How Leading Utilities are Embracing Electric Vehicles

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February 2016
CONTENTS

ACKNOWLEDGMENTS........................................................................................................ ii
EXECUTIVE SUMMARY .................................................................................................. 1
I.  WHY SOUTHWESTERN ELECTRIC UTILITIES SHOULD EMBRACE EVs............................. 2
   Slower Growth in Electricity Demand........................................................................ 2
   Environmental Benefits and Emissions Reductions.................................................. 5
   Creating More Value from Underutilized Capacity.................................................. 6
II. UTILITIES’ BEST PRACTICES FOR PROMOTION OF EVs............................................. 11
   TOU/EV Rates ........................................................................................................ 11
      EVs and Demand Charges.................................................................................... 12
      Second EV Meter versus a Whole-House Rate.................................................... 14
      Renewables for EV Charging............................................................................. 15
   Incentives for Vehicles and Charging Stations....................................................... 15
   Utility Investment in Charging Infrastructure.......................................................... 20
      Large Scale Infrastructure Buildout by Utilities.................................................. 21
      Rate-Basing......................................................................................................... 23
   Additional Opportunities for Utilities and EVs.......................................................... 24
      EVs and Demand Response.................................................................................. 24
      Reuse of EV Batteries.......................................................................................... 25
      Promotion of EVs.................................................................................................. 25
      Clean Power Plan.................................................................................................. 26
III. WHAT MAJOR SOUTHWESTERN UTILITIES ARE DOING TO PROMOTE EVs.................... 27
IV. CONCLUSION ............................................................................................................. 28
APPENDIX A: UTILITIES OFFERING SPECIAL RATES FOR EV OWNERS.......................... 29
APPENDIX B: SOUTHWESTERN COUNTIES AND THE EPA’S 8-HOUR OZONE STANDARD........ 30
ACKNOWLEDGMENTS

The authors would like to thank the following individuals for their review and feedback on this paper: Aaron Young, APS; Kathy Knoop, SRP; Eric Van Orden, Xcel Energy; Kathryn Valdez, Mapleton & Sloan, LLC; Michael Shephard, Esource; Anne Smart, Chargepoint; David Patterson, Chargepoint; Mark Detsky, Dietze and Davis; Sara Stratton, PNM; Marie Steele, NV Energy. The author would also like to thank the following SWEEP staff for their contributions: Howard Geller and Gene Dilworth.

Cover photos from left to right are courtesy of Schneider Electric, Wabash Valley Power and Ford Motor Company.

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Portions of this paper were originally published in SWEEP’s 2014 report: NV Energy: Leading the Way on Electric Vehicles.¹

The Southwest Energy Efficiency Project is a public interest organization dedicated to advancing energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. For more information, visit www.swenergy.org.

SWEEP’s Transportation Program seeks to identify and promote the implementation of policies designed to achieve significant energy savings and reductions in greenhouse gas emissions from the transportation sector. SWEEP’s work focuses on two general strategies: reducing vehicle miles traveled and improving vehicle fuel efficiency.

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EXECUTIVE SUMMARY

The growth of electric vehicle (EV) sales in the United States provides both opportunity and challenge for electric utilities. Across the country, utilities are responding to this growing market 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.

The opportunity stems from the potential new market for electricity sales to power EVs. 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 publically available charging stations and taking a leading role to ensure there are enough charging stations to support significant growth in EV ownership. These programs vary in scope from a handful of strategically placed direct current (DC) fast chargers to thousands of Level 2 stations.

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. Research shows that when given reduced rates for charging late at night and early in the morning, EV owners will charge predominantly during these times. In addition to avoiding increases in peak demand, off-peak charging gives utilities the opportunity to increase electricity demand at a time when they have a large amount of underutilized capacity, which can be an economic drain on the entire system. Innovative utilities are also exploring how to address future challenges and opportunities with research on EVs as providers of demand response, how to integrate EV charging with renewable electricity, and how old EV batteries can be used for grid storage purposes.
Utilities that recognize that their own interests can be served by having a greater number of EVs in their service territory and act proactively to support this developing market will be best positioned to minimize the challenges and maximize the system benefits of EVs.

I. WHY SOUTHWESTERN ELECTRIC UTILITIES SHOULD EMBRACE EVs

Slower Growth in Electricity Demand

Since 2008, utilities across the Southwest have seen growth in electricity sales slow considerably compared to previous decades. This trend has been more prevalent in the residential and commercial sectors, but even the industrial sector has seen decreases in annual growth rates (see Figures 1 and 2). 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 in the Southwest. Compared to historic annual growth rates of 3.7 percent (for all sectors between 1990 and 2007), the EIA projects that the Southwest will see annual increases of only one percent between 2015 and 2040.3

This expected decrease in growth rates can be attributed to energy efficiency measures and distributed generation from rooftop solar. The EIA reports that utilities in all southwestern states (AZ, CO, NV, NM, UT and WY) combined saved 2.3 million MWh in 2014 due to energy efficiency measures installed in that year alone.4 A rough estimate of the distributed solar PV generation from arrays installed in these states in 2014 is another 430,000 MWh.5

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 and a plug-in hybrid electric vehicle (PHEV) to be 261 kWh.6 Figure 3 shows the percentage increase that this additional monthly load would add to the average residential customer’s monthly consumption in each southwestern state (assuming all charging occurred at home).7 Based on existing consumption levels, the addition of an EV would increase each household’s electricity demand between 25 and 40 percent. For comparison, EIA forecasts

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5 This is based on the capacity of net metered solar PV from residential, commercial and industrial customers in each state (EIA form 861, Net Metering) factored with each state’s estimated capacity factor (NREL, The Effect of State Policy Suites on the Development of Solar Markets) AZ, .19; CO, .17; NM, .195; NV, .193; UT, .165; WY, .165. The total for 2013 is then subtracted from the 2014 total to estimate how much was generated with new installations in 2014.
that between 2015 and 2040, all residential electricity sales will grow 22 percent.\textsuperscript{8} So the addition of an EV will more than double the average household’s increase in electricity consumption.

Figure 1 | Average Annual Percent Change in Electricity Sales in All Southwestern States by Sector\textsuperscript{9}

![Average Annual Percent Change in Electricity Sales in All Southwestern States by Sector](image)

Figure 2 | Average Annual Percent Change in All Electricity Sales by State\textsuperscript{10}

![Average Annual Percent Change in All Electricity Sales by State](image)


\textsuperscript{10} Ibid.
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 3,100 kWh in a year (as estimated by INL), it would require 871,000 EVs on the road to consume 2.7 million MWh. In the Southwest, EVs currently make up approximately 0.5 percent of all new light duty vehicle sales and it is estimated that by the end of 2015 there were around 30,000 EVs in this region. By 2040, the EIA estimates that EVs will account for only 1.6 percent of all light duty vehicle sales. At this level of market penetration, EVs are unlikely to have any significant impact on utility electricity sales. The active involvement of utilities now could play an important role in increasing adoption rates above this baseline.

Figure 3 | Growth of Electricity Consumption per Household When an EV is Added

To approach nearly one million EVs on the road in 15 years would require EV sales reaching five percent of all new light duty vehicle sales. While this may seem challenging, it is important to note that some states are already approaching three percent of new vehicle sales and some metropolitan areas in the United States are approaching 10 percent.

