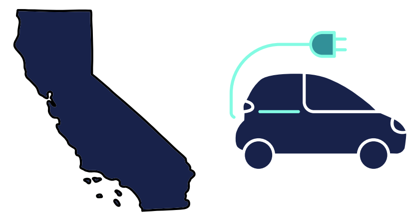
Electric Vehicles Are Driving Rates Down for All Customers



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State Factsheet: California

Electric vehicle drivers in California contributed $2.2 billion more to utilities than their associated costs to the grid over the past 11 years, driving electricity rates down for all customers.

Electric vehicles (EVs) offer a key opportunity to reduce harmful emissions and save consumers money at the same time. EVs are responsible for far fewer greenhouse gases and local air pollutants than conventional vehicles[i] and become cleaner as more renewable electricity is added to the grid. In addition, EVs are generally much cheaper to operate than conventional vehicles.[ii]

The number of EVs on the road is rapidly increasing. By the end of 2023, more than 1.7 million EVs had been sold in California.[iii] Federal, state, municipal and industry action to increase EV adoption will continue to accelerate the clean vehicle transition.[iv] The new electricity load and flexible demand represented by these vehicles has major implications for our future energy system and could increase total electricity use by 25 percent across the United States.[v] By charging during hours of the day when there is least demand on the grid, the electric vehicle transition could reduce electric rates for everyone.

Evaluating the impact of electric vehicles on the road today can help us understand their effect on the grid and how they might shape the power system in the future. Accordingly, this analysis examines costs and revenues associated with EVs between 2011 and 2021 in California. **We observe that over the 11-year period, EV drivers in California contributed approximately $2.2 billion more than their associated costs, driving rates down for all customers.** When we also include utility expenditures for EV programs, EV owners have contributed approximately $1.8 billion more in revenues than in costs.

How Are EVs Affecting Electricity Rates?

Recent growth in EV adoption has raised the question of how EVs affect the electricity rates paid by all households, including those that do not own EVs. This is an important equity question that should be analyzed when determining the role that electric utilities should play in supporting the transition to EVs. Answering this question requires comparing electric utility revenues from EV charging with utility costs associated with serving EV load. If the utility revenues from EVs exceed the utility system costs, then EV adoption can reduce electricity rates for all customers in California because of revenue decoupling.[vi] Conversely, if the costs are greater than the revenues, non-EV owners could end up paying more for their electricity.

Multiple prospective studies have forecasted that utility revenues will exceed costs with future electrification.[vii] However, to address this question using real-world data, Synapse evaluated the utility system revenues and costs associated with EVs purchased within the last decade across California. Specifically, this analysis tracks revenues and costs associated with over 997,000 battery electric and plug-in hybrid EVs sold between 2011 and 2021 in California.[viii]

We analyzed the electricity rates that EV owners pay compared to the marginal cost of providing that electricity (generation, transmission, and distribution costs), plus the expenditures associated with utility EV programs. We used hourly marginal costs based on the California Public Utilities Commission (CPUC)'s Avoided Cost Calculator and load curves from the CPUC's Load Research Reports. We also use a database of EV program expenditures,[ix] assuming that these investments will be paid off over 10 years.

Tracking EV Adoption Across the 50 States

In 2011, which was the first year of our analysis, roughly 6,700 EVs were on the road in California. By 2021, the number of EVs has surpassed 997,000[x] – about a 150-fold increase from 2011. Figure 1 shows cumulative EV sales in California. As can be seen in Figure 1, EV adoption rates are accelerating rapidly in recent years. BloombergNEF predicts that EV sales will represent more than half of all car sales by 2030.[xi]

