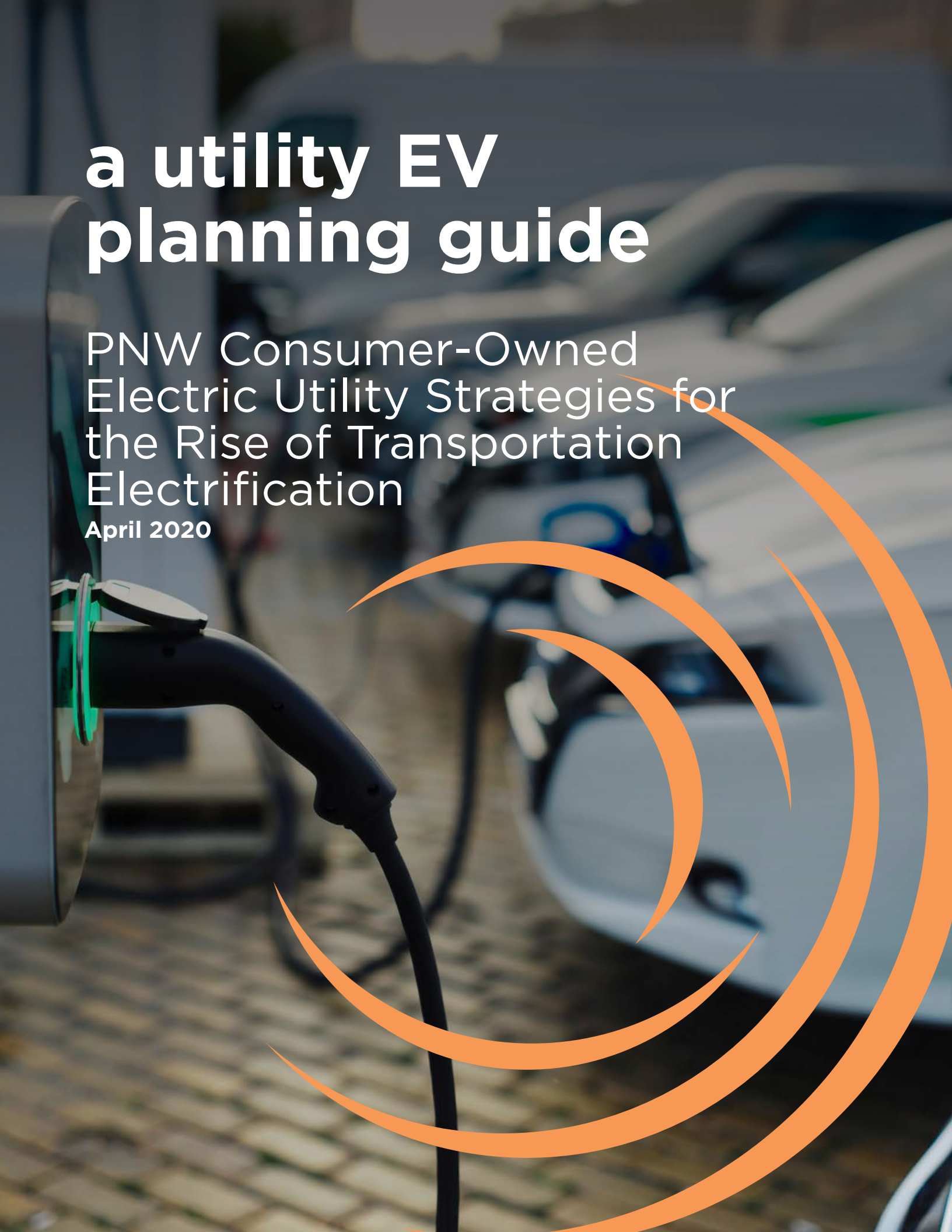

a utility EV planning guide

PNW Consumer-Owned Electric Utility Strategies for the Rise of Transportation Electrification

April 2020

acknowledgements

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executive summary

Electric vehicles (EVs) are expected to continue their proliferation across all markets. Utilities can expect up to a115% to 130% increase in electricity consumption among households that own one or two EVs.[7] While this represents an incredible opportunity for new energy demand, it also will present novel challenges. This report provides an overview of the transportation electrification (TE) ecosystem, while also presenting proactive steps Consumer-Owned Utilities (COUs) of the Pacific Northwest (PNW) can take to best prepare their organization and customers for this transition.

Potential Utility Impacts

Electric vehicles have the potential to drastically impact grid infrastructure, the electricity market, and customer perception of their utility.

As the grid has a large amount of unused capacity, EVs can be leveraged for "valley-filling" and "flattening" load demand. By spreading fixed costs and increasing demand for EVs, experts suggest a downward pressure on rates and savings for customers. Additionally, with the adoption of new systems, such as vehicle-to-grid (V2G/V2X) and virtual power plants (VPP), EVs will also be critical in increasing future grid resiliency.

EVs also represent an opportunity for utilities to engage with their customers in an almost entirely new market. Electric utilities are becoming the new vehicle fuel providers (replacing the oil companies), and studies substantiate that customers are seeking leadership from their local utility on how to adopt these new technologies.

Social Impacts

The PNW has some of the least expensive electricity in the country—a car powered by BPA electricity is nearly a fifth of the cost to fuel of a similar gasoline vehicle. Correspondingly, BPA-produced electricity has possibly the lowest carbon content in the nation, helping decrease climate change causing agents while also eliminating the numerous health issues caused by localized tailpipe emissions from internal combustion engine (ICE) vehicles.

A Rapidly Evolving EV Market

The EV market has exploded in recent years, with dozens of new, longer-range models becoming available. In the next few years, several electric pickup and heavy-duty truck options will come to the market, opening up additional choices to more consumers. Additionally, battery technology has continued to improve over the last decade, and with scaling factories and increased efficiencies, EVs will soon be at price parity with their ICE counterparts—without subsidies.

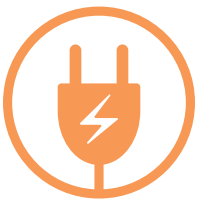
Utility Actions to Advance Transportation Electrification

This section of the report provides a detailed action plan for COUs to follow to begin or continue their TE programs. The core actions are as follows:

Action 1: Form an internal EV team
Action 2: Design and implement a custom transportation electrification (TE) strategy tailored to the utility
Action 3: Cultivate relationships with community stakeholders
Action 4: Engage and support customers on EV-related issues and opportunities
Action 5: Engage and learn from utility peers
Action 6: Track EV adoption in the service territory
Action 7: Develop a "Managed Charging" Program

Action 7, Managed Charging, is one of the most critical strategies electric utilities can begin developing to prepare and take advantage of the evolving EV landscape. This section of the report provides greater details to what managed charging is and strategies for its development.