In addition, two other factors suggest that much higher levels of EV penetration are plausible in the next decade. First, with continuing improvements in battery technology and EV efficiency, at least

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two affordable 200 mile range EVs will likely become available within the next two years, which will make EVs useful for a much broader cross section of the population.

The second major factor is the rise of transportation network companies (TNCs) like Uber and Lyft, and the move towards autonomous vehicles. These vehicles drive far more miles per year than typical personal vehicles, making the cost of fuel much more important to the total cost of ownership. Already, business models are developing to facilitate the use of EVs by TNC drivers. As these services grow, they are likely to account for a significant percentage of vehicle miles travelled in urban areas.

**Environmental Benefits and Emissions Reductions**

Utilities should also promote EVs because they provide significant environmental benefits compared to gasoline vehicles. Across the United States, EVs produce fewer greenhouse gas (GHG) emissions than a new gasoline powered vehicle, 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.\(^\text{14}\)\(^\text{15}\)

In the Southwest, EVs can provide reductions in both GHG emissions and 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 SWEEP on major urban areas in the Southwest showed that except for increased SO\(_2\) 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 region in 2013.

With electricity sources shifting away from coal and towards natural gas and renewables across the country and in the Southwest, 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.


Table 1 | Percent Reduction in Pollutants of EVs Compared to New Gasoline Vehicles in Southwest Metro Areas

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Phoenix(^{16})</th>
<th>Denver(^{17})</th>
<th>Las Vegas(^{18})</th>
<th>Albuquerque(^{19})</th>
<th>Salt Lake City(^{20})</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC</td>
<td>100%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>NOx</td>
<td>76%</td>
<td>5%</td>
<td>37%</td>
<td>62%</td>
<td>76%</td>
</tr>
<tr>
<td>PM10</td>
<td>45%</td>
<td>15%</td>
<td>31%</td>
<td>39%</td>
<td>49%</td>
</tr>
<tr>
<td>PM2.5</td>
<td>60%</td>
<td>17%</td>
<td>59%</td>
<td>52%</td>
<td>65%</td>
</tr>
<tr>
<td>SO2</td>
<td>93%</td>
<td>-371%</td>
<td>-94%</td>
<td>-51%</td>
<td>96%</td>
</tr>
<tr>
<td>CO</td>
<td>100%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>GHG</td>
<td>43%</td>
<td>13%</td>
<td>58%</td>
<td>11%</td>
<td>2%</td>
</tr>
</tbody>
</table>

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 Southwest 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 2012-2014 ozone levels, 33 counties across the Southwest exceed the 70 ppb standard (see list of counties in Appendix B).\(^{21}\) In most of these areas, motor vehicles are among the largest sources of both VOC and NOx emissions (the two precursors that must be present in order for ozone to form).

Creating More Value from Underutilized Capacity

EVs offer utilities an opportunity to increase the demand for electricity, especially during off-peak hours when there can be significant underutilized electric generating capacity. In order to meet peak load demands during summer months, utilities generally have significant amounts of generating capacity that is unused or underutilized during most of the year, especially during the late evening and early morning hours. Many major southwestern utilities have peak summer

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demand that is thousands of MW higher than the average demand over the year (see Table 2). One way to measure a utility’s additional underutilized capacity is to look at its load factor, which measures the average load over a year divided by the utility’s peak load. The lower the load factor, the more potential the utility has to make use of underutilized generating capacity.

Table 2 | Peak Demand, Average Demand and Load Factor from Major Southwestern Utilities in 2014

<table>
<thead>
<tr>
<th>Utility*</th>
<th>Summer Peak Demand</th>
<th>Winter Peak Demand</th>
<th>Average Demand</th>
<th>Load Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevada Power**</td>
<td>5,572</td>
<td>2,907</td>
<td>2,744</td>
<td>0.49</td>
</tr>
<tr>
<td>Sierra Pacific Power**</td>
<td>2,348</td>
<td>1,607</td>
<td>1,043</td>
<td>0.44</td>
</tr>
<tr>
<td>Arizona Public Service (APS)</td>
<td>7,188</td>
<td>4,084</td>
<td>3,903</td>
<td>0.54</td>
</tr>
<tr>
<td>Salt River Project (SRP)</td>
<td>6,760</td>
<td>3,614</td>
<td>4,288</td>
<td>0.63</td>
</tr>
<tr>
<td>Tucson Electric Power (TEP)</td>
<td>2,218</td>
<td>1,551</td>
<td>1,614</td>
<td>0.73</td>
</tr>
<tr>
<td>Xcel Energy - Colorado</td>
<td>6,161</td>
<td>5,783</td>
<td>3,885</td>
<td>0.63</td>
</tr>
<tr>
<td>Public Service Company of New Mexico (PNM)</td>
<td>1,969</td>
<td>1,600</td>
<td>1,388</td>
<td>0.70</td>
</tr>
</tbody>
</table>

*Rocky Mountain Power (RMP) is reported in the EIA statistics as PacifiCorp (which includes CA, OR, WA, ID and WY as well as UT), so it is not possible to give accurate demand information for RMP in Utah.
**Nevada Power (serving Southern Nevada) and Sierra Pacific Power (serving Northern Nevada) are the two companies which make up NV Energy.

Every southwestern utility has the potential to smooth out its demand curve by adding EV charging during off-peak hours.

Underutilized capacity is an economic drain on the entire system because the capital costs of this capacity must be recovered through higher rates if it cannot be spread over a large amount of electricity sales. If underutilized capacity is used more frequently, the fixed capital costs will be spread out over more generation and sales, which would reduce pressure on rates for all customers. Therefore, additional off-peak charging by electric vehicles could help reduce rates for all utility customers. However, if EV charging takes place in the late afternoon when people arrive home from work it could actually exacerbate peak demand issues.

Figure 4 shows the average demand over the course of an average day for all Xcel Energy customers (residential, commercial and industrial) in Colorado contrasted with the percentage of demand occurring each hour from EVs in Xcel Energy’s 2014 EV Pilot. Xcel Energy’s pilot program did

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not feature a TOU rate, so EV customers were charged the same price for electricity regardless of when they charged their vehicle. This resulted in EV demand for electricity beginning to increase significantly around 3:00 pm and periods of high EV demand overlapping with the overall system’s peak demand between 7:00 pm and 9:00 pm. The highest demand period occurred at midnight, which indicates that even without a TOU rate, customers will still charge during off-peak hours. However, as expected, many EV owners will plug in and start charging when they get home from work or afternoon outings if there is no price signal to discourage this. This is clearly a potential problem for utilities as EV penetration grows.

A solution is TOU rates that charge much more for electricity consumed during peak periods compared to off-peak periods. This pricing policy can work well in part because a household EV charger can be programmed to start charging when the electricity price drops. Data from EV owners with separate EV meters at the three major California investor-owned utilities (IOUs) shows that customers appear to respond well to the TOU EV rates offered by the utilities, with each one seeing a significant ramp-up in EV charging whenever their lowest rates go into effect and minimal charging during peak hours (see Figure 5). While this is ideal from a generation standpoint, there are concerns that the distribution system might face challenges from the ramp-up of so many EVs charging at the same time. However, so far the California IOUs have reported that only 0.1 percent of EVs in their service territories have required upgrades to the distribution system in order to meet the additional demand for electricity.