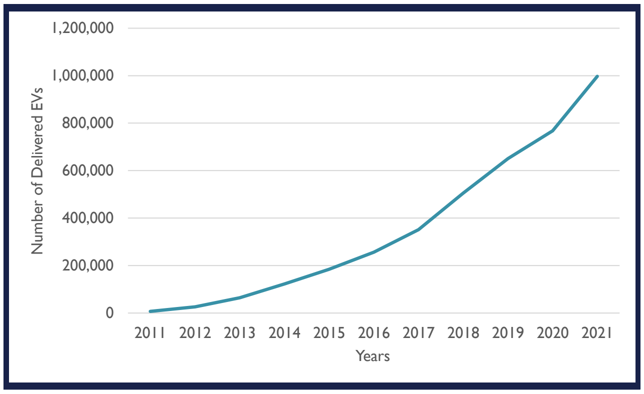

Figure 1. Cumulative EV sales in California, 2011-2021

EV Charging Patterns and Time-of-Use Charging

EVs pull their energy from the electricity grid, but the time of day that the charging occurs defines the cost and carbon content of its power and the impacts on the grid overall. If vehicles charge when demand is already high and electricity is the most expensive, EVs could exacerbate grid impacts and costs. If they can take advantage of low overnight demand or plentiful solar power in the afternoon, they can improve the economic and environmental performance of the power system overall.

For this analysis, we assume the majority of EVs are charging mostly at home and overnight. This hourly use pattern is most typical of the charging patterns of California EVs taking service on time-of-use rates (which represents a large number of EVs on the road currently in California). Time-of-use tariffs affect the costs that consumers pay depending on when they use electricity and can incentivize consumers to use electricity when it is least expensive for everyone (i.e. when there is less overall demand on the grid). Figure 2, below, shows the average daily charging curve for EVs on TOU rates in California alongside average charging curves for EV owners on non-TOU rates.[xii] The grey shaded area represents the hours in California when the electric grid peaks[xiii] and when electricity is most expensive.

As Figure 2 shows, the price signals provided by the time-of-use tariff, combined with EV technology that allows for managed charging, shifts typical EV charging from times of peak use to when demand is typically low. These shifts reduce costs to EV owners and operators for charging their vehicles, while also more efficiently using electricity infrastructure and reducing costs for everyone.

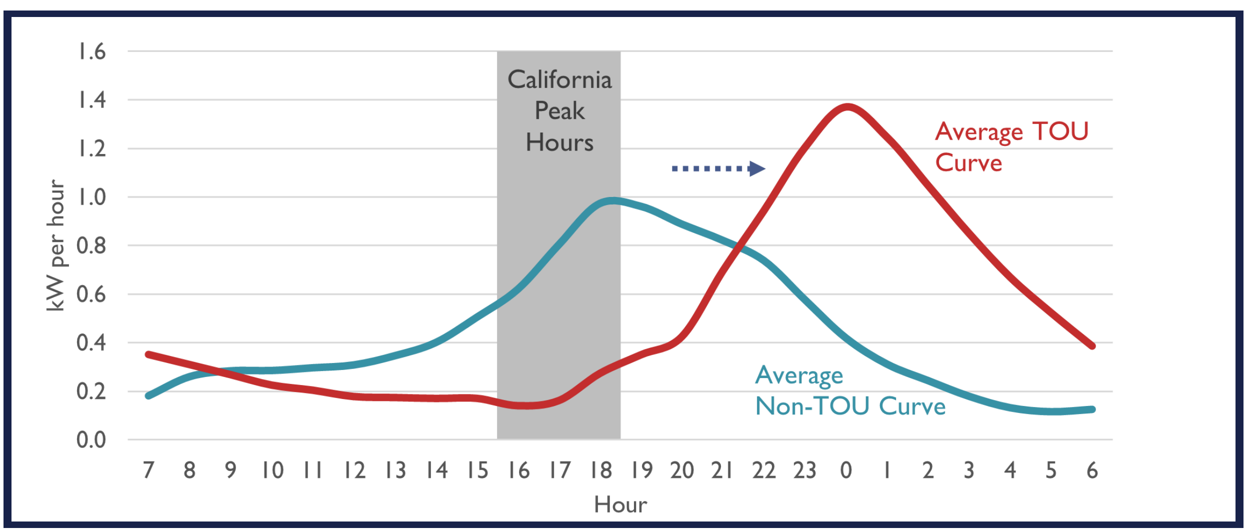

Figure 2. Typical EV charging curve versus the California TOU average EV charging curve, with California peak hours.

