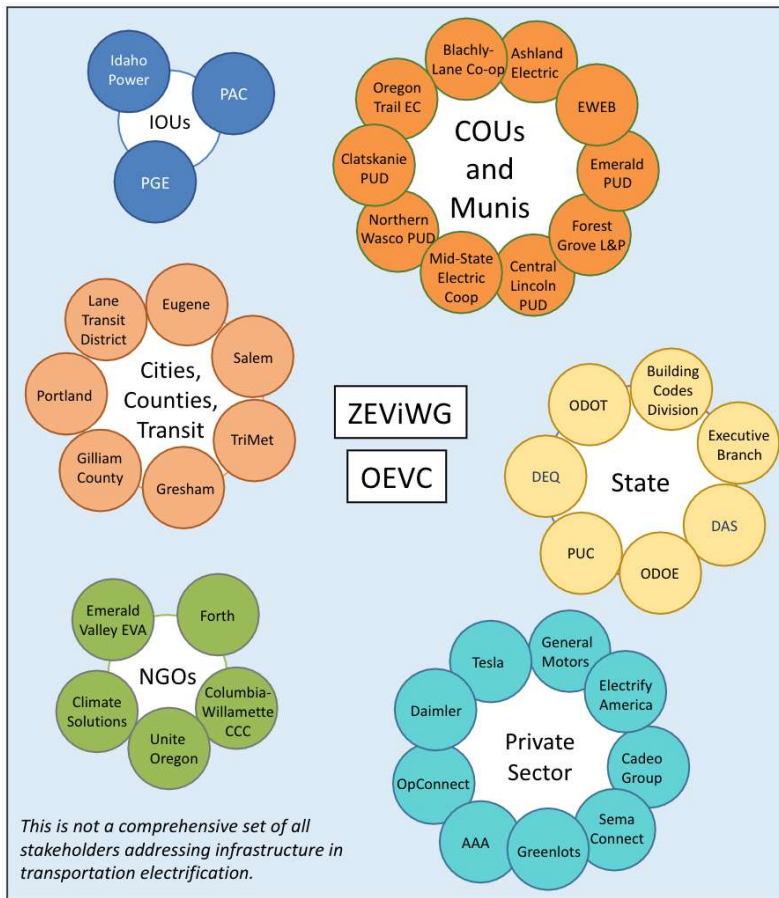


Figure 14. Key stakeholders engaged in transportation electrification in Oregon.

DRAFT

## APPENDICES

The Appendices are ordered in general accordance with the manner in which the study was completed:

- Appendix A: Existing Conditions. Provides a summary of the project's initial efforts to review, inventory and understand existing geographic and ZEV Charger distribution characteristics in Oregon. It was important to complete this work early in the project so that base conditions could be established for use in subsequent analyses.
- Appendix B: Literature Review. Summarizes the results of a nationwide literature review that was conducted in parallel with the assessment of existing conditions in Oregon. The literature review provided important insights into how Oregon's situation compares with other efforts being undertaken across the country. In addition to this nationwide overview, the literature review included a more in-depth review of activities within three states (Colorado, New York, and California) that are providing national leadership and could serve as models for Oregon to emulate.
- Appendix C: Stakeholder Engagement. Summarizes important project input regarding insights and activities being undertaken by the many different entities that are actively engaged in promoting the planning, design and implementation of transportation electrification infrastructure in Oregon. Input was received from several sources, including (1) a 17-member Advisory Group that reviewed and critiqued activities and findings throughout the project duration; (2) 12 separate Listening Sessions, each of which was focused on a particular use case; and (3) public comments, which were received throughout the life of the project via a website and as part of four public meetings.
- Appendix D: Infrastructure Needs Assessment. Describes the modeling analysis and findings regarding infrastructure needs in Oregon. Three bookend scenarios were used to establish a range of expected infrastructure needs across three target dates (2025, 2030, and 2035) for each of nine use cases as well as an optimized condition that considered all use cases in combination.
- Appendix E: Policy Recommendations. Summarizes the study's policy recommendations, which result from the information obtained during the study and summarized in the previous chapters. The recommendations (in the body of the report) are presented in several different ways to enhance their usability and understanding, including (1) in the context of overall infrastructure goals; (2) in accordance with infrastructure priorities and approach by major use case; and (3) as a list of top five recommended priorities to support Oregon's future plan for a ZEV charging infrastructure development strategy.

DRAFT

## END NOTES

---

<sup>1</sup> EV Market Share by State, EV Adoption. <https://evadoption.com/ev-market-share/ev-market-share-state/>

## HECK Zechariah

---

**From:** ANDRETTI Chris \* DOC <Chris.Andretti@doc.state.or.us>  
**Sent:** Wednesday, April 28, 2021 8:57 AM  
**To:** HECK Zechariah  
**Subject:** group meeting advisory EV

**Follow Up Flag:** Follow up  
**Due By:** Tuesday, May 11, 2021 4:30 PM  
**Flag Status:** Completed

This message was sent from outside the organization. Treat attachments, links and requests with caution. Be conscious of the information you share if you respond.

We need charging stations at state of Oregon locations such as prisons. I work at one and no charging stations there. Also new apt complexes should have plug in stations. Thanks

**Christine Andretti CADC II, PSS, QMHA**

Intake Counselor

Correctional Services Division | Intake & Assessments

Oregon Department of Corrections

24499 SW Grahams Ferry Rd.

Wilsonville, OR 97070

Phone: 503-570-2264



## HECK Zechariah

---

**From:** BRINDLE Frances \* Frannie  
**Sent:** Wednesday, April 28, 2021 10:50 AM  
**To:** HECK Zechariah  
**Subject:** EV Charging

Hi,

I am the ODOT Area Manager for Region 2, Lane County. One of my tasks is to review and recommend surplus property not expected to be needed for projects. My concern/opinion is, there are likely opportunities for properties near highway facilities to be used as charging stations or perhaps another GHG reduction effort such as modal connections between transit, highway use and bicycles.

Just wanted to put this on the ODOT radar so that we don't have missed opportunities.

thanks

***Frannie Brindle***

Region 2 Area 5 Manager  
Eugene Office 541-736-9611  
Cell 541-228-8059