25 The EV data was transcribed from Figure 4 of the study, which did not include “morning chargers” whose charging behavior does not match with other EV load profile studies.
Research by Idaho National Laboratory (INL) and the EV Project found that, across the country, electricity demand for EVs peaks around midnight and the lowest demand occurs between 6:00 am and noon.\(^\text{27}\)

INL’s research on how EV rates influence charging behavior shows that customers do adjust their charging times based on different electricity prices.\(^\text{28}\) When off-peak rates are offered that are substantially lower than peak rates, customers will shift the vast majority of their charging to off-peak hours.\(^\text{29}\) The research determined that at ratios of six to one for peak vs off-peak charging rates, customers would be expected to charge their vehicles during off-peak periods 90 percent of the time. Appendix A lists all the utilities in the country that offer some kind of special rate or tariff for EV charging.

EVs generally need only one to three hours at Level 2 (or 240 volts, like a clothes dryer outlet) to fully recharge from their day’s usage.\(^\text{30}\) This means that utilities with demand profiles similar to that of Xcel Energy in Colorado (shown in Figure 4 above, with approximately six hours of very low


demand each day) should have plenty of time for EVs to charge without concerns about spilling over into higher demand periods. Even the vehicles requiring nearly complete charges needed less than five hours to fully charge.

The experience to date shows that, with well-constructed TOU rates, utilities should be able to successfully match up periods of lower overall demand with the large majority of charging demand, thereby accomplishing the system benefits described above.

TOU rates give utilities the opportunity to focus residential charging during off-peak hours. This is critical because over 80 percent of EV charging is currently taking place at residences. As longer-range EVs become available, we may see an even higher percentage of EV charging taking place at home. However, workplace and public charging may present utilities with additional challenges and opportunities in managing EV load.

![Figure 6 | The “Duck Curve”](image)

A related challenge utilities may face is the so-called “duck curve” shown in Figure 6. The duck curve dynamic results from increased solar PV generation during early afternoon hours, which lowers a utility’s net load, followed by a need to significantly ramp up generation as solar PV tapers off and peak demand occurs in the late afternoon and early evening. EVs that are plugged in and begin charging when people arrive home from work in the late afternoon could exacerbate this

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31 Ibid.
problem. In addition to TOU rates to discourage late afternoon charging at residences, smart workplace charging which can ramp up EV charging to meet peak solar generation times may be one method to even out the average load during the day and minimize the duck curve phenomenon. Southern California Edison (SCE) has proposed to study the potential for matching EV demand with solar PV generation.

Some utilities with a large amount of wind capacity face another challenge: wind generation, which tends to peak overnight, can sometimes exceed the load demand, requiring curtailment of wind or other electricity generation during these hours. Xcel Energy in Colorado has had to curtail one to two percent of its wind generation in recent years due to high levels of wind generation compared to demand during off-peak periods.\(^3\) Off-peak EV charging can add to the demand during this period, helping to ensure that there is no wasted wind generation.

## II. UTILITIES’ BEST PRACTICES FOR PROMOTION OF EVs

In order to provide examples to interested utilities, SWEEP has compiled a summary of some of the cutting edge programs and policies that electric utilities across the country have undertaken to support EVs. Information was compiled from utility websites, interviews with utility employees, news articles, utility filings to public utilities commissions, data from the Alternative Fuel Data Center (AFDC), the Energy Information Administration (EIA) and other research reports on utilities. The best practices include how utilities are addressing EVs in rates, the different approaches used to support the build-out of charging stations by third parties or by the utilities themselves, customer incentives for EVs, and other ways utilities are incorporating EVs into their business model. This section is not meant to be a comprehensive review of every incentive or EV program offered by U.S. utilities.

### TOU/EV Rates

As of June, 2015, at least 28 utilities (see Appendix A) across the country offered special EV rates to their customers.\(^3\) In addition, over 200 utilities offer TOU rates to their residential customers that could help to encourage off-peak charging of EVs.\(^3\)

As discussed previously, TOU rates can be beneficial to utilities by increasing demand for electricity during off-peak hours when there is significant underutilized generating capacity. TOU rates can also be economically beneficial to EV owners who take advantage of less expensive electricity prices during off-peak hours. While switching from a gasoline vehicle to an EV already results in

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reduced operating costs (even at only $2 per gallon of gas), the additional savings offered by TOU rates provide a small additional incentive to EV adoption. For example, customers at NV Energy and APS (both of which have special EV-specific TOU rates) can save $245 and $446 each year respectively by charging their vehicles during off-peak hours compared to using the regular residential rates.\(^{36,37}\) On the other hand, utilities that do not offer a TOU rate and also have tiered electricity pricing (the more you use, the more you pay) will create a mild financial disadvantage to EV owners. For example, customers of Xcel Energy in Colorado (which has tiered rates during summer months but does not offer a TOU or special rate) would pay an additional $46 annually to charge their EV, compared to the situation with a flat rate.\(^{38}\)

**EVs and Demand Charges**

Utility rates also play an important role in the economics of publicly available non-residential charging stations. Flexibility around demand charges can give owners of DC fast charging stations much greater potential to recover costs and make a business case for their stations.

Commercial customers who would be likely to set up publicly available stations are often subject to demand charges in addition to a per-kWh energy charge. Demand charges are generally based on the highest level of electricity demand (measured in kW) over a 15-minute period in a billing cycle. So if the highest level of electricity demand was 30 kW, the customer would be charged 30 times the per-kW demand rate for the month. Demand charges can be especially challenging for DC fast charging stations (especially if they are separately metered) because they can create very high levels of peak demand for very short periods of time compared to their overall consumption of electricity. These demand charges are often calculated on a monthly, rather than daily basis, and are typically not calculated to assess demand at the system, substation or feeder peak; thus, they may be recovering costs from EV charging stations in excess of the demand they actually impose on the system.

At least one utility offers special rates for EV chargers that can remove the impact of demand charges and make the chargers more commercially viable. The Hawaiian Electric Company (HECO) offers commercial customers who provide EV charging two rates that remove or mitigate demand charges. The first, EV-C, does not have demand charges for off-peak use and offers TOU rates. The second, EV-F, has higher per-kWh charges on a TOU schedule, but does not apply a demand charge at any time.\(^{39}\)

Xcel Energy in Colorado offers a non-EV specific commercial rate (Secondary General Low-Load Factor, or SGL) which may be useful for entities such as DC fast charging stations that have high demand for brief periods but low total energy usage. This rate offers much lower demand charges

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\(^{38}\) In the absence of tiered rates, the regular residential rates would likely be higher. Xcel Energy offers an online calculator (https://www.colorado.gov/pacific/dora/xceltieredrates) to show the impact of tiered rates on a customer’s monthly summer bill. Using average summer consumption (687 kWh) plus average EV consumption (261 kWh), the average EV user would pay an additional $15 per year due to tiered rates.

of $4.84 per kW compared to the Secondary General (SG) rate (which charges $12.84 to $15.80 per kW, depending on the season) in exchange for energy prices that are $0.10 to $0.14 higher per kWh consumed.40

