Date of Hearing: July 5, 2023

ASSEMBLY COMMITTEE ON TRANSPORTATION
Laura Friedman, Chair
SB 233 (Skinner) – As Amended May 18, 2023

SENATE VOTE:

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

SUMMARY: Requires the California Energy Commission (CEC), in consultation with the State Air Resources Board (CARB) to submit a report to the Legislature related to the bidirectional capability of electric vehicles and electric service equipment by January 1, 2026 and requires all new electric vehicles sold in California to be bidirectional beginning in model year 2030, except as exempted by CARB. Specifically, **this bill**:

1) Requires CEC, in consultation CARB, to convene a bidirectional capability stakeholder workgroup on or before June 30, 2024.

2) Requires the workgroup to examine challenges and opportunities associated with using an electric vehicle as a mobile battery to power a home (vehicle-to-home) or building (vehicle-to-building) or providing electricity to the electrical grid (vehicle-to-grid) and submit a report to the Legislature on or before January 1, 2026, including all of the following:

    a) Potential costs and benefits associated with requiring bidirectional capability for electric vehicle service equipment (EVSE);
    b) Mechanisms to ensure interoperability between bidirectional capable electric vehicles and bidirectional EVSE;
    c) The resources needed from the electricity sector to facilitate vehicle-to-building and vehicle-to-grid practices; and,
    d) The estimated impacts of requiring bidirectional capability for various vehicle weight classes on the state's existing zero-emission vehicle programs and goals.

4) Authorizes CARB to identify vehicles that do not have a likely beneficial bidirectional-capable use and exempt them from the 2030 bidirectional capable sales requirement.

5) Requires CARB, on or before December 31, 2026, in consultation with the CEC and the Public Utilities Commission (CPUC) to modify, by regulation, the definition of "bidirectional capable" for electric vehicles, and to periodically update the definition. Requires as a part of that modified definition, at the time of sale, all necessary electric vehicle components, and their operational parameters, to support and enable bidirectional capability.

6) Requires CARB, on or before December 31, 2026, in consultation with the CEC and CPUC, to modify, by regulation, the definition of "beneficial bidirectional-capable use case" for electric vehicles to determine which electric vehicles are subject to the 2030 bidirectional capable sales requirement.

EXISTING LAW:

1) Provides, pursuant to the California Climate Crisis Act (AB 1279 (Muratsuchi), Chapter 337, Statutes of 2022) that it is the policy of the state to do both of the following:

   a) Achieve net zero GHG emissions as soon as possible but no later than 2045; and,
   b) Ensure that by 2045, GHG emissions are reduced to at least 85% below 1990 levels. (Health and Safety Code (HSC) 38562.2)

2) Defines EVSE as an electric component assembly or cluster of component assemblies designed specifically to charge batteries within electric vehicles by permitting the transfer of electric energy to a battery or other storage device in an electric vehicle. (HSC 44268)

3) Requires CPUC, December 31, 2020, to establish strategies and quantifiable metrics to maximize the use of feasible and cost-effective electric vehicle grid integration by January 1, 2030. (Public Utilities Code 740.16)

Executive Order (EO)

1) EO N-79-20 orders that the following shall be goals of the state, and directs CARB to develop regulations meeting these goals:

   a) 100% of in-state sales of new passenger cars and trucks will be zero-emission by 2035.
   b) 100% of medium- and heavy-duty vehicles in the state be zero-emission by 2045 for all operations where feasible and by 2035 for drayage trucks.
   c) Transition to 100% zero-emission off-road vehicles and equipment by 2035 where feasible.

FISCAL EFFECT: According to the Senate Appropriations Committee:

1) Unknown costs, likely in the low millions of dollars annually (General Fund), for CARB to revise its regulations related to Advanced Clean Cars 2 (ACC 2) Zero-Emission Vehicle (ZEV) and Zero Emission Powertrain Certification, evaluate vehicle grid integration, certify and enforce vehicle compliance, conduct consumer outreach, and participate in the stakeholder working group, among other things.
2) Unknown, potentially significant costs (General Fund or special fund) for the CEC to convene a stakeholder working group.
3) To the extent that the bidirectional charging requirements result in any increases to electric vehicle prices, potential ongoing costs of an unknown amount (various funds) for state purchases of electric vehicles priced higher than what they otherwise would be absent this bill.

COMMENTS:

California has seen increasing sales of electric vehicles in recent years. In April 2023, the state surpassed 1.5 million ZEVs sold, eclipsing the 2025 goal set in EO B-16-12. 21.1% of California new vehicle sales were zero-emission in the first quarter of 2023. The author has introduced this bill because the battery storage capability of electric vehicles offers an opportunity for California's increasing fleet of electric vehicles to "give back" to the grid or homeowners in times of need.

