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**SENATE COMMITTEE ON ENERGY, UTILITIES AND  
COMMUNICATIONS**

**Senator Steven Bradford, Chair  
2023 - 2024 Regular**

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<b>Bill No:</b>	SB 233	<b>Hearing Date:</b>	4/18/2023
<b>Author:</b>	Skinner		
<b>Version:</b>	4/10/2023 Amended		
<b>Urgency:</b>	No	<b>Fiscal:</b>	Yes
<b>Consultant:</b>	Sarah Smith		

**SUBJECT:** Electric vehicles and electric vehicle supply equipment: bidirectional capability

**DIGEST:** This bill requires all electric vehicles (EVs) and electric vehicle service equipment sold in California after January 1, 2027, to be capable of bidirectional charging. This bill also requires the California Energy Commission (CEC) and California Air Resources Board (CARB) to modify existing EV incentives to provide more incentives for bidirectional EVs and chargers.

**ANALYSIS:**

Existing law:

- 1) Defines EV grid integration as any method of altering the time, charging level, or location at which grid-connected EVs charge or discharge, in a manner that optimizes plug-in EV interaction with the electrical grid and provides benefits to ratepayers by doing any of the following:
  - a) Increasing electrical grid asset utilization.
  - b) Avoiding otherwise necessary distribution infrastructure upgrades.
  - c) Integrating renewable energy resources.
  - d) Reducing the cost of electricity supply.
  - e) Offering specified electric reliability services. (Public Utilities Code §740.16)
  
- 2) Requires the California Public Utilities Commission (CPUC) to establish by December 31, 2020, strategies and metrics to maximize the use of vehicle grid integration (VGI) by January 1, 2030. Existing law specifies certain requirements for the strategies, including, but not limited to requiring ratepayer-funded EV integration activities to be in the best interests of ratepayers. (Public Utilities Code §740.16)

- 3) Requires electrical corporations to quantify how ratepayer-funded vehicle electrification investments support VGI strategies. Existing law also requires local publicly-owned electric utilities (POUs) to consider EV-grid integration strategies in their integrated resource plans (IRPs) and requires community choice aggregators (CCAs) to report specified information to the CPUC regarding EV-grid integration activities. (Public Utilities Code §740.16)
- 4) Requires the CEC to conduct a statewide assessment every two years of EV charging infrastructure needed to support the levels of EV adoption required for the state to meet its goals of putting at least five million zero-emission vehicles (ZEVs) on California roads by 2030, and of reducing emissions of greenhouse gases (GHG) to 40 percent below 1990 levels by 2030. (Public Resources Code §25229)
- 5) Establishes the Clean Transportation Program (CTP) at the CEC to provide grants, loans, and other funding opportunities to develop and deploy innovative fuel and vehicle technologies to support California's climate change policies. (Health and Safety Code §44272(a))
- 6) Establishes the Clean Vehicle Rebate Project (CVRP) under the Air Quality Improvement Program (AQIP) to provide rebates to qualified individuals, businesses, public agencies and entities, and nonprofit organizations for the purchase or lease of eligible ZEVs. (Health and Safety Code §44274 et. seq.)

This bill:

- 1) Establishes various definitions for the purpose of the bill, including the following:
  - a) "Bidirectional capable" means the ability of an EV to both charge and discharge electricity through EV service equipment, or as this definition is modified by the CEC and CARB pursuant to this bill.
  - b) "Bidirectional charging" means charging capability that enables an EV to either be charged by the electrical grid or an onsite energy resource, or discharge stored energy capacity to the electrical grid or to serve an adjacent home or building.
  - c) "Bidirectional electric vehicle service equipment" means EV service equipment capable of both charging and discharging electricity from an EV.

