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Utility Involvement in Electric Vehicle Charging Infrastructure: California at the Vanguard

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After a contentious, years-long debate about the role utilities should play in owning electric vehicle (EV) charging infrastructure, California's Public Utilities Commission (CPUC) is set to approve proposals from all of its investor-owned utilities to invest ratepayer money in EV charging infrastructure. The pilot programs are meant to accelerate the adoption of EVs by providing certainty about the availability of public and semi-public infrastructure. With this move, California is now an important testing ground for an interesting policy experiment:

whether involving utilities in electric vehicle (EV) charging infrastructure buildout can reap dividends for climate policy. In particular, in California and beyond, interested parties will be watching whether the state is able to balance multiple priorities in the public interest, including ensuring low and fair electricity rates, retaining a robust market for the provision of charging infrastructure goods and services, and accelerating the adoption of electric vehicles for climate and clean air purposes. Ensuring a proper balance between these objectives will not be easy. The outcomes of California's pilot programs could have enormous implications for the future of both the electricity and transportation sectors in the United States and beyond, and may point to whether and how utilities will be involved in building EV charging infrastructure across the country.

What's happening in California?

After years of debate, California has recently approved two proposals (with a third approval imminent) to move forward with a series of pilot programs testing different models of utility involvement in EV charging infrastructure. These pilot programs evolved out of California's broader climate goals, established by the state legislature and subsequent executive orders starting in 2006, of reducing greenhouse gas emissions to 1990 levels by 2020 and 80 percent below 1990 levels by 2050. To meet this goal, California must significantly reduce emissions from the transportation sector, which account for over a third of the state's overall emissions. There are several state initiatives that target vehicle emissions, with the promotion of vehicle electrification chief among them.

To reduce vehicle emissions, California aims to have 1.5 million electric vehicles on the road by 2025 (an ambitious target that requires aggressive adoption rates <http://next10.org/sites/next10.huang.radicaldesigns.org/files/ucd%20next%2010%20report%20final%20082015.pdf> to reach). The state has multiple policies to encourage and accelerate consumer EV adoption, including a state rebate program, access for zero-

emission vehicles to high occupancy vehicle (HOV) lanes and parking benefits, implemented changes to California building codes to be more EV-friendly, dedicated state revenues for innovation in charging infrastructure, and mandated state agency EV procurement, among others (see California's 2015 ZEV draft action plan <https://www.gov.ca.gov/docs/draft_2015_zev_action_plan_042415.pdf> for more information). But deploying EV charging infrastructure remains a key piece of this puzzle, and the CPUC has been grappling with how to best incentivize the development of a public charging network since it opened a proceeding <http://www.cpuc.ca.gov/general.aspx?id=5597> on alternative fuel vehicles in 2009. The key components of the rulemaking include ensuring that EVs efficiently integrate with the grid, that electric utilities set fair rates that encourage electrification, and exploring ways to finance charging equipment and infrastructure.

The availability of public charging infrastructure is seen by state policymakers as an important barrier to adoption that requires policy action to be removed. Until late 2014, that meant promoting investment in EV charging infrastructure from a diverse range of third-party charging station providers—which explicitly excluded utility ownership, except in the cases where utilities could sufficiently demonstrate a market failure or underserved market. In 2011, the CPUC banned utilities from investing in EV charging infrastructure, arguing that the benefit of their participation would be outweighed by the anticompetitive effect of stifling independent parties in the market. In addition to a desire to promote a vibrant and competitive market, ratepayer advocates and the CPUC were also concerned about the distributional impacts of ratebasing EV charging infrastructure—many protested that it was unfair to force ratepayers to subsidize public infrastructure that would only benefit a small group of disproportionately wealthy EV owners.

A confluence of forces led the CPUC to reverse the decision <http://docs.cpuc.ca.gov/publisheddocs/published/g000/m143/k682/143682372.pdf> to ban utility investment in late 2014. As California policymakers and regulators learned

between 2011 and 2014, animating the market for charging infrastructure is extremely difficult, as there is not a strong business case <http://www.c2es.org/docuploads/business-models-ev-charging-infrastructure-03-15.pdf> for public EV charging infrastructure based on selling electricity alone (see below for more details). Furthermore, the need to accelerate adoption to meet climate targets also led regulators to reexamine the role utilities could play, arguing <http://docs.cpuc.ca.gov/publisheddocs/efile/g000/m140/k045/140045368.pdf> that they were well-positioned to "accelerate the PEV infrastructure market [and] can improve the business case for third parties." After a public comment process that resulted in "near unanimity that utilities should have an expanded role in EV infrastructure," the CPUC approved utility participation. However, noting the ongoing "disagreement in the appropriate degree of increased utility participation," the CPUC declined to predetermine an appropriate level of utility activities, maintaining that it would evaluate proposals on a case by case basis, bearing in mind a balancing test between competitive limitation and the benefits of utility involvement. In late 2015, a bill also passed in the state legislature that directed the CPUC to ask utilities to file applications for investments in EV charging infrastructure. The legislature's directive signaled broader support within the state government to mobilize utilities to help deploy EV charging infrastructure in order to meet climate and clean air goals.

