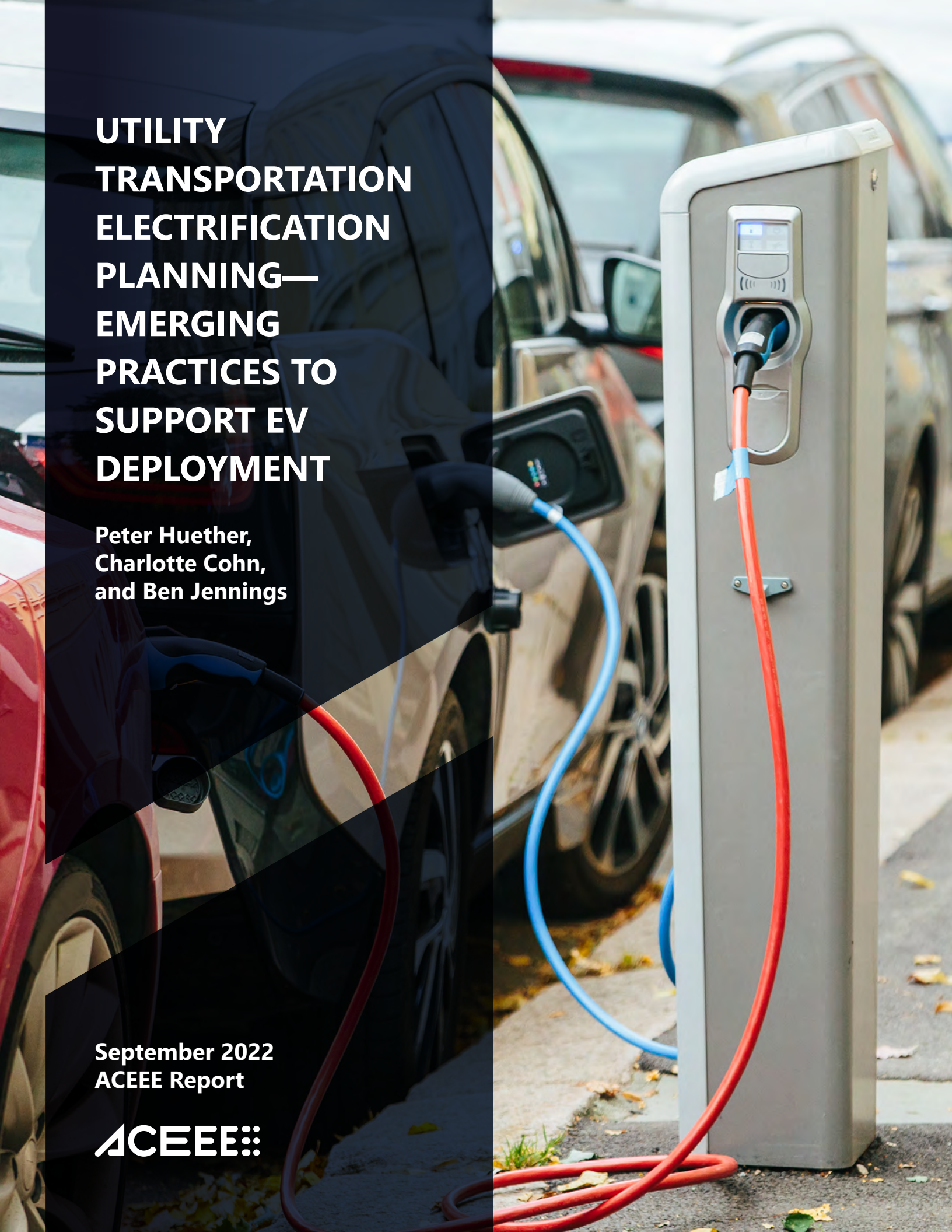

UTILITY TRANSPORTATION ELECTRIFICATION PLANNING—EMERGING PRACTICES TO SUPPORT EV DEPLOYMENT

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Contents

About ACEEE

The **American Council for an Energy-Efficient Economy** (ACEEE), a nonprofit research organization, develops policies to reduce energy waste and combat climate change. Its independent analysis advances investments, programs, and behaviors that use energy more effectively and help build an equitable clean energy future.

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Executive Summary

KEY FINDINGS

- Utilities are expecting millions of new electric vehicles (EVs) to hit the road over the next decade. To accelerate and adapt to this shift, they are planning increased investments in the grid, greater outreach to customers, special rates for EV charging, and direct investments in transportation electrification (e.g., charging infrastructure and vehicle purchases).
- States are increasingly requiring that utilities plan for transportation electrification (TE). A few states require formal, comprehensive plans to be submitted every few years, detailing investment plans and progress.
- Our review of selected utility TE plans found a few emerging trends: Programs are covering an increasingly wide range of charging and transportation use cases, such as for apartment buildings and fleets, and there is a greater focus on level 2 (L2, 240 or 208 V charging providing 10 to 20 miles in range per hour) charging investments. Programs often use both make-ready programs and time-of-use rates, and education and outreach plans are also common. Equity is frequently prioritized but approaches varied.
- A state's requirement to submit formal, comprehensive plans can also help utilities and utility commissions coordinate with other actors, such as state and local governments and regional transportation authorities.
- We recommend that planning processes be transparent, consistent, and ongoing to allow for high-quality input by stakeholders. Additionally, plans should cover a wide variety of use cases, such as for both personal vehicles and trucks; include metrics and goals on a variety of outcomes; incorporate equity; and include meaningful outreach to affected communities.

Sales of electric vehicles are accelerating. Automakers increasingly recognize that the future of driving is electric (Preston and Bartlett 2022; DOE 2022). States also realize that this transition is underway, with many setting ambitious goals for sales of personal and commercial EVs. For example, California plans to phase out internal combustion engine vehicles with its Advanced Clean Cars II regulation, and other states have the option of adopting this policy (Manescu 2022; Buysse, Kelly, and Minjares 2022). This transition will expand the need for EV chargers and will require major upgrades to the grid to handle increased electricity demands. Therefore, utilities need to plan for this growth to ensure that electrical reliability continues and the needs of EV drivers are met.

States, their public utility commissions (PUCs), and utilities themselves have also recognized that utilities can help accelerate this transition, not just prepare for it. Over the past 10 years,

PUCs have approved over $3 billion in utility transportation electrification programming nationwide. These programs could support more than 6,000 DC fast chargers (DCFC, which provides charging through 480 V) and more than 200,000 L2 chargers across a variety of locations such as apartment buildings, workplaces, schools, retail locations, ports, and along highways (Lepre 2021). These are novel and long-term investments for utilities and require careful planning to maximize social benefits, coordinate with state and local transportation goals, and minimize impacts on ratepayers.

This research examines a select sample of utility transportation electrification (TE) planning efforts to identify emerging trends and make recommendations on the planning process. We looked at utilities from across the country and at different levels of ambition, although all utilities had significant enough investments to warrant planning efforts. The 11 utilities we examined, which include ten investor owned and one municipally owned, are detailed in figure ES1. We looked at both the content of plans and the processes themselves. For the content, we examined the efforts across seven criteria: coverage of vehicle types and overall program scope, rates and managed charging, incentives, equity, education and marketing, metrics and progress reporting, and system planning. For processes, a few states require formal plans to be submitted periodically (often every 3–5 years) that detail all aspects of their TE investments. We paid special attention to these processes but drew recommendations from all the documents examined.

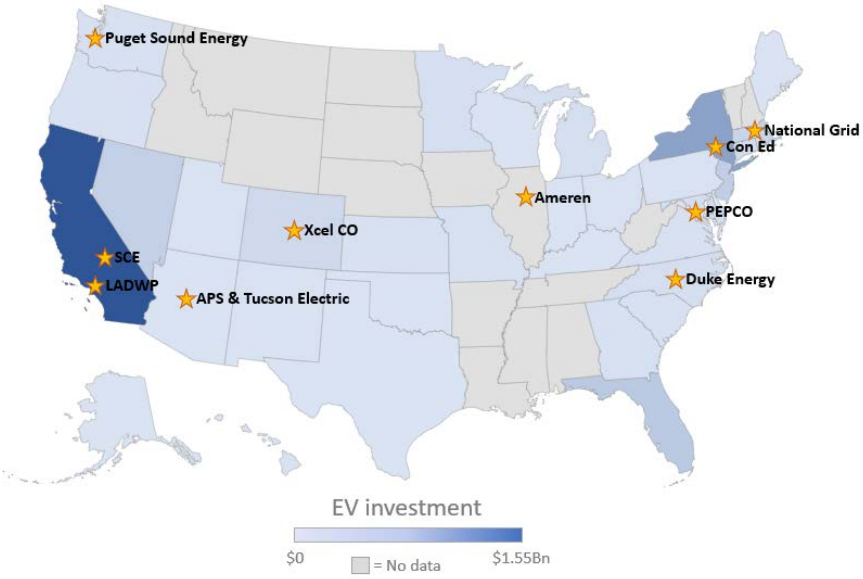


Figure ES1. Map of utilities and EV investment. Sources: Data on approved EV investments by state from Atlas EV Hub (2022) and utility plans included in this review. Note that APS and Tuscon Electric are two separate utilities that filed a plan together.