- d) “Vehicle-to-everything” means the energy technology through which an EV is used as a mobile battery and the battery’s stored energy can be used for benefits, including powering a home (vehicle-to-home), a building (vehicle-to-building), a microgrid, or another vehicle, or providing electricity to the electrical grid (vehicle-to-grid).
- 2) Requires the CEC to establish goals to accelerate the ability to use vehicles as energy storage to power homes, buildings, and export electricity to the electrical grid to support grid reliability, backup power use, and other beneficial uses determined by the CEC. This bill requires the CEC to prioritize investments in disadvantaged communities.
  - 3) Requires the CEC to solicit a third-party entity to hold quarterly interoperability testing events to share products and test the interoperability of EVs, chargers and other technologies that enable the EV’s battery to power things other than the car. These interoperability testing events must focus on improving safety and reliability.
  - 4) Prohibits the sale of new EV vehicles that are not capable of bidirectional charging, starting with the 2027 model year. This bill also requires all bidirectional EVs sold in California to be interoperable with one or more bidirectional chargers, starting with the 2027 model year.
  - 5) Authorizes CARB to exempt certain types of EVs from this bill’s bidirectional mandate and requires the CEC to exempt publicly available chargers, direct current fast chargers, and other types of chargers, as determined by the CEC, from the bill’s bidirectional mandate.
  - 6) Requires the CEC and CARB to allocate existing EVs and chargers funding to provide more incentives for EVs and chargers that are capable of bidirectional charging. This bill expresses legislative intent that EV and charger incentives should prioritize incentives for bidirectional EVs and chargers starting July 1, 2024.
  - 7) Requires the CEC and CARB to revise by December 31, 2024, this bill’s definition of “bidirectional capable” EVs and chargers to specify certain technical requirements for interoperability and enabling EV batteries to provide emergency backup power or grid services. This bill specifies that EV and charger components must comply with the bidirectional capability, as defined, at the time of sale. This bill authorizes the CEC and CARB to periodically update the definition of “bidirectional capable” and other terms related to EV and charger functionality.

## Background

*What are Vehicle Grid Integration (VGI) and bidirectional charging?* Existing law defines EV grid integration as any method of altering EV charging and discharging in a manner that optimizes a vehicle's interaction with the grid and provides ratepayer benefits. VGI includes a range of strategies, rate designs, and technologies aimed helping EV owners optimize their charging behavior to increase the reliability of electric supply, avoid certain costs to the electric system, and help owners charge when their rates provide the best value for charging. A number of electric utilities have adopted specialized rates for EV owners to help incentivize EV ownership and EV charging that limits the addition of new load at peak demand periods. Many EV charging manufacturers work with software developers to create tools EV owners can use to manage their charging. Pursuant to SB 676 (Bradford, Chapter 484, Statutes of 2019), a number of electric utilities have undertaken VGI pilot projects to deploy options for optimizing EV charging with grid needs.

Bidirectional charging is a process by which a bidirectional capable EV works with a bidirectional charger to cycle the car's battery and discharge the electrical current from the car to operate other electrical devices in a home, building or elsewhere. Bidirectional charging is a form of VGI known as vehicle-to-grid (V2G). In May 2022, Pacific Gas and Electric (PG&E) announced the creation of three pilot projects to test bidirectional charging in homes, businesses and with local microgrids in select high fire-threat areas. These pilots are intended to test EVs' ability to send power back to the grid and provide backup power during an outage. California's three largest investor-owned utilities (IOUs), the Sacramento Municipal Utility District (SMUD), the Los Angeles Department of Water and Power (LADWP) and Lancaster Energy have entered into a memorandum of understanding led by the federal Department of Energy to collaborate with other partners to identify barriers and opportunities for bidirectional charging.

*Cart before horse?* This bill establishes a mandate for the EV and EV charger market to transition to bidirectional capabilities; however, it is not clear that bidirectional charging is sufficiently developed to be so widely deployed. While a number of California electric utilities are testing the capabilities of bidirectional charging through pilot programs, these pilots are not mandatory and do not force customers or other companies to invest in bidirectional technology. Bidirectional charging may be emerging in the market as a resource to maximize the economic benefits of EV ownership; however relatively few EVs and charger models on the existing market support bidirectional charging. While some aftermarket chargers may exist to help facilitate bidirectional charging with vehicles that are already capable of this type of battery cycling, reports also indicate that bidirectional charging must be carefully calibrated and used with software that senses battery and

voltage conditions to prevent the EV battery from degrading too quickly. A bidirectional charging impact analysis conducted by staff at the Hawai‘i Natural Energy Institute at the University of Hawai‘i indicate that consistent bidirectional cycling of an EV battery – particularly when done twice per day – can shorten the lifespan of an EV battery to as little as five years. The use of EV batteries as distributed energy resources may be an attractive selling point for some potential EV owners; however, researchers from the Rocky Mountain Institute have indicated that more demonstrations are needed and that most grid-level benefits from VGI can be obtained without bidirectional charging.

