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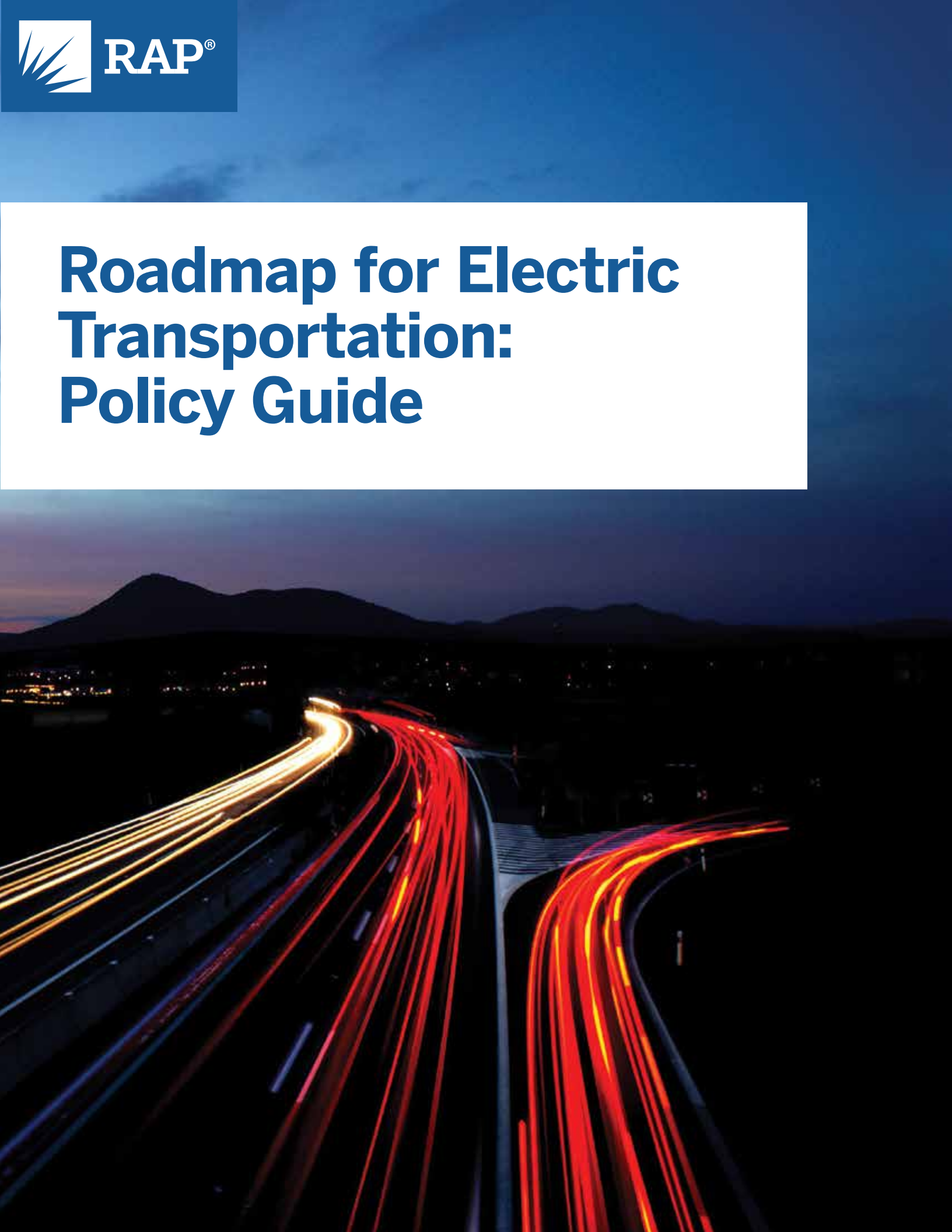
# Roadmap for Electric Transportation: Policy Guide



## Legal disclaimer

Model legislation builds upon the best practices seen in current state legislation and looks to the future for improvements to existing laws. Each model legislative option found in this kit is a starting point for legislators and interested stakeholders. The model legislative provisions are intended to be modified to the particularities of state legal systems and administrative cultures.

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## Links to other websites

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# How to Use This Legislative Kit

Many state legislators are trying to understand how transportation electrification can benefit their state. Staff at the Regulatory Assistance Project have scoured state legislative and regulatory experience to assemble a complete and useful resource for legislators interested in accelerating electric vehicle deployment. The kit includes this policy guide, as well as a set of model legislative options with annotations noting their implications, a fact sheet and presentation slides.

This guide and the model legislation also anticipate many new questions. Users should expect there will be questions and issues that go beyond those contemplated here, as that is the nature of innovation.

## Policy Guide

The full kit begins with this policy guide providing a general overview of transportation electrification. This guide provides legislators and their staff members an overview of electric vehicle issues and options. It begins with a look at the merits of such legislation to answer the all-important question: "Why?" From there this resource outlines the "what" and "how" of the many issues and options. Armed with this, legislators and staff can dig into the detailed model legislation and supporting resources to craft a plan for electrification that saves consumers money, reduces environmental damage and meets the particular goals of their state.

## Model Legislation and Annotations

Each state has unique circumstances, culture and goals that make a one-size-fits-all legislative approach impractical and impossible. This kit recognizes that some states may be starting from scratch while others have existing legislation. This resource provides model legislation and annotations to allow each state to craft legislative provisions that work best within their environment. The model legislation offers a menu of options for most provisions, allowing legislators to choose a provision that works best for the circumstances in their state. Annotations (set off in text boxes) are interspersed with the model legislative provisions, explaining the pros and cons of the provision and analysis of the various options offered, as well as links to additional information. The model legislative options are meant to provide a variety of approaches to accomplish a legislative goal. Many of the provisions are based on existing legislation from across the U.S. but have been changed or edited to make them more widely applicable.

## Fact Sheet and Presentation Slides

This kit also contains a two-page fact sheet and a PowerPoint presentation explaining the legislation and options. Legislators can use these materials as a starting point to explain the issues to their colleagues and constituents.

The full legislative kit is available for download at www.raponline.org/EV-roadmap

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# Abbreviations

EV . . . . . electric vehicle

HOV . . . . . high-occupancy vehicle

PBR. . . . . performance-based regulation

PUC . . . . . public utility commission

ZEV . . . . . zero-emission vehicle

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# Why Do States Want to Electrify Transportation?

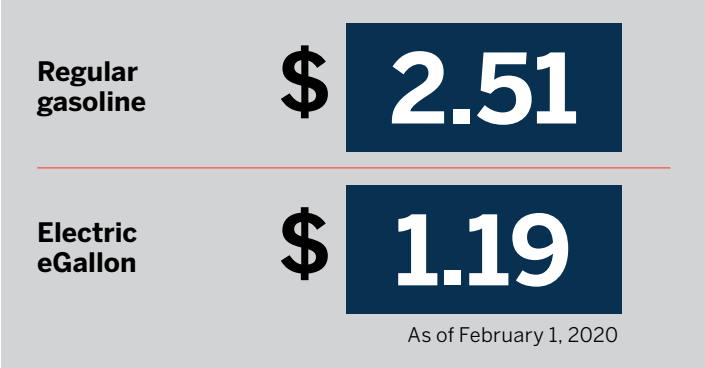
Electrification of the transportation sector (cars, trucks, buses, taxis, ports, etc.) provides an opportunity for states to save citizens money on transport and electricity, increase local jobs and business, address national security concerns, improve public health and combat climate change. Real-world experience and studies show that these benefits can be achieved, but proactive legislative action and state planning are needed to realize the full magnitude of these benefits. Without an early and comprehensive approach, potential benefits will be lost.

This is why many states are adopting legislation to prepare for, shape and accelerate the electrification of the transportation system. Acting at the early stages of electric vehicle (EV)[1] adoption can help ensure that the following benefits are realized.