Zero-emission vehicles are a part of California's climate portfolio. California's climate goals require incremental GHG emissions reductions, and carbon neutrality by no later than 2045. Transportation is the single largest source of GHG emissions, and one strategy for reducing emissions from the transportation sector includes an aggressive reduction in the use of fossil fuels. To this end, CARB adopted the ACC 2 regulation, requiring an increasing percentage of new car sales to be zero-emission, culminating in 100% by 2035 as required by EO N-79-20. CARB's Advanced Clean Fleet (ACF) regulation addresses medium- and heavy-duty vehicles, requiring 100% of these vehicle classes to be zero-emission by 2045 for all operations where feasible and by 2035 for drayage trucks.

ACC 2 battery requirements. ACC 2 requires vehicle manufacturers to provide ZEV assurance measures, that include battery minimum warranty and durability requirements, increased serviceability, and facilitate charging and battery labeling. For example, by model year 2030, ACC 2 rules require vehicles to maintain at least 80% of electric range for 10 years or 150,000 miles. By model year 2031, individual vehicle battery packs are warranted to maintain 75% of their energy for eight years or 100,000 miles.

Bidirectional charging. A typical battery electric vehicle refuels by receiving electricity from a power source. Bidirectional capable electric vehicles can both receive energy (charge) from electric vehicle supply equipment (EVSE) and provide energy to an external load (discharge). Bidirectional vehicles could provide backup power to specific loads, sometimes as part of a microgrid, though vehicle to building or vehicle to home (V2B or V2H) charging, or provide power to the grid through vehicle to grid (V2G) charging. An electric vehicle battery is typically 60 kilowatt-hours (kWh), compared to the average daily home energy usage of 30 kWh, which means a V2H situation could theoretically power a home for two days. Most of today's vehicle chargers, or EVSE, are not capable of bidirectional operations. A bidirectional EVSE must contain an internal converter to handle the electric conversion from direct current (DC) of the vehicle to alternating current (AC), which is what the grid runs on. In other words, bidirectional charging requires compatible vehicles and compatible chargers.

Battery storage could address grid uncertainty. Over the last few years, California has experienced events such as wildfires and extreme heat that highlight our energy system's vulnerabilities. These have resulted in public safety power shutoffs where California's utilities can shut off power to electric lines to prevent causing a fire to ignite. The state has called for flex alerts asking consumers to voluntarily conserve electricity when there is a predicted shortage of electricity. The increasing number of battery electric vehicles projected in the future has led to consideration of utilizing the storage capability of BEVs to feed power back to multiple sources during times of electricity uncertainty.

School buses have been cited as an optimal use case for bidirectional charging. They can be charged overnight when energy demand is low and feed energy back to the school or the grid when the bus is parked during the day. Working with San Diego Gas & Electric (SDG&E) and Nuvve, a technology company, California's Cajon Valley Union School District deployed a V2G project that allows eight electric school buses to send power back to the grid when needed on hot summer days. [Note: Nuvve is a sponsor of this bill.]

V2G Integration. Recently, the California Independent System Operator (Cal ISO), CEC, CARB, and CPUC jointly created the Vehicle Grid Integration (VGI) Working Group tasked with addressing the following question: (a) What VGI use cases can provide value now, and how can

that value be captured? (b) What policies need to be changed or adopted to allow additional use cases to be deployed in the future? (c) How does the value of VGI use cases compare to other storage or demand energy response? What emerged was 320 different VGI use cases across a wide range of sectors (residential, commercial, rideshare, and fleets), applications, and types of charging for both light-duty vehicles and medium- and heavy-duty vehicles. However, the value perceived by Working Group participants for these use cases varied widely. The final report also admitted to limitations in fully assessing barriers to VGI, including customer interest and acceptance.

The working group developed a set of 92 individual recommendations for policy actions that California state agencies, utilities, and community choice aggregators, and CAISO could undertake to advance VGI in the short-term (2020-22), medium-term (2023-2025), and long-term (2026-2030). It is unclear how many of these policies have been taken up for action.

Staff comments:

In addition, to studying V2H and V2G further, this bill would require all new electric vehicles sold in California beginning in model year 2030 to be bidirectional capable.

Adding bidirectional capability to a vehicle increases vehicle cost. CARB ACC 2 rules require electric vehicle manufacturers to warrant minimum battery performance requirements, and to satisfy these requirements they will need to install larger batteries. Batteries are the most expensive component of electric vehicles, therefore price increase could be substantial. Other hardware upgrades may also be required, such as additional circuit breakers and upgraded communications semiconductors. The requirement for bidirectional charging by model year 2030 may also restrict the available supply of electric vehicles as manufacturers may be reluctant to add the capability to its California vehicles if other states and countries do not also require it.