*Bill may exacerbate equity concerns regarding EV and charger deployment.*

California has ambitious goals to transition to ZEVs; however, making that transition will require substantially increasing lower and middle income consumers’ access to EVs and EV chargers. According to information from Consumer Reports, most new EVs sold nationwide cost at least \$61,000. The relative cost of EVs has made it challenging for lower income Californians and smaller businesses to access this market, even with taxpayer and ratepayer-funded incentives. Requiring manufacturers to ensure that new EVs meet this bill’s bidirectional requirements within the next four years could increase the cost of these vehicles and the associated charging infrastructure, limiting the EV sector’s ability to better reach new customers. Bidirectional chargers are also generally more expensive than standard chargers. Generally, EV batteries are significantly larger than home energy storage batteries and have differing voltages. To the extent that homeowners are seeking to facilitate bidirectional charging to their homes, these homeowners may also need to undertake electrical upgrades to facilitate the safe flow of voltage from the vehicle’s battery to the home.

*Bill’s definitions are unclear and may limit manufacturers’ ability to comply with mandates.* This bill defines “bidirectional capable” as the ability of an EV to both charge and discharge electricity through EV service equipment. This bill also defines various other terms that specify the functionality that EVs and chargers must have to be sold after January 1, 2027. However, this bill also directs the CEC and CARB to modify the definition of bidirectional capable by the end of the 2024 calendar year. This bill also authorizes CARB and the CEC to periodically modify other definitions established by this bill. It is unclear how EV and charger manufacturers can engineer and bring compliant products to the marketplace if the specifications for those products changes during the development of the product. It is also unclear how existing stock on the market will be treated when regulations change the specifications of what may be offered for sale. To the extent that specifications change the make-ready electric infrastructure needed for chargers, it is unclear if utilities will have sufficient lead time to plan the interconnection of these bidirectional chargers.

While this bill sets a specific date by which EV chargers sold in California must be capable of bidirectional charging, this bill does not set a clear date prohibiting the sale of EVs that lack bidirectional charging capability. Instead, this bill specifies that new EVs sold in California must be capable of bidirectional charging, starting with the 2027 model year. Vehicle model years do not follow calendar year cycles and vary based on a number of factors, including schedules set by manufacturers. In most cases, model years are made available for sale in the second half of the preceding year. In some cases, model years are sold nearly 12 months earlier than the calendar year. Goods movement challenges resulting from the Covid-19 pandemic resulted in substantial changes to certain model year release dates. For example, Honda released its 2022 Odyssey minivan for sale early in the 2021 calendar year as a result of a supply chain issue. Model years are typically planned far ahead of their release dates, and it is not clear that all manufacturers will be able to switch their design, manufacturing, and assembly productions to produce bidirectional vehicles to meet this bill's deadline for the 2027 model year.

*Need for amendments.* As currently written, this bill mandates the transition to EVs and EV chargers that facilitate bidirectional charging; however, it is unclear if a sufficient amount or variety of bidirectional EVs and chargers exist or will exist to meet this bill's mandate. Additionally, this bill's mandate and the lack of a clear definition of bidirectional EV charging may lead to substantial unintended utility and consumer costs, which could disproportionately impact efforts to deploy EVs and EV chargers to lower income communities. *As a result, the author and committee may wish to amend this bill to delete this bill's existing mandatory requirements and instead direct the CEC to work with CARB to examine the extent to which bidirectional EVs and chargers are available in the light, medium, and heavy-duty vehicle marketplace, the costs and benefits associated with behind-the-meter bidirectional EV and charger use, and the costs and benefits associated with bidirectional EV and charger use that sends electricity back to the distribution system on the utility side of the meter.*

*Dual Referral.* Should this bill be approved by this committee, it will be re-referred to the Senate Committee on Transportation.

### **Prior/Related Legislation**

SB 493 (Min, 2023) would require the CEC to assess the energy sector resourced needed to meet the Advanced Clean Fleets regulations to transition fleets to ZEVs. The bill would also require CARB to incorporate CEC's assessment findings into a strategic plan to meet the deadlines for fleets' ZEV transition. At the time of printing, the bill is pending in the Senate Environmental Quality Committee.

SB 676 (Bradford, Chapter 484, Statutes of 2019) required the CPUC to establish EV-grid integration strategies for certain load-serving entities. The bill also required POU's to consider EV-grid integration strategies in their IRPs and required CCAs to report specified information to the CPUC regarding EV-grid integration activities.