## Savings for EV Drivers

Consumers buy electric vehicles for a variety of reasons, ranging from environmental consciousness to enjoyment of the product. The costs of new EVs are higher than comparable gasoline vehicles, but the cost differential is dropping. EV owners currently save money after purchase because EVs are cheaper to operate and maintain than gasoline vehicles.[2] Maintenance costs of an EV are lower than for traditional vehicles due to fewer moving parts.[3] Fueling costs are cheaper too; on a national average, it costs less than half as much to travel the same distance in an EV as in a conventional vehicle (see Figure 1).[4]

**Figure 1. US average costs of fueling for EV vs. internal combustion engine vehicle**




Source: Based on U.S. Department of Energy. (undated). *Electric Vehicles: Saving on Fuel and Vehicle Costs*

### Electrification wave

The electrification of transportation is only one aspect of a larger transition taking place in the nation's energy sectors, driven by new technologies, falling costs and ambitious targets for reductions in greenhouse gas emissions. Today, states largely treat the power, heating and transportation sectors as separate realms for public policy, if they treat them at all. But electrification of equipment that runs on fossil fuels is spurring innovation that is already having positive effects — for consumers, for labor, for businesses and for the environment.

1 The term "electric vehicles" can be used to describe a wide range of technologies. The defining characteristic of EVs is that a driver can plug them in to charge from an external power source. This distinguishes them from hybrid vehicles, which supplement an internal combustion engine with battery power but cannot be plugged in. EVs include plug-in hybrid electric vehicles, which also have an internal combustion engine, and battery electric vehicles, which do not. Some definitions of electric vehicles also include fuel cell electric vehicles, which use hydrogen to generate electricity to power the vehicle. EVs can also span many different modes of transportation. This legislative kit focuses on passenger vehicles and buses, but electrification is also possible for boats, motorcycles, scooters, airplanes and even spacecraft.

2 Reichmuth, D. (November, 2017). *Going from pump to plug.* Cambridge, MA: Union of Concerned Scientists. Retrieved from https://www.ucsusa.org/sites/default/files/attach/2017/11/cv-report-ev-savings.pdf

3 Coren, Michael J. (2019, March 18). *New York City says electric cars are now the cheapest option for its fleet.* Quartz. Retrieved from https://qz.com/1571956/new-york-city-says-electric-cars-cheapest-option-for-its-fleet/

4 U.S. Department of Energy. (undated-a). *Electric vehicles: Saving on fuel and vehicle costs* [Webpage]. Retrieved from https://www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costs. An "eGallon" is the cost of fueling a vehicle with electricity compared with a similar vehicle that runs on gasoline.

Add smart policies and lower prices for charging at times that are optimal for the grid, and the cost of charging EVs can likely be driven down while gas prices are forecast to increase.[5]

## Improved Public Health

A Massachusetts Institute of Technology study found that road transportation emissions cause 53,000 premature deaths per year nationally, making transportation the largest single contributor to premature deaths from air pollution.[6] Conventional vehicles now account for 55% of U.S. emissions of nitrous oxides[7] and 29% of U.S. greenhouse gas emissions.[8] Emissions from EVs are lower due to two factors. First, EVs are three to four times more energy efficient than gas-powered cars. When operating on battery power, EVs do not generate emissions from the tailpipe, which benefits local air quality and public health, especially in high traffic and dense neighborhoods.[9] Second, emissions from producing the electricity used to charge EVs depend on a regional mix of generation. Even in regions heavily dependent on fossil fuels, EVs result in a net reduction in emissions, and this reduction is rapidly growing as our power sector is increasingly getting cleaner.[10]

## Improved Electric System Efficiency

Charging large numbers of EVs can increase the cost of electricity if done haphazardly. But with efficient policies in place, EVs can provide net benefits to the grid and electricity users. U.S. power grids are increasingly relying on variable sources of power generated by wind and solar. The ability to manage the time EVs are charged helps the grid make efficient use of these renewable resources.[11] EV owners can charge their cars when the cost of electricity is lower, such as when solar and wind resources are plentiful. By moving EV charging to locations and times when renewable energy otherwise would likely be curtailed for lack of demand, grid managers can help reduce the thousands of gigawatt-hours of electricity from existing variable energy resources that are being wasted.[12] This in turn translates to ratepayer benefits, as more efficient use of the grid reduces cost.

## Stronger Energy Security

In 2017, the United States imported about 19% of the petroleum it consumed. Because transportation accounts for nearly three-fourths of total U.S. petroleum consumption, using more energy-efficient vehicles like hybrid and plug-in electric vehicles can have a direct impact.[13] When EVs plug in,

5 U.S. Energy Information Administration. (2019, January 24). *Annual energy outlook 2019*, p. 50. Retrieved from www.eia.gov/outlooks/aeo

6 Chu, J. (2013, August 29). *Study: Air pollution causes 200,000 early deaths each year in the U.S.* MIT News Office. Retrieved from http://news.mit.edu/2013/study-air-pollution-causes-200000-early-deaths-each-year-in-the-us-0829

7 U.S. Environmental Protection Agency. (undated-a). *Smog, soot, and other air pollution from transportation* [Webpage]. Retrieved from https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-local-air-pollution

8 U.S. Environmental Protection Agency. (undated-b). *Fast facts on transportation greenhouse gas emissions* [Webpage]. Retrieved from https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions

9 Crotty, F., Jordan, B., McFarlane, D., Sexton, T., & Simons, S. (2019). *Accelerating electric vehicle adoption: A vision for Minnesota.* Minnesota Department of Transportation, Minnesota Pollution Control Agency and Great Plains Institute. Retrieved from http://www.dot.state.mn.us/sustainability/docs/mn-ev-vision.pdf

10 Widespread transportation electrification would result in a 48% to 70% net reduction in greenhouse gas emissions between 2015 and 2050, as well as widespread air quality benefits. See Electric Power Research Institute. (2015, September). *Environmental assessment of a full electric transportation portfolio.* Retrieved from https://www.epri.com/#/pages/product/3002006881/?lang=en-US

11 See, e.g., Energy and Environmental Economics. (2014, October). *California Transportation Electrification Assessment, Phase 2: Grid impacts*. Retrieved from http://www.caletc.com/wp-content/uploads/2016/08/CalETC_TEA_Phase_2_Final_10-23-14.pdf

12 Farnsworth, D., Shipley, J, Sliger, J., & Lazar, J. (2019, January). *Beneficial electrification of transportation.* Montpelier, VT: Regulatory Assistance Project. Retrieved from https://www.raponline.org/knowledge-center/beneficial-electrification-of-transportation/

13 U.S. Department of Energy. (undated-b). Electric vehicle benefits and considerations. *Alternative Fuels Data Center.* Retrieved from https://afdc.energy.gov/fuels/electricity_benefits.html

they are mostly powered by a domestic mix of energy sources, including natural gas, coal, nuclear, hydropower, wind and solar. This is in stark contrast to gasoline-fueled vehicles, which depend solely on oil — which is subject to a range of global price and availability risks.[14]

A study found that installing 150 EV chargers would generate $14.2 million in economic activity, including $4.6 million in labor income.

