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Transportation Electrification: States Rev Up NGA Submission for EVS33

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Summary

To assist governors in achieving their various transportation electrification goals, NGA hosted a series of four regional workshops, from November 2018 to April 2019, engaging 40 states from across the country. The workshops included officials from governors' offices, state agencies, alongside relevant policy experts. This paper summarizes the lessons learned from those four workshops and identifies areas of common challenges.

The paper is organized around six themes: enhancing state fleet electrification; determining how much charging infrastructure is needed; improving regional coordination; managing the grid for benefits and impacts; achieving electrification for all; and addressing impacts to state revenues.

Keywords: States, transportation, electrification, EV, grid

1 Executive Summary

Governors and states more broadly are pivotal in the ongoing transformation of the transportation sector to one that is increasingly electrified. The transition necessitates decisions regarding a wide range of issues including education and outreach efforts, vehicle and charging infrastructure incentives, the location and specifications of public charging infrastructure, electrification corridor designations and signage and, in some states, allowable vehicle emissions levels.

States have revved up their actions dramatically in the past few years. They have expanded their toolkit beyond tax incentives and education programs that characterized earlier years. New actions include governors issuing executive orders to electrify state fleets, adopting zero-emissions programs, developing strategies for investments under the Volkswagen emissions test cheating settlement, clarifying rules for third party providers of charging infrastructure, approving proposals by electric utilities for using ratepayer funding to support infrastructure investments, and establishing regional programs to advance infrastructure and vehicle programs.

Despite the strong interest in transportation electrification and robust action taken to date, all states are confronting one or more challenges to overcome low adoption rates. These challenges include lack of consumer awareness and education, limited charging infrastructure that contributes to range anxiety, high upfront costs that

prevent equitable access to electric vehicles, and uncertainty in dealing with the impacts to transportation revenue.

To assist governors in achieving their various transportation electrification goals, NGA hosted a series of four regional workshops, from November 2018 to April 2019, that engaged 40 states from across the country. NGA adopted a regional approach to capitalize on similarities such as geography, electricity market structure, current electrification adoption levels and electric power resource mix, to facilitate discussions among neighboring states and because many states already have approached developing electric vehicle charging corridors regionally. The workshops included over 230 officials from a variety of governors' offices, state agencies and departments alongside experts from the private sector, academia, federal agencies and non-profit research and policy organizations. This paper summarizes the insights and lessons learned gathered from those four workshops and identifies areas of common challenges. For each workshop's agenda and slides, please visit [NGA's website](#).

The paper, adapted from a [larger report](#) released by NGA in September 2019, is organized around six themes that were discussed at each workshop:

- Enhancing State Fleet Electrification to Lead by Example
- Determining How Much Charging Infrastructure is Needed, What Type and Where
- Improving Regional Coordination Around Infrastructure Corridors
- Managing the Grid for Benefits and Impacts
- Achieving Electrification for All
- Addressing Impacts to State Revenues

Key observations from the workshops include:

- There is a high degree of interest in the topic of transportation electrification in states across the country, as evidenced by the high level of state participation in the NGA workshops (40 states in total).
- The funds awarded to states under the VW emissions cheating settlement have enhanced interest in electrification broadly, with 35 states opting to use the full 15 percent share allowed for electric vehicle charging infrastructure investments and many leveraging the remaining 85 percent share of funding for electric vehicle incentives and purchases [1].
- States are in different stages of transportation electrification, both within and across regions, with most experiencing low EV adoption rates, although some are moving more quickly and vigorously than others to increase those rates. The top three states for EV adoption, based on market share in 2018, are: **California** – 7.84 percent; **Washington** - 4.28 percent; and **Oregon** – 3.41 percent [2].
- Electrifying state fleets is a largely untapped opportunity, that can include light, medium and heavy-duty vehicles, and calls for procurement and budgeting reforms. These efforts can help states lower costs, increase visibility of vehicles, and encourage manufacturers to provide a greater inventory of EVs in a state.
- States are seeking ideas and examples for how to address equity concerns. Many states are in very early stages, but eager to ensure that electrification benefits are shared across various demographics (income levels, racial identity, urban and rural locations). This was a common comment among states.
- A growing number of states are adopting additional registration fees for electric vehicles, bringing the total to 28 states as of September 2019, as seen in Figure 1 [3]. There is disagreement around whether the levels being adopted are representative of the impact of EVs on transportation infrastructure costs. There is also concern that such fees create a disincentive to EV purchases.

