BACKGROUNDER

Driving Towards a Clean Grid

How EVs Can Support a More Affordable and Reliable Transition to Clean Electricity in California

HIGHLIGHTS

California will need significant investment in clean energy infrastructure to reach its 2045 electricity goals, and integrating bidirectional vehicles into the grid can reduce these projected costs. Grid-integrated vehicles can reduce the amount of grid infrastructure needed by more effectively using renewable energy resources and reducing peak demand on the electricity system. Policies that support deployment of bidirectional charging–capable vehicles should be prioritized as Californians continue to face rising electricity costs.

California's electric grid is a complex network of generation, transmission, distribution, and storage elements that work together to provide a reliable electricity supply. To meet pollution reduction and climate goals, state policies have directed a gradual transition to fully clean energy. Passed in 2018, the 100 Percent Clean Energy Act (SB 100 2018) sets a 100 percent clean electricity sales target to be met by 2045.

To reach this target and meet projected increases in demand, the state will need a significant amount of new generation, transmission, storage, and distribution infrastructure. The California Energy Commission's (CEC) SB 100 analysis indicates the state will need to build more than 180 gigawatts of new solar, wind, geothermal, and energy storage resources by 2045 (CEC 2025). The California Independent System Operator estimates that the amount of transmission needed will cost between $45.8 and $63.2 billion over the next 20 years (CAISO 2024). Additional spending will also be needed to maintain and expand distribution infrastructure.

Although significant grid investments will be necessary, the batteries in electric vehicles (EVs) could be harnessed to reduce the scale and cost of the grid infrastructure buildout. If operated in concert with the grid, EV batteries could be key to increasing grid reliability and easing the transition to clean electricity.

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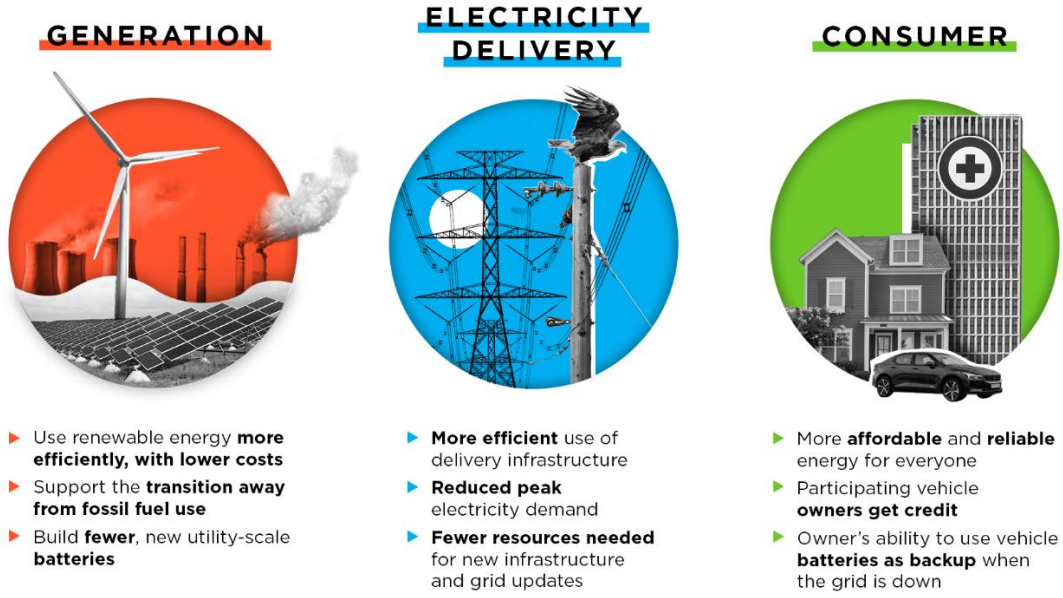
EVs Can Support Electric Grid Reliability and Affordability

Recharging an EV can be as simple as having charging begin as soon as a vehicle is plugged in. However, technology exists that enables smarter EV recharging, which can greatly benefit the electric grid (see Figure 1).

Vehicle-grid integration (VGI), or the practice of controlling the charging and discharging of EVs in coordination with the electric grid, can enable EVs to make better use of renewable energy resources, thereby reducing the need for grid investments, including transmission and distribution investment. VGI can include managed charging (V1G), whereby signals are sent to an EV to control charging timing or rate. For example, V1G could be used to schedule charging during hours of high clean energy generation and not during peak demand hours, reducing grid strain and the need to burn fossil fuels to meet high peak demand.

Bidirectional charging is the ability to take power from the grid to charge an EV's battery and also to discharge the battery. When bidirectional charging is done in coordination with the grid, also known as vehicle-to-grid (V2G) operation, this technology allows EVs to be used as energy storage and to send excess power to the grid during periods of high demand. Because many passenger EVs are in use for only a small fraction of the day, this would allow discharging from EV batteries to support a clean, reliable, and affordable electricity grid while having no impact on drivers' ability to use their vehicles.