Bidirectionality may not be for everyone. It is unlikely that all electric vehicle owners will want to take advantage of bidirectionality. In addition to owning an electric vehicle, electric vehicle owners would also need to make electrical upgrades to their home to take advantage of energy stored in their vehicle. Such upgrades may be costly. Moreover, using a vehicle to charge their home could also strand a family and leave them without a vehicle during a time where there are also electricity shortages. This option would most likely only benefit families with more than one electric vehicle or a second vehicle that is not electric.

Medium- and heavy-duty vehicles may be less ideal for energy storage and bidirectional capability. The bigger battery size of larger vehicles would seem to provide an appealing use case for bidirectional charging. However, medium and heavy duty trucks, unlike school buses and cars, may not spend long periods of time idle during any particular day, or part of the year. This could make battery electric trucks poor candidates for demand response, as they will either be charging or on the road with little expected downtime during peak electricity demand hours.

Putting the car before the grid. Amendments taken in the Senate Energy, Utilities, and Communications committee removed the requirement that all EVSE be bidirectional. There is also no requirement in the bill that the electric grid be made capable of handling bidirectional charging. Without these complementary capabilities an electric vehicle owner will pay for bidirectionality features that may not be useful for many years.

If we mandate it, will they come? Proponents say that with bidirectional vehicles the rest will fall into place. According to background materials provided by the author, "Once this resource becomes widely available, regulatory agencies and utilities will make the changes to take advantage of this resource, and develop incentive plans to help them and everyone benefit from it." However, the feature has been built into the Nissan Leaf since 2012, and only just recently has a compatible charger been made available. There are additional interconnection reforms that likely need to happen in order for this vision to come to fruition. This bill is double referred to the Assembly Utilities and Energy Committee which deals with these issues.

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

In support the Electric Vehicle Association Sacramento Chapter writes, "[This bill] will enable California to address multiple challenges at once by harnessing the untapped battery storage capacity of electric vehicles through bidirectional charging. The electrification of transportation creates a once-in-a-generation opportunity for electric vehicles to not only decarbonize transportation, but also help keep the lights on during power outages, lower energy bills for Californians, and make our electric system more reliable on a daily basis. By utilizing bidirectional charging, electric vehicle batteries can store abundant renewable energy when available and provide peak power when the grid needs it most. Widespread adoption of bidirectional charging in electric vehicles will help California phase out fossil fuel-powered backup generators and reduce reliance on polluting power plants, half of which are sited in low-income neighborhoods."

In opposition the Silicon Valley Leadership Group writes, "Bidirectional charging wears down the battery of the electric vehicle. To accommodate for battery degradation, electric vehicles will have to be manufactured with larger batteries, requiring more critical materials and driving up the cost of the vehicle and any battery replacements. Anyone hoping to use bidirectional charging will not only have to accept the strain that it will place on their car battery, but will have to purchase or have access to compatible bidirectional-capable chargers. This may be impossible for many families or companies already managing the cost of purchasing an electric vehicle, or for those who live in multi-family dwellings without access to the necessary equipment. In short, [this bill] is creating a mandate that will drive up electric vehicle costs for all consumers, regardless of whether they need to, are able to, or even want to bidirectionally charge their vehicle."

Double referral: This bill is double referred to the Assembly Utilities and Energy Committee and will be heard by that Committee as it relates to issues under its jurisdiction.

Previous legislation: SB 676 (Bradford), Chapter 484, Statutes of 2019 requires CPUC to establish electric vehicle-grid integration strategies for certain load-serving entities. This bill also requires local publicly owned electric utilities to consider electric vehicle-grid integration strategies in their integrated resources plans and requires Community Choice Aggregators to report specified information to the CPUC regarding electric vehicle-grid integration activities.

REGISTERED SUPPORT / OPPOSITION:

Support

Nuvvee (sponsor)
The Climate Center (sponsor)
Union of Concerned Scientists (sponsor)
1000 Grandmothers for Future Generations
350 Bay Area
350 Bay Area Action
350 Conejo
350 Humboldt
350 Humboldt: Grass Roots Climate Action
350 South Bay LA
350 Southland Legislative Alliance
350 Ventura County Climate Hub
52nd District
Active San Gabriel Valley
Adopt a Charger
Alameda County Democratic Party
All Rise Alameda
Alliance of Nurses for Healthy Environments
Better World Group
Building the Base Face to Face
California Business Alliance for A Clean Economy
California Climate Voters
California Environmental Voters
California Interfaith Power & Light
California Native Plant Society, Alta Peak Chapter
California Nurses for Environmental Health and Justice
California Religious Action Center of Reform Judaism
Center for Biological Diversity
Center for Community Action and Environmental Justice
Center for Community Energy
Center for Environmental Health
Central California Asthma Collaborative
Central Coast Climate Justice Network
Chademo Association
Change Begins With Me
Citizens Climate Lobby
City of Berkeley
City of Port Hueneme
City of West Hollywood
Civicwell
Clean Coalition