Figure 7 demonstrates the different monthly bills (only demand and energy charges) to operate a separately metered DC fast charging station under the two rates offered by Xcel Energy at different levels of monthly consumption. This assumes that the peak demand is 50 kW in all situations. For situations where there is less than 4,000 kWh per month of electricity consumption, the SGL rate with lower demand charges and higher kWh costs will be much more affordable to a charging station operator. To put these usage amounts in perspective, consider that the average Blink DC Fast Charger involved with INL’s EV Project was used an average of 2.5 times per day and that median energy delivered during a charge session was 9.1 kWh.41 At this rate, the average DC fast charging station would use less than 700 kWh per month and would need approximately six times more usage for the reduced energy cost of the SG rate to offset the higher demand charges. For the purposes of recovering costs, lower monthly bills under the SGL rate mean the station operator can charge EV drivers less to charge their vehicles. In the first situation shown in Figure 7, where there is 1,000 kWh of consumption, a station operator on the SG rate would need to charge EV drivers $0.70 per kWh to recover electricity costs, while a station operator on the SGL rate would need to charge only $0.36 per kWh. Clearly, flexibility around demand charges can give owners of DC fast charging stations much greater potential to recover costs and make a business case for their stations.

Figure 7 | Monthly Electric Bill Under Two Demand Charge Tariffs

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**Electrification of the Transit Sector**

As more transit agencies shift to electric buses, there will emerge another potential area where demand charges can present a barrier to EV adoption. While electric buses have higher capital costs than traditional diesel transit buses, they are much less expensive to operate on a per-mile basis. However, demand charges can significantly reduce the operational savings that electric buses can provide transit agencies.42

Demand charges can be especially high if buses are charged en route or in the midst of their daily operation. Because of the need for high-powered, fast charging to top off the battery, electricity demand can be hundreds of kilowatts.

TOU charges (which are usually highest during the day when buses would be charging en route) may also decrease fuel bill savings. While buses that charge overnight would benefit from TOU pricing, buses that charge en route would likely have to pay peak prices for energy use. Transit agencies would benefit from having optional TOU pricing depending on how they recharge their buses.43

Special demand charge tariffs or no demand charges at all (like those offered by HECO and Xcel Energy) for transit companies operating electric buses will be very helpful in encouraging adoption of these buses.

**Second EV Meter versus a Whole-House Rate**

One issue that utilities and their customers must address is the best way to meter the additional electrical load from an EV. If TOU rates are being used, then an interval meter is necessary to differentiate between usage during peak and off-peak hours. Whether or not a customer or utility uses or requires a separate meter for EV usage is another issue. While an EV-specific meter may be helpful so that a household’s entire electricity consumption is not subject to TOU rates, the cost of the second meter and its installation may outweigh the benefits. Additionally, many EV charging stations contain embedded meters, which can enable utilities to do subtractive billing manually. As part of its charging station proposal discussed below, San Diego Gas and Electric (SDG&E) plans to make use of each charger’s embedded meter and then separately meter the bank of chargers.44 Utilities should consider offering both whole-house and EV-only TOU rates and allow the customer to decide which plan makes the most sense for them.

For example, Pacific Gas and Electric (PG&E) offers EV rates for both the entire household and for only the EV charging station. If the customer opts for a separate EV meter, they need to pay a $100 fee for the second meter and bear the cost of having a second electrical panel installed, which could be hundreds of dollars.45 The remainder of the meter’s cost is recovered by the utility through the

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43 Ibid.
EV rate. Southern California Edison (SCE) also offers a choice of EV rate plans for the whole house or only for the EV. SCE provides the customer with the separate meter at no upfront cost and will install it, but the customer must pay for any necessary upgrades to their electrical system; the cost of the meter is recovered through the EV rate.\textsuperscript{46} SDG&E likewise provides the separate meter at no upfront cost but the customer pays for its installation.\textsuperscript{47}

In California, customers have greatly preferred a whole-house TOU meter as opposed to a separate meter for their EV. Of SCE and SDG&E customers on an EV rate, 92 percent use a whole-house meter rather than a separate EV meter.\textsuperscript{48} Thus the utility system benefits can be even greater than those provided by the EV alone, when purchase of an EV motivates a consumer to opt for a whole-house TOU rate.

**Renewables for EV Charging**

In 2014, the Minnesota legislature passed a bill requiring all retail utilities to offer EV owners a TOU rate and the option to charge their vehicles using only renewable electricity. Xcel Energy in Minnesota offers their Windsourse program to all customers for a premium of about $0.01 per kWh. Xcel Energy is offering 2,500 free kWh to EV customers who sign up for Windsourse. To date, about half of Xcel Energy’s Minnesota customers who have opted for the TOU rate for their EV have also signed up to use only renewable electricity.

Great River Energy (GRE), a rural electric cooperative (REC) serving 1.7 million customers in Minnesota, allows customers to purchase up to 50,000 kWh of wind energy to power their EVs without paying a premium.\textsuperscript{49} This promotion is available to customers purchasing an EV through December of 2016.

**Incentives for Vehicles and Charging Stations**

Because of the potential benefits to utilities and ultimately their customers, a number of utilities are offering incentives to encourage the adoption of EVs. These incentives range from rebates on residential and commercial charging stations to rebates on the vehicles themselves (see Table 4).

Research conducted by the California Electric Transportation Coalition (CALETC) shows that for the major California utilities,\textsuperscript{50} EVs provide net benefits to the utility system due primarily to

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\textsuperscript{46} SCE. 2015. SCE Electrician FAQs.
\textsuperscript{50} Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas and Electric (SDG&E) and Sacramento Municipal Utility District (SMUD).
improvements in a utility’s load factor. The additional revenue generated by the EVs more than
offsets the cost to generate and deliver that additional electricity. This positive net benefit was
demonstrated under several different rate designs (TOU, flat and tiered). The CALETC report also
found that the net lifetime benefit of an EV charging mostly at night under TOU rates was $1,400
greater ($5,000 compared to $3,600) than the net benefit using flat or tiered electricity rates.
Charging off-peak reduces the cost of generation and defers utility investment in generation,
transmission and distribution infrastructure. If the health and environmental benefits of EVs are
included, the net benefits are even greater, although the differential between tiered or flat rates and
TOU rates remains essentially unchanged.

Table 3 | Comparison of Net Benefits of EVs Under Different Types of Rates

<table>
<thead>
<tr>
<th>Rate Type</th>
<th>Net Benefit</th>
<th>Net Benefits including health and environmental benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiered or Flat Rates</td>
<td>$3,597</td>
<td>$4,772</td>
</tr>
<tr>
<td>TOU Rates</td>
<td>$4,977</td>
<td>$6,166</td>
</tr>
</tbody>
</table>

As discussed previously, if EVs can increase revenue for utilities by creating more off-peak demand,
then rates for all utility customers could decrease. If EVs produce a net benefit to the utility, then
there is a justification for offering some portion of the net benefit as an upfront incentive to
increase EV adoption. Thus, there is a sound economic rationale for offering incentives like those
shown in Table 4.