Following the CPUC's order, all three investor-owned utilities in the state submitted plans. Originally, Pacific Gas and Electric (PG&E) proposed <http://www.pge.com/en/about/newsroom/newsdetails/index.page?title=20150209_pge_proposes_major_build-out_of_electric_vehicle_charging_stations> to spend $654 million to install 25,000 charging stations; Southern California Edison (SCE) proposed <https://www.sce.com/wps/wcm/connect/148f4922-5d9d-4a66-8637-1c7337830ea4/111414_scechargereadycustomernotice.pdf?mod=ajperes> a $355 million plan for up to 30,000 chargers, and San Diego Gas and Electric (SDG&E) proposed <http://docs.cpuc.ca.gov/publisheddocs/efile/g000/m089/k642/89642617.pdf> to spend $103

million on 5,500 charging stations at 550 sites. The CPUC balked at the cost and scale of these efforts, and directed the utilities to submit more modest proposals. Two of the new, trimmed proposals have each been approved (PG&E's proposal is expected to be approved soon), and all are different models for utility involvement and the role of third-party vendors in EV charging. In January, the CPUC approved <http://newsroom.edison.com/releases/sce-receives-cpuc-approval-for-charge-ready-pilot-program;-will-install-as-many-as-1-500-electric-vehicle-charging-stations-in-southland> SCE's "Charge Ready" program proposal to spend $22 million for 1,500 stations. SCE will allow customers to select, own, and maintain the charging stations (third-party vendors can take over ownership and maintenance), while SCE will own and oversee the supporting electrical infrastructure, and provide financing for the charging stations. Later the same month, SDG&E also received approval <https://www.sdge.com/sites/default/files/documents/461232896/vgi%20fd.pdf?nid=17366> on its $45 million Vehicle-Grid Integration Program proposal to install 3,500 units at 350 locations (businesses and multifamily homes). Unlike SCE, SDG&E will own the charging stations but will contract with third parties to build, install, operate, and maintain EV charging infrastructure. The third proposal, which will likely receive approval soon following a settlement agreement <http://greenlining.org/wp-content/uploads/2016/03/jtmotiontoadoptsettlementall-03-21-16.pdf>, is from PG&E (although this settlement agreement may be modified further by the CPUC). The utility proposed to install 7,500 charging stations over three years, at a cost of $160 million (this is a significantly higher number in terms of both cost and number of stations than was approved for the other utilities and may come down in the CPUC's final approval). PG&E will own the charging stations, but third-party vendors will install and maintain them, as well as handle billing. Each utility expects to scale up infrastructure deployment depending on the results of the pilot; SCE, for example, announced that it will seek authority to build 30,000 stations at a cost of $355 million. In addition, each utility has proposed to locate a certain share of charging stations in disadvantaged communities.

California is not the only jurisdiction trying to figure out how to promote EV adoption, how much EV charging infrastructure is needed, and how to finance it. Legislatures and public utility commissions in a variety of states are grappling with how utilities should be involved in the charging business, including Oregon, Washington, Illinois, Kansas, and Kentucky. The California experiment is likely to have widespread implications for how other states and jurisdictions tackle this issue; many are watching closely but proceeding cautiously. Washington, which has a goal of 50,000 EVs on the road by 2020, is considering a bill <http://app.leg.wa.gov/billinfo/summary.aspx?year=2015&bill=1853> encouraging utilities to build EV charging infrastructure. In that state, half of carbon dioxide emissions come from the transportation sector. Washington-based utility Avista recently asked the Washington Utilities and Transportation Commission for permission to install and rate-base 265 charging stations in homes, workplaces, and public locations at a cost of $3.1 million (that decision is pending). Oregon, already one of the country's largest EV markets, has specific policy goals encouraging EVs. On March 18, the Oregon legislature passed a bill <https://olis.leg.state.or.us/liz/2016r1/downloads/measuredocument/sb1547/enrolled> that instructs the Oregon Public Utility Commission to direct the state's utilities to submit proposals for programs to accelerate transportation electrification, and explicitly stated that it may include "prudent investments in or customer rebates for electric vehicle charging and related infrastructure." Recently, a coalition of consumer advocates, environmentalists, and utilities in the Pacific Northwest passed a resolution <http://www.nwenergy.org/data/ev-resolution-adopted-12_4_15.pdf> supporting utility involvement in EV charging infrastructure. Depending on the outcomes in these states, more states may soon follow.