AB 2127 (Ting, Chapter 365, Statutes of 2018) required the CEC to conduct a statewide assessment of vehicle charging infrastructure needed to support the state's ZEV deployment goals.

SB 1000 (Lara, Chapter 368, Statutes of 2018) required the CEC to evaluate the extent to which charging infrastructure is proportionately deployed and use funds to more proportionately deploy chargers as needed. The bill also required the CPUC to explore facilitating the development of technologies that promote grid integration and adopting a tariff for heavy-duty EVs that encourages charging during periods of excess grid capacity.

**FISCAL EFFECT:** Appropriation: No Fiscal Com.: Yes Local: No

**SUPPORT:**

The Climate Center, Sponsor  
350 Bay Area Action  
350 Humboldt: Grass Roots Climate Action  
350 Southland Legislative Alliance  
350 Ventura County Climate Hub  
Active San Gabriel Valley  
Adopt a Charger  
Alliance of Nurses for Healthy Environments  
Better World Group  
CHAdmMO Association  
California Business Alliance for A Clean Economy  
California Environmental Voters  
California Native Plant Society, Alta Peak Chapter  
California Nurses for Environmental Health and Justice  
Center for Biological Diversity  
Center for Community Action and Environmental Justice  
Center for Community Energy  
Central California Asthma Collaborative  
Central Coast Climate Justice Network  
CivicWell  
Cleaneearth4kids.org

Climate Action California  
Climate Equity Policy Center  
Coalition for Clean Air  
Cool Davis  
Endangered Habitats League  
Environmental Working Group  
EV-SEg  
Fossil Free California  
Friends Committee on Legislation of California  
Friends of The Eel River  
Green Latinos  
Greenpeace USA  
GRID Alternatives  
High Noon Advisors  
Indivisible CA: StateStrong  
Joint Venture Silicon Valley  
Legacy Solutions  
Let's Green CA!  
Local Clean Energy Alliance  
Los Angeles Business Council  
Marin Clean Energy  
Morongo Basin Conservation Association  
North Bay Electric Auto Association  
Peninsula Interfaith Climate Action  
Plug in America  
Récolte Energy  
San Francisco Bay Physicians for Social Responsibility  
Santa Barbara Standing Rock Coalition  
Santa Cruz Climate Action Network  
Sierra Club California  
Silicon Valley Youth Climate Action  
Sunflower Alliance  
SunPower Corporation  
Sustainable Claremont  
Sustainable Rossmoor  
Synergistic Solutions  
The Clean Coalition  
The Climate Council  
The Climate Reality Project, Los Angeles Chapter  
The Climate Reality Project, San Fernando Valley  
The Climate Reality Project, Silicon Valley  
The Phoenix Group



Union of Concerned Scientists  
Voices for Progress  
World Business Academy  
Yolo Interfaith Alliance for Climate Justice  
Two Individuals

**OPPOSITION, unless amended:**

Alliance for Automotive Innovation  
California Chamber of Commerce  
California Electric Transportation Coalition  
CALSTART

**ARGUMENTS IN SUPPORT:** According to the author:

There are plenty of good reasons to rely on EVs for more than transportation. SB 233 will ensure that new EVs are equipped with bidirectional charging so that EV batteries have the ability to power homes or other facilities when electricity demand is at its peak and prices are high. With bidirectional charging, EVs also have the potential to help power the grid. SB 233 will also help slash energy bills for EV owners and give California the opportunity to harness EVs as mini-power plants on wheels.

**ARGUMENTS IN OPPOSITION:** Opponents largely oppose this bill unless it is amended to remove the mandate for bidirectionality and include an analysis of the potential impacts and benefits of various forms of bidirectional charging. In opposition, the California Electric Transportation Coalition (CalETC) states:

The ramifications of setting a mandatory deadline requiring EVs and chargers to be bidirectional capable will be detrimental to the EV market and risks increasing costs at a time when zero-emission technology needs to be more accessible to consumers, especially equity communities. The V2G and bidirectional charging technology market is still nascent, and it is unclear which use cases justify the costs. Further, the lion's share of benefits to grid stability and resiliency are expected to be realized with managed charging through V1G technology in the near to medium term and at much lower cost. Moreover, a bidirectional EVSE mandate would trigger handling of home charger installations through grid interconnection processes similar to home solar and battery storage projects. This would add cost and extend completion timelines for all projects, regardless of whether bidirectionality contributes value for the customer or the utility.

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