Table 4 and the following text offer an extensive (but not comprehensive) list and discussion of EV-
related incentives offered by electric utilities in the U.S.52

**Alabama Power** will provide $750 rebates to the first 250 customers who purchase an EV.
Commercial customers are eligible for a $500 incentive for the purchase of a charging station.
Alabama Power also offers an upstream incentive of $250 to vehicle dealerships for every EV they
sell or lease in their service area.53

**Jacksonville Energy Authority (JEA),** the electric utility for the city of Jacksonville, Florida, offers
residential customers rebates of either $500 (for PEVs with batteries less than 15 kWh) or $1,000
(for PEVs with batteries 15 kWh or larger).54 JEA has also partnered with the North Florida
Transportation Planning Organization (TPO) to offer commercial customers a free Level 2 charging
station and up to $7,500 for the cost of installation. $300,000 was earmarked for the first phase of
the program, which identified 28 locations in Jacksonville to receive EV chargers. A second phase

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http://www.caletc.com/caletc-research/.
52 Utility programs that can be adequately captured in Table 4 are not described in the text section.
http://www.afdc.energy.gov/laws/state_summary?state=AL.
in_Electric_Vehicles/Electric_Vehicle_Incentives/.
## Table 4 | Incentives Offered by Utilities for EVs and Charging Stations

<table>
<thead>
<tr>
<th>Current Utility Incentives</th>
<th>Residential Charging Stations</th>
<th>Commercial Charging Stations</th>
<th>Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama Power</td>
<td></td>
<td>$500</td>
<td>$750</td>
</tr>
<tr>
<td>Austin Energy&lt;sup&gt;55&lt;/sup&gt;</td>
<td></td>
<td>$1,500</td>
<td></td>
</tr>
<tr>
<td>Central Maine Power</td>
<td></td>
<td>$2,500</td>
<td></td>
</tr>
<tr>
<td>Georgia Power</td>
<td>$250</td>
<td>$500/$10,000</td>
<td></td>
</tr>
<tr>
<td>Glendale Water &amp; Power&lt;sup&gt;56&lt;/sup&gt;</td>
<td>$200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great River Energy&lt;sup&gt;57&lt;/sup&gt;</td>
<td>$500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiana-Michigan Power&lt;sup&gt;58&lt;/sup&gt;</td>
<td>$2,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jacksonville Energy Authority (JEA)</td>
<td>Free and up to $7,500 installation costs</td>
<td>$500/$1,000</td>
<td></td>
</tr>
<tr>
<td>Lansing Board of Water and Light&lt;sup&gt;59&lt;/sup&gt;</td>
<td>$1,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Los Angeles Dept. of Water and Power (LADWP)</td>
<td>$750</td>
<td>$750/$1,000/$15,000</td>
<td></td>
</tr>
<tr>
<td>Northern Indiana Public Service Company (NIPSCO)</td>
<td>$1,650</td>
<td>Free Level 2 $3,000/$37,500</td>
<td></td>
</tr>
<tr>
<td>NV Energy</td>
<td>$30,000 (DCFC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orlando Utilities Commission (OUC)</td>
<td>$500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PECO&lt;sup&gt;60&lt;/sup&gt;</td>
<td>$50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>$500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Miguel Power Authority&lt;sup&gt;61&lt;/sup&gt;</td>
<td>$250/$750</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expired Incentives</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Maine Power</td>
<td></td>
<td>$2,500</td>
<td></td>
</tr>
<tr>
<td>Consumers Energy</td>
<td>$2,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NV Energy</td>
<td>$5,000-$7,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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of the program – installing charging stations for commercial customers – is now accepting applications. The commercial program is supported by Congestion Mitigation and Air Quality funds and is part of TPO’s Regional Alternative Fuels Master Plan.62 The North Florida Clean Fuels Coalition, which is a Clean Cities program, is part of TPO and is responsible for supporting the charging station incentive. North Florida TPO plans to collaborate with other utilities in the area to provide them with charging stations as well.

**Georgia Power**, the utility for the greater Atlanta metro area, offers a wide range of incentives to customers. Residential customers in single-family homes can receive a rebate of up to $250 for a Level 2 home charger. New home builders who install a dedicated Level 2 circuit for a future EV charging station can receive a $100 rebate from the utility.63 To encourage workplace charging, Georgia Power offers rebates of $500 for each Level 2 charger that commercial customers install for their employees. Larger employers and multi-family properties (with over 100 employees or residents) that install at least five charging stations can receive up to $10,000 to offset the installation costs. Georgia Power also has partnered with Nissan to offer those commercial customers already receiving rebates an additional $500 incentive per installed charger.64

The **Orlando Utilities Commission (OUC)** in Florida offers a rebate of up to $500 per charging station.65 This is the third year of a three-year program; it is part of the ChargePoint America program and is funded in part by a grant from the US Department of Energy.

The **Los Angeles Department of Water and Power (LADWP)** offers rebates of up to $1,000 per commercial charging station. Larger sites may receive rebates for multiple chargers. Sites with at least 7,000 daily vehicle visits can choose to receive a $15,000 rebate for the installation of a DC fast charging station.66 Residential customers with an EV also qualify for $750 for a home charging station. The LADWP program is funded by grants from the South Coast Air Quality Management District.

**Northern Indiana Public Service Company (NIPSCO)** offers incentives for commercial customers to install Level 2 and DC fast charging stations. For Level 2 installations, up to two free ChargePoint stations are available and up to $3,000 of the installation costs can be recovered. For DC fast chargers, incentives covering up to 50% of the charger hardware and installation costs (up to $37,500) are available. NIPSCO’s residential customers can receive a rebate up to $1,650 for the installation of a Level 2 home charger. NIPSCO’s EV infrastructure program is part of its settlement with EPA over New Source Review violations.67

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NV Energy has partnered with the Nevada Governor’s Office of Energy to build a fast charging corridor between Reno and Las Vegas along US Route 95 as the first phase of the Nevada Electric Highway. NV Energy is providing $30,000 for the DC fast charging station and two Level 2 ports that will be strategically located along this 450-mile corridor. The Governor’s Office of Energy has established a Demand Charge Offset Program to offset incremental demand charges that the host site may incur as a result of hosting the DC fast charger along the corridor.

**NV Energy has partnered with the Nevada Governor’s Office of Energy to build a fast charging corridor between Reno and Las Vegas.**

**REAs, Rural Electric Generation Cooperatives and Generation and Transmission Cooperatives**

While larger investor-owned utilities (IOUs) have played a major role in promoting EVs, there are a number of rural electric cooperatives (RECs) and rural electrification associations (REAs) that are also taking steps to promote EVs in their service territories. While by no means an exhaustive list, below are several examples of generating co-ops and REAs that are developing programs to increase EV sales.