As governors continue to advance EV adoption, states will be exploring additional actions within these topics as well as others.

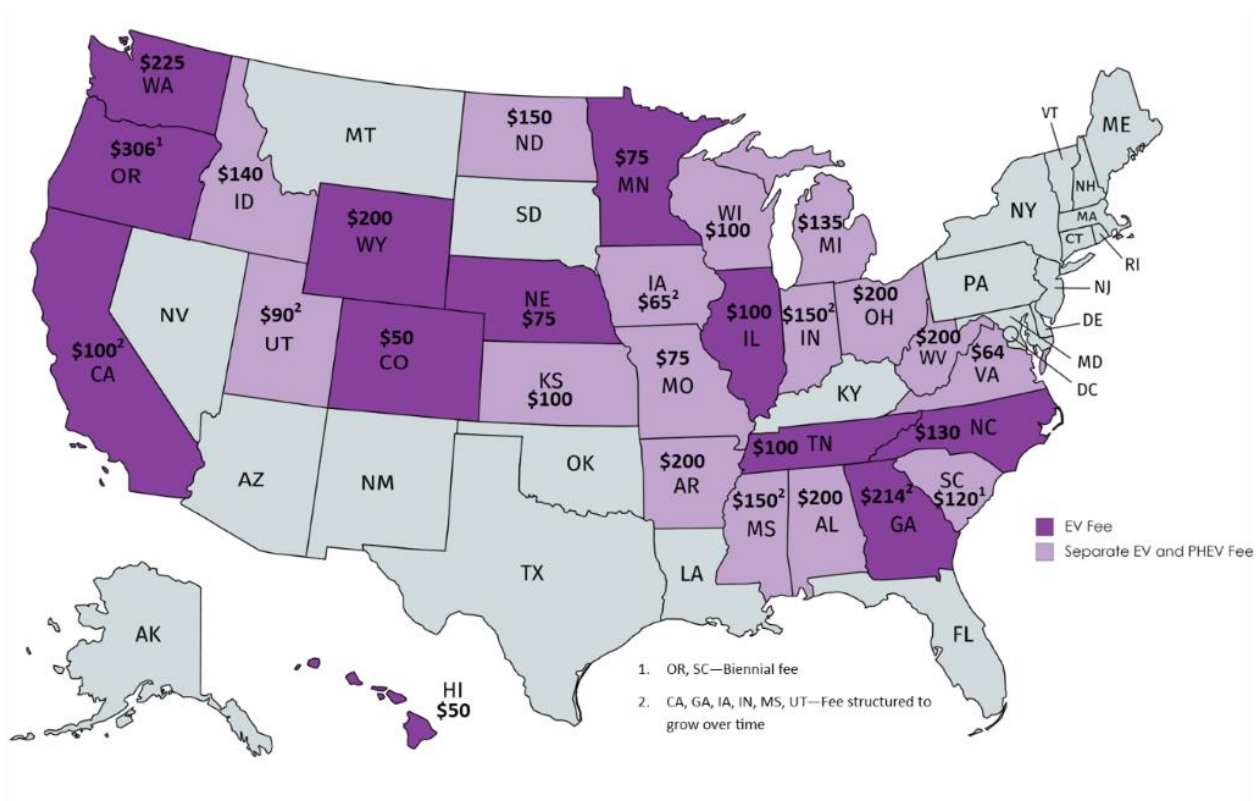


Figure 1: Annual EV Registration Fees by State [4]

2 Enhancing State Fleet Electrification to Lead by Example

States operate large fleets of various vehicle types, including, depending upon the state, light-, medium- and heavy-duty vehicles, public transit and maritime vessels. While only a portion of the national fleet, incorporating electric vehicles into state-owned fleets has two advantages: the vehicles are under the direct control of the state government, and they can be centrally recharged, lowering the infrastructure burden. Electrifying state fleets offers an opportunity for states to lead-by-example, 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.