We found that the formal, comprehensive plans often include a robust discussion about the role of the utility in the TE transition, how they could support statewide transportation or climate goals, and in many cases a broader economic and environmental analysis. Compared

to disparate, program-specific planning documents, these comprehensive plans provide PUCs and the public greater clarity as to the utility's goals, and the impact their investments would have in supporting EV adoption, reducing emissions, and increasing mobility options for consumers. They also provide more opportunities for stakeholder engagement, especially since these plans must be resubmitted periodically. The TE transition is evolving rapidly and will require ongoing coordination among stakeholders and readjustments from utilities. While utility approaches to many planning elements still vary significantly, the plans we examined showed several emerging trends where a consensus may be forming among PUCs and utilities about strategic and beneficial investments by utilities.

- L2 and make-ready investments are getting greater levels of support than DCFC and utility-owned electric vehicle service equipment (EVSE) investments.
- Utilities are investing in a wide variety of TE use cases and charging infrastructure, with a major focus on multi-unit dwelling (MUD) investments.
- Make-ready investments are the most commonly offered incentive programs, with many tailored to a specific TE use case like MUDs.
- Many utilities are also investing in fleet charging infrastructure and providing advisory services.
- Time-of-use rates are the most common, with other managed charging programs being offered or considered.
- Almost all utilities prioritize equity, but approaches vary. Many utilities set aside money for underserved communities, although definitions for these communities vary and in many cases plans for engaging them are limited.
- Many utilities prioritize education, often by partnering with dealerships to facilitate incentives and prepare them for selling more EVs by providing expertise and charging infrastructure.

In general, we do not provide recommendations on what types of programs utilities should be implementing, but we do make recommendations on the overall goals, planning processes, and program elements of utility TE investments. Utility TE investments and plans should be transparent; track benefits and how they support state and local goals; reach as many people as possible, especially low-income communities and communities of color; and touch on all aspects of transportation electrification (e.g., trucks, fleet operators, taxis, and rideshares), not just passenger vehicles.

Our key recommendations for utility TE planning are as follows:

- Utility planning efforts need to be transparent and consistent to help ensure accountability.

- The planning process should also be ongoing, involving periodic plan submissions that provide progress updates and allow for input from regulators and the public.
- Planning efforts should cover all TE use cases, including passenger vehicles, trucks and other heavier classes of vehicles, transit, micro-mobility, and rideshare vehicles.
- Equity must be integrated in all planning to ensure everyone benefits from the TE transition. Underserved communities must be meaningfully engaged early and often to identify these communities' needs.
- Utilities should define metrics and goals related to infrastructure development while also considering a wide variety of impacts, including on greenhouse gas emissions, air quality, and equity.

Achieving widespread transportation electrification will require an all-hands-on-deck effort by stakeholders, including utilities. Utilities increasingly recognize that they not only need to accommodate millions of new EVs on the grid but also have a role in accelerating the transition. However, they will need to plan for these major changes and investments to ensure widespread benefits and optimal use of ratepayer funds. While the format and content of plans may differ, utilities nationwide are tackling similar TE issues and therefore are proposing programs that share many similarities.

Analyzing plans against our seven key criteria, we found emerging trends and similarities across a diverse set of utilities. Our findings can help states and utility commissions think about potential TE investments in their locations, help utilities learn from what their peers are planning, and inform other stakeholders about the role of utilities in the TE transition. Our findings can also help policymakers develop beneficial and effective planning processes to support their goals.

Introduction

The shift to electrified transportation is accelerating in the United States for personal vehicles, taxis, transportation network company vehicles, buses, and trucks. As automakers increase their offerings, the growth of electric vehicle (EV) sales is outpacing conventional vehicles (Preston and Bartlett 2022; DOE 2022). State and federal policy is helping to drive this shift, with the Biden administration announcing a goal of 50% of new vehicle sales to be EVs by 2030, California aiming for all new vehicle sales to be EVs by 2035, and Washington State planning for full electrification for new passenger vehicles by 2030 (White House 2021; California Office of the Governor 2020; Kroman 2022). Numerous states have their own transportation electrification (TE) goals for the number of electric vehicles on the road and the infrastructure that will be needed to support drivers charging away from home. Fourteen states follow California's Zero Emissions Vehicle program, which sets out a roadmap for greater and eventually full light-duty EV adoption (Manescu 2022). California has also announced its Advanced Clean Fleets and Advanced Clean Trucks (ACT) regulations, setting requirements for a greater number of new truck sales and other fleet vehicles to be zero emissions; the latter has been adopted by five other states (Buysse, Kelly, and Minjares 2022). Many of these same states have also come together to plan for the electrification of the medium- and heavy-duty vehicles in their states and provide incentives for purchases of new EVs (Howard et al. 2021). Seventeen states and the District of Columbia, representing over 36% of the nation's heavy-duty vehicles, signed a memorandum of understanding to adopt California's ACT rule, if they had not already, and to work toward a target of 30% of new truck and bus sales to be zero emissions by 2030.

Given these trends, the United States could go from almost 2 million EVs on the road today to almost 26 million by 2030. This transition will provide numerous benefits to air quality, the climate, and drivers' pocketbooks, but will also require significant investments in charging infrastructure from governments, building owners, charging companies, and electric utilities. By some estimates, more than 1.3 million workplace chargers, 1.1 million public chargers, and 1 million chargers in apartment buildings will be needed, in addition to all the chargers in private homes. Investments in public and workplace charging will be needed to refuel drivers on long trips and support drivers without good access to home chargers, such as apartment and rental unit residents (Bauer et al. 2021). Charging infrastructure will also be needed for other transportation types that are electrifying, such as public transit, school buses, and large trucks.

Widespread transportation electrification will require significant upgrades to the grid to support the required EV charging infrastructure. Utilities play a key role in meeting this greatly increased demand for electricity. To serve all customers and maintain grid reliability, utilities must invest in grid infrastructure to provide electricity when and where it is needed. At a minimum, utilities need to prepare for transportation electrification where it will stress their grid assets and require long-term planning and investments in their distribution network as well as (where necessary) at the transmission level.

Utilities can not only support but also accelerate the transition to EVs—and deliver important benefits like cleaner air, transportation affordability, and equity. Recognizing this, many states are supporting their long-term TE goals by leveraging their public utility commissions (PUCs), which must approve the investments of most utilities. Minnesota's PUC, for example, ordered utilities to take action to accelerate TE through investments in infrastructure, rate changes, and public education. The state's utilities are required to submit their investment plans and must include how they will alleviate pollution and increase mobility access for all customers, including low-income ones (Sierra Club 2018). Utilities are in a unique position compared to other businesses due to how they are regulated; they can be key stakeholders in furthering TE if a state requires or allows them to do so.

Over the past 10 years, PUCs have approved over $3 billion in transportation electrification programming nationwide, laying the foundation for the widespread adoption of EVs. Utilities' initiatives have supported charging at apartment buildings, workplaces, schools, retail locations, and ports, to name a few. They have also experimented with alternative charging rate programs like time-varying rates, managed charging offerings to encourage grid-beneficial charging behavior, as well as some EV charger and electric vehicle purchase subsidies. These programs often have components dedicated to underserved, low-income, or communities of color to ensure greater equity in the transition to EVs (Lepre 2021).

Transportation electrification is a long-term pursuit. All actors involved need to plan carefully to ensure that the billions of dollars in investments by utilities effectively serve TE needs and use ratepayer dollars wisely. This paper examines the TE planning efforts of utilities with the goal of identifying emerging trends that other utilities might successfully adopt. To get a broader picture of current trends, we looked at the TE planning efforts of ten investor-owned utilities that are regulated by state PUCs as well as one municipally owned utility. We hope to improve utilities' planning efforts and inform the states and PUCs that play a primary role in directing utility TE planning and investment. We examined these planning efforts by primarily looking at seven criteria: coverage and level of investment, rates and managed charging, incentives, equity, education and marketing, metrics and progress reporting, and system planning.

TRANSPORTATION ELECTRIFICATION: PLANNING FOR THE LONG TERM

Like other grid investments, the transportation electrification investments that utilities are making will take years to complete. Some public utility commissions (PUCs) require utilities to create and file plans for regulatory approval to ensure these investments are appropriately designed to achieve policy goals. Transportation plans usually detail what the utility's targets are, how they intend to achieve those goals, how much they expect to spend (in ratepayer funds), what benefits these investments will bring, and which customers will receive these benefits. A secondary purpose of these plans is to inform the public, particularly advocacy groups and other NGOs, of the utility's efforts and to hold the utility accountable for goals and outreach plans. These plans can also inform local and regional planning efforts. The states listed in table 1, such as Colorado and Arizona, are requiring all

their investor-owned utilities to file periodic TE plans that describe their efforts for the next 3–5 years as well as the expected impacts and costs. Often in conjunction with statewide TE goals, these planning efforts establish an ongoing dialogue about the role of utilities in TE and provide a central document for the various TE programs the utility undertakes.

Table 1. States requiring periodic TE plans

State	Source of requirement
Arizona	Utility commission
California	Utility commission (proposed)
Colorado	State legislation
Illinois	State legislation
New Mexico	State legislation
Oregon	State legislation
Virginia	Utility commission
Washington	State legislation

State requirements vary. In Arizona the requirement comes from an order by the utility commission, while in Colorado it is based on legislation, although the plans are submitted to the utility commission. Colorado set a goal of 940,000 EVs on the road by 2030, and the TE plans must show how the state's utilities will support that goal. The Arizona Corporation Commission, the state's PUC, has its own EV adoption scenarios that inform the planning process, with the moderate scenario projecting 1.076 million EVs on the road in 2030. Both commissions require their utilities to update these plans every three years, reflecting the need to modify programming based on experience as well as to revise plans to address new TE goals or other state policies (Energy and Environmental Economics 2019; Xcel Energy 2020).