Finally, Appendix A provides a comprehensive menu of programs and examples COUs can potentially use to prepare (or accelerate) EV adoption in their service territory. While not an exhaustive list, it can serve as a jumping off point for many utility general managers.



Utilities can expect up to a

130%

increase in electricity consumption among households that own one or two EVs.7

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introduction

Electrification has been identified as a major focus for expanding clean energy and facilitating decarbonization. The transportation sector has the potential to shift a massive amount of energy use from the liquid fuels sector to the electricity sector.

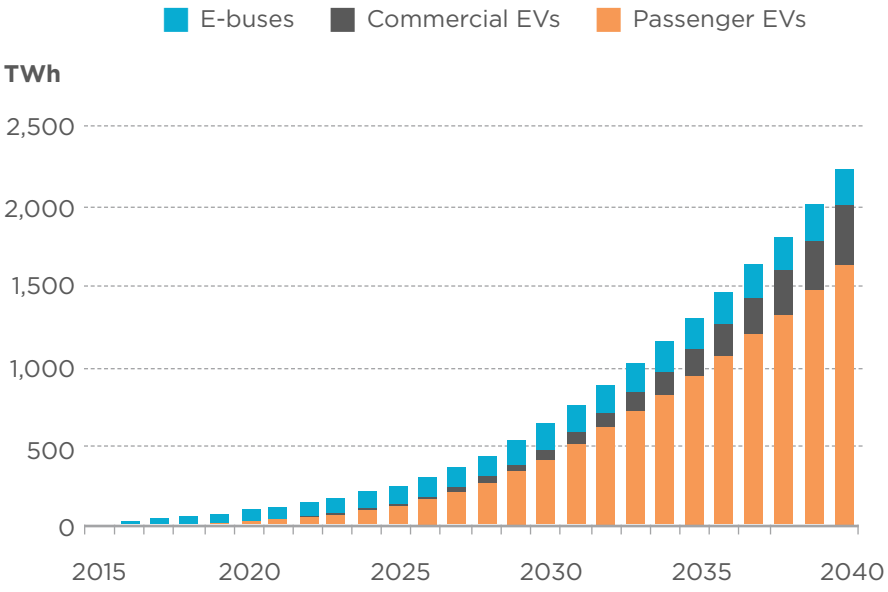
EVs offer an answer for slow or declining load growth. While electricity sales grew at about 2% between 1990 and 2007, the Department of Energy's Energy Information Administration projects growth of only 0.5% per year between 2015 and 2040.[1] With many more EVs coming to market in the next five years, transportation electrification is an unprecedented opportunity for electric load growth at a time when sales have been flat or declining. Figure 1 below shows projected load growth for world EV adoption over the next 20 years.

To help utilities best prepare for this large opportunity and mitigate any risks, Bonneville Environmental Foundation (BEF) commissioned a study and companion report to explore the benefits and costs that increased EV adoption will bring to COUs in the PNW. The proceeding sections and appendix A of this report highlight trends in the transportation electrification (TE) ecosystem, while presenting strategies COUs can take to leverage their own TE programs.

For a detailed breakdown of the economic outcomes of increased EV adoption for COUs, please refer to the Electric Vehicle Costs and Benefits for BPA Full Requirement Customers report, which summarizes a cost-benefit analysis conducted by Energy and Environmental Economics, Inc. (E3).

Figure 1: World Electricity Consumption Projections for EV Adoption Through 2040.[2]

Yearly electricity consumption from passenger EVs, commercial EVs and ebuses



Section 1

potential utility impacts

Grid Benefits

The grid has a large amount of unused capacity, especially during the night hours. If managed well, EVs can provide "valley-filling" benefits by flattening the load during this time.[3] EVs have the potential to act as distributed storage resources for utilities, enabling them to accept excess energy generated off-peak and to feed that energy back to the grid on-peak. Unlike lights or air conditioning, EV drivers don't have a preference about when energy is flowing to the car, so long as charging is complete at a certain time. Most chargers and all vehicles offer options for delaying or managing the time of charging, which can alleviate any late-afternoon peak impact, if drivers are encouraged to take advantage of these technologies.

EV charging is not expected to create widespread electrical demand issues at low levels of penetration. An MIT study found the existing generation and transmission capacity of the nation's grid could accommodate 5 to 50 million EVs.[4] Similarly, impacts on the distribution system remain low for a given feeder at low EV penetration levels. In select territories, a small percentage of transformers already near capacity and near a grouping of EV owners may need upgrading. At higher EV market penetrations, more distribution system upgrades will be necessary. While infrastructure effects are forecast to be mild in the next five to ten years, their impact will be greater if vehicle charging goes unmanaged or vehicle growth occurs according to aggressive forecast cases.

EVs can potentially offer a range of other grid services such as voltage or frequency control, play a role in capacity markets, or create virtual power plants (VPP) as some PNW utilities are exploring. A study by the Lawrence Berkley National Lab found that in California, EVs could meet the State's 1.3 GW storage mandate for one-tenth the cost of stationary energy storage approaches.[5] Vehicle-to-grid technology (V2G/V2X) enabled vehicles and charging equipment are developing and will represent an exciting avenue for utilities to continue to increase resiliency and create greater economic benefits for their customers.

Distribution System Monitoring

Several studies have shown that widespread EV adoption will have little to no effect on generation and transmission systems. The utility will need to monitor how the new EV load impacts the distribution grid, particularly since EVs may tend to "cluster" in specific neighborhoods. However, distribution system upgrades are likely to be minimal. For example, a report by Southern California Edison (SCE) found that grid impacts in its service territory were minimal, despite being home to 12 percent of the nation's EVs. "Since 2010," states the SCE report, "of all the nearly 400 upgrades made to (or identified for) circuits that serve EV customers, only 1% of that work was required due to additional power demands from EVs. The rest of the work was required under its regular infrastructure upgrade and maintenance schedule."[6]

Increased Electricity Sales and Downward Pressure on Rates

Although the electricity needs of different EV models vary—an average of 1 kWh per 3.5 miles of EV driving is common. Utilities can expect a 20% to 130%+[7] increase in electricity consumption among households that own or two EVs, with annual mileage and vehicle type being the key variables influencing overall energy consumption.[8] Furthermore, most evaluations related to the rate impacts of EVs show that increased EV adoption will put downward pressure on rates by increasing the utilization of the system and spreading fixed costs.