A major challenge for state fleet electrification is the high upfront costs for many electric vehicles, particularly transit vehicles such as buses, where battery costs remain steep. State workshop participants also highlighted the barriers of limited range and slow installations for heavy-duty charging stations. Other challenges include navigating budget processes that do not account for operational and maintenance savings; installing charging infrastructure on state property; and overcoming complex procurement systems. Furthermore, fewer states directly own public transit vehicles and have less leverage in decision-making. Despite a lack of fleet ownership, states may be looked to for fleet purchase incentives. As EV technology advances and battery costs decrease, larger fleet electrification will become more viable for states to support.

2.1 State Solutions

Several states are utilizing their VW Settlement funds to address the upfront cost barrier to state fleet electrification. **Hawaii** is using more than half of its VW Settlement to electrify school buses, shuttles and public transit [5]. **Rhode Island** committed its entire VW Settlement to fleet electrification and is replacing up to 20 diesel buses with battery electric transit buses [6]. **Washington** is allocating a portion of its VW Settlement to fleet electrification, including funding for electric ferries. In addition, Washington state offers incentives for electric trucks, buses and vessels and has the most aggressive EV fleet requirement in the country: 50 percent of all new state passenger vehicles must be electric by the end of 2020 [7].

Apart from VW Settlement funding, **Maryland** and **New York** offer vouchers to help with fleet vehicle deployment. **Maryland**'s program offers up to \$20,000 for fleet vehicle purchases, while **New York** offers vouchers of up to \$60,000 for eligible trucks [8,9]. **Vermont**'s zero-emission vehicle action plan requires 25 percent of its fleet be zero emissions by 2025. These states are taking the lead in fleet electrification and identifying strategies to spur EV adoption despite limited funding and ownership of fleet vehicles.

3 Determining How Much Charging Infrastructure is Needed, What Type and Where

The fear of being unable to complete a trip in an EV due to a depleted battery and lack of chargers, known as “range anxiety,” is a key barrier to EV adoption. To overcome this hurdle, more charging infrastructure in appropriate locations, as well as faster charging options such as Direct Current fast chargers (DCFC), may be needed. Electrify America is developing its own nationwide charging network, growing out of the \$2 billion VW Settlement allocation. States also are making decisions around use of utility ratepayer funds, standardizing charging infrastructure and managing billing systems.

Electrify America is a key driver for charging infrastructure construction and participated in the workshops. The private company is a subsidiary of Volkswagen and tasked with building out a network of electric vehicle charging stations as a result of the VW Emissions Test Settlement. Electrify America plans to site 2,000 chargers in nearly 500 locations across 42 states by the end of 2019. The company will spend its \$2 billion funding allotment by 2026 over several cycles and aims to install chargers 70 miles apart on all major roadways [10]. States at the NGA workshops demonstrated an eagerness to partner in upcoming cycles with Electrify America to improve coordination for siting charging infrastructure.

Installing charging infrastructure is a significant undertaking. McKinsey and Co. estimates that the United States will need to spend up to \$11 billion by 2030 to ensure that charging stations in both public and private settings are as accessible as gas stations [11]. Currently, 80 percent of all charging occurs at home, typically with level two chargers, but many individuals lack the ability to charge at home, creating a significant barrier to EV ownership [12].

3.1 State Solutions

To address charging needs, most states are utilizing their VW Settlement funds for eligible charging infrastructure projects. There are 35 states utilizing the full 15 percent allocation for EV charging installations [13]. **Tennessee** plans to use its VW Settlement to install chargers at government- and non-government-owned facilities, workplaces and multi-unit residences to prepare for increased EV adoption [14]. **Virginia** used its VW Settlement funding to contract with EVGo to set up a charging corridor on frequently traveled roads. The corridor will feature DCFC's and multiple plug-ins per site, ensuring that 95 percent of state residents live within 30 miles of a charger [15].