Figure 1. V2G Benefits to the Electricity System and Consumers



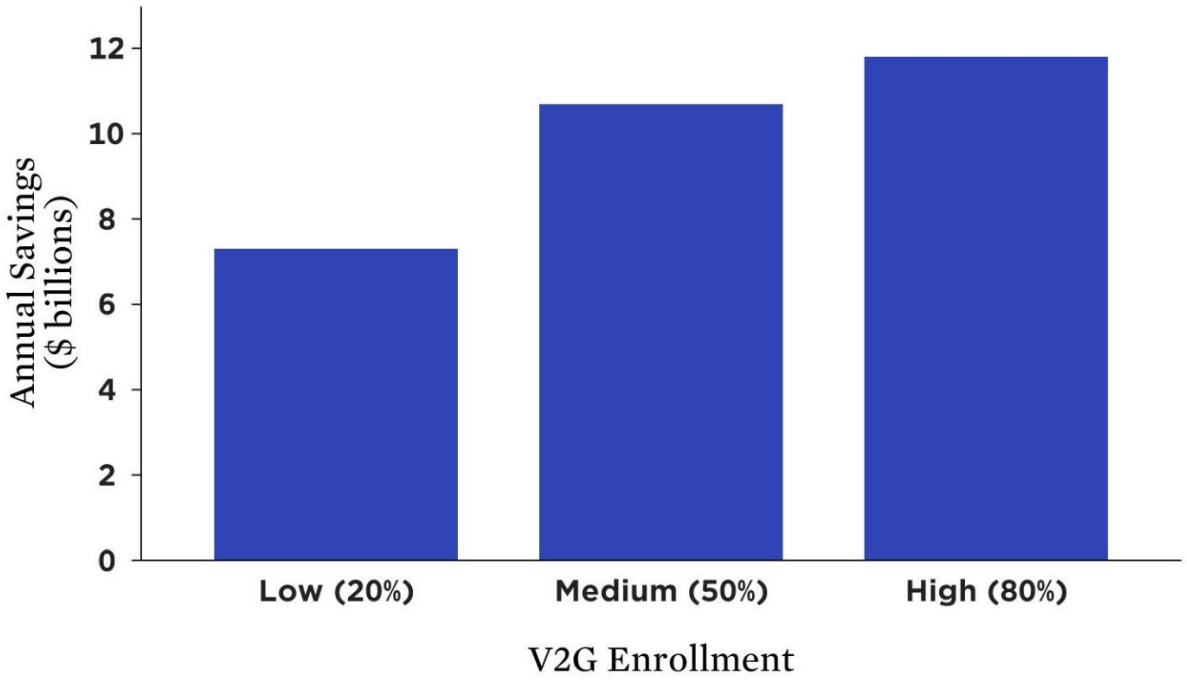
Using bidirectional charging–capable EVs at scale will have significant benefits throughout the electricity system, including reduced costs and more efficient use of renewable energy sources.

Modernizing Transportation Will Strengthen California's Grid

Union of Concerned Scientists analysis has shown that there is significant potential for bidirectional EVs to put downward pressure on electricity costs in California. With high levels of EV adoption (consistent with California's Advanced Clean Cars II regulations) and 50 percent V2G enrollment by EVs, savings could top $10 billion annually in electricity grid costs in the state by 2045 (see Figure 2) (Houston, Reichmuth, and Specht 2025). With many Californians already experiencing rising utility costs, the vast savings potential that grid-integrated EVs can bring should not be overlooked.

Current law (SB 59 2024) allows the CEC to require some EVs to have bidirectional charging capability. However, buyers of new EVs are limited by the options manufacturers make available. With recent changes to vehicle regulations and incentives, deployment of bidirectional charging–capable vehicles will probably fall short of the levels needed to achieve potential grid savings.

Figure 2. EVs Participating in Bidirectional Charging Could Result in Significant Electricity System Savings in California



Total annual electricity system savings in California shown for 2045, assuming EV deployment reaches levels consistent with vehicle regulations as of December 2024. V2G vehicles can conduct both managed charging and bidirectional charging.

California should enact policies that strongly encourage bidirectional charging–capable EV purchases to ensure that the future vehicle fleet in the state can support the electric grid. Vehicles that are fully integrated into California's electric grid can be part of the state's strategy to ensure a clean, reliable, and affordable grid for all.

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Acknowledgments

This report was made possible by the generous support of Foundation M, the Heising-Simons Foundation, the William and Flora Hewlett Foundation, and UCS members.

For their expertise and feedback, the authors thank UCS colleagues Samantha Houston and Mark Specht.

The opinions expressed herein do not necessarily reflect those of the organizations that funded the work or the individuals who reviewed it. The Union of Concerned Scientists bear sole responsibility for the report's content.

References

CAISO (California Independent System Operator). 2024. *2024 20-Year Transmission Outlook*. Folsom, CA. https://www.caiso.com/documents/2024-20-year-transmission-outlook-jul-31-2024.pdf

CEC (California Energy Commission). 2025. *SB 100 Joint Agency Report.* Sacramento, CA. https://www.energy.ca.gov/sb100

Houston, Samantha, David Reichmuth, and Mark Specht. 2025. *Harnessing the Power of Electric Vehicles.* Cambridge, MA: Union of Concerned Scientists. www.ucs.org/resources/harnessing-power-electric-vehicles https://doi.org/10.47923/2025.15888

SB 59 Battery Electric Vehicles: Bidirectional Capability. 2023-2024. Accessed November 25, 2025. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB59

SB 100 California Renewables Portfolio Standard Program: Emissions of Greenhouse Gases. 2018. Accessed November 19, 2025. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100