Potential Leadership Role in Utility Communities and Regions

Transportation electrification is an opportunity for electric utilities to engage with their customers to offer a new, exciting product line with economic and environmental benefits. Research shows that utility customers are expecting to hear more from their utility on issues and opportunities related to EVs. A survey of consumers conducted by the Edison Electric Institute found that almost two-thirds of respondents wanted their electric utility to take a leadership role in encouraging a shift toward electric transportation.[9]

Section 2

social impacts

Electric cars are cheaper to operate

Oregon, Washington, Idaho and Western Montana have some of the least expensive electricity in the country. Powering a car with average BPA served electricity in the Northwest costs about 2.5 cents per mile whereas an average gas-powered car costs 11.5 cents per mile, a 4.3-fold advantage for electric fuel.[10] This is equivalent to buying gas for about 67 cents per gallon.[11] Local gas prices in a utility service territory, retail electric rates vehicle type can have a large effect. Including a calculator on the utility website can be a great tool.[12] Moreover, electricity prices are more stable than gas prices. A 2018 study from the University of Michigan's Transportation Research Institute found that in fuel alone, the average for a gasoline-powered vehicle is $1,338.[13] Using the study's assumptions to calculate electric fuel costs for average BPA[14]-served customers demonstrates an annual fuel cost of $355 per year.[15] Further, electric vehicles are also cheaper to maintain, with minimal fluids and fewer moving parts (no air filters, timing belts, or spark plugs).[16]

EVs Offer Significant Environmental Benefits

Air Quality

Nearly one half of Americans live in areas that don't meet federal air quality standards.[17] Fossil fuel-powered passenger vehicles and heavy-duty trucks are a major source of this pollution, which exacerbates and causes neurological, cardiovascular and respiratory health issues and leads to decreased life expectancy.[18] EVs have immediate health benefits with no tailpipe emissions.

Carbon Emissions

The transportation sector is a major source of carbon emissions (the *largest* sector of carbon emissions in Idaho, Oregon, and Washington).[19] EVs are an important strategy for carbon emission reduction, especially in the Northwest where the carbon content of electricity is the lowest in the country.[20] The Union of Concerned Scientists estimates that EVs powered by grid-average electricity in the Pacific Northwest generate an equivalent amount of carbon as a gasoline car that gets 96 mpg.[21] This value has been climbing steadily as the grid grows cleaner. BPA load-following utilities have the cleanest electric fuel in the nation.[22]

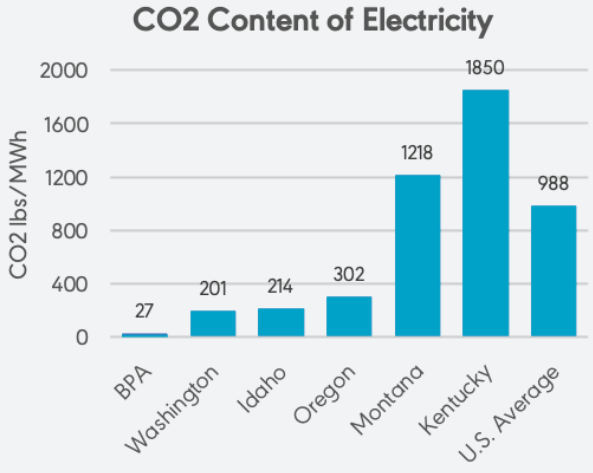
Battery Reuse and Recycling

An ecosystem is developing which will use batteries as grid assets at the end of their primary life in automobiles, at roughly 20-30% capacity degradation. If a battery cannot be used as a stationary storage asset or has degraded significantly further as a grid asset, battery recycling companies such as Battery Resourcers based in Boston, MA can reclaim the constituent materials to make more EV batteries.[23] This loop system forming as EVs continue to scale further reduces environmental impacts in the manufacturing process.

Potential Rural and Urban Energy Burden Reduction to Increase Equity

Energy burden is the percentage of household income that goes toward energy costs, including transportation costs. On average, Americans spend roughly 13% of their household income on transportation alone.[24] Low income families often spend a disproportionately higher percentage of their income on transportation.[25] As evidenced above, strong ratepayer benefits are associated with each EV added to a service territory. With potential to apply downward pressure on rates, EVs can foster equity in numerous ways. Unlike gasoline prices, which tend to fluctuate over time, electricity prices are stable, offering a reliably low cost of transportation fuel. In addition, electricity purchased from the local electric utility stays in the community whereas gasoline revenue is exported out of the community.[26]

Figure 5: CO2 Emissions from Electricity Production[23]



Section 3

a rapidly evolving electric vehicle market

The following factors are expected to influence the growth of the EV market and articulate the importance of catalyzing increased market development.

Electric Vehicle Supply to Span Most Customer Segments

In recent years, several affordable, longer-range EVs have become available. Nearly every major automaker, notably Volkswagen,[27] Ford, General Motors,[28] and Honda[29] committed to expanding battery electric vehicles.[30] Tesla's rapid expansion as market leader along with several new companies will add many affordable 200-300+ mile range EVs across various market segments in the next two to three years.[31] A sea change is coming—and it's because automakers are making serious investments to scale EV production.

A common refrain from customers, especially in rural areas, is the lack of options to fit their needs. Electric pickup trucks are coming from Ford, GM (2021), Tesla (2021) and startups like Rivian (2020), among others. Within the next two years, crossover SUVs are arriving from Tesla (Q2 2020), General Motors, Volkswagen, Ford (Q4 2020), Volvo (2020) and Nissan. Medium Heavy Duty (MHD) and Heavy Duty (HD) segments are also evolving rapidly. Electric regional class 8 trucking is on the way, with Daimler and Tesla set to produce these vehicles in the next couple of years, as well as a variety of class 5-7 vehicles filling many roles, such as delivery applications. Industry experts believe these segments will electrify quickly due to fleet decisions being based on total cost of ownership (TCO). Municipal vehicles such as garbage, hybrid electric utility bucket, and fire trucks are being deployed in pilots across various climates in the US. School buses and transit buses are ramping up production and deployment. The agricultural industry will likely see electrification as companies such as Solectrac, John Deere and Fendt work on innovative electric farm vehicles.

Battery Technology Gains Translate to Cost Parity

The key to understanding the trajectory of the electric vehicle space is batteries. Scale drives cost reductions. Battery costs decreased by around 90% between 2010 and 2019.[32] To drive scale and reduce costs further, lithium-ion "gigafactories"[33] are being built or expanded in the United States, China, Korea, Japan, and Europe. This will allow leading[34] manufacturers to offer vehicles at cost parity[35] with ICE vehicles without subsidies in the next few years.[36] Norway drove cost parity with incentives while retail EV costs remained higher.[37] Norway is a strong example of how EV adoption can accelerate[38] rapidly once EVs are near the cost of comparable ICE vehicles, due to their superiority in many ways, from performance to lower operating cost. In 6 years, Norwegian plug-in vehicles went from minimal adoption to over 50% market share for new vehicles. According to Christina Bu, chief executive of Norway's EV association, '"We get the question all the time: Why is it working in Norway? It's a simple answer," Bu explained. "The price is more or less level." She said that regular consumers should not be expected to pay thousands of dollars extra for an unfamiliar technology, especially for a big-ticket item like an automobile.'[39] We are now seeing this happen in other European countries.