Finally, states are using tools developed by researchers at MJ Bradley and the National Renewable Energy Laboratory (NREL) to tackle “range anxiety” by making a more precise identification of charging needs and locations. MJ Bradley offers an [EV charging tool](#) where states can input charging infrastructure priorities and subsequently generates optimal locations for chargers. NREL similarly developed a [planning tool](#) to identify EV

charging needs per state. The tools are being used by states to identify charging needs based on various policy objectives such as EV targets.

4 Improving Regional Coordination Around Infrastructure Corridors

Range anxiety is often cited as a core barrier to greater EV adoption. Several programs at the federal and state levels are working to build range confidence by coordinating infrastructure deployment around heavily traveled corridors across multiple states. Such efforts call for a variety of federal, state, local and private partners. Having a large number of partners can mean efforts can take a while to get under way but ultimately will have larger impacts than any one player working independently. Additionally, state participants discussed how coordination among various stakeholders can be challenging.

A key challenge for states is the federal prohibition on commercial activity at interstate rest areas. Particularly, this creates barriers to EV charging in rural regions where a rest area could be a convenient plug-in opportunity. This law was instituted in 1960 to incentivize cars to stop at local businesses in towns instead of commercial enterprises on interstates [16]. The prohibition contributes to “range anxiety” for drivers along highway routes with limited charging options.

4.1 State Solutions

At the federal level, the Federal Highway Administration (FHWA) is helping states tackle this challenge by designating Alternative Fuel Corridors and increasing transportation awareness for EV owners. During the NGA workshops, the FHWA provided guidance to state participants in how to apply for corridor-ready or corridor-pending designations. As of 2018, the program has nominated 79 corridors covering more than 135,000 highway miles. Corridor signage is another component of the program and is undergoing installation in **Louisiana, Minnesota, Rhode Island** and **South Carolina** [17].

Meanwhile, states from various regions have established their own collaborative efforts to offer EV drivers range confidence:

- The West Coast Electric Highway is a collaboration between **California, Oregon, Washington** and British Columbia to establish a network of EV fast-charging stations infrastructure along major interstates and roadways.
- REV West is a regional collaborative initiated by a Memorandum of Understanding signed by the governors of the eight intermountain states of **Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah** and **Wyoming**. The program identifies best practices for creating an EV corridor across major roadways in the region.
- The Transportation and Climate Initiative is a collaboration of the 12 East Coast states of **Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont** and **Virginia**, that includes the Northeast Electric Vehicle Network to support the development of EV fast-charging corridors. These efforts build on the region’s cap-and-trade program for electric utilities, the Regional Greenhouse Gas Initiative, to help reduce carbon emissions from the transportation sector [18].

5 Managing the Grid for Benefits and Impacts

Transportation electrification brings new challenges and opportunities to the electricity system. Utilities, grid operators and public commissioners must prepare for new, dispersed load growth and expanded peak demand that could strain the electric grid. EVs also offer potential benefits as flexible loads: EVs can charge during lower demand periods and store energy during peak demand periods while playing a role in resiliency strategies. These efforts are still under development but highlight potential for an improved electric grid system.

As the deployment of EVs increases, there is growing concern that they will, at high levels of adoption, add significantly to peak demand and create costly power system ramping needs while threatening grid reliability. States are looking for how to design utility rates to support charging behaviors that enhance not threaten grid reliability and costs, namely inducing homeowners to not charge during peak demand periods, such as immediately after work.

5.1 State Solutions

Time-of-use (TOU) rates are emerging as a solution to concerns over changes to the electric grid. Such rates, especially when paired with “smart charger” technology, can help drivers charge during off-peak hours and enable cheaper “fill ups” that also benefit the grid by smoothing demand fluctuations. Various charging rates include (1) whole house TOU rates, (2) EV-Only TOU rates, or (3) incentivize reward programs. Whole house TOU rates involve one meter for the entire household but may need to shift other energy loads to maximize cost savings [19].