**Great River Energy (GRE)** is a non-profit G&T organization that provides wholesale power to 28 distribution co-ops that serve 1.7 million customers in Minnesota. It has developed the *Revolt* program to give EV owners served by their member co-ops the option to power their vehicles with only renewable electricity from wind at no additional cost. The utility will purchase 5 MWh of renewable energy credits for each year the vehicle is owned by their customer.68

The Wright Hennepin Co-op, one of GRE’s member cooperatives in Minnesota, offers two EV charging rates for customers and is installing two public charging stations in its service territory.69

The **Illinois Electric Co-op** offers customers the opportunity to finance an EV for 0.5% interest over 60 months.70

The **New Hampshire Electric Co-op** partnered with local businesses to install seven publicly available Level 2 chargers in its service territory as part of a pilot project to better understand charging behavior.71

The **San Miguel Power Authority** in western Colorado offers customers a $250 rebate for the purchase of a PHEV and $750 for a full EV.72

The **York Electric Co-op (YEC)** in South Carolina offers customers an EV rate.73

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Utility Investment in Charging Infrastructure

A number of utilities are going beyond providing incentives to encourage the installation of charging stations and are investing in building out the infrastructure themselves. There are a number of reasons why it may make sense for utilities to be more directly involved in the development of charging station infrastructure.

First, utilities are well positioned to take a long-term approach to building EV charging infrastructure in the same manner as they take a long-term approach to building power plants or transmission lines. Second, they are comfortable making large-scale investments and amortizing the investment over a long period of time, receiving an approved rate of return when capital is invested. This allows utilities to consider installations in underserved areas where the private sector has not yet stepped in. And third, due to their knowledge of load management, utilities are uniquely positioned to set up fast charging stations with minimal demand charges and they understand how to reduce stress on the distribution system.

Several utilities are engaged, or are planning to engage, in a wide range of infrastructure support models and levels of investment.

Georgia Power, in addition to offering incentives for the installation of commercial stations, is installing 50 public charging stations in its territory, which it will own and operate.74 It plans to try to recover the cost of this investment through base rates but has not yet submitted this plan to the state’s utilities commission.

The Hawaiian Electric Company (HECO) is in the process of installing up to 25 DC fast chargers on different islands in its service territory. This is part of a demonstration project where the utility will install, own and operate DC fast chargers at host sites in areas without sufficient EV charging stations. HECO also will conduct research on how DC fast chargers interact with the grid and how they may be used for demand response.75,76 HECO received approval from the state’s public utilities commission to recover the costs of this project through base rates, though the commission plans to carefully scrutinize the program to ensure costs are in line with projections.

In November of 2015, the Louisville Gas and Electric Company and Kentucky Utilities Company filed a joint application to their state utilities commission, requesting the ability to own and operate

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76 Maui Electric Company, Limited; 2015 Test Year Rate Case; Book 5; Docket No. 2014-0318.
publicly available charging stations. Host sites (non-residential customers) would pay for the installation and pay a monthly fee as part of their bill for the utilities to recover the cost of the charging station.\(^77\)

**Kansas City Power and Light** (KCP&L) has installed more than 1,000 public charging stations across their service territory at partner host sites. The cost of the charging station buildout is approximately $20 million and KCP&L is asking the Missouri Public Service Commission to allow them to recover the cost of the charging stations by increasing base rates for their customers. KCP&L has partnered with ChargePoint to supply the stations and manage them once they are installed.\(^78\)

**Large Scale Infrastructure Buildout by Utilities**

In late 2014, the California Public Utilities Commission (CPUC) ruled that IOUs, which had been barred from supporting the deployment of charging infrastructure, were now able to do so. In making this decision, the CPUC indicated it would review proposals made by the state’s three largest IOUs to invest ratepayer funds into charging stations. SDG&E, SCE and PG&E have all submitted proposals to install charging stations in their service territories.

The original plans for the three utilities included a total of 60,000 chargers at a cost of over $1 billion. All of the utilities’ customers support the program as part of their base rates.

**SDG&E** proposed to install 5,500 stations, primarily at multi-family dwelling and workplaces, at a cost of $103 million. The utility plans to recoup the expenditure by adding it to customer rates. SDG&E would own and operate the stations and would sell electricity to drivers or the site hosts. The proposal would test rates that vary by the hour to see how much this type of dynamic rate influences charging behavior. The utility also plans to test the potential for EVs to serve as energy storage to better adjust to peak demands on the system.\(^79\)

**SCE** wants to install 30,000 chargers at a cost of $355 million. Rate-basing this investment is estimated to increase rates by 0.2% or approximately $0.001 per kWh. SCE would own and maintain the supporting electrical infrastructure for the buildout and provide their customers a rebate to purchase commercial charging stations. These customers would then own and operate the stations. SCE’s proposal is an example of a “make ready” approach, whereby the utility takes on upgrading and improving electrical infrastructure on both sides of the meter so that everything is ready for the installation of a charging station. SCE envisions a two-phase program with an initial phase consisting of a pilot program deploying 1,500 charging stations at a cost of $22 million, along with initial market education. The results of this first phase would then inform the roll-out of the

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larger second phase. SCE’s proposal focuses on locations with occupancy times of four hours or more, such as workplaces, multi-family housing and other appropriate destinations. To help keep installation costs down, SCE wants each site to install at least 10 charging stations. In January of 2016, the CPUC approved the first phase of SCE’s program.

PG&E’s initial proposal was to install 25,100 chargers (100 would be DC fast chargers) at a variety of locations, including commercial businesses, multi-family housing and workplaces. The total cost of the buildout would be $654 million and the cost to ratepayers is estimated to be approximately $0.001 per kWh if the investment is added to base rates. PG&E would own the stations while their third party partners would operate the stations; however, PG&E would have control over the technologies and vendors utilized by station operators. The program will also include education and outreach to both site partners and EV drivers. In September of 2015, PG&E’s proposal was significantly scaled back by the CPUC due to insufficient demonstration that the utility’s entrance into the market on such a large scale would not have a negative effect on market competition and would meet the CPUC’s balancing tests. PG&E’s desire to own the stations and control hardware and service providers also raised concerns. In October, PG&E filed two revised proposals, one of which is limited to 2,510 charging stations and the other which would build out 7,500 stations. These proposals are now under review by the Commission; a decision is expected in June 2016.

The proposal from SCE provided much greater flexibility for customers operating the stations and received much broader support that that of PG&E, especially from private charging station companies, ratepayer advocates and end-user customers.

Outside of California, Commonwealth Edison (ComEd) in Illinois is seeking legislative approval to rate-base the cost of spending up to $100 million to install 5,000 charging stations over five years in their service territory (see description of rate-basing below). Charging stations would be focused on multi-family housing, workplaces, local governments, long-term parking areas and lower income areas.

**Utility Ownership of Charging Stations**

As the generators and distributors of electricity, utilities seem to be a good match for owning and operating charging stations. Utilities clearly have experience in operating electrical infrastructure. They know how to handle new electrical loads and have the expertise to determine where charging

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stations could best be located to minimize impacts to the electrical grid. The proposals by California utilities (described above) are driven by a strategic objective to have enough charging stations to support the state’s long-term EV adoption goals along with the belief that the private sector alone will not provide a sufficient number of stations. A major concern with utilities’ owning charging stations is that they will have a strong competitive advantage over the private sector and their entry in the marketplace would make it even more difficult for private companies to be successful in this area.

State public utility commissions decide whether or not IOUs should be able to rate-base investments in charging stations they own (see discussion of rate-basing below). Initial decisions in places such as Hawaii and California seem to indicate that there is regulatory support for this approach in certain situations.