Utility involvement in EV Infrastructure: The Past, Present, and Future of the Debate

There is a consensus among policymakers, industry and environmental stakeholders that the current availability of EV charging infrastructure is insufficient to achieve the level of market penetration necessary to meet long-term climate objectives. For several reasons, significant barriers to the growth of an EV infrastructure charging network exist. First, and most significantly, as has been demonstrated in California and other markets, establishing a profitable business model for EV charging infrastructure has been challenging. High upfront investment costs, low and uncertain near-term demand, and competition from home charging are all barriers to infrastructure deployment (see this report <http://www.c2es.org/docuploads/business-models-ev-charging-infrastructure-03-15.pdf> for more detail on the challenges and potential solutions regarding the business case for public EV charging infrastructure). EV owners always have the option to charge their vehicles at home, and home is the primary location where charging is expected to take place. That fact limits the amount of money that EV charging providers can charge for their service, making it challenging to pay back the high upfront costs of charging stations in a reasonable period. In addition, there is relatively limited data available about EV owner charging behavior, and uncertainty about how representative it might be. Uncertainty about future demand for charging is a serious issue for investors that also raises financing costs. As a result, depending on the relative price of public charging and a driver's range needs, the amount of public infrastructure necessary (and where to best locate it) remains somewhat uncertain. Given the uncertainties about the scale of infrastructure needed, the difficulty of the business case for EV charging based on selling the commodity alone, and the desire to incentivize a low-carbon transportation sector in a short time frame, many analysts and stakeholders have seen the utility as the way to overcome all three of these challenges: utilities can address uncertainty by being told by regulators to install infrastructure (and at a pace directed by the regulator), can address the financing challenges by seeking ratebasing for the infrastructure, and can deploy in the immediate term if directed

to do so by public utility commissions. In short, the market challenges faced by third-party EV charging vendors evaporate when the utility is the one doing the installing.

Of course, utility involvement does bare risk to ratepayers, and potentially stifles competition. Disagreement remains about the appropriateness of utility participation in this market, the degree of utility involvement, and the ultimate utility role in building, owning, and maintaining EV charging infrastructure. There are advantages and disadvantages to allowing utilities to use ratepayer funds to finance and deploy EV charging infrastructure. Proponents of significant utility involvement argue that there is a need for EV charging infrastructure today in order to build an EV market for tomorrow, and that utilities are the only player that can finance and build this infrastructure at a scale necessary for meaningful deployment on an immediate time scale. Utilities are well-positioned, proponents argue, to overcome two related problems that currently exist for third-party investors: cost and risk. Utilities, it is argued, can overcome both of these obstacles by accessing low-cost capital (backed by ratepayers) while ensuring investors on both the supply and demand side that there is a future market. Therefore, due to their regulated nature, utilities are able to overcome the problems of business and financial risk that may hamper other market participants—and their investments can further mitigate risk for other third-party participants by reassuring investors that a market exists. Furthermore, utilities' investments are overseen by state regulatory commissions which can monitor deployment, direct it where it is needed, and make sure capital outlays are prudent and in the public interest. Finally, proponents of utility involvement argue that utilities will have to be engaged in the business of EV infrastructure anyway, given that EV charging will have an impact on the dynamics of the grid and alter the way that utilities manage demand, supply, and load. Having utilities involved early can encourage the adoption of new rates structures that will be necessary for grid optimization of distributed and intermittent energy resources.

Many utilities see the benefit of involvement, because EVs are seen as one of the only potential areas of future load growth (in a paper <http://www.eei.org/issuesandpolicy/electrictransportation/fleetvehicles/documents/eei_utilityfleetsleadingthecharge.pdf> released in 2014, the utility industry association called transportation a "huge, albeit long-term opportunity for load growth" and that it "makes good business sense today"). In this way, ratepayers may actually benefit from PEV deployment; one study <http://www.caletc.com/wp-content/uploads/2014/10/caletc_tea_phase_2_final_10-23-14.pdf> focused on California found that under four different scenarios, "additional revenue from PEV charging exceeds the marginal costs to deliver electricity to the customer, providing positive net revenues that put downward pressure on rates." In fact, the impact on utility revenues is complex and challenging <http://www.nreca.coop/wp-content/uploads/2015/06/managing_the_financial_and_grid_impacts_of_plugin_electric_vehicles.pdf> to assess due to unknown consumer charging behavior, potential impact to the distribution network from clusters of EVs, and an unknown impact on wholesale markets. But the potential exists to increase demand but shift that demand to off-peak times of the day, lowering overall costs for ratepayers and improving the efficiency of the system as a whole.