## More Jobs

Using electricity to power transportation leverages changes in the electricity sector to create local jobs. As state electricity providers continue to develop renewable energy from wind, solar, hydroelectricity and biomass, more electricity is produced locally. Clean energy jobs are growing in each state[15] and frequently increase at a greater rate than the overall employment rate. Greater EV adoption and charging will only increase these employment prospects. Communities and businesses that host public charging[16] stations may also see economic benefits as EV drivers eat or shop while their vehicles charge.[17]

There is concern that the transition to EVs could negatively affect auto workers and others in the internal combustion engine industry. Multiple studies suggest, however, that the U.S. could see between 52,000 to 109,000 net new jobs annually between 2015 and 2040 and a $2.5 billion to $9.9 billion increase in gross domestic product annually.[18] In Minnesota, a study found that installing 150 EV chargers would generate $14.2 million in economic activity, including $4.6 million in labor income.[19] The United Auto Workers union supports EVs but is also calling for decision-makers to work with automakers to retool existing facilities and retrain workers to produce new energy vehicles.[20]

14 Schefter, K., & Knox, B. (2018, February). *Accelerating electric vehicle adoption.* Edison Electric Institute. Retrieved from https://www.eei.org/issuesandpolicy/electrictransportation/Documents/Accelerating_EV_Adoption_final_Feb2018.pdf

15 See, for example, Clean Jobs Count to see job statistics by state at https://cleanjobscount.org/impact-state/

16 EV charging opportunities occur at home, the workplace and public places. Distinct policies are needed to address barriers to each of these charging scenarios.

17 Crotty et al., 2019.

18 Winebrake, J., Green, E., & Carr, E. (2017, October). *Plug-in electric vehicles: Economic impacts and employment growth.* Energy and Environmental Research Associates LLC. Retrieved from https://caletc.com/wp-content/uploads/2019/05/EERA-PEV-Economic-Impacts-and-Employment-Growth.pdf; and Melania, M., Bush, B., Eichman, J., Wood, E., Stright, D., Krishnan, V., Keyser, D., Mai, T., & McLaren, J. (2016, December). *National economic value assessment of plug-in electric vehicles.* Volume 1. National Renewable Energy Laboratory. Retrieved from https://www.nrel.gov/docs/fy17osti/66980.pdf

19 Crotty et al., 2019.

20 Jones, G. (2018) Labor voices: Electric vehicles are the future, but we can't leave workers behind [Opinion]. *Detroit News.* Retrieved from https://www.detroitnews.com/story/opinion/columnists/labor-voices/2018/08/21/electric-vehicles-future-but-we-cant-leave-workers-behind/1042072002/

# How Can States Prepare for EVs?

Carefully crafted legislation can increase and accelerate the benefits of electrifying transportation. High levels of EV adoption with smart charging can provide benefits to all of society — not just EV owners — and the grid. The converse is also true. Inaction in this area could lead to slow penetration of EVs, problems with uncontrolled EV charging, sporadic access and forgone societal benefit.

The rationale for electrification will vary by state: Some are interested for economic and jobs reasons, others for climate and air quality reasons.

The rationale for electrification will vary by state: Some are interested for economic and jobs reasons, others for climate and air quality reasons. As with any systemic change, decision-makers at all levels throughout the world are contemplating some weighty questions and wondering how best to achieve the benefits of electrified transportation at the least cost.

There are a variety of considerations for state legislators interested in electrification of transportation. We have divided legislative actions on EVs into the following four sections:

- Plan your destination.
- Drive investment with incentives.
- Remove roadblocks.
- Empower regulators.

These categories in this guide, and in the accompanying legislative materials, can help legislators determine the best course of action on this topic for their state.

## Plan Your Destination

Experience shows that government policies can accelerate the transition to EVs. For example, EVs already account for over 50% of all new car sales in Norway. Norway has accomplished this by having goals and policies to incentivize and develop an EV market. In the U.S., states are starting to set EV goals too. In early 2019, 48 states plus the District of Columbia took action on regulation, financial incentives or market development initiatives related to electric vehicles.[21] Electrification of transportation offers a variety of advantages to states, but the inherent barriers to EVs mean that state legislative action is needed to realize the greatest benefits and avoid pitfalls. The following topics represent different ways states have developed plans for EVs. Armed with this information, states can craft a plan for electrification that saves consumers money over the long run and reduces negative environmental impacts.

State EV plans have included some or all of the following components.

### Establish Goals and Timelines

Some states are setting transportation electrification goals within state EV planning processes; other state plans reference state goals that have been set separately. EV goals have been set by executive order of governors[22] and legislative action.[23] California set the zero-emission vehicle (ZEV) regulation, which contains EV adoption goals as part of its mandate on automakers.[24] Other states have adopted the ZEV regulation: Colorado, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island and Vermont.

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21 Carr, A., Lips, B., Proudlove, A., & Sarkisian, D. (2019, May). *50 states of electric vehicles: Q1 2019 quarterly report.* Executive summary. Raleigh, NC: North Carolina Clean Energy Technology Center. Retrieved from https://nccleantech.ncsu.edu/wp-content/uploads/2019/05/Q1-19_EV_execsummary_Final.pdf

22 Governors in California, North Carolina and Oregon.

23 Oregon Legislative Assemby.

24 On September 19, 2019, the U.S. Environmental Protection Agency withdrew the Clean Air Act preemption waiver it granted to California in January 2013 as it relates to California's greenhouse gas and ZEV programs. On September 20, 23 states sued to block the Trump administration from undoing California's authority to set strict car pollution rules. Litigation is pending as of the date of this publication.

### Zero-emission vehicle program

California is the only state authorized by § 209(b) of the Clean Air Act (CAA) to adopt motor vehicle emission standards that are more stringent than federal standards.[25] CAA § 177, in turn, authorizes other states to adopt California's vehicle emission standards. Ten states have exercised this authority and adopted the ZEV regulations promulgated under California's Advanced Clean Cars Program. In May 2014, eight states released an action plan in support of the ZEV regulations, detailing an agreement to put 3.3 million ZEVs on the road by 2025.[26] A 2018-2021 Multi-State ZEV Action Plan builds on the efforts of the original plan.[27]

Minnesota and New Mexico have indicated they plan to adopt the ZEV regulation in the near future.[28] Three other states — Delaware, Pennsylvania and Washington — and the District of Columbia are following California's low-emission vehicle standards but have not adopted the ZEV program.[29]

## Create State EV Policy Plans

Electrification of transportation has broad implications across many state agencies. Legislative leadership can assure that all agencies are guided by a single state EV policy. Transportation electrification requires coordination among state agencies of transportation, air quality and environment, commerce, tourism and energy, and public utility commissions (PUCs). Legislation can ensure mechanisms exist to coordinate between various offices of state government and local jurisdictions that will be affected by increased EV penetration and to involve all potential stakeholders.

## Lead by Example With State Fleet Vehicles

States operate large fleets of various vehicle types that may include light-, medium- and heavy-duty vehicles, public transit and maritime vessels. States are uniquely positioned to lead by example and electrify fleets, as the vehicles are under the direct control of the state government and can be centrally recharged, which lowers the infrastructure burden.[30] The National Governors Association notes that "electrifying state fleets offers an opportunity for states to promote efficient transportation, support a nascent market, reduce state fuel and maintenance costs by switching to a less expensive and more stable fuel source, and lower related transportation emissions."[31] A few states have elected to lead by example and have required some level of state or local fleet vehicles to be electrified. These provisions typically provide exceptions for vehicles that cannot be viably electrified currently.[32]

## Enable Regular Statewide Assessment Updates

Electrification of transportation is a rolling development. Accordingly, a few states have required state agencies to provide periodic assessments to the legislature on electric vehicles and related infrastructure status. This allows the legislature and other stakeholders to adjust state policy accordingly.

