

**Comments on the Treatment of Electricity Used by Electric
Vehicles in the EPA's Proposed Clean Power Plan Rule
Docket ID No. EPA-HQ-OAR-2013-0602**

**Southwest Energy Efficiency Project (SWEET)
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Introduction

The intent of these comments is to examine the potential impact of the proposed rules on state and utility policies to support electric vehicles, and propose a modification that would avoid unintended adverse impacts on the adoption of electric vehicles.

There are a number of state and utility policies that reduce total carbon emissions, while shifting emissions from other sectors to power plants. The most significant are policies to expand the use of electric vehicles (EVs)¹. Increased deployment of EVs will increase electricity consumption and thus will generally increase carbon emissions by utilities but in most states will reduce total carbon emissions on a net basis through reduced petroleum consumption. Furthermore, the net reduction in carbon emissions due to EV adoption will increase over time as electricity generation is decarbonized. And, over the long term, transportation electrification is essential to meet the goal of deep reductions in greenhouse gas emissions from the transportation sector. While the focus of the Clean Power Plan is reducing carbon pollution from stationary power plants, the Rule should not discourage states or utilities from promoting EVs.

State Policies Have A Significant Impact on EV Deployment

State policies do have a large impact on the number of electric vehicles that are purchased. In 2013, the share of electric vehicles as a percentage of new vehicles sold varied by more than an order of magnitude across the states, from under 0.1% in some states with no policy support up to 1.4% in California and 1.6% in Oregon.

A variety of states have adopted rebates or tax credits for the purchase of EVs, tax credits or grant funds to support the installation of EV charging stations, EV incentives in high occupancy vehicle lanes, building codes to support EV charging, deregulation of the sale of electricity for vehicle charging, and other incentives. A number of utilities have also adopted policies such as EV rates that incentivize off peak charging and reduce total costs for EV drivers, and have provided rebates to support the installation of EV charging.

California and nine other states have adopted a Zero Emission Vehicle (ZEV) mandate. The California Air Resources Board estimates that 15% of new vehicles sold in California will be

¹ Another technology that raises similar issues is the use of high efficiency electric heat pumps to replace natural gas or fuel oil boilers and furnaces.

electric vehicles or hydrogen fuel cell vehicles by 2025². In addition, California is strongly supporting electrification of medium and heavy duty vehicles as part of their strategy to achieve compliance with federal ozone standards.

Expanded Deployment of EVs is Essential to Achieving Greenhouse Gas Emissions Reductions and Meeting Air Quality Standards

Electric vehicles have no tailpipe emissions, but do have upstream emissions associated with the power plants that produce the electricity to power the vehicles. Each additional EV will increase electricity consumption, and thus power plant carbon emissions. However, because this EV will replace an internal combustion engine vehicle, it will also avoid the tailpipe carbon emissions that would have been generated by the burning of gasoline or diesel fuel. The net emissions impact will vary, depending on both the carbon intensity of electricity generation in the state during a particular point in time, and the fuel economy of the vehicle that is replaced.

In most states, EVs will lead to a net reduction in carbon emissions in the near term compared to the average new vehicle meeting the Corporate Average Fuel Economy (CAFE) standards³. This emissions benefit will increase with the implementation of the Clean Power Plan, as carbon emissions from power plants go down. The EPA has recognized the emissions benefits of electric vehicles by adopting incentives for electric vehicles in the greenhouse gas standards that it adopted in tandem with the adoption of the most recent CAFE standards by the NHTSA.⁴

In addition, over the longer term, vehicle electrification is necessary in order to achieve deep reductions in carbon emissions from the transportation sector. While fuel efficiency improvements and reductions in per capita vehicle miles travelled can lead to some reductions, achieving the goal of an 80% or greater reduction in carbon emissions by 2050 will require that a

² California Air Resources Board, *California's Zero Emission Vehicle Program* (June 2009), http://www.arb.ca.gov/msprog/zevprog/factsheets/zev_tutorial.pdf