Most states do not require their utilities to submit periodic comprehensive TE plans, including many states with utilities that are actively investing in transportation electrification. California and New York together account for a majority of the approved utility TE investments in the United States, yet neither state requires utilities to engage in a comprehensive TE planning process per our definition (Lepre 2021). Even in the absence of regulatory or legislative requirements for comprehensive TE plans, utilities are planning for widespread transportation electrification and seeking approval for large-scale TE investments and programs. These utilities still provide much of the same information as utilities required to submit comprehensive TE plans, including documents detailing their programming and investment plans to their PUCs or regulatory authorities. While the format of these documents and the processes by which they are produced and submitted may

differ, they can be equally important in analyzing and learning from the planning efforts of utilities.

California requires its investor-owned utilities (IOUs) to support the state's TE goals, some of the most ambitious nationwide. California has set a goal for all new cars and light trucks sold to be electric by 2035 and for larger trucks by 2045 (CPUC 2022). This creates a huge need for charging and grid investments and as a result, the state has the largest utility TE investments in the country. With years of TE programming experience across a variety of areas (Huether 2021), the state has begun working toward a more coordinated and holistic approach for its IOUs to facilitate consistent planning for all stakeholders and streamline the approval process for the PUC (CPUC 2021). Similarly, New York also has ambitious TE goals, and the state government is involving utilities to accelerate the transition and plan for a future with significantly more EVs on the road. The state's Public Service Commission, its PUC, ordered all IOUs to develop multi-year TE programs that are consistent in scope and size and support the state's goal of 850,000 EVs on the road by 2025 and net zero emissions by 2050 (NYPSC 2020).

Even in states without a policy mandate or target to deploy more EVs, expanding TE planning makes sense. The increase in electric vehicles on the road will profoundly affect utility business models. In regions where utilities face declining sales, EVs represent an opportunity for new load growth. The rise in kilowatt-hours (kWh) sales due to EV charging may in many cases put downward pressure on electric rates over the longer term for all customers (Frost, Whited, and Allison 2020). However, the increased demand may require additional grid infrastructure investments in some places, placing upward pressure on electric rates. Utilities can enable smoother integration of electric vehicles by managing the load from EV charging, whether through behavioral time-of-use rates for EVs, smart charging programs, or vehicle-to-grid (V2G) interaction, thus increasing use of power from renewable energy sources while mitigating excessive power demand. This type of grid integration will require extensive planning and coordination. TE plans help utilities to stay ahead of these changing grid conditions, outlining their near- and long-term plans to meet their customers' charging needs while keeping electricity affordable for everyone, including non-EV owners. Utilities can also maximize benefits by coordinating with local and regional governments on their transportation planning efforts.

Methodology

CRITERIA EVALUATED IN TRANSPORTATION ELECTRIFICATION PLANS

We examined the utility TE planning documents based on seven criteria, evaluating whether a utility addressed certain elements or had certain programs. The criteria are

- coverage and scope
- rates and managed charging

- incentives
- equity
- education and marketing
- metrics and progress reporting
- system planning

Coverage and Scope*:* Understanding the overall purpose and scope of these plans is important to get a sense for the current state of a utility's TE efforts. Utilities across the country are at very different stages in the TE process and have different levels of ambition. Utilities can also take different approaches and set different goals that inform their programming. Some of the research questions for this category are

- What is the overall level of funding and time period addressed?
- What are the types of chargers (see figure 1) or other EV investments?
- What TE use cases are targeted by investment?
- Are there goals associated with charging installation or other elements related to EV deployment?

Rates and Managed Charging*:* How utilities approach rate design for EVs can have a big impact on grid utilization. For example, EVs may have their own rates or be treated no differently from any other load. Managed charging programs go one step further than rate design, allowing automation of EV charging to further mitigate peak demand impacts while preserving price signals to encourage grid-beneficial behavior. To better understand some of utilities' preliminary efforts to manage future load growth and changes in load shape from EVs, we consider the following questions:

- Does the utility offer time-varying rates for EV charging?
- Do they offer fleet or commercial rates?
- Do they offer reduced demand charges?
- Do they have a managed charging program?
- Are there different rates based on charger type?

Incentives*:* Accelerating TE will require significant expenditures to transform the transportation system and subsidize expensive, upfront investments. The primary way utilities are advancing TE is through direct spending on charging infrastructure and EVs, but incentives can vary widely in amount and application. PUCs also differ in how much

involvement they allow utilities and how much is left to the private market or taxpayer-funded programs; this is evident in the size and types of incentives approved. Figure 1 below provides further explanation regarding incentives. Some of the research questions for this category are

- Does the utility offer incentives for EV purchases?
- Do they have incentives for charging equipment?
- Do they have a make-ready program?
- Do they have a utility-owned EVSE program?

***Equity**:* Incorporating equity into TE planning is critical to ensure that all communities benefit from investments and that communities are prioritized that have historically borne a disproportionate burden of transportation externalities. Low-income and historically marginalized communities, including majority Black, Latino, and immigrant communities, can benefit in various ways from utility investment in TE: cleaner air, more affordable transportation options, and economic growth and development, among others. However, if TE is carried out without regard to equity, it can exacerbate existing inequities by placing infrastructure and investment out of reach of communities that need them the most. Utilities often make large, long-term investments, and it is important that equity is woven throughout to ensure that (1) underserved communities are not left behind as our transportation system electrifies and (2) these investments respond directly to community-identified needs and challenges. There are many ways to do this, including focusing investments on underserved communities or on use cases that target benefits to these communities, such as transit. Some of the research questions for this criterion are

- What definitions does the utility use in addressing equity?
- How much funding is dedicated for equity?
- What equity-focused programs are offered?
- Is the utility meaningfully engaging with local, underserved communities?

***Education and Marketing**:* Educating customers and the public can be crucial to the success of utility TE programs. Many customers are unaware of the basics of TE and what support utilities can offer. Utilities can also leverage their strong name recognition and brand power in their territory to advance TE. They already have education and marketing experience with energy efficiency that they can apply to TE. However, education around TE is still a new field for utilities. Practices vary, as do approaches of regulators, including whether ratepayer funding can be used for these efforts. Some of the research questions for this category are

- Does the utility have a comprehensive education plan?

- What audiences are they trying to reach?
- What methods are they using?
- Is the utility partnering with other TE stakeholders?

Metrics and Progress Reporting*:* It is crucial to track the progress of TE programs and evaluate if they made the expected impact on infrastructure development as well as market transformation, air quality, and transportation affordability. These programs can require substantial ratepayer funds, so PUCs and the public deserve to know if they have been effective. These programs are also critical to meeting wider state goals in TE, equity, air quality, and climate; progress should be measured against these goals. Tracking progress and reporting back to a PUC is generally required for all utility-approved programs, but the processes can vary. Regardless of process, it is important that the data are collected, shared, and cover a wide enough variety of metrics to guide PUC decisions and inform other stakeholders. Some of the research questions for this criterion are

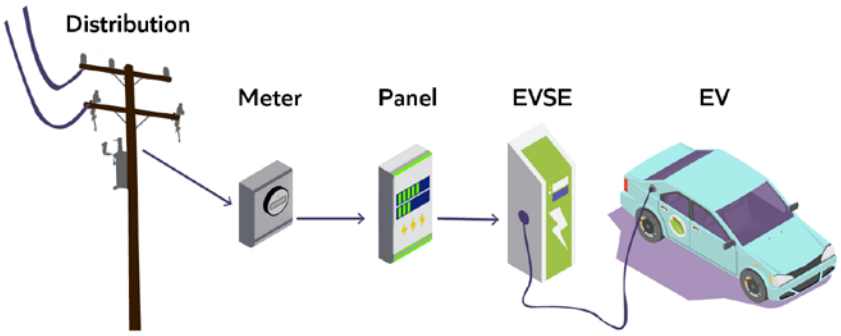
- In the TE plan, is there a section on metrics and performance indicators to track progress on EV programs? Is there a plan for how the utility will collect relevant data? Are metrics mentioned, and if so, who develops them?
- What metrics relate to implementation, direct outcomes, and indirect outcomes?
- Are there equity-specific metrics to track how investments are being directed and their impact on LMI communities and communities of color?
- Are there consequences to not meeting identified performance indicators?

System Planning*:* Utilities must plan for the profound grid impacts of widespread transportation electrification. To meet their energy, capacity, and ancillary service needs, utilities use various resource and system planning processes that fit their regulatory and market structures. It is critical to examine whether TE planning and overall grid impacts are integrated in these processes. Some research questions for this category are

- How does TE planning relate to overall system planning?
- Is TE planning coordinated with the relevant resource and system planning processes?

These criteria cover a wide variety of topics that utilities consider when planning their TE investments and that PUCs should examine when evaluating plans. While most of the criteria focus on the specific contents of program offerings, we also looked at the planning processes and formats, including their stated purpose and supporting programming like education and outreach. Different utilities have different capacities and programming budgets, but they can still learn from one another in areas such as customer education, stakeholder outreach, and metrics.

While these criteria generally incorporate all the information in utility TE plans, we also captured some information that was not included in our seven criteria, including state-specific requirements, economic and environmental analyses, and other unique efforts. We anticipated some heterogeneity but looked for common policies and planning strategies among the plans. There are a variety of utility approaches to planning for EV and EVSE deployment, as our findings below show.



