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Vehicle Grid Integration (VGI) Solutions

Additional submitted attachment is included below.

CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

Electric Program Investment Charge 2026–2030 (EPIC 5) Research Concept Proposal Form

The California Energy Commission (CEC) is currently soliciting research concept ideas and other input for the Electric Program Investment Charge 2026–2030 (EPIC 5) Investment Plan. For those who would like to submit an idea for consideration, please complete this form and submit it to the CEC by **August 8, 2025**. More information about EPIC 5 is available below.

To submit the form, please visit the e-commenting link: https://efiling.energy.ca.gov/EComment/ECommentSelectProceeding.aspx and select the Docket **25-EPIC-01**. Enter your contact information and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you in advance for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

Ben Clarin, bclarin@epri.com, 650-714-9319

2. Please provide the name of the contact person's organization or affiliation:

Electric Power Research Institute, Inc. (EPRI)

3. Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

This concept proposes developing a data platform and accompanying method(s) to validate vehicle grid integration (VGI) solutions such as smart charging solutions installed in the field can and are providing a set of basic grid functions. The concept proposes working with technology providers and VGI market actors looking to validate that their products are eligible for California VGI activities/incentives in exchange for data from their respective systems. The aim is to help build confidence in California utilities and energy decision makers that VGI solutions can and are operating as intended to maintain affordability and reliability as well as enhance resiliency of the energy system.

The concept seeks to show the industry how a VGI solution validation mechanism can be set up – potentially validated through a set of existing/future California project(s) and opportunities.

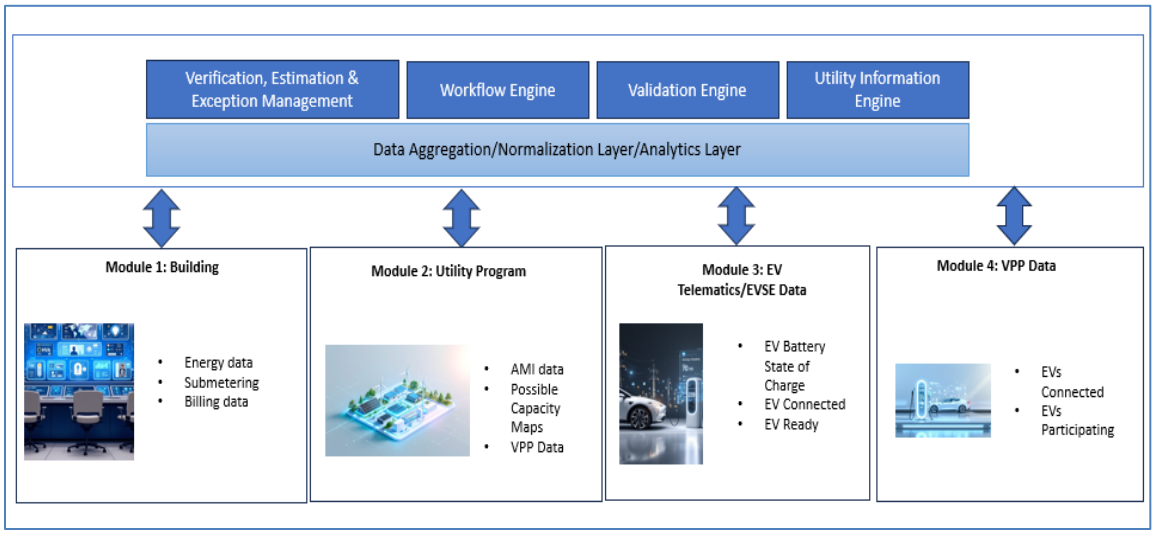

Figure 1 : Validation of VGI programs currently comes from a set of heterogeneous data sources.

The concept aims at evaluating this method through data collection of electric vehicles participating and not participating in utility smart charging programs in California. The concept intends to develop a set of "modules" resembling how charge management programs and associated data collected are deployed today (Figure 1). Sources could include data directly from EV telematics and/or electric vehicle service providers (EVSP), through building management systems, directly from aggregation service such as virtual power plants (VPP)s or grid-edge distribution energy resource management systems (DERMS) or other utility provided systems. The advantage of this approach is that this would: (1) benchmark current capabilities of how technology providers provide charging data, (2) provide real-time/intime system validation in deployment scenarios to support vehicles as grid resources, and (3) propose a framework through which technologies providers can validate that their technologies are continuing to enable prioritized grid functions. The modules then feed into a data normalization, aggregation, and analytics layer intended to provide standardized data collection, analysis, and reporting. The intended outputs are to be leveraged by energy decision makers and included into industry planning, operations, and management practices.