³ Nick Nigro and Shelly Jiang, *Lifecycle Greenhouse Gas Emissions from Different Light-Duty Vehicle and Fuel Pathways: A Synthesis of Recent Research* (Arlington, VA: Center for Climate and Energy Solutions, 2013), <http://www.c2es.org/publications/lifecycle-greenhouse-gas-emissions-different-light-duty-vehicle-fuel-pathways-synthesis>;

Don Anair and Amine Mahmassani, *State of Charge: Electric Vehicles' Global Warming Emissions and Fuel Cost Savings Across the United States*, (Union of Concerned Scientists, Boston, MA, 2012), http://www.ucsusa.org/assets/documents/clean_vehicles/electric-car-global-warming-emissions-report.pdf;

Mike Salisbury and Will Toor, *Transportation Fuels for the Southwest: Life-cycle Energy Use & Environmental Impacts of Electric, CNG and Gas Vehicles* (Southwest Energy Efficiency Project, 2013), http://www.swenergy.org/publications/documents/Regional_Fuel_EmissionsFNL.pdf

⁴ US EPA, *EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Year 2017-2025 Cars and Light Trucks*, <http://www.epa.gov/otaq/climate/documents/420f12051.pdf>

significant portion of the transportation fleet be electric vehicles powered by no carbon or very low carbon electricity⁵.

Given these emissions reductions, the existence of state policies supporting EVs, the inclusion of ZEV mandates in state clean air plans, the fact that the EPA has adopted regulations to incentivize electric vehicles, and fact that the federal government has adopted other policy support including tax credits for the purchase of EVs, it would be very unfortunate if the Clean Power Plan worked at cross purposes, discouraging states and utilities from acting to increase the adoption of EVs.

How the Clean Power Plan Could Affect State or Utility Action To Support Electric Vehicles

The Clean Power Plan proposal allows states to choose between CO₂ emissions rate-based goals or mass-based goals.

In the case of a rate-based goal, additional deployment of EVs could either help or hamper a state in achieving its goal depending on whether EVs in aggregate increase electricity generation from power plants that have above average or below average CO₂ emissions rates for the state as a whole. If EVs increase electricity generation from power plants with below average emissions rates, these plants will be weighted more heavily in the calculation of the overall state average emissions rate, and the state average emissions rate will go down. And the reverse is true if EVs increase electricity generation from power plants with above average emissions rates.

SWEEP has noted in previous comments to the EPA and in its primary comments on the draft Clean Power Plan Rule that natural gas-fired power plants, not coal-fired power plants, are on the margin most of the time throughout the nation.⁶ This means that increased electricity generation due to adoption of EVs will tend to increase the operation of power plants with below average CO₂ emissions rates. This is particularly the case in states with a mix of natural gas and coal-fired plants. In addition, adoption of EVs may facilitate increased levels of renewable electricity generation either by owners of EVs or at sites where public charging stations are located, or by utilities that see electric demand increased at night and can increase wind power generation in response. Thus, SWEEP concludes that the Clean Power Plan in general will not discourage the adoption of EVs in states that choose a CO₂ emissions rate goal, and we

⁵ Yang, C., McCollum D., McCarthy, R., Leighty, W., *Meeting an 80% reduction in greenhouse gas emissions from transportation by 2050: a case study in California*, Transportation Research Part D: Transport and Environment 14, 2009; Melaina, M. Webster, K., *Role of fuel carbon intensity in achieving 2050 greenhouse gas reductions within the light-duty vehicle sector*, Environmental Science and Technology 45 (9), 2011.; International Energy Agency, *Transport, Energy, and CO₂: Moving Towards Sustainability*, 2009.

⁶ *Incentivizing and Providing Appropriate Credit for Energy Efficiency Improvement in Forthcoming CO₂ Emissions Standards for Existing Power Plants*. A policy paper issued by the Regional Energy Efficiency Organizations. Nov. 2013. pp. 9-10.