	Utility service equipment	Site-specific equipment	EV service equipment
Traditional model (no incentive)	Utility owned	Customer owned	Customer owned
Make-ready	Utility owned	Utility owned	Customer owned
Utility owned	Utility owned	Utility owned	Utility owned
EVSE incentive	Utility owned	Customer owned	Subsidy

Figure 1. Utility EVSE investment types

SELECTION OF UTILITIES

We selected 11 utilities from across the country based on their geographic location and their progress in EV planning. We only looked at distribution utilities or the distribution system investments of vertically integrated utilities. We did not want more than one IOU represented from any particular state; as a result, we could not include a significant number of comprehensive TEPs[1], since they all came from the handful of states that require them. We only considered one TEP from each of these states and only three overall from Arizona,

[1] We define comprehensive transportation electrification plans as those that detail a utility's entire TE strategy and programming, not just one particular program, and are required to be submitted to a PUC, often resulting from a legislative requirement. They are usually resubmitted every 3–5 years to provide a progress update and state any changes to programming.

Washington, and Colorado. Since most states do not require their utilities to submit comprehensive TE plans, including many states with ambitious TE goals and utilities with billions of dollars of planned TE investments, we decided to consider other planning documents as well. For these other states, we selected utilities with planning documents that had a multi-year scope and with current and proposed programs that extend beyond pilots. We selected large utilities with some of the highest sales figures nationally, all spanning multiple municipalities except for Pepco DC. A map of utilities we looked at and overall levels of EV investment by state appear in figure 2 below.

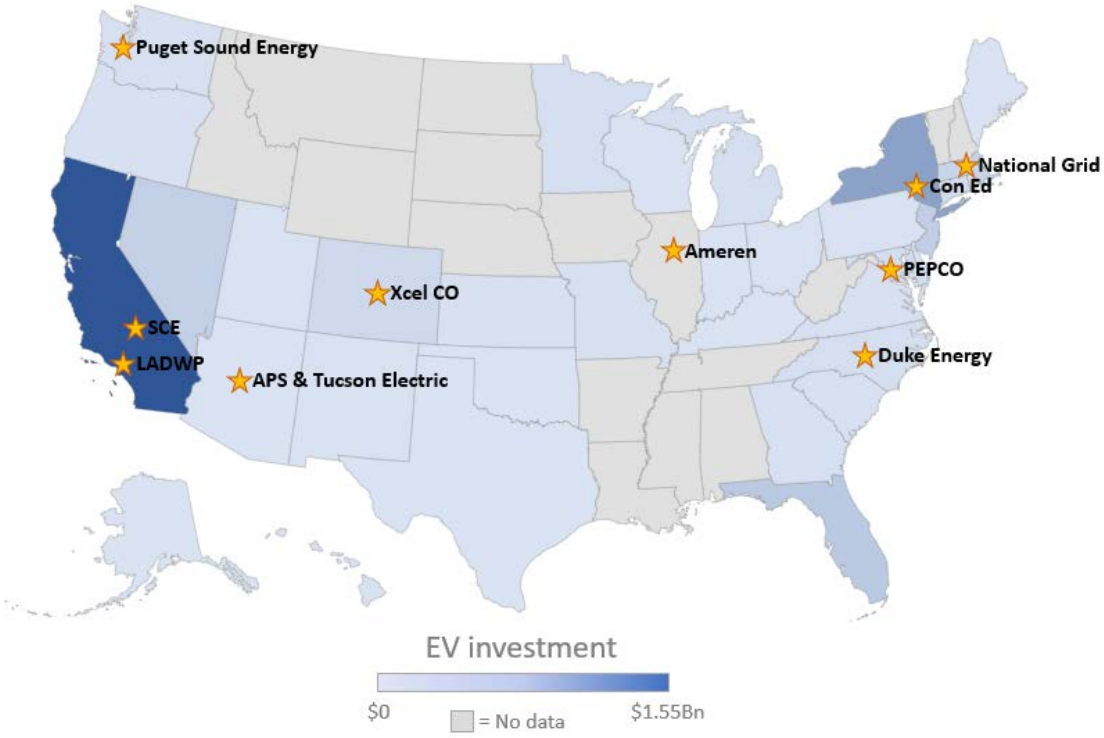


Figure 2. Map of utilities and EV investment. Sources: Data on approved EV investments by state from Atlas EV Hub (2022) and utility plans included in this review.

Municipally owned utilities are different from IOUs because they are regulated by cities instead of state-wide PUCs and do not generate profits for the benefit of investors. Many municipally owned utilities also engage with TE and may have different planning processes and requirements; we chose to include one, LADWP, for added context. We did not include co-op utilities, which are owned by their customers and frequently cover rural areas, because they are often small and have unique challenges and opportunities compared to IOUs. Table 2 below provides a full list of the utilities researched for this paper.

Table 2. Utilities researched[2]

Utility	State/City	Type of plan
Ameren	Illinois	Multiple TE filings[3]
Arizona Public Service and Tucson Electric Power Company	Arizona	Comprehensive TEP
Consolidated Edison	New York	Multiple TE filings
Duke Energy	North Carolina	Multiple TE filings
LADWP	California	Multiple TE filings
National Grid	Massachusetts	Multiple TE filings
Pepco	DC	Multiple TE filings
Puget Sound Energy	Washington	Comprehensive TEP
Southern California Edison	California	Multiple TE filings
Xcel Energy	Colorado	Comprehensive TEP

DATA COLLECTION

The primary data source used to conduct research into utility TE planning was Atlas Public Policy's EV Hub. The EV Hub includes links to utility plans, planning documents, filings, and investment information. This database, however, includes only filings to and final decisions from PUCs and only investments by investor-owned utilities. To fill in the remaining gaps, including for LADWP, our team sought out and researched PUC websites, press releases, and other official documents found through Internet research. We generally limited our search to filings and plans approved in 2019 and 2020 but included a few from earlier periods if plans were approved in multiple parts.

Findings

Our findings are organized into two categories: the planning process and format, and the program content of the plans. The plan formats and planning processes indicate what the plans are required to include, what the planning process looks like, and how these differ

[2] For utilities that operate in multiple states, we only examined the subsidiary in the state appearing in this table.

[3] Illinois's Climate and Equitable Jobs Act requires Ameren Illinois and Commonwealth Edison to file Beneficial Electrification Plans by July 1, 2022, that meet our definition of a comprehensive TEP but were submitted too late to be included in this report.

between utilities with comprehensive plans and those without. The findings related to content are organized by the seven criteria we selected and focus on each utility's TE programs to identify emerging practices.

COMPREHENSIVE TRANSPORTATION ELECTRIFICATION PLANS

The approaches states, PUCs, and utilities take to plan for EV growth are varied, but many common elements exist. Programmatic elements like the product and service offerings and TE needs served are fairly common across utilities and states, which face similar challenges when transitioning to electrified transportation. However, the nature of the planning process, including whether states or PUCs require comprehensive transportation electrification plans (TEPs) from their utilities, is inconsistent across the country. We generally define comprehensive TEPs as those that are required either by a state statute or PUC order and must lay out a utility's TE strategy, its various programs and offerings, its projections for TE in its territory, and potentially other elements such as an economic or environmental impact analysis or equity strategy. Utilities may also be required to submit updated versions periodically. These are much more thorough than documents submitted to a PUC for approval of a program.

Most states do not require comprehensive TEPs, including some of the states with the largest utility TE investments to date like California, New York, New Jersey, and Massachusetts (EV Hub 2022). States that do so are listed in table 1. These comprehensive plans can provide an opportunity for dialogue between states, utilities, local and regional transportation planning bodies, and other stakeholders over the role of utilities in advancing TE and supporting statewide goals. States that require these plans generally call for updates every 3–5 years, creating a consistent process by which utilities can revise the scope and design of their programming to meet new challenges and market conditions.

In general, the comprehensive plans we examined differed from the plans of utilities who submitted disparate, program-specific plans. These comprehensive plans often include a broader discussion of the role of the utility in supporting TE and associated state goals, like GHG emissions reduction and equity. All three of the comprehensive TEPs we evaluated have a section regarding the role of the utility, often described as its "vision" for programming and its "guiding principles." A common understanding of the utility's role and programming approach can provide greater clarity to all stakeholders on the activities that the utility will be involved in even as the landscape of TE evolves.

Example Utility: Puget Sound Energy

Puget Sound Energy (PSE) dedicated the first chapter of its TEP to the TE vision, which includes a thorough discussion of its six guiding principles: advancing clean mobility, customer focus, social equity and environmental justice, creating a resilient and modern grid, contributing to statewide carbon goals, and collaboration and partnership. PSE explicitly discusses the role it

should play in transforming the market and supporting customers who are electrifying, including providing educational resources and investing in charging infrastructure. The TEP highlights PSE's role in ensuring a clean and reliable grid as TE accelerates, stresses how they can and will address infrastructure gaps, further equity and inclusion, and think expansively about all the different customer segments. Supporting Washington State's ambitious TE goals is also emphasized. As the utility's first TEP, it sets out the overall strategic framework for programming and therefore puts greater emphasis on vision than programmatic specifications or budgets.