It is important to address customer concerns about battery longevity and cold weather performance. Battery cycle life is improving substantially, and with Tesla claiming to have a million-mile battery, manufacturers are producing more energy-dense batteries. This means the same battery capacity becomes lighter and smaller, enhancing a vehicle's range for a given battery capacity. While cold weather does diminish EV range, the effects can be managed. Drivers and utilities can prepare and plan for winter range reduction with strategies such as cabin and battery preheating and more robust charging infrastructure.

An Evolving Policy Landscape

Some states are adopting policies that encourage utility participation in transportation electrification. It can be helpful to understand the impact such programs have on transportation electrification program strategies. For example, utilities in Oregon may participate in the Clean Fuels Program—a program that provides financial incentives to utilities based on the number of light duty electric vehicles registered in the utility's service area.

Tesla's rapid expansion as market leader along with several new companies will add many affordable

200-300+

mile range EVs across various market segments in the next two to three years.

Section 4

utility actions to advance transportation electrification

Potential Utility EV Goals

1

Ensure that the utility is prepared to maximize the benefits of EV growth, including financial, grid, air quality and customer service benefits of EVs to the utility and customers.

2

Meet and exceed customer expectations, with utilities becoming the ‘go-to’ resource for customers on electric vehicles, especially electric vehicle charging.

Core Actions for Addressing Potential EV Goals and Challenges

The following activities are suggested to address previously mentioned goals:

Action 1

Form an Internal EV Team

Action 2

Design and Implement a Custom TE Strategy Tailored to the Utility

Action 3

Cultivate Relationships with Community Stakeholders

Action 4

Engage and Support Customers on EV-Related Issues and Opportunities

Action 5

Engage and Learn from Utility Peers

Action 6

Track EV Registrations in the Service Territory

Action 7

Develop a Managed Charging Program to Maximize Benefits for All

Action 1

Form an Internal EV Team

The utility can assemble an internal team that is responsible for coordinating transportation electrification work and developments. A sample team could include:

- General Manager
- Engineering Supervisor
- Community and Public Relations Supervisor
- Energy Services Supervisor
- Customer Accounts Supervisor

The utility can select a team lead who will convene this group regularly as the following actions unfold.

Action 2

Design and Implement a Custom TE Strategy Tailored to the Utility

The team can partner with other organizations to help gain a good understanding of the local EV market and to set more advanced EV goals. The strategy could look at grid implications of higher EV ownership and incorporate EV adoption forecasts into load planning.

- Forth has assisted utilities in conducting a half-day EV education session for the EV team, and to facilitate the discussion needed to finalize the EV Strategy.
- Columbia River PUD developed a custom TE strategy with Forth's assistance to address their unique needs. This helped CRPUD take decisive actions which have boosted EV adoption in their service territory while being prepared to accommodate this increased adoption.

Action 3

Cultivate Relationships with Community Stakeholders

Building relationships with a variety of community stakeholders is a key step to address transportation electrification goals in utility territories. It will be important to have working relationships with members of city government(s) in the service territory, transit agencies, officials from school boards as well as mechanics, local and regional air quality agencies (e.g. DEQ), local environmental and nonprofit organizations and other community stakeholders such as anti-poverty and equity groups.

It is also paramount that governmental and private fleet operators are identified. These may range from school and transit buses to garbage trucks, police vehicles, and local government fleets to delivery vehicles, refrigerated trucking, forklifts, regional class 8 trucking and future agricultural applications. These relationships will be critical as the utility helps foster transportation electrification across many segments to improve workplaces, generate economic benefits, and reduce local air pollution.

Action 4

Engage and Support Customers on EV-Related Issues and Opportunities

Utilities can engage with their customers through various platforms including its website, newsletters, and through direct mail. Expanding EV information will influence the market because consumers view utilities as a trustworthy source. This may need to coincide with developing in-house staff expertise on EVs from a customer perspective and making sure customers are transferred to that team or expert.

Action 5

Engage and Learn from Utility Peers

Utility working groups are a fantastic place to share ideas with peers. Forth also hosts the nation's premier transportation electrification conference, Roadmap, in Portland, OR each year. With utility-specific tracks and workshops, Roadmap is an excellent opportunity to network and interact with other utilities from the PNW and beyond. Additionally, Forth organizes a PNW utility working group with calls, meetings, and webinars quarterly. The Smart Electric Power Alliance (SEPA), while national in scope, hosts several working groups for utilities to interact and share resources.

Action 6

Track EV Registrations in the Service Territory

Setting up a system to track EV adoption will allow the utility to see where EV load is coming onto the system—and will also be a critical part of meeting Goal 1. Some state agencies may provide EV registration data. The Oregon Department of Environmental Quality (DEQ) provides quarterly updates on a comprehensive list of registered EVs by county and utility. For more detailed information, some utilities are implementing their own programs to gather data on EVs in their territory. For instance, Emerald PUD offers a $100 reward to customers for registering their EV through their website. It is also possible to explore load disaggregation tools to locate EV loads on a utility system.

Action 7

Develop a Managed Charging Program to Maximize Benefits for All

EV benefits climb dramatically when managed charging is employed. As electric vehicles continue to proliferate, they present one of the greatest opportunities for increased flexible load. Managed charging provides utilities with the tools to influence charging behavior (e.g. control electric vehicle load demand) to maximize benefits for consumers, the utility, and the grid.

Maximizing the financial benefits to all and keeping customers satisfied translates to a goal of reducing EV charging during suboptimal periods, such as expensive Heavy Load Hours for some utilities, while maintaining enough battery state of charge for customers to complete all vehicle trips. Additionally, Managed Charging increases grid resiliency by providing utilities with access to additional emergency load response mechanisms.

E3 found that, in the PNW, moving charging to Light Load Hours can roughly double[40] an EV's net benefits for the ratepayer. There may be instances where active managed charging might move charging to certain HLH times to reduce the BPA Demand charge, but this will occur on a case by case basis and won't be possible without the ability of the utility to control when vehicles are charged.

Managed Charging Programs can take two primary forms: *Passive* or *Active.*

- Passive Managed Charging (also known as behavioral load control) relies on customer behavior to affect charging patterns (primarily *when* they charge.)
- Active Manage Charging (also known as direct load control) gives the utility (or other third party) the ability to directly control either *when* a vehicle is charging or *how much* load a charging vehicle is drawing from the grid at any given time.

The managed charging ecosystem is undergoing rapid development. However, a full unified set of standards or means of implementation has yet to be adopted. A Washington-based utility, Avista, learned from their EVSE pilot that "EVSE-to-network interoperability through the use of industry standards such as the Open Charge Point Protocol (OCPP) is critical to reduce the risk of stranded assets and take advantage of performance and cost improvements in the market."[41]

Utilities need to realize that managed charging can take many different paths as this technology continues to evolve. The key is future proofing infrastructure to ensure the ability to adapt with rapidly evolving managed charging solutions. What is clear is that Level 2 residential and workplace charging is the key to unlocking grid benefits in the future. Without utility education and intervention, residential charging infrastructure, or lack thereof, could result in not being able to effectively manage charging in the future, and the inability to realize the utility benefits that managed charging can provide.