<http://www.swenergy.org/publications/documents/Carbon Emissions Standards & Energy Efficiency - November 2013.pdf>

recommend no adjustment to the goals to accommodate promotion of EVs in states that choose the rate-based approach.

However, for states that adopt a mass-based goal, the increased electrical load due to additional deployment of EVs will make it more difficult for the states to achieve their goals. It is conceivable that EVs could account for 1% of electricity demand by 2020, and up to 5-7% of electricity used in the leading EV states by 2030. Over the longer term, if all light duty vehicles in a state were converted to EVs, electricity consumption would rise by approximately 20%.⁷ These are large enough increases in electricity consumption to have a material impact on state's ability to meet mass-based targets under the Clean Power Plan.

On November 6, the EPA released supplemental guidance on translation of rate-based to mass-based goals⁸. This guidance lays out two illustrative approaches. In the first approach, the target is based upon historical electricity demand from existing electrical generating units. Under this approach the total generation is based upon a set of adjustments to existing generation, then the target is set based upon the emissions rate target. The state is able to use all of the building blocks, including demand side efficiency measures, to meet this goal. Under this approach, increased transportation electricity demand served by existing generating sources will make it harder for a state to meet its mass-based interim and final goals.

The second approach in the Technical Support Document on translation of rate-based to mass-based goals includes both existing and new sources of generation. In this approach, the targets are based upon a presumed rate of increase in electricity demand based on the Reference Case projections from the U.S. Energy Information Administration's *2013 Annual Energy Outlook* (AEO). The 2013 AEO is very conservative in its projection of future EV market penetration. For example, in California 1.47% of sales in 2030 would be EVs, and 1.01% of vehicles on the road in 2030 would be EVs according to the 2013 AEO. For comparison, in 2013 EV sales in California were already at 1.4% and ZEV sales are expected to reach 15% by 2025. Under this approach, states will be penalized if they take actions to increase EV adoption beyond the levels assumed in the AEO forecast, and in fact would be incentivized to roll back existing policies promoting EV adoption.

The approaches in the Technical Support Document on translation of rate-based to mass-based goals are described as simply illustrative approaches, and states may have the flexibility to use other methodologies to set mass-based targets. One option would be for a state to make its own projection of future electricity demand, based on existing policies. Presumably, states would include projected future EV numbers and associated electrical consumption, based on current policies, into these projections. The state would then convert its rate-based goal to a mass-based goal using this projection of future electricity demand. In this scenario, the state would next develop a state plan showing how it will meet or exceed the mass-based goals. Any new policies

⁷ Christopher Yang and Ryan McCarthy, *Electricity Grid, Impacts of Plug-In vehicle Charging*, (University of California Davis Institute for Transportation Studies, 2009), pubs.its.ucdavis.edu/download_pdf.php?id=1290

⁸ <http://www2.epa.gov/sites/production/files/2014-11/documents/20141106tsd-rate-to-mass.pdf>.

to support additional EV market penetration would increase total electricity demand, and associated power plant emissions, making it harder to meet the mass-based goals. Thus, states will be discouraged from adopting additional policies to expand the use of EVs, and once again would be incentivized to roll back existing policies.

Let us consider a numeric example. Suppose that a state has one million more EVs in a given year than was projected in their reference case (either the AEO Reference Case or the state's own reference case), and that on average each EV consumes 3 MWh during that year. Total electricity consumption increased by 3,000,000 MWh. Let us further assume that this state has an average CO₂ emissions rate of 1,000 pounds per MWh in this year, so total power plant CO₂ emissions increase by 1.5 million tons (3 billion pounds) due to the additional EVs. Thus, the expansion of EVs has increased the state's power plant CO₂ emissions by 1.5 million tons, requiring the state to take other additional actions to reduce emissions by this amount in order to meet their goal. This will act as a disincentive for the state or utilities in the state to actively support EVs.