The comprehensive planning process also facilitates dialogue between regulators, utilities, planners, and other stakeholders like communities and NGOs by providing a centralized document on which everyone can comment. The joint Arizona TE plan, for example, is actually a two-part plan, submitted over the course of two years with the second phase incorporating stakeholder comments generated after approval of the first phase. This allows additional opportunities for incorporating public comments into the broader planning process. By providing a single document detailing a utility's role and plan for its TE programming, comprehensive plans may present better opportunities for stakeholder engagement.

Comprehensive plans go into much greater detail on aspects not directly related to the utility's TE programming. This includes discussions of the economic and environmental impact of TE as well as the state of the EV market. These discussions can provide context to understand the size and scope of the utility's plans, including how many EVs are expected (or desired based on state goals), how many chargers are therefore needed, and what demand on the grid will ensue. Discussing the environmental and economic benefits of TE can also help inform the public of the need for greater investment and use of ratepayer funding. These analyses are important for the utility's strategy and can also help inform the PUC in its activities. Other utilities we examined without comprehensive plans have discussed similar topics and projections as part of their filings but to a lesser extent. In addition, comprehensive plans are more likely to include a discussion of metrics to evaluate program success and include metrics on indirect benefits of their TE programs, like greenhouse gas emissions avoided and improved air quality.

FINDINGS BY CRITERIA

Our examination of the plans across the seven criteria highlighted in the methodology section are discussed below and detail the results from the questions presented above.

Coverage

Table 3 below describes the overall level of spending in the TE plans we evaluated as well as the time period over which the funds are allocated.

Table 3. Utility TE spending and time periods

Utility	Total spending on TE	Time period
Ameren	N/A (not specified)	N/A
Arizona Public Service and Tucson Electric Power Company	N/A (not specified)	2020–2030 (10 years)
Consolidated Edison	$338 million	2021–2025 (5 years)
Duke Energy	$25 million (approved) $56 million (pending)	2021–2024 (3 years)
LADWP	$80 million	2019–2021 (1 year)
National Grid	$338 million	(4 years)
Pepco DC	$15 million	2018–2022 (4 years)
Puget Sound Energy	$75 ~ $109 million	2021–2025 (4 years)
Southern California Edison	$436 million (light duty) $356.4 million (MHDV)	2021–2025 (LD) (4 years) 2021–2024 (MHDV) (3 years)
Xcel Energy	$108 million	2021–2023 (3 years)

Among all the planning documents we examined, most outline investments and programs for 3–5 years, with only a few having longer or unspecified time periods. This period of time is longer than what be expected for just a pilot program but not too long as to limit programmatic changes if warranted. Despite their relatively short time frames, many of these plans are still very large and ambitious. In general, the amount expected to be spent corresponds with the size of the utility's territory and the TE ambition of the state, PUC, or utility. The three largest programs we examined were from Southern California Edison (SCE), Consolidated Edison (ConEd) in New York, and National Grid in Massachusetts, ranging from $278 million to $436 million. These utilities are all the largest or second largest utilities in their respective states by number of customers, are among the biggest in the country overall, and are located in states with ambitious climate and TE goals (Relf et al. 2020).

The utilities we examined emphasize make-ready charger investments over investments in utility-owned chargers, and L2 charging over DCFC. Generally, utilities got approval to build or subsidize many more L2 chargers than DCFC. While this can partly be explained by the significantly lower costs of building an L2 charging station, greater dollar amounts in investment were generally approved for L2 as well. More utilities also have make-ready programs than utility-owned EVSE programs. Both utility-owned charging and DCFC investments are generally used for specific purposes, such as in utility-owned charging in multi-unit dwellings (MUDs) or DCFC for fleets, while L2 and make-ready investments have a wider variety of use cases. As a result, utilities' charger goals favor L2 chargers in most cases. However, although DCFC chargers can be considerably more expensive than L2 chargers,

utilities are still making large investments in DCFC, albeit by installing fewer ports. DCFC can serve certain EV use cases and charging scenarios more effectively than L2, such as fast charging at highway truck rest stops or for multi-use stations like those used by both the public and rideshare drivers.

The plans we analyzed also cover a wide variety of locations; almost all plans address charging needs in MUDs, single-family homes, workplaces, and in public spaces. Commercial fleet, transit, and other medium- and heavy-duty (MHD) vehicle charging are also identified as common needs to be addressed by programming among the plans examined. MUDs, in particular, are seen as an area in need of major investment given their greater challenges than single-family homes and the fact that most charging is expected to occur at home (Baldwin, Myers, and O'Boyle 2020). MUDs are often rental buildings where the owners may not have any incentive to invest in EV charging and the parking setup may make EV charger installation challenging. In general, policymakers, PUCs, and utilities see the need to direct resources toward these buildings.

Charging for heavier-duty vehicles, including transit and school buses, is more commonly addressed by utilities with larger investments in TE. Southern California Edison has focused extensively on heavier-duty vehicles with its Charge Ready Transport program. This make-ready program provides low or no-cost charging infrastructure to companies and other vehicle owners and aims to support the electrification of at least 8,490 medium- and heavy-duty vehicles. The program has specific carve outs for transit and port electrification as well as higher subsidies for transit and projects in disadvantaged communities (DACs). SCE's territory includes one of the largest ports in the United States, the port of Long Beach, as well as the major logistical hub in the Inland Empire region of California. This, along with California's ambitious electrification goals, helps explain the emphasis on medium- and heavy-duty programming at the utility.

However, as shown in table 4, about half the plans detailed fleet advisory services for both light- and heavy-duty fleets. A common element are fleet assessments, which give fleet operators an idea of what electrification would cost in terms of infrastructure investments and ongoing vehicle charging as well as determining if current facilities require upgrades to handle the necessary load. These services help fleet operators understand the business case for electrifying and the investments and special rates the utility could offer. A few utilities also offer solutions specifically geared toward certain fleet operators, like transit agencies, or in certain locations, like underserved communities.

Table 4. Utility fleet advisory services

Utility	Have fleet advisory service?
Ameren	-
Arizona Public Service and Tucson Electric Power Company	Yes, fleet charging pilot and developing a commercial EV rate

Utility	Have fleet advisory service?
Consolidated Edison	Yes, provide fleet assessments with site feasibility studies and tailored rates
Duke Energy	Proposed
LADWP	-
National Grid	Yes
Pepco DC	-
Puget Sound Energy	Yes, including turnkey options for disadvantaged communities and schools; commercial fleet pilot as well
Southern California Edison	Yes, being expanded to include light-, medium-, and heavy-duty vehicles; also includes fleet assessments, site feasibility studies, demonstrations, and assistance with grant writing and other general support
Xcel Energy	Yes, company-owned EVSE for workplaces and fleets, income-qualified rebates, and small commercial solutions

Example Utility: Xcel Colorado Fleet Services

Within the $108 million, three-year TE Plan from Xcel Energy Colorado, the utility has earmarked approximately $50 million for commercial charging infrastructure to support fleets, including light-, medium-, and/or heavy-duty fleets; workplace charging; and public charging. The company expects to install close to 3,000 commercial L2 chargers, with ~380 of those chargers in locations that serve low-income customers, such as public charging depots or businesses in income-qualified communities. The utility also expects to install 200 DCFC chargers along transit corridors and at designated public charging hubs. These make-ready projects may be installed at any eligible site at no cost to the current property owner. The site owner has the option to procure their own charging equipment from a list of prequalified vendors provided by Xcel Energy. The utility will install, own, and maintain all of the service equipment on the utility side of the charging station.

In addition to the company's incentives for commercial EV charging, Xcel also provides a range of advisory services on the residential, commercial, and community levels to support a broad

and comprehensive electrification plan. The fleet advisory service uses telematics data to identify which vehicles in a fleet are best suited for electrification, helps business owners find effective infrastructure locations, and offers advice on rates and charging. These advisory services have a total budget of $13 million and are a core aspect of the company's 2021–2023 outreach and marketing plan. The utility plans to conduct 100 total fleet assessments over that time period.

EV Rates and Managed Charging

For the United States to reach its adoption targets for electric vehicles, a large percentage of vehicles hitting the road in the coming decades will need to be electric. This will have substantial impacts on the power grid. Electric vehicle charging is already one of the fastest-growing areas of electric load. This load, however, is flexible, and appropriate incentives can encourage charging at times that minimize both greenhouse gas emissions and power grid impacts. Rather than burdening the grid, EVs have the potential to be an asset in reducing emissions and meeting utility and state GHG goals.

Increasing electrification directly affects how utilities provide services and make money through rates charged to their customers. EVs represent a customer class that can become a major source of new revenue for utilities, particularly those that have seen a decline in kWh sales due to customer-side energy efficiency and distributed generation. New revenue from electricity sales to EV owners can be returned to utility customers in the form of lower rates and bills, particularly in states where regulators have enacted *revenue decoupling*, which separates utility revenues from total kWh sales (NRDC 2020). However, this is only the case if EVs do not significantly increase peak demand on the electric grid. If electric vehicles are charging during the 1–2 hours of highest demand in the day, utilities might have to build out more power generation and supply infrastructure, contributing to increased costs and GHG emissions. By proactively managing this growing EV load through specialized customer rates and smart charging, utilities can mitigate the impact of EVs on the power grid and even potentially leverage EV charging as a grid resource.