## Plan for Future Transportation Funding Sources

Federal investment in highways has historically been paid for from the dedicated Highway Trust Fund, which is supported by user fees, primarily the federal excise tax on motor fuels

25 Union of Concerned Scientists. (2019, September 12). *What is ZEV?* [Webpage]. Retrieved from https://www.ucsusa.org/resources/what-zev

26 ZEV Program Implementation Task Force. (2014, May). *Multi-state ZEV action plan.* Retrieved from https://www.nescaum.org/documents/multi-state-zev-action-plan.pdf/

27 Multi-State ZEV Task Force. (undated). *Multi-state ZEV action plan, 2018-2021: Accelerating the adoption of zero emission vehicles.* Retrieved from https://www.nescaum.org/documents/2018-zev-action-plan.pdf

28 Shepardson, D. (2019, September 25). *Minnesota, New Mexico to adopt California vehicle emissions rules.* Reuters. Retrieved from https://www.reuters.com/article/us-autos-emissions-california-minnesota/minnesota-new-mexico-to-adopt-california-vehicle-emissions-rules-idUSKBN1WA2SJ

29 Center for Climate and Energy Solutions. (2019, January). *U.S. state clean vehicle policies and incentives* [Webpage]. Retrieved from https://www.c2es.org/document/us-state-clean-vehicle-policies-and-incentives/

30 Rogotzke, M., Eucalitto, G., & Gander, S. (2019, September). *Transportation electrification: States rev up.* Washington, DC: National Governors Association Center for Best Practices. Retrieved from https://www.nga.org/wp-content/uploads/2019/09/2019-09-15-NGA-White-Paper-Transportation-Electrification-States-Rev-Up.pdf

31 Rogotzke et al., 2019.

32 See also Sierra Club & Plug In America. (2018, June). *AchiEVe: Model state & local policies to accelerate electric vehicle adoption.* Oakland and Los Angeles, CA: Authors. Retrieved from https://www.sierraclub.org/sites/www.sierraclub.org/files/program/documents/EV%20Policy%20Toolkit.pdf

— a tax per gallon of gasoline and diesel that has remained the same for 25 years.[33] The fund has decreased for a number of reasons, including inflation, the increased cost of construction and greater fuel efficiency.

Recognizing that nongasoline vehicles might not be paying their share in transportation fees and taxes, several states are considering mechanisms to ensure that EVs contribute fairly.[34] As of September 2019, 28 states had implemented an additional EV registration fee on top of standard vehicle registration fees.[35] Alabama, Colorado, Oregon and Washington are using a portion of the collected fees to support EV infrastructure investments.[36] Still others, such as Maryland and Vermont, are waiting to implement additional registration fees until EVs reach a more significant adoption rate.[37]

Given the dwindling size of the transportation fund, notably due more to inflation and increased internal combustion engine efficiency than to electric vehicles, states will need to consider how they want to plan for future transportation funding sources across all users.

## Drive Investment With Incentives

Recognizing the wide range of benefits that EVs can provide, jurisdictions around the world have provided direct financial support to encourage the electrification of transportation. Electric vehicle costs will come down over time as their adoption increases, which will itself be a consequence of a combination of supporting incentives and policies that will accelerate market development.[38] Such incentives include tax rebates and reductions, requirements for parking and lane access, charging infrastructure, and education and outreach activities.[39] Legislators will need to determine which incentives make the most sense for their states and the duration of the incentive. Many states have enacted some sort of incentive for electrification of the transportation sector. The U.S. Department of Energy provides a listing of tax credits and other incentives for electric vehicles at the federal and state level.[40]

### Funding of Incentives and EV Infrastructure

States themselves have financed incentives in a variety of ways:

- Most jurisdictions have financial incentives to decrease the cost of electric vehicles and other policies to encourage EV ownership. These incentives are paid for by taxes, with the realization that electrification delivers societal benefits.[41]
- Most U.S. states also have Volkswagen settlement money, which allocated $3 billion for the Environmental Mitigation Trust to fund transportation projects across the country. Up to 15% of each state's money can be used to fund EV charging infrastructure.[42]
- Some jurisdictions also allow utilities to provide EV incentives and infrastructure and to recover the costs of doing so in regulated utility rates.

Electrification of transportation is a multisectoral effort and provides benefits across the energy, transport and building sectors, as well as environmental and health benefits. Decision-makers can think broadly in terms of how these costs and benefits are paid for and shared. For example:

- Air quality is a significant concern in many states or regions, and transportation-related emissions are a main contributor to regional pollution.[43] Targeted transportation electrification in these areas can address air quality

33 Farnsworth et al., 2019.

34 Spector, J., & Pyper, J. (2017, July 5). *Updated: 17 states now charge fees for electric vehicles.* Greentech Media. Retrieved from https://www.greentechmedia.com/articles/read/13-states-now-charge-fees-for-electric-vehicles

35 Rogotzke et al., 2019.

36 Rogotzke et al., 2019.

37 Rogotzke et al., 2019.

38 Yang, Z., Slowik, P., Lutsey, N., & Searle, S. (2016, June). *Principles for effective electric vehicle incentive design.* Washington, DC: International Council on Clean Transportation. Retrieved from https://theicct.org/sites/default/files/publications/ICCT_IZEV-incentives-comp_201606.pdf

39 Yang et al., 2016.

40 U.S. Department of Energy. (undated-c). State laws and incentives. *Alternative Fuels Data Center.* Retrieved from https://afdc.energy.gov/laws/state. For more information on EV incentives and rebates see Sierra Club & Plug In America, 2018.

41 U.S. Department of Energy, undated-c, and Sierra Club & Plug In America, 2018.

42 Casale, M., & Mahoney, B. (2019, May). *Volkswagen settlement state scorecard.* U.S. PIRG Education Fund and Environment America Research & Policy Center. Retrieved from https://uspirg.org/sites/pirg/files/reports/USP%20VW%20Scorecard%20May19.pdf

43 U.S. Environmental Protection Agency, undated-a.

issues, often at a lower cost than other options. A complex mix of actors (emissions sources, consumers, taxpayers and more) generally bear the burden of protecting air quality. Legislators may want to consider issues of fairness and cost causation and decide how to fund spending on EV incentives and infrastructure aimed at addressing air quality in the state.

- Federal funding is also available for air quality improvement through transportation projects. The Congestion Mitigation and Air Quality Improvement Program is one element of the Federal-Aid Highway Program that provides a funding source for states, local governments and transit agencies to fund transportation projects and programs that help meet the requirements of the Clean Air Act and help reduce regional congestion in transportation networks.[44] Other federal funding is available for certain types of EVs (two-wheeled and four-wheeled), transport hubs such as airports and ports that use ZEVs, and electric charging infrastructure in a variety of locations.[45]
- Climate change-related storms are causing increasing amounts of damage in states. Electrified transport decreases carbon emissions and is a recognized carbon reduction strategy. States that have enacted carbon cap-and-trade programs can use program funds to finance EV infrastructure deployment and vehicle incentives using carbon allowance auction revenues.[46]
- State efforts to spur job growth generally focus on building things for public benefit, from hospitals and roads that provide construction jobs to tax breaks for corporations relocating to a state.[47] States can provide EV incentives and infrastructure as a method to increase jobs or, alternatively, focus on encouraging EV manufacturing and related industry jobs in the state.