Table 2: Examples of Passive and Active Managed Charging[42]

PASSIVE	ACTIVE
EV time-varying rates, including time-of-use rates and hourly dynamic rates	Direct load control via the charging device
Communication to customer to voluntarily reduce charging load (e.g., behavioral demand response event)	Direct load control via automaker telematics
Incentive programs rewarding off-peak charging	Direct load control via AMI, a smart circuit breaker, or panel

conclusion

Utilities can take actions that can impact transportation electrification and should begin to plan their efforts soon.

This guide highlights the potential utility and social impacts of EV adoption, the rapidly growing EV market, and an action plan for utilities to prepare for an electrified transportation sector. The appendix below highlights numerous additional examples of forward-thinking utilities that are striving to maximize the benefits of EV market growth. **Because of our low electricity prices and the low carbon content in our electricity—Northwest utilities in particular have much to gain from the growth of the EV market. Northwest utilities have a unique opportunity to shape and influence the transition to a transportation system that is fueled by electricity.**

Appendix A

full menu of program implementation activities for advancing transportation electrification

The following should be considered a resource for utility planning and includes a full set of actions for utilities to consider when building a comprehensive TE program.

Activity Area 1

Learn

Visit an Electric Vehicle Showcase or Learning Center

One of the best ways to learn about EVs is to visit an electric vehicle learning center, such as Forth's Electric Vehicle Showcase in downtown Portland, Oregon. There, visitors can see and are able to test drive a variety of electric vehicles while interacting EV experts. The showcase is located at: 901 SW 1st Ave, Portland, OR 97204 https://forthmobility.org/showcase. Utilities are also starting to get involved in the EV education space.

- Idaho Power also has a Charging Showcase, allowing customers to see five types of Level 1 and 2 charging stations.[43]
- Forest Grove Light and Power is exploring opportunities to have an EV ready for test drives.
- Some NW Utilities have company EVs that they can loan out to customers to help educate them on the benefits of this technology.

Utility Staff Education and Utility Workplace Ride and Drives

Similar to with the general public, there is often an informational gap about electric vehicles among utility employees. In order to most effectively advocate for EV adoption and develop impactful programs, utility staff need to be apprised of how these technologies function, the electric vehicle ecosystem, and the latest industry developments. Forth provides "EV 101" trainings, semi-annual working group meetings, webinars, and other resources to educate utility staff.

- Forth has delivered EV 101 trainings with the City of Ashland and Coos Curry Electric Cooperative in the past year.
- Forth has also partnered with utilities, including Columbia River PUD to offer ride and drives for utility employees to get a palpable experience riding, driving, and plugging-in EVs.

Meet EV Owners

Electric vehicle owners tend to be passionate, well-informed, and eager to talk about their EV experience. Connecting with EV owners provides an opportunity to learn about the local EV market and learn how EVs might work for a variety of consumers with different driving habits. Each September, Plug-In America, Sierra Club, and The Electric Auto Association support a national EV celebration to raise awareness and highlight the benefits of plug-in vehicles called National Drive Electric Week. The week features events held throughout the country, led by local EV drivers, advocacy groups, and utilities such as the Oregon Electric Vehicle Association (OEVA), Seattle Electric Vehicle Association (SEVA), and Idaho Power. These events typically include EV parades, ride-and-drives, electric tailgate parties, press conferences, award ceremonies, and informational booths. With more than more than 300 events in 2019 they provide excellent engagement with local owners and drivers.[44]

- Forth's "EV Ambassador" group aims to leverage the passion of these disparate groups and individuals into a program with targeted impacts. Forth has established connections with EV advocacy groups across the PNW, and will continue to grow these relationships.
- EV owner relationships have allowed for Ride and Drive events to take place in areas with little to no dealer inventory such as in North Idaho.

Purchase EVs for the Utility

Shopping for an EV is an educational experience within itself and provides utilities with valuable experience while creating marketing potential. Publicizing the vehicle to customers in newsletters, on the website and at events positions the utility as a prime source of EV information.

- Flathead Electric leases a Nissan Leaf, which its members can test drive at no cost for a few hours or days. They offer an online rental form for customers to complete through their website.[45]
- Bucket trucks: Some utilities are purchasing hybrid electric bucket trucks for utility operations. These purchases demonstrate utility support for plug-in vehicles but also offer superior operating conditions by allowing the truck implements to be operated via the battery instead continuing to run the diesel engine for about 6 hours of field work.

Activity Area 2

Manage

Flexible approaches to demand charges for MHD & HD fleets

The electric options for medium- and heavy-duty vehicles have increased dramatically over the past few years. However, demand charges are proving to be a significant barrier in some cases. Some utilities are adjusting rate structures to make investments in EVs more cost-effective for commercial and municipal operations. Reduced demand charges can sometimes be justified by the increased revenue generated by electricity sales to these fleets; through higher per-kwh rates; by the benefits from battery storage for frequency and voltage control, or alleviating distribution constraints.

- Foothills Transit near Los Angeles looked at electric transit buses, which are four times as efficient as their current CNG buses, but more costly to run because of high demand charges. In order to ramp up the program the California PUC agreed to a temporary moratorium on demand charges, followed by a gradual phase-in. This allows the transit agency to cost-effectively increase the number of electric buses until demand charges become a smaller percentage of electricity costs.[46] Similarly, Southern California Edison created TOU rate classes for 0-20kW, 20-500kW and above 500kW. Super off-peak rates at night allow a fleet user such as a transit agency to charge without demand charges at a reduced rate. Using battery storage to buffer charge rates is also becoming more cost-effective.
- Seattle City Light & King County Metro have agreed to flexibility in demand charges to encourage charging off peak.
- PG&E has proposed[47] a tiered subscription-based pricing model for EV charging of commercial vehicles. This subscription model would reduce the variability associated with demand charges for commercial EV charging and increases predictability for fleet managers.

Flexibility around demand charges for DC fast charge stations

Direct Current Fast Charging (DCFC) stations can have very high, but short term, peak loads. Until there are larger numbers of electric vehicles on the road, these demand charges make up a disproportionate share of DCFC costs. For example, Pacific Power found that many fast chargers in the Pacific NW were spending over 80% of their monthly costs on demand charges. Especially in rural areas, these costs are detrimental to the economic operation of charging stations. Pacific Power has responded by proposing a 10-year phase in for demand charges, with higher kWh costs that gradually decline over that period. Other utilities and jurisdictions have completely waived demand charges for DCFC, recognizing that fast chargers are essential to serve an EV market that - overall - provides substantial ratepayer benefits. Utilities may also consider piloting new types of rate structures which would seek to better reflect the growth and behavior of EV charging.