EV-Only TOU rates avoid this issue by isolating a meter for EV charging activity which subsequently is effective at reducing electricity bills for customers [20]. Utilities in **Maryland** and **New Jersey** are implementing these rates as pilot programs. Other utilities are offering rebates or incentives for consumers to engage in TOU programs. In **New York**, Con Edison launched a program to reduce EV owners’ charging costs, improve grid efficiency, and increase resiliency benefits [21].

More than half of all investor-owned utilities have allowed time-of-use rates. Additionally, **California** requires its investor-owned utilities to provide TOU rates. A challenge with new utility rates is customer understanding of their energy bills. Utilities like Xcel Energy are seeking to address this issue by providing consumer education through TOU pilots. Xcel’s program seeks to install 17,500 smart meters and expose the public to electric rate fluctuations [22].

EVs provide valuable grid services like other distributed energy resources (DERs). Traditionally, DERs are viewed as renewable energy sources that are locally connected to distribution systems. EVs with a 30-kWh battery (which is a typical minimum for most light duty EVs) can store as much energy as an average household consumes daily [23].

A potential EV grid service is peak demand reductions and smoothing. In particular, EVs can help address the “duck curve” concerns raised by the use of intermittent renewable resources, especially solar power [24]. With solar resources, energy is provided to the grid while the sun is shining. This energy source is lost at night, which coincides with most people returning home, turning on lights and running appliances that increase electricity demand. The resulting spike in energy usage requires a ramp-up of higher cost energy sources. EVs can avoid exacerbating peak demand by storing energy with owner encouragement to avoid peak-time charging.

Greater benefits could be realized with vehicle-to-grid (V2G) technology, where EVs feed electricity back into the grid. An intelligent fleet of EVs designed around demand response programs can help smooth grid demands, if they are enabled with smart chargers and V2G technology, as well as the necessary regulatory incentives. Such a system is not yet viable, as V2G technology and regulatory programs still are under development and automakers are struggling with concerns over warranty issues [25]. Finally, TOU rates need further refinement as utilities are observing EV charging spikes immediately as off-peak hours begin [26].

6 Achieving Electrification for All

All citizens can share in some of the benefits of EVs, regardless of whether they drive an EV, including lower grid costs and lower greenhouse gas emissions [27]. However, many residents of lower-income and rural communities are not able to share in the full range of benefits, including local air quality improvements, lower overall costs of ownership, improved performance and the convenience of at-home refueling options. This can be due to a variety of barriers, including high upfront costs, incentives that do not align with income levels, a charging infrastructure that is focused on urban locations and single-family homes, and limited EV model offerings that do not include many that function in rugged terrain.

Ownership data indicates that there is an income barrier to EV purchases as some 70 percent of EV owners make more than \$75,000 per year [28]. Moreover, many low-income individuals are unable to take advantage of incentives such as the \$7,500 federal tax credit, or may live in multi-family dwellings without access to charging locations. They may not be able to afford a new vehicle if they can afford a vehicle at all. Rural residents may rely upon medium-duty vehicles that have high upfront costs and live far from a public recharging infrastructure.

6.1 State Solutions

Many state participants in the NGA workshops expressed interest in policy ideas that could help support a more equitable system that would enhance access for all residents. While this issue continues to emerge, there are a growing number of examples of how states can help achieve vehicle electrification for all.

As noted previously, in the discussion of incentives, states including **Maryland** and **Delaware** limit rebates for vehicles exceeding certain price thresholds. **Oregon** and **California** tier rebates based on income eligibility [29]. **Washington** state refined its sales tax incentive program to ensure that consumers who cannot afford a new EV are supported if they wish to purchase a used EV. Washington also makes charging at home and at work more practical by requiring that all new buildings that provide on-site parking equip 10 percent of their parking spaces with EV charging and allocate enough power to eventually handle 20 percent of parking charging capacity [30].

