



# How and why leading utilities are embracing electric vehicles

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## ABSTRACT

Electricity sales from electric vehicles can help utilities make up for slower sales growth, but only if electric vehicles are a larger share of automobile sales. To increase sales, utilities offer incentives for charging stations and install their own networks of public charging stations. Utilities also offer time-of-use rates to encourage off-peak charging when there is underutilized capacity.

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## 1. Introduction

Across the country, utilities are responding to the growing market for electric vehicles (EVs) with a wide variety of policies and programs meant to promote the sales of EVs while ensuring that their additional electricity consumption benefits the electric system.

Utilities have experienced slower growth in electricity sales in recent years and the expansion of energy efficiency programs and distributed solar photovoltaic (PV) generation is expected to further diminish future sales growth. EVs offer the potential to offset these decreases, but only if they make up a much larger share of the market than today. As the providers of fuel for electric vehicles, electric utilities clearly can play an important role in growing and shaping the market for EVs.

Electric utilities are taking a number of actions to support the adoption of EVs. To boost the number of charging stations and bolster EV owners' confidence in their driving range, utilities have offered rebates and incentives for residential and commercial charging stations. A number of utilities are now installing and operating their own publicly available charging stations and taking a leading role to ensure there are enough charging stations to support significant growth in EV ownership.

The main challenge that utilities face with regards to EVs is that, in order to be most beneficial to the utility system, the additional electricity consumption must not coincide with peak periods of electricity demand (generally, hot summer afternoons and early evenings). To shift EV charging to off-peak hours, utilities across

the country have offered time-of-use (TOU) rates, sometimes with special EV rates.

This article seeks to describe the best practices and leading edge programs from electric utilities across the country regarding electric vehicles to provide insight to other utilities on how to effectively engage with electric vehicles.

## 2. Why electric utilities should embrace EVs

### 2.1. Slower growth in electricity demand

Since 2008, electric utilities across the United States have seen growth in electricity sales slow considerably compared to previous decades (Fig. 1). This decrease in growth rates is reflected in the U.S. Department of Energy's (DOE) Energy Information Administration (EIA) forecasts for future electricity growth. Compared to historic annual growth rates of 2% (EIA, 2015a) (for all sectors between 1990 and 2007), the EIA projects that the US will see average annual increases of only 0.5% between 2015 and 2040 (EIA, 2015b).

This expected decrease in growth rates can be attributed to energy efficiency measures and distributed generation from rooftop solar. The EIA reports that utilities across the U.S. combined saved 26.4 million MWh in 2014 due to energy efficiency measures installed in that year alone (EIA, 2015c). A rough estimate of the distributed solar PV generation from residential and commercial arrays installed in 2014 is another 2.9 million MWh (Greentech Media, 2015; SunShot Vision Study, 2012). Thus, new installations in these two sectors displaced an estimated 29.3 million MWh of electricity generation in 2014 alone.

EVs offer utilities the opportunity to increase demand and potentially even reverse the trend toward lower electricity sales. The Idaho National Laboratory (INL) estimates the average monthly electricity consumption of an EV or a plug-in hybrid electric vehicle (PHEV) to be 261 kWh (INL, 2015). Fig. 2 shows the percentage

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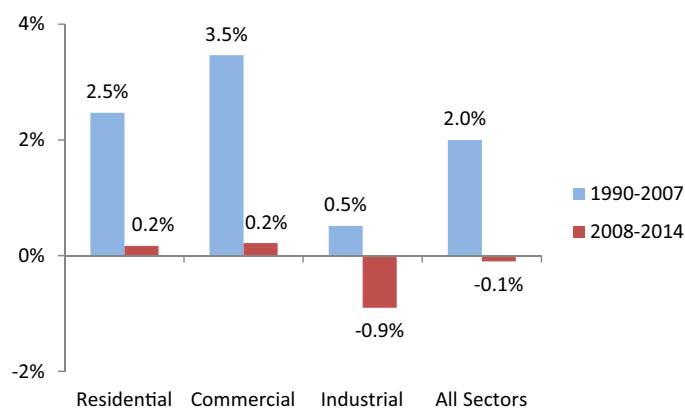


Fig. 1. Average Annual Percent Change in Electricity Sales in United States by Sector (EIA, 2015a).

increase that this additional monthly load would add to the average residential customer's monthly consumption (assuming all charging occurred at home) (EIA, 2015d). Based on existing consumption levels, the addition of an EV would increase the average household's electricity demand by 30%. For comparison, the EIA forecasts that between 2015 and 2040, all residential electricity sales will grow 13% (EIA, 2015b). So the addition of an electric vehicle more than doubles the average household's growth in electricity consumption.