Clean Power Campaign
Cleanearth4kids.org
Climate Action California
Climate Equity Policy Center
Climate Health Now
Climate Reality Project, Silicon Valley Chapter
Climate Reality Project, Los Angeles Chapter
Climate Reality Project, San Fernando Valley
Climate Resolve
Cloverdale Indivisible
Coalition for Clean Air
Community Environmental Council
Contra Costa Move On
Cool Davis
Courage California
DCBEL
Defending Our Future
Democrats of Rossmoor
Dolores Huerta Foundation
East Valley Indivisibles
El Cerrito Progressives
Elders Climate Action, Nor-Cal and So-Cal Chapters
Electrify Now
Endangered Habitats League
Environment California
Environmental Working Group
Ev-Seg
Feminists in Action
Feminists in Action Los Angeles
Fierce Courage Consulting
Fossil Free California
Friends Committee on Legislation of California
Friends of the Eel River
Glendale Environmental Coalition
Greenlatinos
Greenpeace USA
Grid Alternatives
High Noon Advisors
Hillcrest Indivisible
Human Impact Partners
Indi Squared
Indian Valley Indivisibles
Indivisible 30/Keep Sherman Accountable
Indivisible 36
Indivisible 41
Indivisible Auburn, CA
Indivisible Beach Cities
Indivisible CA Statestrong
Indivisible CA-25 Simi Valley-Porter Ranch

Indivisible CA-29
Indivisible CA-3
Indivisible CA-37
Indivisible CA-39
Indivisible CA-43
Indivisible CA-7
Indivisible CA: Statestrong
Indivisible Claremont/inland Valley
Indivisible Colusa County
Indivisible East Bay
Indivisible El Dorado Hills
Indivisible Elmwood
Indivisible Euclid
Indivisible Lorin
Indivisible Los Angeles
Indivisible Manteca
Indivisible Marin
Indivisible Media City Burbank
Indivisible Mendocino
Indivisible Normal Heights
Indivisible North Oakland Resistance
Indivisible North San Diego County
Indivisible OC 46
Indivisible OC 48
Indivisible Petaluma
Indivisible Sacramento
Indivisible San Bernardino
Indivisible San Jose
Indivisible San Pedro
Indivisible Santa Barbara
Indivisible Santa Cruz County
Indivisible Sausalito
Indivisible Sebastopol
Indivisible SF
Indivisible SF Peninsula and CA-14
Indivisible Sonoma County
Indivisible South Bay LA
Indivisible Stanislaus
Indivisible Suffragists
Indivisible Ventura
Indivisible Westside L.A.
Indivisible Windsor
Indivisible Yolo
Indivisible: San Diego Central
Indivisibles of Sherman Oaks
Joint Venture Silicon Valley
KLM Consulting
Leap
Legacy Solutions

Let's Green Ca!
Livermore Indivisible
Local Clean Energy Alliance
Long Beach Alliance for Clean Energy
Los Angeles Business Council
Los Angeles Regional Collaborative for Climate Action and Sustainability
Lutheran Office of Public Policy - California
Mill Valley Community Action Network
Morongo Basin Conservation Association
Mountain Progressives
Move LA
North Bay Electric Auto Association
Nothing Rhymes With Orange
Orchard City Indivisible
Orinda Progressive Action Alliance
Our Revolution Long Beach
Peninsula Interfaith Climate Action
Plug in America
Queers 4 Climate
Recolte Energy
Redwood Coalition for Climate and Environmental Responsibility
Restore the Delta
Riseup
Rising Sun Center for Opportunity
Romero Institute
Rooted in Resistance
Ross Valley Indivisible
Sacramento Electric Vehicle Association
San Diego Indivisible Downtown
San Francisco Bay Physicians for Social Responsibility
Santa Barbara Standing Rock Coalition
Santa Cruz Climate Action Network
San Fernando Valley Indivisible
Sierra Club California
Silicon Valley Youth Climate Action
Stand.Earth
Sunflower Alliance
Sustainable Claremont
Sustainable Rossmoor
Synergistic Solutions
Tehama Indivisible
Terraverde Energy
The Phoenix Group
The Resistance Northridge-indivisible
Together We Will Contra Costa
TWW/Indivisible - Los Gatos
Vallejo-Benicia Indivisible
Venice Resistance
Voices for Progress

Vote Solar
Women's Alliance Los Angeles
World Business Academy
Yalla Indivisible
Yolo Interfaith Alliance for Climate Justice

Opposition (unless amended)

Alliance for Automotive Innovation
CalChamber
California Electric Transportation Coalition
California Trucking Association
CALSTART
Silicon Valley Leadership Group

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