- Leveraging private investment is a largely untapped source of funding for EV charging infrastructure, also known as electric vehicle supply equipment. Installing charging infrastructure at malls and other retail industry locations allows EV owners to power up while shopping, eating and resting, as well as providing mall owners with an additional marketing tool and a revenue source. Recognizing this, Walmart, Kroger and mall owners are installing charging stations in retail locations. More formalized public-private partnerships could help build out needed EV infrastructure.[48]

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44 U.S. Department of Energy & U.S. Department of Transportation. (2016). *Guide to federal funding, financing, and technical assistance for plug-in electric vehicles and charging stations.* Retrieved from https://www.energy.gov/sites/prod/files/2016/07/f33/Guide%20to%20Federal%20Funding%20and%20Financing%20for%20PEVs%20and%20PEV%20Charging.pdf

45 U.S. Department of Energy & U.S. Department of Transportation, 2016.

46 California has elected to use cap-and-trade funds to finance EV incentives. See Brown, E.G. (2017, January). Climate change. In *2017-18 Governor's budget summary,* p. 95. Retrieved from http://www.ebudget.ca.gov/2017-18/pdf/BudgetSummary/FullBudgetSummary.pdf. Transportation Climate Initiative member states are likely to adopt something similar to the Regional Greenhouse Gas Initiative cap-and-invest model, which allows states to raise money and invest carbon reduction revenues in carbon mitigation strategies as they see fit. Some states may elect to use these funds for EV incentives or EV charging infrastructure. See Transportation Climate Initiative. (2019, December 17). *Draft memorandum of understanding of the transportation climate initiative.* Retrieved from https://www.transportationandclimate.org/sites/default/files/FINAL%20TCI_draft-MOU_20191217.pdf

47 Francis, N. (2016). *State tax incentives for economic development.* Washington, DC: Urban Institute. Retrieved from https://www.urban.org/sites/default/files/publication/78206/2000636-state-tax-incentives-for-economic-development.pdf

48 Cattaneo, L. (2018). *Investing in charging infrastructure for plug-in electric vehicles: How to accelerate deployment.* Center for American Progress. Retrieved from https://www.americanprogress.org/issues/green/reports/2018/07/30/454084/investing-charging-infrastructure-plug-electric-vehicles/

## Best Practices for Structuring Financial Incentives

Electric vehicle incentives come in four general types: income tax credits, vehicle purchase rebates, one-time vehicle tax reductions and annual vehicle tax reductions. Several key lessons about incentive design can be drawn from experiences both in the U.S. and globally.[49]

### Apply Them at the Point of Purchase

Customers, whether an individual, a business or a municipal or state government, pay particular attention to first cost. Incentives that apply at the point of sale and therefore reduce the cost of the vehicle right away are most effective.[50] These incentives should also be clear and easy to understand. If the value of the incentive is unclear to the buyer and the seller at the time of a vehicle transaction, it is unlikely to work. Incentives that either directly reduce the cost of the vehicle at the time of purchase, or through tax exemptions, appear to be effective solutions.

### Be Transparent

Governments can work to expand the appeal and awareness of electric vehicles to a larger consumer market. Consumer education campaigns that increase awareness about the benefits of EVs are an important part of ensuring incentive programs are successful. Along with transparency about the incentive, experience shows that simple incentives work; complex incentives may not. The types of vehicles to which the incentives apply are important too. Decision-makers

49 Recommendations from this section are based on Yang et al., 2016.

50 Researchers have identified many reasons why offering consumer incentives at the point of sale can be so important, including the availability of capital, uncertainty about the future and discounting of future benefits. Yang et al., 2016.

should ensure that the incentives are available for mainstream, midpriced vehicles, which will appeal to a larger segment of the population. Public awareness of the incentive, the vehicles to which it will apply and the clarity of the incentive structure are important factors to success. Other public policy goals may drive policymakers to link incentive availability to such things as income level.

### Make Incentive Programs Durable

Decisions to purchase or lease an electric vehicle are rarely made at the spur of the moment. For most consumers, it's a major investment that may involve securing financing, selling an existing vehicle, going on test drives and more. More importantly, a state's commitment to incentives may persuade investors to plan and build infrastructure that could take years to complete. This means incentives should be predictable. Something that is here today and gone tomorrow rarely works. Incentives that start high and phase down as milestones are hit can work.[51] The key is predictability. Commitment to durable incentives allows manufacturers, dealers, public outreach campaigns and consumers to rely on them for at least several years.[52]

## Nonfinancial Incentives

Nonfinancial incentives that enhance the consumer experience, such as preferred parking or use of high-occupancy vehicle (HOV) lanes, are also effective inducements.

Most states have clarified in law that parking spaces with charging facilities for electric vehicles shall not be occupied by internal combustion vehicles. Many of these provisions provide a grant of power to local towns and municipalities to designate and enforce electric vehicle parking. Many state and local governments also provide free parking and charging for EVs.

Another nonfinancial incentive is access to HOV lanes. Under current federal law, public authorities, such as states, may choose to exempt any type of plug-in electric vehicle or alternative fuel vehicle from HOV or high-occupancy toll lane restrictions.[53] Given the congestion on roadways in some jurisdictions, expanding access to HOV lanes to electric vehicles is a real incentive. In a 2013 survey of California drivers, 59% of those surveyed stated HOV lane access was extremely important or very important in their decision to purchase an EV.[54]

# Remove Roadblocks

If states want to encourage electrification of the transportation sector, some of the best actions are to remove barriers to electrification. These include lack of charging infrastructure and the existence of building codes that don't accommodate EV charging. A National Renewable Energy Laboratory study confirmed that the biggest concerns to drivers about purchasing an EV in 2017 were cost and lack of charging infrastructure in the community and at home (see Figure 2 on the next page).[55] A study in 2019 confirmed that these are still the top concerns.[56] Legislative action is also important to ensure that an equitable distribution of EV infrastructure occurs and that rural and low-income communities are not left behind. Other barriers, such as cost of EVs, are addressed in prior sections on incentives or state planning.

Legislators can take action to remove these barriers, such as:

- Ensure consumer-friendly charging infrastructure and EV charging is widely available.
- Ensure building codes provide for an electrified future.
- Ensure electrification benefits all of society, including rural and low-income communities.

51 Incentive programs should be phased out when EVs become cost competitive on their own or when incentives otherwise are not needed to continue growing the EV market.

52 Hall, D., & Slowik, P. (2018, April 12). *Electric vehicle charging infrastructure and incentive design best practices*. Washington, DC: International Council on Clean Transportation. Retrieved from https://www.nj.gov/dep/cleanair/PPP/2018/Electric%20Vehicle%20Charing%20Infrastructure%20and%20Incentive%20Design%20Best%20Practices.PDF

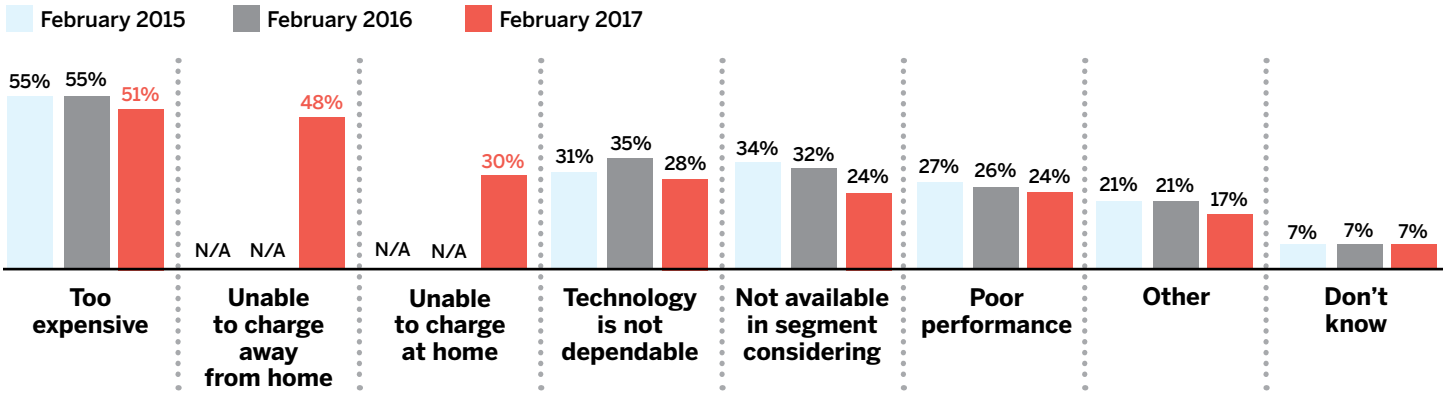
53 U.S. Department of Energy. (undated-d). Alternative fuel vehicles and high occupancy vehicle lanes. *Alternative Fuels Data Center.* Retrieved from https://afdc.energy.gov/laws/HOV