However, much higher levels of EV penetration will be necessary to make up for the decreases in demand due to energy efficiency and solar PV. If an average EV (combination of PHEV and EV) consumes 3100 kWh in a year (INL, 2015), it would require approximately 9.4 million EVs on the road to consume 29.3 million MWh. In the U.S., EVs currently make up approximately 0.7% of all new light-duty vehicle sales and by the end of 2015 there were just over 400,000 EVs in the country. By 2040, the EIA estimates that EVs will account for only 1.6% of all light-duty vehicle sales (EIA, 2015e). While this is an extremely conservative estimate (Tesla alone has already presold more long-range EVs than the EIA has projected 15 years from now) it does describe a low-end scenario, and at this level of market penetration, EVs will not have a significant impact on utility electricity sales. The active involvement of utilities now could play an important role in increasing adoption rates above this baseline.

To approach nearly 10 million EVs on the road in 15 years would require EV sales reaching 5% of all new light-duty vehicle sales. While this may seem challenging, some states are already approaching 3% of new vehicle sales and some metropolitan areas in the United States are approaching 10% (ICCT, 2015).

## 2.2. Environmental benefits and emissions reductions

Utilities should also promote EVs because they provide significant environmental benefits compared to gasoline vehicles.

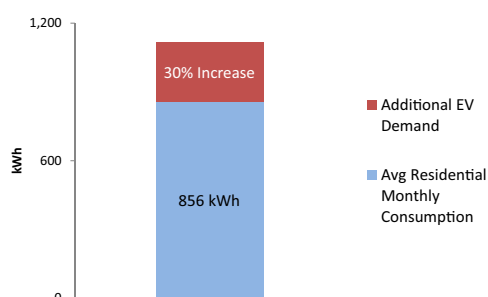


Fig. 2. Growth of Electricity Consumption per Household When an EV is Added.

Across the U.S., EVs produce fewer greenhouse gas (GHG) emissions than a new gasoline-powered vehicle (Union of Concerned Scientists, 2014), and a recent study by the Electric Power Research Institute (EPRI) and the Natural Resources Defense Council (NRDC) found that EVs will provide even greater GHG reductions by 2050 (EPRI and NRDC, 2015).

EVs can also provide reductions in harmful criteria pollutants, compared to a new gasoline vehicle. Reduction of these pollutants provides a public health benefit by reducing respiratory ailments, especially in vulnerable populations such as children and the elderly.

Detailed research conducted by the Southwest Energy Efficiency Project on major urban areas in the Southwest showed that except for increased SO<sub>2</sub> due to the presence of coal plants in some metropolitan areas, EVs reduced all criteria pollutants and GHG emissions compared to a new gasoline vehicle. Because many power plants that supply electricity to the metropolitan regions are located outside the urban airshed, EVs do not contribute to air pollution in the urban areas. Table 1 reflects the electricity mix in each Southwestern metropolitan region in 2013.

With electricity sources shifting away from coal and towards natural gas and renewables across the country, increasingly cleaner electricity mixes mean that the emissions advantages of EVs will increase over time, even as new gasoline vehicles become more efficient and less polluting.

The additional load realized by shifting the transportation sector towards EVs thus comes with an environmental benefit to everyone. This is particularly important as many metropolitan areas across the country will face challenges meeting federal ozone standards. In 2015, the U.S. Environmental Protection Agency (EPA) adopted a new standard of 70 parts per billion (ppb) for ground level ozone, down from the previous standard of 75 ppb. Based on recent ozone levels, 239 counties across the United States exceed the 70 ppb standard (Los Angeles Times, 2014). In many areas, motor vehicles are among the largest sources of both VOC and NO<sub>x</sub>

**Table 1**  
Percent Reduction in Pollutants of EVs Compared to New Gasoline Vehicles in Southwest Metro Areas (Salisbury, 2013a, 2013b; Salisbury, 2014a, 2014b; SWEEP and Utah Clean Energy, 2013).

| Pollutant | Phoenix | Denver | Las Vegas | Albuquerque | Salt Lake City |
|-----------|---------|--------|-----------|-------------|----------------|
| VOC       | 100%    | 99%    | 99%       | 100%        | 100%           |
| NOx       | 76%     | 5%     | 37%       | 62%         | 76%            |
| PM10      | 45%     | 15%    | 31%       | 39%         | 49%            |
| PM2.5     | 60%     | 17%    | 59%       | 52%         | 65%            |
| SO2       | 93%     | –371%  | –94%      | –51%        | 96%            |
| CO        | 100%    | 99%    | 99%       | 100%        | 100%           |
| GHG       | 43%     | 13%    | 58%       | 11%         | 2%             |

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