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# Policy Considerations for Advancing Bidirectional Electric Vehicle Charging in California

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## Issue

Electric vehicles (EVs) are proliferating in California, with over 1.8 million operating in the state. Modern EVs have considerably larger battery packs than early models, in many cases 80-100 kWh for 250-300-mile driving ranges. Charging power for EVs is also increasing. With the appropriate wiring, residential charging at Level 2<sup>1</sup> has reached up to 19.2 kW though 7-10 kW is more typical, making EVs among the most demanding household power loads. These charging loads can stress local electricity distribution feeders, particularly in the early evening when power use typically peaks. Figure 1 depicts this evolution, where renewable energy can now meet 100% of California’s needs in the middle of the day, but when solar resources drop off in the evening there is a steep ramping up period, culminating in the early evening peak.

Many EVs now, and many more in the future will have bidirectional or vehicle-to-grid (V2G) capability, meaning their large battery packs can be discharged for a variety of uses—from providing backup power to homes and businesses to providing a larger set of grid services including supporting local voltages and 60 Hertz cycle frequency.<sup>2</sup> Studies show that incorporating EVs with

V2G into the grid can be two to three times more valuable in providing electric services and consumer benefits than “unidirectional” managed charging. As shown in Figure 2, managed or “smart” charging can reduce EV charging bills from about \$250 to \$100 according to one analysis, while V2G operations can provide net revenues to a vehicle driver of up to about \$300 per year while still providing the electricity for their mobility needs.

## Policy Considerations

To help unlock the potential of V2G for the benefit of EV drivers and California ratepayers, policymakers may want to consider the following concepts.

**Establish state V2G targets for 2030 and beyond.** The state could adopt targets such as the number of EVs enrolled in managed charging programs, total installed

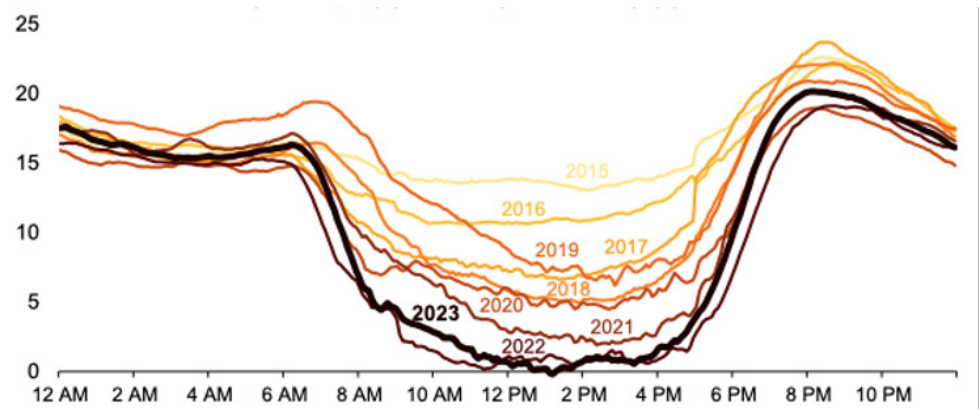


Figure 1. California Electricity Grid “Duck Curve” Evolution (Y-axis units are Gigawatts)

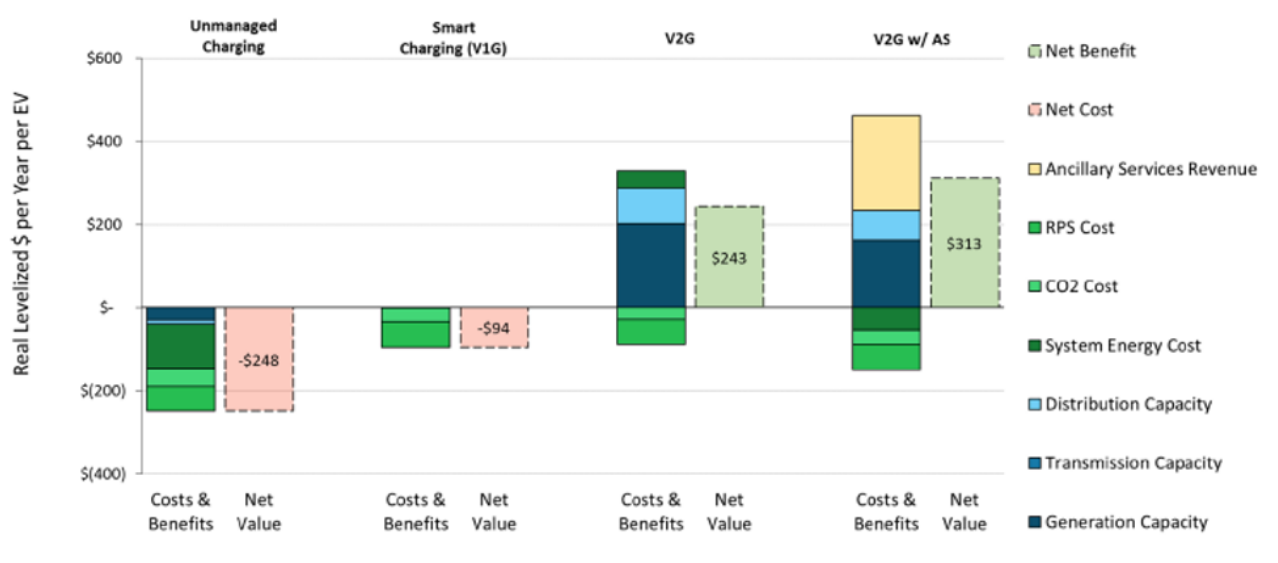


Figure 2. Vehicle-Grid Integration and V2G Grid Value Assessment. Source: EPRI, 2019<sup>3</sup>

capacity for bidirectional chargers, or other appropriate metrics. Managed charging programs help drivers reduce the costs of charging by scheduling charging at the lower cost time periods for their electricity rate, and as a secondary objective, these programs can also schedule charging at times that minimize greenhouse gas emissions from electricity production.<sup>4</sup> Similar to state procurement targets for battery-based storage, California could require major utilities to install a base of bidirectional chargers and enroll vehicles needed to provide important grid support for the ultimate benefit of electricity ratepayers.

**Include EV-based V2G in the California Self-Generation Incentive Program.** This program currently supports stationary batteries for grid support and local reliability.<sup>5</sup> It is currently under-subscribed. Allowing bi-directional capable EVs to participate would provide a \$7,500 incentive to homeowners to help offset installation and interconnection costs to provide critical home backup services. Program

qualification could be limited to low-income residences, those in wildfire / public safety power shutoff zones, and/or those with critical medical device backup needs.

### More Information

To learn more, visit [www.ucits.org/research-project/rimi-3k](http://www.ucits.org/research-project/rimi-3k). For more information about the findings in this brief, contact Timothy Lipman at [telipman@berkeley.edu](mailto:telipman@berkeley.edu).

### Footnotes

- <sup>1</sup>A Level 2 charger requires a dedicated 240-volt or electrical circuit, similar to what is required for a clothes dryer or electric range.
- <sup>2</sup>Maintaining grid alternating-current frequency very close to 60 Hertz, or 60 cycles per second, is important for the proper operation of sensitive electrical devices.
- <sup>3</sup>Electric Power Research Institute (EPRI) (2019), “Open Standards-Based Vehicle-to-Grid Value Assessment,” Report: 3002014771, June.
- <sup>4</sup>One example of a managed charging program: <https://www.bmwchargeforward.com>
- <sup>5</sup><https://www.cpuc.ca.gov/sgip>

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