Smart charging incentives can encourage EV owners to charge their vehicles during hours of the day when carbon-free energy is abundant, such as midday to take advantage of solar energy, or when overall system demand is low, such as after midnight. Using more of the grid's excess energy capacity makes the entire system more efficient, and potentially drives down costs for all customers (PNNL 2020). A specialized electricity rate or rates provide a financial incentive for customers to charge more cheaply off-peak and/or when grid emissions are lowest. Managed charging goes a step beyond incentives, allowing the utility or a third party to strategically enable or interrupt charging across many vehicles. When implemented at scale, this effectively allows a vehicle fleet to function as a virtual power plant and provide additional reliability on the grid. Through strategic rate design and

managed charging, utilities accommodate more EVs on existing grid infrastructure and delay or forestall the need to build out more supply-side infrastructure to meet rising demand.

Time-Varying Rates

Almost all the utilities we examined offer some form of time-varying rate, often time-of-use (TOU) rates, which include lower costs to charge during off-peak times and higher costs on-peak. The structure of these rates can vary, with most utilities we looked at offering models consisting of two rates for on-peak and off-peak hours, while a few include three or more time periods such as a "super-off-peak" rate. Seasonal variation in pricing is common, since many grid regions experience peak demand during particular months of the year. While incentives are usually based on a lower price per kWh, some utilities such as Con Ed and Ameren IL utilize bill credits and other incentives to encourage off-peak charging. Most if not all EV rates involve voluntary participation with the option for customers to opt in or out at will. Figure 3 shows how two of the utilities (Xcel CO and Ameren IL) approach TOU rate structures for EV customers.

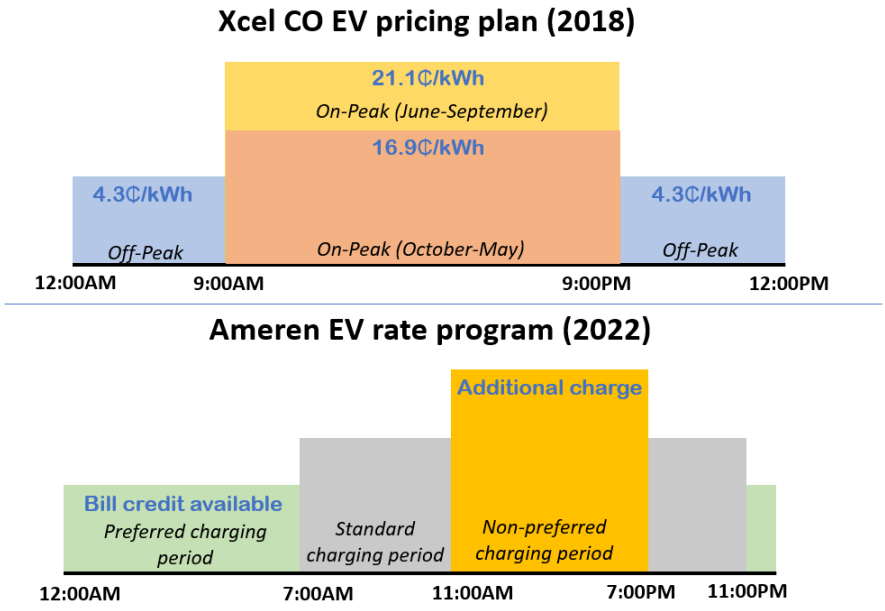


Figure 3. Time-varying EV rates for Xcel CO and Ameren IL customers.
Sources: Xcel Energy 2018; Ameren IL 2022.

DCFC Rates

DC fast charging draws a large amount of power from the grid in a short amount of time, resulting in an irregular and inconsistent power demand for many DCFC stations. This can contribute to extremely high costs for DCFC operators who are responsible for paying the

demand charge[4] based on EV customers utilizing their public charging infrastructure. This charge can quickly make DCFC cost prohibitive for small- and mid-sized businesses; a demand-based charge can sometimes account for up to 81% of the station's total electricity cost (McFarlane and Prorok 2019). DCFC is especially costly for businesses that offer fast charging services in areas with low charger utilization. In regions where regulators have an interest in expanding private ownership of fast-charging infrastructure, they may permit or encourage utilities to offer a special electric rate or other operating cost relief mechanism that reduces or removes the demand charge for DCFC stations. A few utilities we examined mention DCFC-enabling rates in their TE plans and/or associated documents. Of the utilities we examined, Xcel CO and Ameren IL offer some form of DCFC-enabling rate and National Grid MA proposes offering one. Consolidated Edison offers operating incentives to eligible DCFC chargers. In general, utilities are still in the exploratory phase when it comes to alternative rate structures.

Managed Charging

Managed charging, or "smart" charging for L2, is another tool that utilities and third-party companies can provide to optimize EV charging as a grid resource. These programs are generally proposed or offered to customers (usually as a condition for receiving other EVSE incentives) in the form of a device or software that sits between the charger and the vehicle, or an automated service built into the charging equipment itself. This service can enable or curtail EV charging automatically in response to signals sent by the program manager or grid operator. Rather than relying on EV owners to charge in response to a price signal, managed charging programs do it for them automatically. Especially when combined with a TOU rate, managed charging programs can deliver savings to the consumer and peace of mind to the grid operator. Currently, the application of managed charging is limited among the utilities we examined, with only two, Xcel CO and National Grid MA, offering smart charging programs. Other utilities, such as Puget Sound Energy, Duke Energy NC, and Ameren IL have proposed or indicated an interest in piloting such a program but are still awaiting approval.

We looked at the approaches various utilities take to offering specialized rates or programs to encourage smart EV charging, as described in table 5.

Table 5. Time-varying rates for EV charging

[4] A demand charge is a fee incurred on a utility bill based on the highest level of kW demand placed on the grid. Because DCFC draws a high amount of power from the grid in short bursts of 3–40 minutes, it places significantly higher demand on the grid than low-power charging options.

Utility	L2 EV time-of-use rate	DCFC-enabling rate	Managed charging program
Ameren	Yes	Yes	Proposed
Arizona Public Service and Tucson Electric Power Company	Yes	Yes	-
Consolidated Edison	Yes	Yes	-
Duke Energy	Proposed	-	Proposed
LADWP	Yes	-	No
National Grid	Yes	Proposed	Yes
Pepco DC	Yes	-	-
Puget Sound Energy	Proposed	-	Proposed
Southern California Edison	Yes	-	-
Xcel Energy	Yes	Yes	Yes

Incentives for EVs and EVSE

The cost to purchase an electric vehicle and install the necessary EV Service Equipment (EVSE), including wiring and service upgrades, can be a major barrier that utilities seek to overcome by offering incentives to their customers. We categorize these incentives into four main types: incentives for EV purchases, incentives for EV chargers, make-ready incentives for pre-wiring an EV charging site, and utility-owned EV charging stations. Table 6 describes which utilities offer or propose incentives in their TE plans and other documents.

Table 6. Incentives for EVs, EV chargers, make-ready, and utility-owned chargers

Utility	EV purchase	Charger	Make-ready	Utility-owned EVSE
Ameren	-	-	-	-
Arizona Public Service and Tucson Electric Power Company	No—incentives are being developed in conjunction with dealerships as part of Phase II planning	No—incentives are being developed as part of Phase II planning	No—EV Infrastructure Working Group identified make-ready planning as important	-
Consolidated Edison	-	-	Yes—50–100% of costs for workplaces, public parking, commercial sites,	-

Utility	EV purchase	Charger	Make-ready	Utility-owned EVSE
			MUDs, and sites in DACs	
Duke Energy	-	No—proposed at $1,000 per L2 charger	Yes—credits for a portion of the cost of new or upgraded electric service to support EVs	Yes— 160 public L2, 40 DCFC
LADWP	Yes—$2.6 million allocated for used EV purchase incentives	Yes—up to $4,000 per L2 charging station (+$1,000 for DACs); up to $75,000 per DCFC; up to $125,000 per MHD station	-	-
National Grid	-	For environmental justice communities (EJCs), 100% of installation costs are covered for L2 ports. For municipal properties, other public properties, and workplace properties, 50% of installation costs are covered. Up to $40,000/DCFC port rebate is available with max site incentive of $400,000.	Yes—stipend to support 4 years of networking at $480/port for public, L2 chargers and any EJC L2 chargers, and full cost of installation (up to $4,000) rebate for EVSE make-ready in EJCs	-
Pepco DC	-	Yes—$300 for residential L2	Yes—for MUDs, Low- and Moderate-Income (LMI) areas, public parking	Yes—public charging
Puget Sound Energy	Yes – Equity Pilot	-	Yes	Yes—MUDs, public charging, commercial
Southern California Edison	Yes	–	Yes—workplace, MUDs, public charging and fleets, up to $2,000 per L2; up to $27,000 per	Yes—in MUDs, DACs, parking structures, and on-street, up to 50% of costs in DACs or

Utility	EV purchase	Charger	Make-ready	Utility-owned EVSE
			DCFC, up to 100% of cost for MUD/DAC sites, and up to 80% for other sites	for transit and other buses
Xcel Energy	Yes—$5,500 for new EVs, $3,000 for lease	Yes—$500 for residential, $2,300 for LMI; includes wiring and EVSE. Also, commercial incentives with $50 million allocated to support 2,000 charging ports	Yes—for MUDs, including distribution upgrades, panel, conduit, wiring	Yes—residential program with no upfront cost. Options for bring-your-own EVSE and customer-owned.