Opponents are concerned about the immense cost of the venture falling on ratepayers that will not benefit from these investments. They argue that EV charging infrastructure is a large investment, and the enormous costs (which are born by all ratepayers) benefit a relatively small group of people (those who can afford expensive EVs) and provide few other benefits. There is also concern about building out infrastructure before enough is known about future EV adoption and how much infrastructure is ultimately needed. In addition, it is argued, utilities will (intentionally or not) crowd out competition in the nascent infrastructure charging market. Finally, some stakeholders are not opposed to utility involvement in theory, but opposed to the scale of investment being proposed in California.

How should we evaluate California's efforts?

So far, California is leading the way in trying to manage a very difficult balancing act; whether it is able to continue do so as the pilot programs roll out, and eventually scale, remains to be seen. Nonetheless, the state has demonstrated that it will prioritize and encourage public involvement in its decision making, promote competition and non-utility ownership of EV charging infrastructure, reward prudent but forward-thinking investments, and promote creative and new rate structures necessary to manage a grid with high levels of distributed resources. Ultimately, California's success will be judged by several criteria, and there are reasons to be optimistic about California's approach on each. These criteria include:

- *Whether the infrastructure is seen as encouraging EV adoption* . In particular, regulators and stakeholders will be watching to see whether and how charging infrastructure is used. Researchers have relatively little data on charging behavior, and it will be important to judge not just if the infrastructure encourages further adoption but how and when consumers charge. In approving relatively small pilot programs, California is retaining the room to change its approach based on data, if necessary.
- *Whether further infrastructure deployment leads to progress on climate goals* . It is not a given that further EV deployment will lower greenhouse gas emissions, but depends on several factors, including whether EVs substitute for gasoline powered cars, and what source is used to generate the electricity used to charge cars. California's ambitious goals to reduce greenhouse gas emissions from its electric power sector are assumed to address the latter, although data will be needed to confirm this is the case.
- *Whether California can properly manage the distributional impacts* . The perceived fairness of these programs is an essential element in their being widely accepted and scaled up. The state currently has a significant amount of influence over where infrastructure is built, and one of the benefits of using utilities to finance these investments is that the state can direct them to invest in low-income neighborhoods and on multifamily properties that private developers might ignore. California has mandated that a certain share of charging stations be installed in disadvantaged communities, and that utilities have to spend a certain amount on clean transportation in those communities (SCE and SDG&E are both installing 10% of infrastructure in disadvantaged neighborhoods; PG&E has proposed to install 15% of infrastructure in these neighborhoods). In addition, by including new rate structures in the pilot programs, California may be able to shift load in ways that defers expensive new generation or transmissions assets. This remains to be seen, but could result in lower rates overall.

- *Whether the state can successfully promote new partnership models between utility providers and third-party equipment and management vendors* . In particular, the issue is whether competition in the EV infrastructure and services market will be maintained. California has so far encouraged a competitive market, and is allowing utilities to experiment with how best to balance financing, ownership, maintenance, and billing. Some utilities remain concerned about PG&E's proposal, but whether California has managed to strike a balance between promoting markets and accelerating deployment remains to be seen.
- *How utilities manage broader EV penetration* —and begin to think about EVs as grid assets—is an important part of the policy consideration in California and for others. California is taking pains to make sure that EV adoption and grid management evolve together, and has developed <http://www.cpuc.ca.gov/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy/energy_programs/demand_side_management/ee_and_energy_savings_assist/cpucenergydivisionvehiclegridintegrationzevsummit.pdf> a forward-thinking set of principles for vehicle-grid integration. Clearly, California is thinking about this and how best to encourage utilities to think about how EVs fit into not only the grid of today, but the grid of tomorrow as well. Another way that California has signaled it is thinking strategically about the interaction between vehicles and the grid is through new rate structures for EV owners, which encourage them to charge based on the time of day and resources available to the grid. For example, SDG&E's pilot program includes a dynamic pricing rate to encourage customers to charge when renewable energy is plentiful. If these new rates are successful, it would have enormous implications for grid management, could drive down system costs and increase optimization as well as giving utilities practical experience with offering customers new and varied rates. It could also help them think about new ways to manage distributed resources on the grid, and go a long way to helping utilities figure out the best ways to engage with customers on these complex issues. Of course, this is not a

given—many factors could impede progress in this regard; for example, new rate structures will need to be known and understood by customers in order to be effective.

On all of these items and more, California's CPUC, utilities, and third parties are likely to continue to experiment with new models, financing, and programs. Undoubtedly, not all will be success. But if, on balance, California manages to succeed in most of these goals, it may influence other states to follow its lead.

Michelle Melton is an associate fellow in the Energy and National Security Program at the Center for Strategic and International Studies (CSIS) in Washington, D.C.

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Contact H. Andrew Schwartz
Chief Communications Officer
Tel: 202.775.3242

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