A key reason why revenues from EVs outweigh the costs is that EV customers — particularly those on TOU rates — tend to charge during off-peak hours. By charging during off-peak hours, EVs impose minimal additional costs on the grid and help to utilize resources more efficiently. In fact, a report published in 2019 by Lawrence Berkeley National Laboratory, PG&E, and the Natural Resources Defense Council shows that shifting EV charging to off-peak times could allow the grid to accommodate all homes having EVs without upgrading most parts of the distribution system.[xiv]

How does EV charging impact overall electricity rates?

By comparing the revenues generated by EV charging to the utility's marginal cost to serve these EVs, we can construct a picture of whether EVs are creating more revenues than costs (driving costs for everyone down) or creating more costs than revenues (driving costs for everyone up).

The results of our analysis indicate that in California, **EVs have increased utility revenues more than they have increased utility costs, leading to downward pressure on electric rates for EV-owners and non-EV owners alike.** We estimate that EV drivers across the state have contributed $2.2 billion *more* in revenues than associated costs, cumulatively between 2011 and 2021 (in 2021 dollars). Figure 3 shows the extent to which revenues from EVs outweigh the generation, transmission, and distribution costs for the period 2011-2021.

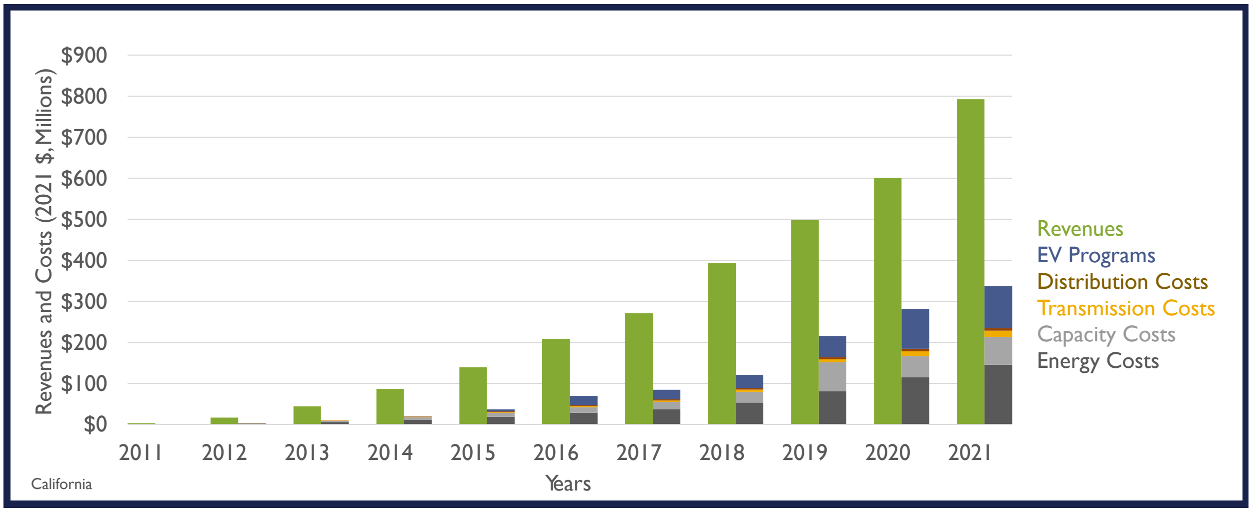

Figure 3. Total costs versus total revenues of EV charging in California per year from 2011-2021.