EPIC funding is needed as establishing a blueprint detailing how industry infrastructure can be developed with key stakeholders such as EV OEMs, California Community Choice Aggregators (CCA)s, electric vehicle service providers (EVSP)s, IOUs, and other energy companies. EPIC funding could be highly beneficial to develop needed industry platforms that vet solutions that are

scalable from one utility service territory to another, which would enable EV OEMs and other service providers to develop vehicle specifications and associated business systems that can provide these critical functions. With EPIC funding, this work could address essential elements needed to provide smart charging solutions that are focused on energy affordability and grid resiliency through rapid technological change. This is done by providing the missing data and methods to help energy decision makers build confidence that smart charge management and other VGI solutions can operate and will operate.

4. In accordance with Senate Bill 96[i], please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals." For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technology or innovation? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, provide more information on what data and information gaps the proposed concept would help fill, and which specific parties or end users would benefit from the results, and for what purpose(s)?

California expects over 15 million EVs on the road by 2035.[1] These EVs can quickly become one of California's largest distributed energy resources (DERs) as deployment accelerates if their significant battery capacity is leveraged. As a result, California's energy industry has put together several tools, technologies, and targets around vehicle-grid integration. Targets include utility targets such as Pacific Gas and Electric (PG&E) aiming for 500MW of flexible load management attributed to electric vehicles (EV)s by 2030 and Southern California Edison (SCE) aiming to include 65% of the electric vehicles (EV)s participating in managed charging/vehicle grid integration (VGI) activities by 2045.[2,3]

While there have been technological advancements in VGI, and there are several VGI pilots and programs offered by California energy companies, there are considerable market barriers to scalable and extensible industry offerings. Lack of California program offerings is potentially due to the following challenges: (1) utilities are at various levels of EV adoption and grid modernization, (2) accuracy and availability of electric vehicle telematics data varies from one EV OEM to another; (3) current pilots and programs are still nascent compared to other

[1] https://www.energy.ca.gov/data-reports/reports/electric-vehicle-charging-infrastructure-assessment-ab-2127

[2] Kight-Costadone, Amy. "VGI Roadmap at PG&E." Electrification 2024. Mar. 2024, EPRI, Savannah.

[3] Link Here .

methods of grid planning, operation, and management – with limited information on persistence, scalability, and operational costs; (4) electric grid needs vary not only by time, but also by location, and (5) regulatory reporting requirements vary from one area to another. This lack of industry uniformity poses challenges to the industry interested in developing products that can be not only in California, but nationally.

As a result, a 2024 Congressionally Appointed EV Working Group (EVWG) recommends addressing the current industry challenges: (1) lack of signals indicating grid conditions and the need for flexibility from EVs, (2) uncertainty of dependable response from EV/EVSPs to shift load, (3) fractured and tailored solutions that are currently being implemented, and (4) large number of friction points and poor customer experience limit participation.[4]

Table 1: Concept's Approach to Overcome Smart Charge Management Challenges as Determined by a National EV Working Group in 2024

Current Challenge	Concept's Approach to Overcome Challenges
Lack of signals indicating grid conditions	California is ahead of the nation in its approach of identifying potential mechanisms to provide economic and other singles to indicate local grid conditions. California works such as MIDAS[5], utility Distributed Energy Resource Management System (DERMS), California Dynamic Pricing Rate Pilots[6], and other ways to indicate local grid conditions. The concept focuses on customer technology as a way of collecting data and providing information of its ability to provide a set of grid services compliments existing California activities. A specific focus on energy affordability and grid resiliency also intends to center the industry on critical objectives.
Uncertainty of dependable response	The concept proposes to create not only a framework grid function validation, but continuous data reporting to ensure a dependable response from field deployed technologies. The intended result is increasing confidence that technology will be available to be used as reliable grid resources.
Fractured and tailored solutions being implemented.	The concept focuses on the feasibility of existing systems and developing data reporting mechanisms. The intended result is validation of smart charging even in an environment of fractured and tailored solutions.
Large number of friction points and poor customer experience.	The project aims at leveraging existing hardware and software already being deployed by EV OEMs, EVSPs, and utilities. Strong focus on data collection and not adding additional customer touch points intends to show paths and identify solutions that minimally impact the customer's experience.

[4] Recommendations of the Electric Vehicle Working Group - 2024
[5] https://www.energy.ca.gov/proceedings/market-informed-demand-automation-server-midas
[6] https://www.dret-ca.com/dynamic-rate-pilot/

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to improve safety,[ii] reliability,[iii] affordability,[iv] environmental sustainability,[v] and equity?[vi]

Studies such as the one conducted by Kaluza in 2023 estimate that it will cost California's IOUs 50 billion dollars to upgrade the grid to support the electrification of transportation. Minimizing the cost to upgrade California's energy infrastructure requires a focus on affordability – and a concentrated effort to ensure we neither overbuild (causing electricity prices to go up) nor under build (causing the reliability of the grid to decrease) the electric grid. Electric vehicles (EV)s represents a large, inherently smart, and potentially flexible load that could be leveraged to minimize the energy costs associated with upgrading California's energy infrastructure. However, while there are several demonstrations and pilots completed and ongoing using vehicles as grid resources, very few scalable solutions have been identified – especially that help support grid (especially distribution) planners and operators defer and/or eliminate capital investments such as upgrading secondary transformers,

The proposed concept intends to address many of the strategic objectives that EPIC funding could potentially address by CPUC Decision D.24-03-007[7]. See Table 2.