Activity Area 3

Educate

Outreach Campaign

A recent study from University of California at Davis revealed that even within the largest electric vehicle market in the country, with a growing number of charging stations and policies supporting electric transportation, consumers are generally unaware of the benefits of EVs.[48] This demonstrates a tremendous potential and need for investment in education and outreach campaigns. Utilities can have great reach and credibility with consumers. An effective outreach campaign can have multiple channels and activities, including the website, newsletters, bill stuffers and events. Utilities should be sure to identify and train someone to be an expert in EVs to be able to answer questions for customers as well as promote the vehicles with staff.

- Columbia River PUD has a variety of EV information on their website, including “EV Facts”, benefits of driving electric, cost savings, information on tax credits and rebates, environmental benefits, a list of available EV models, and more.[49] In 2018, Eugene Water and Electric Board (EWEB) partnered with the University of Oregon and local car dealers to offer

rEV Up Eugene![50] This workshop series provided residents with everything they needed to about EVs. Workshop attendees were eligible for exclusive rebates from participating local dealers.

- Involving Customers: Flathead Electric has an "Electric Vehicle Blog" in which its members can share their stories and experiences with EVs. Salem Electric included EV trivia questions in their monthly newsletter in 2019 as an interactive way to spread the word about an EV101 and Ride and Drive the utility hosted during the summer. Several PNW utilities have partnered with Forth to offer EV education at their annual customer appreciation days.

Organize a Ride and Drive Event

Ride and drive events provide participants with an opportunity to learn about EVs and to test drive in a neutral setting, without having to visit an auto dealership. These events are a key component of education and outreach. A well-executed ride and drive integrates with a community event attracting thousands of people who are exposed to utility programs and can learn about EVs available locally. Ideal community events for ride and drives include farmer's markets, sustainability-related events (e.g., Earth Day events), or classic car shows. Test drives open people's eyes to the myriad advantages EVs offer, especially their responsiveness. Local auto dealers realize the benefits and are even more excited to participate after they experience their first ride and drive.

- Forth has partnered with many utilities (Puget Sound Energy, Avista, Tacoma Utilities, Portland General Electric, Pacific Power, Columbia River PUD, Eugene Water and Electric Board, and City of Ashland, among others) in the Pacific Northwest to offer ride and drive events

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Activity Area 4

Charging, Build It and They Will Come

Charging Support: Direct investment in public charging infrastructure

It makes sense for utilities of all structures, from investor-owned to consumer-owned, to be directly involved in the build out of charging infrastructure, as it is a natural extension of electricity delivery to customers. By investing in charging infrastructure, the utility can support market growth and select the right smart charging equipment that will allow for load shifting and peak shaving.

- PGE is working with Greenlots to develop "Electric Avenues," which are charging hubs with several DC Fast and Level 2 stations around the Greater Portland Metro. Currently, four are up and running, with three more being built in Beaverton, Wilsonville, and Salem.[51]
- Free Level 2 charging: Chelan PUD has installed these chargers by partnering with local businesses to host the stations. Rocky Mountain Power offers free L2 charging at parks, municipal buildings, recreation centers and golf courses.[52]

Charging Support: Public Highway and Tourism Charging Infrastructure

A crucial piece to drive EV adoption is the build-out of highway charging infrastructure. For rural, suburban, and urban dwellers alike, selection of an EV correlates with their ability to travel. Across many rural highway corridors, the local utility may be the only entity willing and capable of investing in this crucial infrastructure. As mentioned above, it's important to create relationships with various groups in the utility service territory and state. In this case, the state Department of Transportation (DOT), tourism organizations, ski resorts, state parks, among others, can be key allies in creating a network of DCFC and L2 chargers throughout the utility service territory. As mentioned previously, being directly involved in the build-out of charging infrastructure is a natural extension of the utility's role in delivering electricity to customers. By investing in charging infrastructure, the utility can accelerate market growth and spur the local economy by enabling EV tourism, while capturing the economic benefits of EV charging on its system.

- Avista's pilot program invested in the installation of publicly accessible level 2 chargers and seven DC fast chargers at strategic locations to connect Spokane with the Palouse and future DCFC locations planned connecting Spokane with Canada, Northern Idaho and western Washington via US 395, 195 and I-90.

Charging Support: Utility Fleet Charging

Another great way for utilities to understand EVs and help drive adoption is by incorporating EVs into the utility fleet and to enable EV adoption among employees with workplace charging. This can help the utility think through what it takes to offer workplace charging and see first-hand the enthusiasm among employees while working through implementation challenges. Likewise, workplace charging helps drive wider EV adoption.

- Idaho Power has begun using hybrid-electric bucket trucks in their fleet as well as electric forklifts, electric utility vehicles, battery-assisted trucks and branded passenger EVs which generate buzz at community events. Situated in a regional trucking hub, Idaho Power is also working to electrify refrigerated trucking in their service territory.[53]
- Forest Grove Light & Power has begun transitioning its fleet to electric vehicles, beginning with light duty and incorporating medium and heavy-duty purchases as the market progresses.

Charging Support: Residential

One way for utilities to support EV adoption is by offsetting the cost of a residential EV charger through rebates. Some utilities now offer rebates for level 2 chargers for residential customers. By offering incentives, utilities can ensure chargers are installed that enable future managed charging programs.

- Benton Rural Electric Association, Orcas Power and Light Cooperative, Puget Sound Energy (WA), City of Ashland and Eugene Water and Power (OR), and Kootenal Electric (ID) offer between $250 and $500 for customers to install qualifying EV home chargers.
- Orcas Power and Light Cooperative offers customers the option to finance their EVSE through funding OPALCO received through the Rural Energy Savings Program within RUS/USDA. This provides the co-op with 0% money from RUS to relend to members at a low rate via an on-bill tariff. This structure can assist low income residents and renters.
- Some utilities in the PNW and elsewhere (Austin Energy etc) are pioneering subscription plans for EV charging where a customer pays a flat monthly fee for unlimited home (Level 1 or 2) or workplace (Level 2) charging.

Charging Support: Multi-Family

Multifamily developments pose a special challenge for the location of charging equipment. Some utilities that serve large portions of multifamily dwellings are experimenting with new approaches.