EVs Can Continue to Put Downward Pressure on Rates

EVs can provide substantial emissions reductions while also helping to reduce electricity rates for all customers by using the system more efficiently. Utilities can play an important role in ensuring that EVs benefit both EV drivers and non-EV drivers alike by encouraging EV customers to enroll in TOU rates and charge during off peak periods. In addition, utility investments that facilitate the deployment of charging infrastructure can accelerate the EV market, growing the potential benefits from widespread EV adoption.

Our analysis indicates that EV adoption in the US, including California, has already resulted in more electricity revenues than costs, and future growth in the EV market will lead to further increases in utility revenues. Implementing TOU rates and targeted investments in charging infrastructure can accelerate EV adoption, reducing utility bill costs and harmful emissions for EV and non-EV owners alike.

This factsheet is part of a series of state-specific factsheets, based off a national analysis of the rate impact of EVs. More information can be found at: https://www.synapse-energy.com/evs-are-driving-rates-down

Endnotes

[i]Rocky Mountain Institute (2022). More EVs, Fewer Emissions. Available at: https://rmi.org/insight/more-evs-fewer-emissions.

[ii]Taylor, T., Rosenburg, J. (2022). Total Cost of Ownership Analysis. Atlas Public Policy. Available at: https://atlaspolicy.com/wp-content/uploads/2022/01/Total-Cost-of-Ownership-Analysis.pdf

[iii]Alliance for Automotive Innovation (2023). Advanced Technology Vehicle Sales Dashboard. Data compiled using information provided by S&P Global Mobility and Hedges & Co. Last updated 3/3/2023. Available at https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard.

[iv]See California's requirement that all vehicles sold by 2035 will be plug-in electric vehicles and General Motors' announcement that they will only sell zero-emissions vehicles by 2035.

[v]National Renewable Energy Laboratory (2022). Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States. Available at: https://www.nrel.gov/docs/fy18osti/71500.pdf.

[vi]S&P Market Intelligence. November 12, 2019. RRA Regulatory Focus Adjustment Clauses.

[vii]For example, see: Public Advocates Office, Distribution Grid Electrification Model – Study and Report, 2023, available at https://www.publicadvocates.cpuc.ca.gov/-/media/cal-advocates-website/files/reports/230824-public-advocates-distribution-grid-electrification-model-study-and-report.pdf, and California Public Utilities Commission, Utility Cost and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates, and Equity Issues Pursueant to P.U. Code Section 913.1, 2021. Available at: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2021/senate-bill-695-report-2021-and-en-banc-whitepaper_final_04302021.pdf

[viii]Atlas EV Hub. State EV Registration Data. Available at: https://www.atlasevhub.com/materials/state-ev-registration-data/.

[ix]Atlas EV Hub. Electric Utility Filings. Available at: https://www.atlasevhub.com/materials/electric-utility-filings/

[x]Atlas EV Hub. State EV Registration Data. Available at: https://www.atlasevhub.com/materials/state-ev-registration-data/

[xi]Boudway, Ira. "More Than Half of US Car Sales Will Be Electric by 2030." September 20, 2022. Bloomberg. Available at: https://www.bloomberg.com/news/articles/2022-09-20/more-than-half-of-us-car-sales-will-be-electric-by-2030.

[xii]National load curve developed using data from DOE's EVI-Pro Lite tool. We took an average of the load curves from each state's largest city, weighted by number of registered EVs per state. Department of Energy, Alternative Fuels Data Center. Data retrieved July 2023. Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite. Available at: https://afdc.energy.gov/evi-pro-lite.

[xiii]System peaks from 2019 – 2021. Peak load data from U.S. Energy Information Administration, form 930.

[xiv]Coignard et al., "Will Electric Vehicles Drive Distribution Grid Upgrades?: The Case of California". June 5, 2019. Institute for Electrical and Electronics Engineers. Available at https://ieeexplore.ieee.org/document/8732007.