In southwestern states there are some limitations on what utilities may do regarding owning and operating charging stations. In Colorado, IOUs can own and operate charging stations, but they are prohibited from using regulated funding to purchase or support these stations. Public Service of New Mexico (PNM), the largest utility in that state, would need to ask its state utilities commission for permission to use ratepayer funds to own charging stations. In Arizona, the state utilities commission denied APS’s 2010 proposal to own public charging stations (as part of a larger EV program).

Rate-Basing
Utilities have relied on a variety of sources to provide funding for their efforts to support EV and EVSE development. Some have relied on grants, others on partnerships with air quality agencies, and several have rate-based their investments in EVs. Rate-basing allows utilities to recover the costs of investment by charging all of their customers a small fee. If regulated utilities wish to rate-base their costs, they must get the approval of their state utilities commission and justify why all ratepayers should support the investment in EVs. To date, utilities such as Puget Sound Energy (PSE) and HECO have received approval from their respective state commissions to recover the costs of their EV incentives or buildouts through all customers’ rates. Indianapolis Power and Light sought to rate-base the expenditures to build out charging stations for an EV car sharing program but the Indiana commission ruled that ratepayers’ funds should not be used to support charging stations that would be owned by a private company.

PSE estimated that, over its 15-year life, an EV would create $770 of net benefit to the utility, reflecting the marginal revenue from the additional kWh used by the EV. PSE had originally asked for an incentive of $600 for each Level 2 charger a customer installed but the Washington commission reduced the incentive to $500 per charger and limited the program to 5,000 participants. The commission also asked PSE to include research into the actual impacts of EV charging on the grid as part of the incentive program.

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The proposals from the California IOUs all seek to rate-base their investments.

In 2015, the state of Washington adopted legislation stating that electric utilities are allowed to make investments in EV-related infrastructure and to rate-base expenditures for charging stations as long as the increase in rates is less than 0.25%. This legislation was needed to overturn an existing law that prohibited utilities from investing in anything that increased load.\textsuperscript{88}

In 2012, Oregon’s utilities commission ruled that electric utilities are able to own and operate charging stations only if there is no other non-utility entity able to provide charging stations, so as not to impede the development of the private sector. Further, they ruled that utilities are able to rate-base expenditures for the installation and operation of charging stations, pending commission approval of the specific plan, which will be “very closely scrutinized.”\textsuperscript{89} The commission stated that utilities would need to make a “compelling” case that rate-based expenditures on charging stations would provide a net benefit to all their customers.\textsuperscript{90} In addition, the commission indicated that criteria such as a utility’s unique ability to provide infrastructure, compared to the private sector, would also be weighed as a factor.\textsuperscript{91} To date, no utilities have come forward with a proposal to own charging stations, perhaps because it may be challenging to show that there is no other option for providing charging stations.

\textbf{Additional Opportunities for Utilities and EVs}

\textbf{EVs and Demand Response}

One area where EVs may be useful to utilities is as part of demand response programs. Utilities use demand response programs to reduce electricity demand during peak usage times, such as hot afternoons in the summertime. For example, utilities often have demand response programs that allow the utility to turn off or turn down an end user’s air conditioner a specified number of times during the peak season. If a utility is able to reduce this air conditioning load during peak hours, then it can reduce the amount of peak generating capacity it needs to bring online, as well as run costly power plants less during peak periods (or reduce costly spot market power purchases). Since peak power can often be expensive to generate or purchase it can be much less expensive for utilities to reduce demand rather than provide electricity at these critical times.

Utilities are beginning to examine the potential for EVs to play a part in demand response events. SCE is currently researching the potential for demand response among employees who drive EVs at 80 designated workplace charging stations. SCE will offer participants three options for charging their vehicle when they plug in:

\textsuperscript{90} Ibid.
\textsuperscript{91} Ibid.
• Receive a full charge regardless of the cost
• Allow their charging to be suspended if the utility has a demand response event
• Charge as long as they wish with slower charging stations.

The research will utilize a variety of different prices for electricity to test how responsive participants are to the price they pay to charge.92

Along with smart charging, EVs may also give utilities the ability to ramp up EV charging levels during peak renewable generation times. Current charging station technology already allows owners to increase or decrease charging levels. As part of its EV charging infrastructure buildout, SCE is proposing to examine the potential to see how solar PV generation during the day can be coordinated with EV charging to smooth out demand.

Reuse of EV Batteries
Because EV batteries will still have 70 percent of their capacity when they are deemed no longer useful for driving, there is significant potential to use old EV batteries for electricity storage. PG&E is partnering with the German auto manufacturer BMW to research the potential for old EV batteries to be used for electricity storage that can be called on during demand response events. The research is being paired with a demand response program in which PG&E will be able to delay EV charging if a peak demand event is occurring. The batteries from BMW’s old demonstration vehicles will serve as a backup in case there are not enough vehicles available to reduce demand to the level that PG&E desires.93

Nissan and Mitsubishi are also launching pilot projects to see how arrays of old EV batteries can serve as energy management systems.94, 95

Promotion of EVs
One simple step that utilities can use to educate all of their customers about EVs is to provide a link to information about EVs on their main web page.96 While most utilities now have some information about EVs on their website, it is not always easy to find. Examples of utilities that have a link to information about EVs on their main page (or at least a link on a drop down menu on their main page) include Rocky Mountain Power, PG&E and SDG&E. By having this link on the main page, a wider audience than those specifically searching for EV information will be exposed to the utility’s promotion of EVs.

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Utilities have many additional opportunities to explain EVs to their customers. These include the use of bill inserts and inclusion of information on EVs in energy efficiency programs. For example, many utilities contract with energy auditors or energy advisors who work directly with residential and business customers. These advisors could provide information about EVs at the same time they are helping customers learn about efficiency opportunities.

In addition, utilities have significant interactions with major commercial and industrial customers that often have large vehicle fleets. Utilities are well positioned to talk to these customers about the total cost of EV ownership, which is often significantly less than ownership of gasoline vehicles, and to refer customers to other companies that offer larger-scale EV fleet conversion packages.

**Clean Power Plan**

As utilities develop their plans to comply with the EPA’s Clean Power Plan they must consider how the growth of demand due to electric vehicles could impact their compliance. States are able to adopt either a rate-based or a mass-based CO₂ emissions goal. A rate-based goal considers the average emissions rate (in pounds/MWh) for all affected fossil-based power plants. As marginal electricity supply to charge EVs is more likely to come from natural gas-fired rather than coal-fired power plants, additional generation to power EVs would likely improve emissions rates (at least in states with a mix of coal and natural gas). A mass-based goal sets a gross CO₂ emissions target that must be met by the state. Additional power generation for EVs, even if from relatively clean electricity sources, could make it more difficult for states to meet the mass-based goal. Utilities cannot claim credit for the reduced tailpipe emissions of EVs as these emissions are already accounted for in the federal fuel economy and greenhouse gas standards from the EPA and NHTSA. Thus, it is important to be sure that projected EV load growth is built into the mass-based targets.

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96 Natural gas power plants are more likely to be used to meet increased demand from EVS than coal plants which provide more baseload power.

III. WHAT MAJOR SOUTHWESTERN UTILITIES ARE DOING TO PROMOTE EVs

As Table 5 shows, most of the major utilities in the Southwest have adopted TOU rates. Arizona Public Service, Tucson Electric Power, Salt River Project and NV Energy also offer an EV-specific rate.