- Puget Sound Energy's Multi-Family (MF) pilot program will run for two years and is designed to increase availability of EV charging, identify impacts on system demand and demand charges, and build out best practices in MF charging. Over two years, 25 properties will have charging stations installed and usage will be monitored by the utility. Additionally, as part of PSE's "Public Charging Pilot", they will ensure that two of the first eight public fast charging sites are within close proximity to MF housing, to determine if these charging locations can remove barriers to transportation electrification for MF buildings and renters. Seattle City Light has developed a guide for housing developers that lists the steps to take to install charging infrastructure at MF housing.
- Austin Energy encourages multifamily building owners to provide charging stations by reimbursing them for EV charging and providing contractors to clean and maintain the charging stations. All electricity provided at these MF stations is 100% renewable.[54]

Charging Support: Workplaces

Workplace charging presents itself as an exciting opportunity to enhance electric vehicle adoption and provide benefits for both employees (especially those without access to home charging like renters and multi-family residents) and utilities. The U.S. Department of Energy reported that employees of organizations who provide and support workplace charging programs are 20x more likely to drive a plug-in than the average worker.[55] Additionally, by encouraging charging during non-peak workplace hours, utilities can displace potential increases in evening peak demand associated with individuals plugging in when they return home from work.[56]

- The City of Ashland provides businesses $500 per charging unit for businesses to install a workplace charging station.[57] Eugene Water and Electric Board (EWEB) offers $300 toward buying a new or used EV or installing a workplace Level 2 charging station. EWEB is also offering a 4% loan to encourage installation of commercial charging infrastructure.[58]
- Pacific Power[59] offers a quarterly grant to cover up to 100% of costs to install non-residential charging stations in their service territory. Puget Sound Energy is launching a two-year workplace charging pilot to gauge successful solutions to increase workplace charging. PSE will test various employer outreach methods and partner with EVSE providers and installers to complete workplace charging installations. Covering the costs of installation, customers may qualify for up to 10 chargers at their location. PSE plans to install 75 ports across 25 locations during the two-year pilot, while continuing to monitor and analyze usage data. Idaho Power provides financial incentives to eligible business customers to cover up to 50% of costs associated with installing EVSE for passenger vehicles (up to $15,000). Additionally, Idaho Power will pay for up to $7500 to install charging infrastructure for forklifts.

Activity Area 5

Steps to Creating a Managed Charging Program

Prepare

1. Identify the penetration of light-duty residential EVs in the utility's service territory using vehicle registration or DEQ data (depending on the state) or load disaggregation tools.

2. Consult with utilities and groups such as Forth and SEPA for help detecting and navigating foreseeable challenges or risks. Join a working group, such as those offered by Forth and SEPA, in order to learn more. Collaborate with the EV industry to develop industry-wide standards for the entire "ecosystem" of information exchange and communication. COUs should be on the forefront of developing an ecosystem suited to the utility, rather than just what IOU or urban utilities dictate. Utility voices are needed to inform the industry discussion of the utility's needs.

3. In collaboration with such partners, model how many vehicles are expected within utility territories. Such models should include more aggressive cases to prepare for a potentially rapid transition to electric transport. Calibrate utility program to align with anticipated needs.

4. Identify available distribution capacity and potential constraints (substations, transformers).

5. Leverage data from step one determining that EV resources are located on the distribution system

to define the cost-benefit of avoided distribution upgrades, which can vary significantly from one circuit to the next.

6. Identify the utility's goals from a managed charging program (e.g. reduce peak demand and capacity constraints, shifting load from heavy load hours (HLH) to light load hours (LLH), build resiliency on distribution system, apply downward pressure on rates, prepare for future increased intermittent generation, etc.).

7. Define the business model for managed charging—including the costs and payback for both the utility and the EV driver—and establish utility standards to reduce costs, barriers, and complexity.

8. Understand what types of incentives and management strategies will shift load effectively, while maintaining a satisfactory user experience for drivers.

Design and Implement

1. Develop a managed charging program that offers consumers maximum flexibility—including opt-out and override capabilities and financial benefits, to increase customer participation.

2. Identify least-cost and reliable communication solutions.

3. Proactively engage customers and provide information on managed charging-capable charging EVSE and network Service Providers (NSPs).

4. Identify the resources available or needed to implement strategy (digital communication with customer, smart meters, networked charging stations, telematics from vehicle manufacturer, etc.)

5. Identify metrics on which to measure success. How many customers need to enroll in order to make a difference for load management?

6. Identify available budget, including for staff management, infrastructure, and marketing. According to SEPA, the number one attribute of customer enrollment in EV TOU programs was marketing budget.

7. Launch a pilot or a full-scale program.

Residential Managed Charging Pilot Programs

Many utilities are conducting residential managed charging pilot programs to understand the various methods (both passive and active) for affecting customers' vehicle charging habits.

- Xcel Energy in Colorado first launched an EV charging pilot in 2014 which allowed them to interrupt customer vehicle charging for a limited number of hours in exchange for a credit. In 2020, Xcel Energy will launch a new pilot, "Charging Perks"[60] to test active managed charging through vehicle manufacturer telematics. By using the onboard OEM systems, this program will not require any infrastructure investment by Xcel or customers. Xcel expects to enroll up to 600 customers in the pilot.
- Idaho Power[61] offers an opt-in Time of Day Plan for its customers, with off-peak rates between 9 PM and 1 PM. Depending on needs, this plan may provide benefits for EV drivers, while shifting the load demand away from evening spikes.

Activity Area 6

Promote

Working with Dealers to Improve Engagement Around EVs

In many markets, a key barrier to increased EV adoption is a lack of EV inventory or EV sales focus at auto dealerships. The Sierra Club's recently released 2019 Rev Up EVs report substantiated these findings, concluding that a third of dealership sales people engaged in the study did not discuss any federal or sales tax credits or rebates, and that 50% of sales staff did not provide any information about how to fuel an EV.[62] Further, despite automaker investments and commitments, currently most sectors have a limited supply of EV models even though where models are more available, EV sales are dramatically higher.[63] Utilities can support EV adoption by demonstrating their commitment to increasing EVs in their territory to dealerships. Having a plan for dealer outreach and engagement is an important step in effectively promoting EVs to customers. While limited supply provides a challenge, it is also providing an opportunity for utilities to increase overall EV demand by fostering a broader, educated and motivated buyer pool.

Additionally, the culture and regulatory framework of dealerships varies state-to-state. Specific rules exist about how, where, and to what ends utilities can engage with dealerships. Most states have a nonprofit dealership trade organization, such as the Oregon Auto Dealer Association; contacting a local representative organization to discuss the dealer regulatory environment is recommended.

- Avista partnered with Forth in an outreach to local auto dealers to better understand supply in the area and educate dealers on utility incentives. While this outreach began as preparation for a Ride & Drive event in Spokane WA, it builds an ongoing relationship to support auto dealers, helps them obtain and sell more EVs, and grows the utility's EV program. Sales staff were excited by the utility sales promotion incentive (SPIF) for referring customers to Avista's EV program.
- Forth is seeking utilities to participate in a Dealer Engagement Program in their service territories. With this initiative, Forth will provide education and marketing collateral (to be co-branded with the utility and participating dealerships) while the utility provides financial incentives

for dealership staff to make an EV sale. For their participation, dealerships are branded as a "*Utility Name*—Certified EV Dealer," and are promoted through the utility's marketing channels.