54 U.S. Department of Energy, undated-d.

55 Singer, M. (2017). *The barriers to acceptance of plug-in electric vehicles: 2017 update* (NREL/TP-5400-70371). Boulder, CO: National Renewable Energy Laboratory. Retrieved from https://www.nrel.gov/docs/fy18osti/70371.pdf

56 Volvo Car USA. (2019). *Poll finds Americans feel electric vehicles are the future of driving* [Press release]. Retrieved from https://www.media.volvocars.com/us/en-us/media/pressreleases/248305/poll-finds-americans-feel-electric-vehicles-are-the-future-of-driving

**Figure 2. Reasons given for not considering buying or leasing a plug-in EV**




Source: Based on Singer, M. (2017). *The Barriers to Acceptance of Plug-In Electric Vehicles: 2017 Update*

## Ensure Charging Infrastructure Is Available

Consumer concern about lack of available charging infrastructure is a significant barrier to electrification of the light-duty transport sector. Currently, there are approximately 24,000 charging stations in the U.S., compared with 150,000 gas stations.[57] The lack of widespread charging stations leads to a chicken-and-egg problem for EV adoption. Legislators will need to consider the extent to which publicly funded charging will be available in their state and the extent to which public utilities should be involved in providing charging.

It is also important for legislators to ensure the EV market in their state develops fairly. Legislators can enact legislation to provide widely available charging infrastructure to meet consumer needs, including requirements on public and private charging for EVs and fleets. Many states have required charging systems work for all EVs, regardless of vehicle type, equipment type or the ownership/operation model. Legislation can also require proper monitoring and maintenance to maximize equipment availability, reliability and safety.[58]

## Ensure Building Codes Provide for an Electrified Future

Home charging, where practical, is convenient for EV drivers because connecting overnight can recharge a vehicle sufficiently to meet the needs of a typical daily commute. In fact, private charging at homes with access to a garage or carport is the most common type of charging among early adopters of EVs. Lack of a garage or carport is an inherent barrier for multiunit dwellings. Roughly 30% of U.S. housing stock is in structures with three or more dwelling units.[59] In urban areas, this percentage can be much higher.[60] Because home charging is currently[61] and will likely continue to be the most commonly used type of EV charging as the market develops, it will be necessary to address the absence of charging infrastructure for multiunit dwellings, where residents often park in a shared garage or on the street with no dedicated spot. Legislation can require an update of single-family, multiunit and commercial building codes to mandate EV charging capability. Legislation can also require the addition of charging points to existing garages for renters.[62] Some states have passed "right to charge" laws, which make it harder for a property management entity

57 Penn, I. (2019, June 22). L.A. to Vegas and back by electric car: 8 hours driving; 5 more plugged in. *The New York Times.* Retrieved from https://www.nytimes.com/2019/06/22/business/energy-environment/electric-cars-charging.html?searchResultPosition=1l

58 Schefter, K., & Knox, B. (2018, February). *Accelerating electric vehicle adoption.* Washington, DC: Edison Electric Institute. Retrieved from https://www.eei.org/issuesandpolicy/electrictransportation/Documents/Accelerating_EV_Adoption_final_Feb2018.pdf

59 U.S. Census Bureau. Selected housing characteristics: 2012-2016 American Community Survey five-year estimates. *American Fact Finder.* Retrieved from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_DP04&src=pt

60 Farnsworth et al., 2019.

61 Currently EV drivers do more than 80% of charging at home. U.S. Department of Energy. (undated-e). *Charging at home.* Retrieved from https://www.energy.gov/eere/electricvehicles/charging-home

62 Farnsworth et al., 2019.

to prevent residents from installing charging stations when certain conditions are met.[63]

### Ensure Rural and Low-Income Communities Share in Electrification Benefits

Ensuring that the benefits of transportation electrification are shared equitably will require states to consider the degree to which all consumers have access to electricity as a transportation fuel, regardless of their economic and geographic circumstances. Legislators can acknowledge equity issues and take steps to ensure more equal sharing of the benefits of electrified transport. States will also need to work with low-income and rural communities to identify barriers and develop solutions that deliver on inclusivity goals, which may include electrified mass transit solutions.[64]

Transport electrification will also have different implications in rural communities. Rural communities differ in significant ways from cities, and their transportation needs differ as well. Rural residents may be more likely to be physically or financially dependent on shared transit rather than private car ownership.[65]

Legislative provisions that plan for equitable transportation needs are important to ensure communities are not left behind. Actions can include broadly engaging stakeholders in state planning processes, addressed above, and requiring studies to provide necessary information where lacking. Legislators can also explicitly include consideration of low-income and rural access to electrification in regulatory actions discussed in the next section.

## Empower Regulators

The electricity sector intersects with electrification of transport in several important ways:

- The rapid deployment of electric vehicles can affect investment needs for the local grid.
- Depending on policies in place, electric vehicles can help or hurt the electric grid's capacity to integrate increasing use of variable wind and solar resources.
- Electricity pricing policy can either help or hurt the grid and the penetration of electric vehicles.[66]
- Depending on state policy, electric utilities can have differing responsibilities and interactions with charging infrastructure.

All of this means that state regulators — primarily PUCs but also energy offices, transportation agencies and others — will need sufficient legislative direction to make the best use of EVs. To most effectively plan for the electrification of the transportation system, PUCs will need to:

- Require utilities to integrate EV load projections and any investment in charging infrastructure into the utilities' regularly filed resource plans.
- Implement tariffs that make the most use of EVs as a resource to the grid.
- Provide direction on utility involvement in charging infrastructure and cost recovery of utility investment.
- Enable performance-based regulation (PBR) incentives for utility charging infrastructure achievements.

63 California, Florida, Colorado, Oregon and Ontario are examples of jurisdictions that have adopted "right to charge" laws. See Farnsworth et al., 2019. For sample building codes and ordinances, see Sierra Club & Plug In America, 2018.

64 Farnsworth et al., 2019.

65 Rural residents are more reliant on personally owned, single-driver automobiles for transportation than their urban counterparts. However, personal vehicles can be expensive to purchase and maintain, and some residents may not have a driver's license. Additionally, rural residents who have physical or mobility limitations may not be able to drive. Rural Health Information Hub. (2015, April). *Transportation use in rural areas* [Webpage]. Retrieved from https://www.ruralhealthinfo.org/toolkits/transportation/1/use-in-rural

66 A study from Norway, which has an EV market penetration of 10% as of October 2018, shows that there is also danger in not planning for EV charging. Uncontrolled EV charging — that is, when customers do not receive price signals to charge during optimal times for grid management — exacerbates existing demand peaks, typically when people return home from work. This has huge implications for the cost of EV integration. The study found that controlled EV charging could be met with the existing grid network but that uncontrolled EV charging could require grid investments of 1 billion to 2 billion Norwegian kroner for one city. Hildermeier, J., Kolokathis, C., Rosenow, J., Hogan, M., Wiese, C., & Jahn, A. (2019, April). *Start with smart: Promising practices for integrating electric vehicles into the grid.* Brussels, Belgium: Regulatory Assistance Project. Retrieved from https://www.raponline.org/knowledge-center/start-with-smart-promising-practices-integrating-electric-vehicles-grid/

## Integrated Planning That Includes EVs

Most states require utilities to submit plans to their utility commissions outlining resource needs in order to meet expected electricity demand over a long-term planning horizon. An increasing number of states are also starting to require some form of integrated distribution planning that addresses upgrades to aging infrastructure, incorporation of distributed energy resources and grid modernization.[67] Legislation could direct that utilities submit plans to the PUC that account for EV load growth in the state and any utility involvement in charging infrastructure in a manner that is inclusive of other utility operations and makes the best use of the resources that EV load provides to the grid.[68]

## Smart Rate Design for EVs

One of the most important decisions legislators can make on EV development for their state is to require their PUC to consider time-varying rate design. If time-varying rates are in place, the electric grid, consumers and the environment all benefit. Without time-varying rates, ratepayer costs will increase with avoidable capital additions to serve a rising electric peak, and the electric grid will not realize potential benefits of EVs.