<table>
<thead>
<tr>
<th>Utility</th>
<th>TOU Rate</th>
<th>EV-Specific Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona Public Service</td>
<td>❖</td>
<td>❖</td>
</tr>
<tr>
<td>Salt River Project</td>
<td>❖</td>
<td>❖</td>
</tr>
<tr>
<td>Tucson Electric Power</td>
<td>❖</td>
<td>❖</td>
</tr>
<tr>
<td>Xcel Energy - Colorado</td>
<td>❖</td>
<td>❖</td>
</tr>
<tr>
<td>NV Energy</td>
<td>❖</td>
<td>❖</td>
</tr>
<tr>
<td>Public Service Company of NM</td>
<td>❖</td>
<td>❖</td>
</tr>
<tr>
<td>El Paso Electric Power</td>
<td>❖</td>
<td></td>
</tr>
</tbody>
</table>

To date, NV Energy is the only southwestern electric utility that has provided incentives for the adoption of EVs or charging stations. In 2013 and 2014, NV Energy offered its *Shared Investment Program* which provided an incentive of between $5,000 and $7,000 for partners to set up publicly accessible charging stations. The utility partnered with 50 commercial customers to double the number of public EV charging stations in the state. In 2015, NV Energy partnered with the Nevada Governor’s Office of Energy to incentivize the installation of DC fast chargers and Level 2 charging stations along a corridor called the Nevada Electric Highway, with the first phase of development taking place along U.S. Route 95 between Reno and Las Vegas. Successful applicants will receive $30,000 to defray the cost of charging station hardware and installation. The Governor’s Office of Energy developed a Demand Charge Offset Program to alleviate incremental costs that a host site may incur as a result of hosting a charging station at their location.

In November of 2015, Rocky Mountain Power (Utah’s largest utility) announced plans to provide $4 million to support the purchase of EV charging infrastructure.98 The proposal has been introduced in early 2016 as one component of Senate Bill 115.

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IV. CONCLUSION

For electric utilities to benefit from EVs, there must be much higher market penetration and EVs should be encouraged to charge during off-peak periods that are beneficial to the grid.

Electric utilities can play a critical role in spurring adoption of EVs by expanding the availability of charging stations for EV drivers. Across the country, leading utilities have offered customers incentives to install charging stations and are beginning to install and operate charging stations themselves. Utility installations range from a handful of DC fast charging stations to thousands of Level 2 stations.

Once EVs are on the road, utilities should encourage charging to take place when it is most beneficial to the electric grid. Charging should be discouraged during system peak times and encouraged when there is a lot of underutilized capacity or during peak generation times for intermittent renewables such as solar PV and wind. TOU rates and smart charging technology are two methods to channel EV charging into optimum time periods.

Utilities that recognize that their own interests can be served by having a greater number of EVs in their service territory and act proactively to support this developing market will be best positioned to minimize the challenges and maximize the benefits that EVs provide.
APPENDIX A: UTILITIES OFFERING SPECIAL RATES FOR EV OWNERS

<table>
<thead>
<tr>
<th>Utility</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama Power</td>
<td>AL</td>
</tr>
<tr>
<td>Arizona Public Service (APS)</td>
<td>AZ</td>
</tr>
<tr>
<td>Salt River Project (SRP)</td>
<td>AZ</td>
</tr>
<tr>
<td>Tucson Electric Power (TEP)</td>
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<tr>
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<td>Georgia Power</td>
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<tr>
<td>Indianapolis Power and Light (IPL)</td>
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</tr>
<tr>
<td>Northern Indiana Public Service Company (NIPSCO)</td>
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<tr>
<td>Louisville Gas &amp; Electric (LG&amp;E)</td>
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</tr>
<tr>
<td>Baltimore Gas &amp; Electric (BGE)</td>
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<tr>
<td>Pepco</td>
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<tr>
<td>Consumers Energy</td>
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<tr>
<td>DTE Energy</td>
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<tr>
<td>Lansing Board of Water and Light (BWL)</td>
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<tr>
<td>Connexus Energy</td>
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<tr>
<td>Dakota Electric</td>
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<tr>
<td>Xcel Energy</td>
<td>MN</td>
</tr>
<tr>
<td>Wright Hennepin Cooperative Electric Association (WH)</td>
<td>MN</td>
</tr>
<tr>
<td>NV Energy</td>
<td>NV</td>
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<td>ConEdison</td>
<td>NY</td>
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<tr>
<td>York Electric Co-op (YEC)</td>
<td>SC</td>
</tr>
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<td>Dominion Virginia Power</td>
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APPENDIX B: SOUTHWESTERN COUNTIES AND THE EPA’S 8-HOUR OZONE STANDARD

Appendix B lists the southwestern counties that would be in non-attainment of the EPA’s new ozone standard of 70 ppb based on 2012-2014 ozone values. EPA is likely to base non-attainment status on data from 2014-2016 and expects improvements in air quality between these two periods. The table also indicates which counties are in non-attainment for the current standard of 75 ppb. Based on current levels and currently implemented (or planned) policies and actions, the EPA estimates that by 2025 only Jefferson and Larimer Counties in Colorado will still not be in attainment of the new standard.

<table>
<thead>
<tr>
<th>State &amp; County</th>
<th>2012-2014 Value(^{100})</th>
<th>Currently in Non-Attainment for 8-hour Ozone(^{101})</th>
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<tbody>
<tr>
<td><strong>Arizona</strong></td>
<td></td>
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<tr>
<td>Cochise</td>
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<td>Coconino</td>
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<td>Gila</td>
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<td>La Paz</td>
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</tr>
<tr>
<td>Maricopa</td>
<td>80</td>
<td>^</td>
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<tr>
<td>Pima</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Pinal</td>
<td>73</td>
<td>^</td>
</tr>
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<td>Yavapai</td>
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<td></td>
</tr>
<tr>
<td>Yuma</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td><strong>Colorado</strong></td>
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</tr>
<tr>
<td>Adams</td>
<td>73</td>
<td>^</td>
</tr>
<tr>
<td>Arapahoe</td>
<td>71</td>
<td>^</td>
</tr>
<tr>
<td>Boulder</td>
<td>75</td>
<td>^</td>
</tr>
<tr>
<td>Denver</td>
<td>65</td>
<td>^</td>
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<td>81</td>
<td>^</td>
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<td>El Paso</td>
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<tr>
<td>Jefferson</td>
<td>82</td>
<td>^</td>
</tr>
<tr>
<td>Larimer</td>
<td>78</td>
<td>^</td>
</tr>
<tr>
<td>Rio Blanco</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Weld</td>
<td>74</td>
<td>^</td>
</tr>
</tbody>
</table>


## Nevada
- Clark: 78
- Washoe: 70
- White Pine: 71

## New Mexico
- Bernalillo: 68
- Dona Ana: 74
- Eddy: 71

## Utah
- Duchesne: 78
- Salt Lake: 75
- Tooele: 71
- Uintah: 76
- Utah: 74
- Weber: 73

## Wyoming
- Lincoln: *(data not available)*
- Sublette: 64
- Sweetwater: 64