Organizations like EVHybridNoire have led “Just Like Me” campaigns on the campuses of historically black colleges to dispel the notion that EVs are not for everyone. States can consider similar efforts to help distribute benefits more uniformly, including for low-income communities. **California** is utilizing 35 percent of its VW Settlement to prioritize EV charging and incentives in low-income communities, as required by the state legislature. The state plan is required to consider air quality benefits for low-income communities that typically face disproportionate effects from vehicle emissions [31].

Rural communities face different barriers to electrification, including limited charging availability and higher electricity rates. Holy Cross Energy in **Colorado** is a rural co-op with proactive incentives to enable EV services in its community. Holy Cross offers its members access to free Level 2 chargers and devices to take advantage of time-of-use charging rates [32]. These actions are enabling access to EVs for more drivers.

7 Addressing Impacts to State Revenue

States have historically relied on motor fuel tax revenue to support transportation infrastructure projects and operations, as roads and bridges continue to require significant maintenance and upgrades. Fully electric vehicles are not subject to motor fuel taxes, which may put a strain on state revenues as adoption rates increase, alongside other strains due to increasing vehicle efficiency and rising infrastructure costs that are, in many states, not matched by motor fuel tax indexing. Many states are pursuing funding alternatives such as EV registration fees and exploring road-use charges or other mileage-based user fees. States are looking ahead to the need to develop a long-term stable funding stream in light of increasing transportation electrification.

As of September 2019, 28 states had implemented an additional EV registration fee on top of standard vehicle registration fees [33]. These additional fees are designed to capture the “lost” gas tax revenue for transportation operations, but the total revenue is minimal due to EVs accounting for only 2 percent of new vehicle purchases on average [34]. There also are conflicting views on what level of additional fee accurately represents the actual burden placed on the transportation system by each EV [35]. Moreover, there are concerns that such fees are not aligned with state goals to encourage EV adoption.

One well-cited example of the impact of a state registration fee can be found in **Georgia**. Prior to 2015, **Georgia** offered a \$5,000 tax rebate for EV buyers. However, in 2015 the rebate was eliminated and replaced with a \$200 registration fee. The combined effect was that EV sales plummeted in the state, falling 90 percent in the year following the policy changes [36].

7.1 State Solutions

States are approaching vehicle fees in various ways. **Maryland** and **Vermont** are waiting to implement additional registration fees until EVs reach a more significant adoption rate. Other states are mitigating potential disincentives by utilizing vehicle fees to support charging infrastructure. **Alabama, Colorado, Oregon,** and **Washington** are using a portion of the collected fees to support EV infrastructure investments. These approaches highlight innovative approaches that other states may look to as EVs eventually have a greater impact on transportation revenue.

Other policy alternatives such as mileage-based user fees show promise but also raise challenges of their own. For instance, tracking vehicle miles traveled may lead to privacy concerns, but existing pilots have shown that the technology exists to alleviate the risk of misusing travel data. Furthermore, cross-state travel may pose a challenge to mileage-based user fees if neighboring states do not participate. Additional problems that state participants discussed included unsustainable future revenues if vehicle use patterns change, and the inequitable treatment of rural drivers.

Despite certain challenges, mileage-based user fees offer benefits by more precisely charging vehicles for their miles driven. **Oregon** is seeking to capture these benefits and is the first state to enact a fully operational road user charge with its OreGO program. The program enables users to receive credits on gas tax paid and instead pay for vehicle miles traveled. OreGO utilizes a tracker to identify miles driven and fuel consumed. Due to privacy questions, program managers have assured citizens that it does not track locations. To address cross-state travel, the program uses gas taxes as a proxy in the absence of a more generalized model.

8 Conclusion

NGA workshop speakers and participants provided many valuable insights into transportation electrification policy. While many solutions and best practices were discussed, there were many challenges that remained. States need to continue educating the public on available EV models, incentives and charging stations. Additionally, states will have to determine which incentives are most impactful as well as equitable to consumers. States should continue utilizing the VW Settlement funding and take advantage of the electrification potential. Finally, states should respond to demand impacts caused by EVs with effective rate designs. These challenges signal that significant work remains but may be overcome by innovative policies and additional state efforts.

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