Utilities build the electric system to meet the peak demand — that is, the highest demand for all customers. The cost to build a system to meet this peak demand is a major driver of utility rates. Growth in use of the utility system at nonpeak times of the day or year does not add significantly to this cost. This is where rate design and strategic use of technologies that can shift peak demand have great value to the electric grid.

EVs have the potential to add benefits to the grid for the following reasons:

- There are a few critical hours when the grid is stressed due to high customer demand, and rate design can send signals to EV owners to avoid charging during those hours.

If time-varying rates are in place, the electric grid, consumers and the environment all benefit.

- There are many hours when the grid is lightly loaded, and EVs can take advantage of those hours to improve utilization of grid assets.
- There are hours when renewable energy is abundant but there isn't enough load to use it. Rate design can send signals to EV owners to charge at these times and make use of resources that are otherwise wasted.
- By avoiding high-cost hours and focusing on low-cost hours, EVs can avoid the cost of expensive new resources such as new generation plants and storage and save consumers money.
- Future technology may enable EVs to be a resource to the grid and function as battery storage.

### Real-world examples

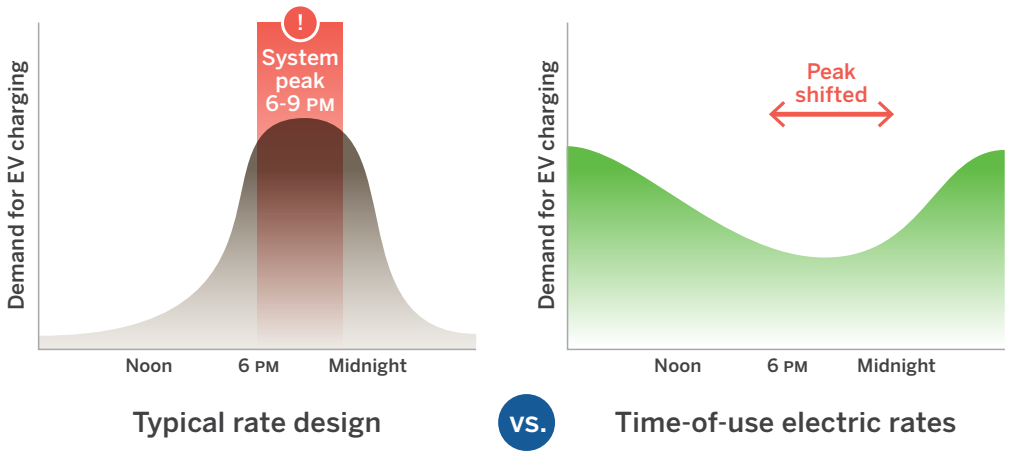
A study of five states in the mid-Atlantic and Northeast found that rate design that sends signals to influence the timing of EV charging — indeed, all electric use — has value for ratepayers.[69] The analyses indicate that annual utility customer benefits will be 30% to 60% greater if EV owners charge during lower-cost, off-peak times than if they simply plug in and charge whenever they arrive home. Increasing peak loads — adding demand for electricity during periods when demand is already high — will more quickly drive the need to acquire additional supply and upgrade distribution infrastructure, and thereby raise costs. If EV owners are given cost-reflective price signals to charge during off-peak periods, their behavior will change, the electric system will be more efficiently utilized, and total costs for both the system and the consumer will be reduced.

67 Homer, J., Cooke, A., Schwartz, L., Leventis, G., Flores-Espino, F., & Coddington, M. (2017, December). *State engagement in electric distribution system planning.* U.S. Department of Energy, Grid Modernization Laboratory Consortium. Retrieved from http://eta-publications.lbl.gov/sites/default/files/state_engagement_in_dsp_final_rev2.pdf

68 EVs can absorb low-cost renewable energy when it is available because EV load is able to be controlled. EVs in the aggregate can also act as a massive battery that grid operators can draw upon when needed to manage peak load.

69 M.J. Bradley & Associates. (2017). *Electric vehicle cost-benefit analyses.* Retrieved from https://www.mjbradley.com/reports/mjba-analyzes-state-wide-costs-and-benefits-plug-vehicles-five-northeast-and-mid-atlantic

**Figure 3. Shifting of EV charging away from peak periods in response to time-varying rates**




Unlike typical electric rates, time-sensitive rates reflect the different cost of providing electricity at different times of the day, and they signal this price difference to consumers. By using well-designed rates to encourage customers to shift their demand to less expensive times, utilities can make more efficient use of grid resources.

EVs can provide more efficient use of the electricity grid and the integration of renewable energy and other grid services. But none of these benefits will be realized without effective rate design to send the necessary price signals to EV owners to change what they would otherwise do. For example, time-varying rates can encourage charging when costs are low, as illustrated in Figure 3.

Leaving flat rates in place as EV charging grows has dire consequences for the grid. Experience in Norway shows that "without a price signal, drivers will generally plug in and charge immediately upon arriving home after work, exacerbating evening peak demand."[70] Good rate design can address these problems by sending price signals to customers that encourage them to charge their vehicles during off-peak periods, when there is less stress on the system. If EV customers with time-sensitive rates decide to ignore price signals, then they will pay for the electricity at a higher-than-average price that reflects the higher-than-average system costs. This result protects non-EV customers and EV customers who are responding to the price signals from subsidizing the costs that other EV customers are imposing on the system during peak periods.[71]

## Roles and Regulation in Developing Charging Infrastructure

Legislative action to clarify ambiguity on the regulation of EV charging stations and the role of the utility in providing EV charging can provide certainty to stakeholders and foster EV market growth.

One ambiguity in many states is whether EV charging stations are covered by the laws and rules that govern regulated utilities. State public utility laws often define "public utility" in broad terms, which can lead to uncertainty over whether state PUCs need to regulate entities providing electricity for EVs in the same way they do public utilities that deliver power to homes and businesses.[72] Many states have addressed this by affirmatively determining, either by statute or through a declaratory ruling by the PUC, that EV charging station owners and operators are not public utilities. EV proponents say regulatory uncertainty can be a hindrance to greater deployment.[73]

A second ambiguity in many states is the degree to which utilities should be involved in EV charging station ownership and management. States have taken varied approaches to utility involvement in charging infrastructure. There are at least five potential roles for the utility, covering the range of