Modifying the Clean Power Plan Proposal to Not Discourage Promotion of EVs

We believe that the Proposed Rule should be modified to be “EV neutral” in a state that adopts a mass-based goal, neither encouraging nor discouraging state EV policies. The objective is to remove the CO₂ emissions liability associated with the increased electric load due to the adoption of EVs. SWEEP recommends that this objective be met by the EPA allowing states to adjust their mass-based goals to reflect actual electric vehicle load.

In our proposal, adjusted mass-based goals would be calculated as follows:

$$M_t = M + (E_{\text{actual}}) * R_{\text{avg}}$$

Where:

M_t is the adjusted mass-based emission goal

M is the unadjusted mass-based goal adopted by a state pursuant to the final EPA Rule

E_{actual} is the incremental actual transportation sector electrification load, subtracting out transportation load incorporated into M

R_{avg} is the state's average target CO₂ emissions rate (either the interim or final rate)

This approach does not exclude transportation electrification load from the compliance demonstration. It simply allows a state's mass-based goals to be adjusted based upon the actual electricity consumption of EVs, consistent with the underlying goal of meeting the rate-based targets set for the state.

Under this approach, the EPA will in principle have to adopt a procedure to estimate the transportation electrification load contained in each state reference scenario. For the illustrative approaches described in the November 6 supplemental guidance, the electrification load is so small that in practice it may be possible to treat this as *de minimus*. For other approaches that may be adopted by individual states pursuant to the final EPA rule, procedures would need to be adopted assuring that assumed transportation electrification load is reported.

EPA will also need to adopt procedures for how actual transportation electrification load will be measured. In the long-term, with the expansion of smart grids and communication between vehicles and the grid it may be possible to directly measure this load. However, there are reasonable procedures that could be adopted for estimating the load until direct measurement is possible. We describe one methodology below. This is not meant to be prescriptive, but rather is illustrative, meant to demonstrate that it is feasible to correct for transportation load; other methodologies may also be feasible.

The first step would be for a state to use its vehicle registration database, which includes data on make, model and year, to identify all of the light duty battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEV) in operation in a particular year.

For each BEV, the Office of Transportation and Air Quality at the US EPA tracks the electricity use per mile. For the 2014 model year, energy use varies from the most efficient BEV, a BMW i3 at 0.27 kWh/mile, up to a Toyota Rav4 EV at 0.44 kWh/mile.

The next step would be for a state to estimate the average number of miles driven per vehicle. The average number of miles driven per vehicle can be calculated using data available from the American Community Survey or the US FHWA Highway statistics database. This could be done using statewide averages, or by using more fine-grained data which incorporates different travel behavior in different metropolitan areas across a state.

Then the formula for calculating the total electricity load of BEVs is as follows:

$$E = \sum e_i \times n_i \times T$$

Where:

- E is the actual light duty BEV load
- e_i is the efficiency of vehicle i in kWh/mile;
- n_i is the number of vehicle i registered in the state
- T is the annual average number of miles driven per vehicle

For PHEVs an analogous calculation would be performed, supplemented by use of either survey data or a representative sample of vehicles tracked by onboard telematics to determine what percentage of PHEV miles are traveled in all electric mode.

Heavy duty vehicles would require a different measurement technique. The energy consumption of these vehicles will be heavily influenced by how heavily they are loaded. Because electric trucks and buses will have very specific niches, the use of average vehicle miles travelled data would be inappropriate. However, these uses will likely be in areas such as ports, urban delivery vehicles, intermodal centers, and urban transit routes, where almost all charging will occur at a relatively small number of company owned charging locations, unlike the dispersed residential charging that will dominate the light duty sector. This makes tracking the actual electricity consumed feasible through metering at these locations.

Conclusion

SWEEP is proposing a modification to the Rule to allow states that adopt mass-based goals to adjust their targets based upon the actual level of electricity used for charging electric vehicles. These modifications are feasible to implement, and would make the rules neutral to future EV load. This would assure that the Clean Power Plan does not inadvertently provide a disincentive to state and utility support for additional vehicle electrification. SWEEP is not recommending any changes in the Proposed Rule to accommodate EVs for states that choose CO₂ emissions rate-based goals.