Promoting EV Ride and Car Sharing and Other Rural Solutions for Elderly or Low-Income Residents

The success of Uber and Lyft has made ride sharing a larger share of urban traffic. Electric utilities are partnering with these companies to encourage their drivers to use EVs. Additionally, some car-share companies are also beginning to incorporate EVs into their fleets.

- In 2019 and 2020, Puget Sound Energy is launching several pilots to discern the applicability of transportation electrification projects in low-income communities, including a non-emergency medical services transportation pilot and a multi-family and low-income housing car share pilot. Pacific Power was a primary funder for Forth's Community Electric Vehicle (CEV) Pilot Project. The project was a partnership between Forth and Hacienda CDC to test the feasibility of an electric car share in the Cully Neighborhood, one of Portland's most diverse and lowest-income areas. Work related to the project took place between 2016 and 2018, with the full-scale pilot operating between March and December 2017.[64] Forth has partnered with Pacific Power and other partners to launch an EV car-share in rural Hood River, Oregon to test the financial sustainability of car-sharing for low income residents, City employees, and the community at large.
- As a way of overcoming one of the key barriers to EV adoption - access to vehicles - Forth has launched a financing pilot. This program offers rideshare drivers who are low-income or have poor credit lower interest rates for a used EV and coaching on which vehicle could be ideal for their driving needs. Lyft is funding bulk-buy monthly memberships for rideshare drivers through PGE's "Electric Avenues", where drivers can quickly charge on DCFC and get back on the road. Through this membership, if drivers only charge during off-peak hours, they can pay nothing for electric fuel. For full-time drivers, this can save over $12,000 in gas expenses alone. PGE was able to offer this bulk-buy rate through a tariff.

Promoting EVs Along with Clean Energy

Utility regulators, policy makers and customers have been pushing utilities to increase clean energy generation. BPA load-following utilities are fortunate to provide the nation's cleanest power. As the grid's generation mix changes with more solar and wind, these intermittent generators can create demand response opportunities for utilities. Some parts of the country, including the Northwest, are seeing the overall supply of renewables exceed demand at certain times of the day or year, and EVs connected to active managed chargers can be an answer to this problem. This creates an opportunity for depressed power prices and offering inexpensive charging with clean energy is a great way to satisfy customers.

- In Minnesota, many Great River Energy (GRE) co-ops offer their customers a special rate to charge at night with 100% wind power. Kandiyohi Power Coop is one of many GRE coops to offer low off-peak rates advertising EV charging with 100% wind power.
- Portland Metro's Transit Agency, TriMet, has branded their new electric buses as "Wind Powered by PGE (Portland General Electric)" to visually make the connection between EVs and clean energy.
- Midstate Electric's Bolt is branded to demonstrate that it is powered by clean hydropower.[65]

Rebates for New and Used EVs and E-Bikes

EV rebates are a powerful tool some utilities have employed to sell more EVs. The utilities that have offered these rebates have combined them with requirements or incentives for charging equipment.

- In 2019, the City of Ashland provided up to $300 for business or nonprofit EV or e-bike purchases.
- Many utilities, such as Midstate Electric and Eugene Water and Electric have partnered with Nissan to offer group buy discounts of up to $3,500 to customers purchasing new Nissan Leafs. This discount is offered by the manufacturer and is therefore not an additional cost to the utility aside from registering for the program.

Utilities as Influencers of Electric Vehicle Policy

Some choose to advocate for EV policy at the local, state and federal level, either directly or through utility or nonprofit organizations.

- In March 2018, thirty-six of the nation's largest utilities sent a letter to congressional leadership requesting the vehicle cap for federal EV tax credits be removed. Signers included Portland General Electric, Seattle City Light, Tacoma Power, and Pacific Power and many more covering almost every state in the US.[66]
- Idaho Power and the Treasure Valley Clean Cities Coalition developed an EV interest group. The group meets several times per year to share information and look for ways to work together to support EV adoption through programs or policy.

Appendix B

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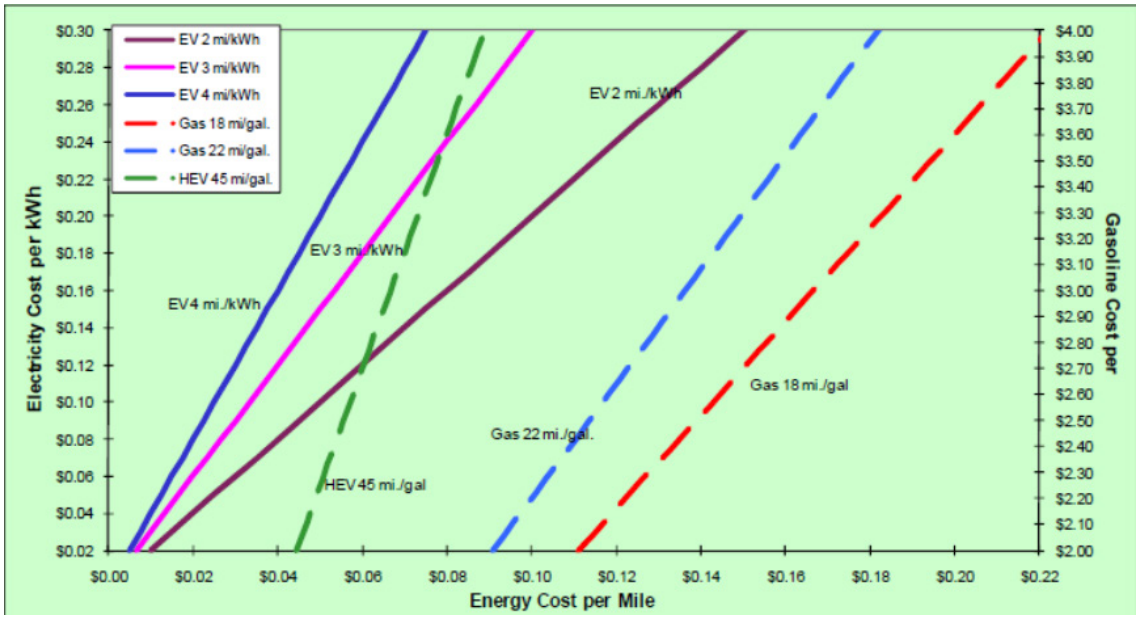

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11,443 mi/yr @ 30kWh/mi yields 114.43/yr X 30kWh= 3433 kWh/yr
3433kWh/yr X $.0939/kWh = $322.36/year
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renewables
program

Bonneville Environmental Foundation, 1500 SW 1st Avenue, Suite 885, Portland OR 97201
503-248-1905 | regops@b-e-f.org