EV Purchase Incentives

Four out of the 10 utilities offer some form of incentive to customers for purchasing an EV, including incentives that are limited to certain beneficiaries like community-based organizations and cases where state dollars are used, such as from a low-carbon fuel standard, but the program is administered by the utility. Given the large secondary market for vehicles including EVs, LADWP offers a used-EV incentive. Xcel Colorado offers both purchase and leasing incentives for EVs, as well as mentions partnerships with dealerships within the utility's education and marketing plan.

EV Charger Incentives

Incentives for the charger itself—that is, the plug and user interface that the customer directly accesses to charge their vehicle—are also offered by about half of the utilities we examined. The majority of other incentives are rebates based on proof of purchase of the charger and may include a higher level of incentive for certain classes of customers, such as low-income and MUDs. DCFC incentives, where offered, were quite high ($27,000–75,000) because of the specialized equipment and infrastructure costs associated with fast charging service.

Make-Ready Incentives

Make-ready incentives provide rebates for everything up to the EV charger: electric panel upgrades, wiring, and distribution service upgrades (where needed). Seven of the 10 utilities we looked at have a make-ready program that covers all or a portion of these costs for their consumers. Make-ready programs may target specific types of customers or charging environments, including MUDs, low-income communities, fleets, workplaces, destination centers, and other public spaces. A few specified different coverage rates, or how much of the make-ready cost they would cover for the customer. Higher coverage rates were often reserved for higher-need customer segments such as MUDs or underserved communities.

Utility-Owned EV Chargers

Where regulators permit utilities to build and operate their own EV service stations, some of the utilities include these in their TE plans. In some ways utilities are very well-suited to provide EV charging services directly to customers: They have the expertise to operate these systems, they have access to public infrastructure (e.g., power poles and street lamps) for ease of siting chargers, and they have their own engineers to install and maintain the equipment. However, it is precisely these advantages, as well as the ability to recover costs from ratepayers, which have led some regulators in states like Massachusetts and New York to generally prohibit utility ownership of EVSE, citing competitiveness concerns with private companies who would be undercut by a monopoly utility. As a result, many utility-owned public charger programs are focused on sectors less likely to be served by the competitive market, such as MUDs, low-income areas, and rural service areas.

Equity in Transportation Electrification Planning

Transportation electrification represents a major opportunity to address long-standing inequities in our energy and transportation systems by providing mobility, investment, and environmental justice solutions to historically marginalized groups and communities. However, this transition may also have adverse effects on the most vulnerable members of our society, such as through rising upfront vehicle costs or unequal distribution of investments and incentives. The importance and time-sensitive nature of building a more equitable transportation and power system mean that nearly all TE plans address the issue of equity in some way. Table 7 describes the various approaches to defining equity and allocating funds, targets, and programs to these vital communities.

Table 7. Approaches to equity in TE plans

Utility	Definition of equity focus	Equity carve-out in program spending?	Pilot programs?	Community engagement plan?
Ameren	-	-	-	-
Arizona Public Service and Tucson Electric Power Company	Disadvantaged community (DAC) and low-income community (LIC) defined by state	-	-	
Consolidated Edison	DAC (defined by state)	Up to 20% of $233 million can be used to fund up to 100% make-ready costs of DAC projects	-	-
Duke Energy	Low- and moderate-income communities	-	-	-

Utility	Definition of equity focus	Equity carve-out in program spending?	Pilot programs?	Community engagement plan?
LADWP	DAC (defined by state)	40% of public charging stations located in DACs	-	-
National Grid	Environmental justice communities (EJ/EJC)	10% of residential ports by 2025 to be placed in EJ communities; 20% of public ports; commitment of 20 DCFC in 10 EJCs. 40% of fleet make-ready ports in EJCs. There are also 300 EJC school bus cost rebates (~$175,000/bus)	Pole-mounted EVSE in 5 EJ communities (4-year pilot)	Engagement with MUD site hosts, Community Action Program agencies, and EJC stakeholders
Pepco DC	-	-	-	-
Puget Sound Energy	Low-income, disadvantaged, Black, Indigenous, and people of color	25–30% spending carve-out: 30% of MUD chargers, 50% of utility-owned public chargers, 40% of commercial/fleet spending, 30% of education/outreach spending in DACs	Yes, including providing transportation and EV funding for a local community group	Yes—various channels, equity advisory group, co-creating pilots with communities
Southern California Edison	DAC (defined by state)	50% of spending, 40% of fleets, 50% of make-ready ports, 50% of ports in new construction, at least 15% of all make-ready ports in MUDs in DACs	-	Input from community-based organizations on siting for DCFC; outreach with community and faith-based organizations to communicate with disadvantaged/LMI customers

Utility	Definition of equity focus	Equity carve-out in program spending?	Pilot programs?	Community engagement plan?
Xcel Energy	Income-qualified, based on enrollment in utility or state needs-based programs and/or household income below 60% state median and/or 200% federal poverty level	$21.5 million over 3 years (~23% of total budget)	EV School Bus Program	Utility will participate in community and industry events to engage relevant audiences and promote education and access to TEP benefits

Equity concerns in TE programming are addressed in some form by all but two utilities. Among those that did, definitions of the communities that could benefit from greater transportation electrification varied, with all including some consideration of socioeconomic status and most including another factor such as environmental pollution burden or race. Often these definitions are based on state definitions established for the purpose of directing climate, energy, or economic development funding toward communities in need or those experiencing the greatest historical environmental pollution burden. Many of the utilities have also dedicated to these communities a portion of their investment dollars or a portion of the chargers they plan to install, often in the range of 20–40%. Some of the utilities offer higher investment levels for customers in underserved communities or have programs specifically dedicated to these communities. Charging for MUD residents in underserved communities was a common focus, given that these communities often have a higher proportion of residents living in MUDs.

Engaging underserved communities is important to improve the success of TE programs and many of the utilities plan on doing so. However, these plans often focus on general education and outreach, with only some soliciting feedback on programming from community groups. In general, the plans are lighter on specifics as to how this engagement would be accomplished, what groups would be targeted for outreach, and what feedback would be most beneficial.

Education and Marketing for EV Services

As electric vehicles currently represent a relatively small percentage of the nationwide vehicle fleet, educating the public about program offerings and the benefits of EVs is crucial to ensure uptake and scale transportation electrification into the mainstream. Many utilities see education as a core component of their efforts to incentivize, optimize, and equitably deliver TE services to their customers. Table 8 describes the public education, outreach, and marketing approaches from the utilities we examined.

Table 8. Utility marketing and outreach efforts for TE

Utility	Comprehensive education plan detailed?	Targets mentioned for education/outreach?	Stakeholder partnerships?
Ameren	Yes—EV awareness, charging rate program information, consumer guides for EV charging	No specific audiences identified	-
Arizona Public Service and Tucson Electric Power Company	Yes—Subsection 5.3.3 mentions EV awareness materials, rate charging education, technical training and assistance	Residential and commercial customers, dealerships, state and local agencies	State offices, automakers, and transit agencies
Consolidated Edison	Yes—site and business guidance, program eligibility, social media and email campaigns, industry events	Large customers, commercial developers, governments, and DACs	Businesses, governments
Duke Energy	-	-	-
LADWP	No, but multiple strategies exist	Consumers, city agencies, DACs	Collaboration with public charging station operators, EVSE installers, mayor's office, sister city agencies, permitting agencies (Bureau of Engineering, LA Department of Building and Safety, LA Department of Transportation)
National Grid	No, but forthcoming	Customers, EJ/LI customers, hard to reach/underserved communities	Dealerships, state agencies, municipalities, community orgs, and local non-profits
Pepco DC	Yes	Residents, local businesses	Publicly accessible properties
Puget Sound Energy	Yes	Light-duty vehicle/residential customers, commercial	Dealerships and low-income and

Utility	Comprehensive education plan detailed?	Targets mentioned for education/outreach?	Stakeholder partnerships?
		and fleet operators; did outreach with 20 nonprofits, government agencies, community service organizations, and private mobility organizations	disadvantaged communities
Southern California Edison	Yes	Industry stakeholders (dealerships, architects and developers)	Preexisting TE advisory board
Xcel Energy	Yes	Residential, multifamily, fleets, communities, dealerships, electricians/workforce	Dealerships, electricians, fleet managers, communities

While the educational programs for a few utilities are limited to general marketing, many utilities have more comprehensive plans with mentions of specific target audiences, including community-based organizations, dealerships, state and local governments, industry stakeholders, developers and building managers, and customers in underserved communities. Common education efforts include general marketing, website updates, and social media campaigns. A few utilities plan to go further with ride-and-drive events or partnerships with dealerships, such as Xcel Energy reaching out to dealerships and providing training and education for sales staff about the benefits of EVs and Xcel's offerings.

Example Utility: Arizona Public Service and Tucson Electric Power Company

Chapter 6 of the Arizona transportation electrification plan outlines initiatives for EV education and outreach. Several programs are already in place, including a multimedia marketing and promotion campaign for EVs, the online EV Infrastructure Cost Estimation Tool, and the Residential EV Calculator, which is designed to aid Arizonans in better understanding the cost savings potential and total cost of ownership of EVs. Businesses and larger organizations can use a Fleet Conversion Planning Tool to project the upfront costs, environmental benefits, long-term savings, and returns on investment when converting to an EV fleet. In-person community events are also part of the planned education and outreach strategy. While many of these meetings have been postponed or cancelled due to COVID, they are still an important component of the utilities' education

programs and more are planned for the future in partnership with dealerships, schools, and business and community organizations across the state.