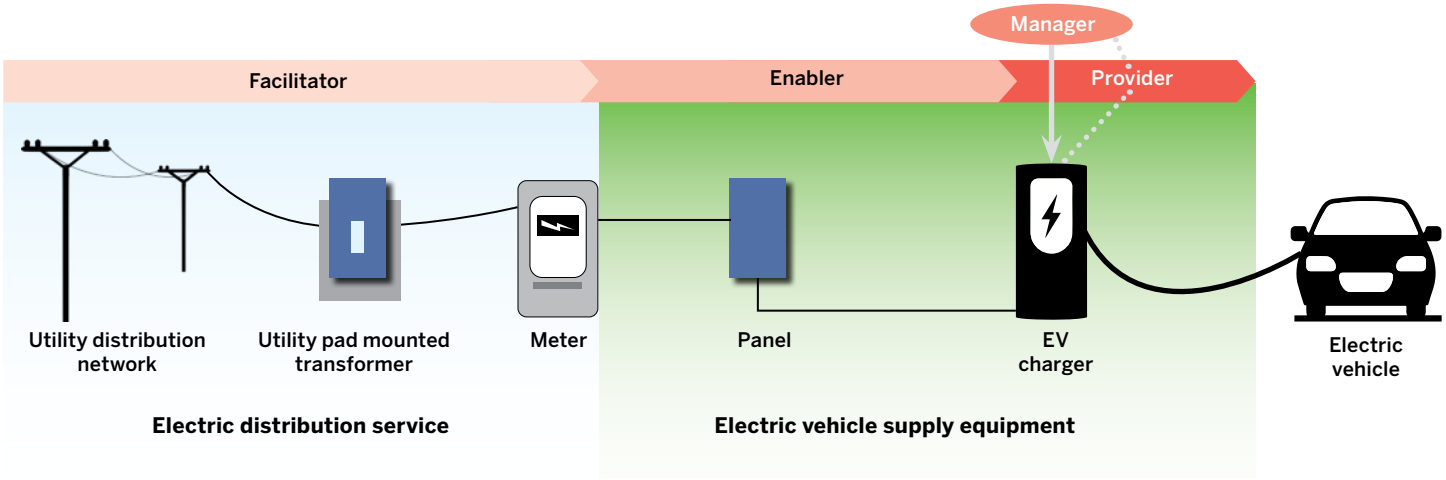
70 Regulatory Assistance Project. (2017). *Getting from here to there: Regulatory considerations for transportation electrification.* Montpelier, VT: Author. Retrieved from https://www.raponline.org/knowledge-center/getting-from-here-to-there-regulatory-considerations-for-transportation-electrification/

71 Regulatory Assistance Project, 2017.

72 Sangi, E. (2013, September 25). PUCs: Are EV charging stations utilities? [Blog post]. Advanced Energy Economy. Retrieved from https://blog.aee.net/pucs-are-ev-charging-stations-utilities

73 Morehouse, C. (2019, June 17). *Should EV charging stations be regulated as utilities? Kentucky joins majority in saying no.* Utility Dive. Retrieved from https://www.utilitydive.com/news/should-ev-charging-stations-be-regulated-as-utilities-kentucky-joins-major/556972/

**Figure 4. Potential roles for utilities in EV charging infrastructure**




Sources: Base illustration based on California Public Utilities Commission, Application 15-02-009, Proposed Decision of ALJ Farrar, Mailed November 14, 2016. Roles drawn from Nelder, C., Newcomb, J., and Fitzgerald, G. (2016). *Electric Vehicles as Distributed Energy Resources*; and Advanced Energy Economy. (2018). *EVs 101: A Regulatory Plan for America's Electric Transportation Future*

possibilities. Figure 4[74] illustrates the areas of responsibility for the first four of the following roles.

1. Utility as facilitator: The utility treats EV charging like any other potential load, providing nondiscriminatory electric service when and where requested but not engaging directly in the business of vehicle charging.
2. Utility as enabler: The utility deploys additional infrastructure up to the point of connection to the charging infrastructure to build out capacity in key areas to enable project development — also called the make-ready option — but does not take a direct role in installing, owning or operating the charging infrastructure.
3. Utility as manager: In addition to delivering electric service to the location of the vehicle charger, the utility manages the charging operation to better integrate charging with grid capabilities and grid needs.
4. Utility as provider (may include manager role): The utility delivers electric service to the charging equipment, which the utility owns and is able to earn a return on, and the utility provides charging services.
5. Utility as exclusive provider (may include manager role): Vendors other than the utility are prohibited from reselling electricity to the public, which could be inclusive of charging service, effectively extending the utility monopoly functions to plug-in EV charging and the deployment of charging infrastructure.

States have pursued a variety of approaches to utility involvement in charging infrastructure, but none so far has

### California's change in direction

The state of California has struggled with the question of utility involvement in charging infrastructure and ultimately reversed direction. In 2011, the California Public Utilities Commission initially limited the role of its investor-owned utilities, expecting greater market activity from third-party EV charging providers to occur.[75] This was the case until the 2015 passage of SB 350, which directed investor-owned utilities to plan for transportation electrification in their integrated resource plans and required the California commission to approve utility EV programs that accelerate transportation electrification.

74 Base illustration based on California Public Utilities Commission, Application 15-02-009, Proposed Decision of ALJ Farrar, mailed November 14, 2016, p. 8. Retrieved from http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M171/K213/171213824.PDF. Roles drawn from Nelder, C., Newcomb, J., & Fitzgerald, G. (2016). *Electric vehicles as distributed energy resources.* Rocky Mountain Institute. Retrieved from http://www.rmi.org/pdf_evs_as_DERs; and Advanced Energy Economy. (2018). *EVs 101: A regulatory plan for America's electric transportation future.* Retrieved from https://info.aee.net/advanced-energy-policy-brief-ev-101

75 Regulatory Assistance Project, 2017.

included the exclusive provider role. State legislators will need to consider the pros and cons to each of these roles and analyze them in light of state goals and policies.

## Performance-Based Regulation

Most utility regulation in the United States today is cost-of-service regulation. This means that consumers pay utilities for the cost of providing electric service (e.g., for transmission, distribution and other utility infrastructure), plus a regulated return on their investment. This approach incentivizes certain behaviors: Regulated utilities recognize they can maximize revenue and profits by building more assets (generation, transmission, distribution and other infrastructure) and by selling more electricity.

But today, average residential customers are increasingly able to control their energy usage through efficiency upgrades and energy management tools and even to become grid resources themselves through behind-the-meter solar or storage. Consumers are seeking and have access to different energy options. And states, regulators and utilities are seeking ways to incorporate smaller, distributed energy resources that are both consumer- and utility-owned into grid operations. This is a fundamental shift from the 20th century era of large, centrally operated generating plants.

Performance-based regulation is one route to improve on the cost-of-service model, which suits large, centralized power generation, and adapt it to a more dynamic system of energy generating sources that may be customer- or utility-owned. Instead of solely evaluating utilities' costs and investments (inputs), performance regulation introduces an added focus on the public policy outcomes that policymakers and stakeholders (regulators, utilities, consumers, advocates) establish. It then rewards utilities based on their performance in achieving or enabling those outcomes. While traditional cost-of-service regulation looks at performance in terms of sales, revenue, rates and often reliability, performance regulation addresses these concerns and additionally incentivizes state goals, which can include customer engagement and empowerment, environmental outcomes and cost-effectiveness. The good news is that PBR can take a variety of forms and pursue different goals, from measuring improvements and outstanding performance of familiar utility functions to measuring progress and innovation in newer activities.[76]

In many states, PUCs have statutory authority to implement and act on PBR objectives. However, it must be clear which governmental entity has the authority to define what performance regulation means for the state.[77] In states where the utility commission does not have the authority to implement PBR, legislators may want to consider provisions that could give regulators this tool.

76 Kadoch, C., Littell, D., & Shipley, J. (2018, June 14). Brewing up the regulation of the future [Blog post]. Regulatory Assistance Project. Retrieved from https://www.raponline.org/blog/brewing-up-the-regulation-of-the-future/

77 Advanced Energy Economy. (2018, June 5). *Performance-based regulation: Aligning utility incentives with policy objectives and customer benefits.* Retrieved from https://info.aee.net/hubfs/PDF/PBR.pdf

# Conclusion

Electrification of the transport sector (cars, trucks, buses, taxis, ports, etc.) provides an opportunity for states to save citizens money on transport and electricity, increase local jobs and business, address national security concerns, improve public health and combat climate change. Real-world experience and studies show that these benefits can be achieved, but proactive legislative action and state planning are needed to realize the full magnitude of these benefits. Without an early and comprehensive approach, potential benefits will be lost.

This is why many states are adopting legislation to prepare for, shape and accelerate the electrification of the transportation system. Acting at the early stages of electric vehicle adoption can help ensure that these benefits are realized.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