Table 2: How Research Concept Supports California's Additional EPIC Strategic Objectives.

California Strategic Objective	Opportunity
Overcoming barriers to EV benefits in disadvantaged communities.	The concept's benefits focus on energy affordability. This ensures that those with EVs and those without EVs are not adversely impacted by transportation electrification. This is important as studies show that customer programs have historically favored: (1) incentivizing technologies and (2) providing those incentives to those at higher income levels.[8] Energy infrastructure impacts everyone – especially low income and disadvantaged households who spend more of their monthly budget on energy and transportation. Solutions that are not reliant on incentivizing the technology to buy

[7] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M527/K228/527228647.PDF
[8] https://www.aceee.org/press-release/2023/05/report-most-states-dont-ensure-energy-efficiency-programs-benefit-underserved

	down the capital cost of the technology have a higher likelihood of equitable benefits.
Impacts Research for new generation and storage	At scale, the potential to leverage an electric vehicle's battery and smart charging capabilities can be a considerable tool to maintaining the affordability and reliability of the electric grid. This concept is developing a platform and necessary infrastructure that enables impact assessments of vehicles as grid resources and intends to extend those efforts to a greater research and development community.
Providing data input into a Value of DER Framework	The core function of this concept is to develop a platform that creates standardized data outputs. The intent is to streamline information into current and future Value of DER frameworks.
Smart systemwide planning tools for new load	Standardized data outputs enabled by this concept could be fed into current and emerging system planning tools – potentially increasing the confidence in leveraging VGI solutions as a means of deferral and/or eliminating utility capital investments.
Reducing feeder/circuit peaks	Transportation electrification is and has impacted distribution and circuit-level peaks as EV adoption and associated impacts varies by location. Methods for data collection and incorporation methods to incorporate this information to distribution planning and operations tools can potentially reduce feeder/circuit peaks – maximizing the use of California's existing grid.
Leveraging DERs for grid and community resiliency	Use of smart charge management functions and other dynamic signaling to EVs can potentially prevent power outages when energy supply and/or distribution infrastructure can not support energy demand at certain times of the year. The use of an electric vehicle's battery can also be used as a means to temporarily power a home, building, or community during unplanned power outages. Data collected from this platform can support increased industry confidence in building an infrastructure that continues to validate that these emerging systems are providing these functions.

A successful project develops the infrastructure to support vehicle grid integration projects recognizing: EV OEMs and other technology providers moving at speeds of rapid technology change to meet evolving consumer needs; Evolving industry standards that could be applied differently depending on the EV, EVSP, and/or EVSE; and an interdependent, nascent industry to support, operate, and maintain these systems. At-scale, the concept intends to provide a mechanism to enable a more dynamic method of validating customer technology's capabilities to provide a grid resource like ENERGY STAR's data reporting requirements for connected

thermostats. [9] The intended result is that technology providers then have transparency to develop infrastructure to support data transfer necessary to validate vehicle grid functions. Utilities can then benefit from including a more dynamic set of VGI data to justify grid planning, operation, and management investments.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

Quantitative metrics that could be used to evaluate impacts of the proposed concept would be based on how industry adopts, accepts, and contributes to the data platform. These metrics could include:

1. Number of IOU and CCA pilot/programs feeding data and information to the platform.
2. Number of electric vehicles and/or EVSE equipment providing information to the data platform
3. Number of EV, EVSE, and/or EVSP providers participating in the data platform.

The concept creators have elicited feedback, had interest, and had previous support from the overall and/or parts of this data platform and toolkit development concept. Interest has come from various market actors such as California IOUs, California municipal utilities, California CCAs, EV OEMs, and EVSPs.

Qualitative metrics that could be used to evaluate impacts of the proposed concept are based on long-term impacts enabled by such a data platform that leads to reduced cost of electricity for all Californians. This could include:

1. Incorporation and influence of concept to certain industry and standards
2. Incorporation of data reporting requirements to utility planning and operation practices
3. Development of a dynamic approved VGI product list based on periodic data reporting requirements

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9 https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Program%20Requirements%20for%20Connected%20Thermostats%20Version%201%200%20Draft%203_0.pdf

7. Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

The concept is built off over 15 years of research, development, and deployment activities enabling and evaluating vehicle technology as a grid resource. See references below (Table 3) for a sample of previous and current activities.