Metrics

Most utilities mention metrics they plan on tracking and reporting to regulators. However, we did not find instances of consequences for meeting certain targets, including utility or statewide TE, climate, or air quality goals. Implementation-related metrics, such as number of chargers installed, applications filed, dollars spent, and cost per port, are much more common than metrics related to outcomes. About half of the utilities have some metrics related to direct outcomes, such as total kWh for EV charging, number and length of charging sessions, peak versus off-peak charging, and customer satisfaction. These metrics are often included because they are required by statute or by the PUC and generally serve to increase transparency and inform the PUC and other stakeholders of program success. They also support updating the programming over time to adjust for implementation issues and changes in the TE market. Some utilities also track indirect benefits, with four tracking CO_2 abatement (Puget Sound Energy, Arizona Public Service/Tucson Electric Power Company, Xcel Colorado, and National Grid Massachusetts) and three tracking air pollutant abatement, largely NO_x and ozone, from increased electrification. Many of these utilities also mention statewide climate or EV goals that are connected to these indirect benefit metrics.

Utilities largely appear to be using metrics for reporting purposes, although performance on some of these metrics will likely influence future program filings and planning. No utility states a direct consequence for not meeting certain internal or statewide goals, although program outcomes will likely be assessed by regulators. For example, Xcel Colorado's TE plan, in addition to monitoring the number of EVs and charging stations deployed within the utility's service area, also includes transparency metrics such as the impact of programs on utility rates, utilization levels of installed charging equipment, peak demand impacts from EV charging, actual costs of EV-related projects, anonymized data on customers and vendors involved in utility incentive programs, and more. These metrics will be accounted by an independent third-party evaluator and published semi-annually for the sake of accountability and improvement.

Equity-related metrics are very limited, with some simply tracking how much investment occurred or how many chargers were installed in underserved communities or to LMI customers. Only one utility, Puget Sound Energy, mentions more indirect or long-term benefits to underserved communities from these programs, though specifics are lacking.

System Planning

The growth in EVs is expected to significantly increase the demand for electricity and potentially stress the grid in capacity-constrained areas. Utilities will need to plan for these changes to ensure reliable service. However, among the utilities we examined, only a few

discuss how they will integrate EVs into their general system planning efforts; of course, EVs might have been considered in system planning documents that we did not examine. To the extent system planning was mentioned, it was generally in regard to managed charging or TOU rates—that is, different ways to shift charging demand to optimal times from a grid standpoint. A few utilities also mentioned shifting loads to times when renewable energy resources were more available to reduce greenhouse gas emissions.

Emerging Trends and Recommendations

Transportation electrification is an emerging field for utilities; practices and programs that utilities are undertaking vary considerably across the nation. However, we can see some emerging trends in certain areas where many or sometimes all the utilities whose plans we reviewed have similar TE programs on the books. These trends could be emerging due to the need to address common TE challenges or because regulators are coalescing around a similar philosophy regarding the role of utilities in the transition to electrified transportation. The following trends, which we identified among the utilities we examined, shed a light on what programs utilities are undertaking, how they fit into the larger TE transition, and what TE issues are most often addressed.

- L2 and make-ready investments are getting greater levels of support than DCFC and utility-owned EVSE investments.
- A wide variety of TE use cases and charging infrastructure are being invested in, with MUD investments a major focus.
- Make-ready investments are the most common incentive program offered; many are tailored to a specific TE use case like MUDs.
- Fleet investments and advisory services are also being provided by many utilities.
- Time-of-use rates are very common, with other managed charging programs being considered.
- Equity is addressed by almost all utilities but approaches vary. Many utilities set aside money for underserved communities, although definitions for these communities are inconsistent and plans for engaging with them are also limited.
- Education is frequently a priority. Many utilities mention partnering with dealerships to facilitate incentives and prepare them for selling more EVs by providing expertise and charging infrastructure.

A summary of the plans that include certain emerging trends is exhibited in table 9.

Table 9. Select emerging trends in utilities

Utility	Make-ready program	Targeting MUDs	Fleet advisory service	TOU rate	Equity carve-out
Ameren	-	-	-	Yes	-
Arizona Public Service and Tucson Electric Power Company	-	Yes	Yes	Yes	-
Consolidated Edison	Yes	Yes	Yes	Yes	Yes
Duke Energy	Yes	Yes	Proposed	Proposed	-
LADWP	-	-	-	Yes	Yes
National Grid	Yes	Yes	Yes	Yes	Yes
Pepco DC	Yes	Yes	-	Yes	-
Puget Sound Energy	Yes	Yes	Yes	Proposed	Yes
Southern California Edison	Yes	Yes	Yes	Yes	Yes
Xcel Energy	Yes	Yes	Yes	Yes	Yes

While many of the utilities we examined have laudable goals and plans to achieve them, others are lacking in certain areas; no plan was without room for improvement. Transportation electrification is a complicated process that requires thorough planning and a multifaceted approach. Utilities should also be ensuring that these processes are equitable and that progress toward goals is tracked. Our main recommendations to improve these plans in ways we consider vital to success are as follows:

- Utility planning efforts need to be transparent and consistent to help ensure accountability.
- The planning process should be ongoing, involving periodic plan submissions that give updates on progress and allow input from regulators and the public.
- Planning efforts should cover all TE use cases, including passenger vehicles, trucks and other heavier classes of vehicles, transit, micro-mobility, and rideshare vehicles.
- Equity must be integrated throughout to ensure that everyone benefits from the TE transition. Underserved communities must be meaningfully engaged early and often to identify these community's needs.

- Utilities should develop metrics and goals related to infrastructure development while also considering a wide variety of outcomes, including those related to greenhouse gas emissions, air quality, and equity.

Although state legislatures and utility commissions are still developing the utility transportation electrification planning process, some key elements should always be included. Assuring a high degree of coordination among stakeholders, accountability for utilities, and the inclusion of equity and educational programming will all help ensure these investments effectively use ratepayer funds to achieve their stated societal benefits. These elements can also help ensure that utility actions work in concert with state and local transportation and climate goals.

Achieving widespread transportation electrification will require an all-hands-on-deck effort by stakeholders, including utilities. Utilities not only need to support the transition by accommodating millions of new EVs on the grid, but they have also demonstrated that they have a role in accelerating the transition with new TE investments. Utilities will crucially need to plan for these large-scale changes and investments to ensure accountability and effective use of ratepayer funds. As we have seen, planning can take many forms, including in a few cases comprehensive plans that detail all aspects of a utility's involvement and are periodically updated as the market and investments change. Other utilities detail their plans in discreet documents submitted to regulators that can provide much of the same information but may present less clearly the entirety of their efforts.

Both processes are valuable for regulators, public advocates, and other stakeholders, although comprehensive plans more effectively support accountability and facilitate public discussion around a central document. Policymakers should ensure that regardless of the exact process, utility planning efforts are transparent and consistent to help ensure accountability. This could involve a single document like the comprehensive plans we analyzed or a single docket where multiple documents are collected for ease of examination. The planning process should also be ongoing, involving periodic plan submissions that give updates on progress and allow for input from regulators and the public. Through this process, utilities can express their strategic vision for TE and regulators and the public can respond. Utilities have been approved for billions of dollars in investments over the next decade and need to spend that money wisely to maximize public benefits. States and PUCs must ensure that the planning process is transparent and creates a space for dialogue with the public and advocacy groups.

The transportation sector is more than just passenger vehicles. Utilities should be prepared for and invest in the transition of the entire sector, including freight trucks large and small, transit buses that provide an alternative to cars and are an affordable option for many, and rideshare and taxi services, which have unique infrastructure needs compared to personal vehicles. Investments in electrifying the sector should also account for the transportation needs of all people and address historical inequities. The TE transition is an opportunity to improve mobility options, lower transportation costs, and reduce pollution in heavily polluted communities, especially low-income and communities of color—but only if equity is

built into plans from the beginning. Equity should also involve including community voices in the process and working with many stakeholders when designing, implementing, and evaluating programs. Utilities are starting to incorporate equity and engage communities, but these efforts have considerable room for improvement (see Huether 2021).

Metrics and tracking progress are also crucial to ensure plans actually become outcomes. States and utilities alike have ambitious goals for climate emissions and air pollution reduction, but utilities should improve the ways they assess if they are meeting those goals. All utilities should be tracking direct and indirect outcome metrics, including how they impact underserved communities, and assessing these metrics against their TE goals. Improved metric development and tracking can also improve the regulatory and public oversight of these TE plans.

Conclusion

While the format and content of plans may differ, utilities are tackling similar TE issues and therefore have proposed similar programs in many respects. Through our analysis of the plans using our seven key criteria, we found emerging trends and similarities across a diverse set of utilities. These findings can help states and utility commissions think about potential TE investments in their states, allow utilities to learn from what their peers are planning, and inform other stakeholders about the role of utilities in the TE transition.

Common priorities include the need to accelerate adoption of EVs, ensure adequate charging infrastructure, set appropriate rates and manage stress on the grid, and educate the public about the benefits of TE. The size and scope of the programs generally depend on the utilities' ambitions as well as the goals of their state or PUC. Many of the largest programs are in states with legislated climate or TE goals, although utility TE programs exist in less ambitious states as well. We recommend that plans be transparent and periodically updated, address a wide variety of TE use cases, focus on delivering equitable outcomes, and use metrics to track progress toward their goals. The transition to electrified transportation is a large undertaking but with improved planning, utilities can not only support the transition but help lead the way.

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