Table 3: Previous Projects Supporting Technical Merit of Proposed R&D Concept

Project	Project Summary	Report
Open Vehicle-Grid Integration Platform	Project with leading global automotive manufacturers and the utility industry in a collaboration—initiated in 2012—to develop a unified platform for plug-in electric vehicle (PEV) and grid integration.	Link Here
Customer-Centric Load Aggregation and Data Analytics.	CEC project establishing feasibility and controllability of technologies typically owned by customers such as connected HVAC, water heaters, batteries, and EVs.	Link Here
Distribution System Constrained Vehicle-to-Grid Services for Improved Grid Stability and Reliability	CEC project that designed, developed, integrated, and demonstrated (including valuation aspects) of plug-in electric vehicles capable of providing vehicle-to-grid services using open standards-based communication and control protocols. This project is the first ever end-to-end system implementation, demonstration, and application of the Society of Automotive Engineering standards suite addressing distribution and localized integration of vehicle-to-grid capable vehicles.	Link Here
Methodology for Testing the Accuracy of Data Collected from Managed Charging Enabling Technologies	Project for the New York distribution utilities developing a test mechanism to evaluate data feasibility, availability, and accuracy of various technologies and products that comprise a VGI ecosystem.	Link Here
Open Standards-Based Vehicle-to-Grid Value Assessment	Technoeconomic analysis methodology for valuing stacked value and benefits of vehicles as grid resources	Link Here

8. The EPIC 5 Investment Plan must support at least one of five Strategic Goals:[vii]
   a. Transportation Electrification
   b. Distributed Energy Resource Integration
   c. Building Decarbonization
   d. Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas
   e. Climate Adaptation

   Please describe in as much detail as possible how your proposed concept would support these goals.

The proposed concept primarily supports EPIC 5's Strategic Goals of transportation electrification and distributed energy resource integration. See Table 4.

Table 4: How Proposed Concept Would Support EPIC 5 Strategic Goals.

EPIC 5 Strategic Goal	How Proposed Concept Would Support EPIC 5 Strategic Goal
Transportation Electrification	The research concept in supporting the integration and interaction between EV OEM, EVSP, EVSE, and utilities intends to help build stability and confidence to start building the necessary infrastructure to support California's ambitious transportation electrification targets. Its focus on developing mechanisms to support energy affordability through the rightsizing of energy infrastructure investments intends to support an equitable transportation electrification transition by not passing on the cost/impacts historically associated with industry transition. The concept focuses on fully integrating EVs into grid planning and using EVs to mitigate transmission and distribution cost upgrades align with California's goals and objectives as laid out in SB 676[10].
Distributed Energy Resource Integration	In 2022, CA passed SB 846, which more than doubled the state's load flexibility capacity from 3.1 GW (2024) to 7 GW by 2030[11]. Electric vehicles can potentially be a considerable contributor to California's load flexibility capacity needs. This concept focuses on developing a tool to support industry (EV OEMs and utility) investments through data transparency help support California's DER integration objectives such as those laid out by SB 846.

[10] https://calmatters.digitaldemocracy.org/bills/ca_202520260sb676
[11] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB846

About EPIC

The CEC is one of four EPIC administrators, funding research, development, and demonstrations of clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned electric utilities.

EPIC is funded by California utility customers under the auspices of the California Public Utilities Commission.

To learn more about EPIC, visit: https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program

EPIC 5 documents and event notices will be posted to: https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5

Subscribe to the EPIC mailing list to stay informed about future opportunities to inform the development of EPIC 5: https://public.govdelivery.com/accounts/CNRA/signup/31897

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i See section (a) (1) of Public Resources Code 25711.5 at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25711.5.

ii EPIC innovations should improve the safety of operation of California's electric system in the face of climate change, wildfire, and emerging challenges.

iii EPIC innovations should increase the reliability of California's electric system while continuing to decarbonize California's electric power supply.

iv EPIC innovations should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs and help enable the equitable adoption of clean energy technologies.

v EPIC innovations should continue to reduce greenhouse house gas emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system, including land and water use.

vi EPIC innovations should increasingly support, benefit, and engage disadvantaged vulnerable California communities (DVC). (D.20-08-046, Ordering Paragraph 1.) DVCs consist of communities in the 25 percent highest scoring census tracts according to the most recent version of the California Communities Environmental Health Screening Tool (CalEnviroScreen), as well as all California tribal lands, census tracts with median household incomes less than 60 percent of state median income, and census tracts that score in the highest 5 percent of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

vii In 2024 the CPUC adopted five Strategic Goals to guide development of the EPIC 5 Investment Plan. A description of the goals can be seen in Appendix A of CPUC Decision 24-03-007 available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M527/K228/527228647.PDF