

**DOT Federal Highway Administration  
Response to RFI #FHWA-2021-0022**

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**To:** DOT Federal Highway Administration

**From:** Vehicle-Grid Integration Council,  
with support from the following organizations:

*Leadership Circle Members:*

- *American Honda Motor Co., Inc.*
- *Enel X North America, Inc.*
- *Ford Motor Company*
- *General Motors Company*
- *Nissan*
- *Nuvve Holding Corporation*
- *Stellantis N.V.*
- *Toyota Motor North America, Inc.*

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- *dcbel*
- *ENGIE NA*
- *Fermata Energy*
- *FlexCharging*
- *The Mobility House*
- *Sunrun*
- *Veloce Energy, Inc.*
- *WeaveGrid*

**Subject:** Response to RFI #FHWA-2021-0022

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## Executive Summary

### **Vehicle-Grid Integration: Unlocking EVs as a Strategic Grid Resource**

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*Vehicle-grid integration represents a unique opportunity to establish and advance US leadership at the intersection of a decarbonized transportation and electric sector by ensuring the value from flexible electric vehicle charging – and discharging – is recognized and compensated.*

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The EV Charging Program and Charging and Fueling Infrastructure Program will support widespread adoption of millions of electric vehicles (EVs) which, if enabled, will have untapped potential as crucial, flexible resources to support the evolving electricity grid. In doing so, managed charging and vehicle-to-grid technology provides opportunities for customers to capture additional benefits, from reduced charging costs and integration with on-site generation and storage, to payment for exports, to backup power. By unlocking these key customer benefits, the EV Charging Program and Charging and Fueling Infrastructure Program can have a much larger impact in accelerating the widespread adoption of EVs.

Vehicle Grid Integration Council (VGIC) is a 501(c)(6) nonprofit trade association focused on accelerating the role of smart EV charging and discharging through policy development, education, outreach, and research. VGIC supports the transition to a decarbonized transportation and electric sector by ensuring the value from EV deployments and flexible EV charging and discharging is recognized and compensated in support of achieving a more reliable, affordable, and efficient electric grid. Scaling VGI will help accomplish the following public policy goals:

- **Benefit drivers and fleet owners** by reducing the cost of ownership.
- **Decarbonize the transportation sector** by accelerating EV adoption.
- **Support decarbonization of the power sector** by providing essential grid services as renewable energy and distributed energy resource penetration increases.
- **Increase affordability** by reducing electricity bills for all customers.
- **Improve grid resiliency** and security during extreme weather events.
- **Foster economic activity** through innovation, competition, and market transformation.

With federal support and thoughtful EV Charging Program and Charging and Fueling Infrastructure Program design, we believe this vision could become a reality and that EV drivers and owners across the United States can take part in the acceleration of both transportation electrification and grid decarbonization. **Our vision for VGI encompasses the following key elements:**

- **Ensure customer mobility needs are satisfied.** Drivers will be able to participate in a wide variety of VGI services, nationwide, without compromising their mobility needs.
- **Managed charging will provide benefits to EV drivers and fleet operators:** Drivers in every state will be given the choice to align charging with the times of day when electricity prices are low, reducing operating costs by as much as 50% compared to unmanaged charging. Lowering the total cost of ownership will help to accelerate overall EV adoption by drivers and fleet managers.

- **EVs provide emissions-free emergency power during blackouts:** During extreme weather blackouts or other power outages, EVs can utilize two-way charging and discharging capabilities to send energy to a building or home, serving as a generator and providing safe backup power.
- **Charging infrastructure dollars go further:** Smarter management of EV charging will help manage the cost of deploying EV charging infrastructure, which encourages wider access to EV charging with equal or lower overall cost burden.
- **EVs provide necessary services to the grid and get paid for it:** V1G (unidirectional charging) and vehicle-to-grid (“V2G” – bidirectional charging) will enable EVs to both receive and/or feed power back to the grid, supporting advanced grid services such as frequency control, demand response, peak shaving, and more. Providing these services can unlock new revenue streams for EVs, lowering the total cost of ownership.

VGI is a unique opportunity for the DOT to establish and advance US leadership in affordable, decarbonized, reliable, and resilient transportation and electricity. We are grateful to the US Department of Transportation and the Federal Highway Administration for opening this RFI. The VGIC would be happy to further discuss any part of this RFI response in a follow-up meeting.

### **RFI Response**

**Consideration 2:** *Connections to the electric grid, including electric distribution upgrades; vehicle-to-grid integration, including smart charge management or other protocols that can minimize impacts to the grid; alignment with electric distribution interconnection processes, and plans for the use of renewable energy sources to power charging and energy storage*

The VGIC appreciates the US Department of Transportation and Federal Highway Administration’s leadership in considering in the development of guidance for the EV Charging Program. There are a number of areas where DOT leadership can significantly accelerate progress for VGI through the EV Charging Program:

- 1. Allow for some portion of the EV Charging Program funds to be directed towards establishing an ongoing, “VGI Collaborative Forum.” This forum would aid EV Charging Program applicants in identifying best practices and receiving technical assistance for VGI efforts pursued in conjunction with their EV Charging Program investments.** As charging infrastructure is scaled up through the EV Charging Program, there will be a parallel opportunity to scale up VGI-related products and services. However, VGIC recognizes that the market for VGI products and services is still in its early stages.<sup>1</sup> This may create challenges for program applicants who seek to establish VGI programs and activities as part of their state plan but are not well versed in its technical details. Thus, VGIC believes there is a critical need for a national VGI Collaborative. As the markets, policies, technologies, standards and best practices for VGI advance, the national VGI Collaborative should serve as an ongoing forum for EV Charging Program applicants to share specific VGI implementation strategies and develop unified frameworks for topics such as V2G interconnection,

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<sup>1</sup> VGIC considers “VGI” to be a broad category including a variety of technologies and use cases including managed/smart charging (i.e., V1G), automated load management, and bidirectional charging such Vehicle-to-Building, Vehicle-to-Home, or Vehicle-to-Grid.

compensation mechanisms, and VGI program design, and interoperability.<sup>2</sup> Issues such as harmonizing or streamlining V2G interconnection policies across the nation could be of particular importance for an entity the VGI Collaborative to address (see Recommendation 5 below for more detail on V2G interconnection).

VGIC recognizes that VGI opportunities will be limited at corridor DCFC charging stations. However, for states where corridors are deemed “fully built out,” a VGI-focused forum will take on increased importance and relevancy as states seek to deploy non-corridor charging at workplaces, multi-family homes, and fleet depots using EV Charging Program funds. VGIC believes the national VGI Collaborative could be funded partially or wholly through the EV Charging Program and could receive supplementary funding from participating EV Charging Program funding recipients. For example, when submitting its state plan for DOT, each state could indicate whether it is electing to participate in the national VGI Collaborative to engage in knowledge sharing around VGI best practices. VGIC recommends the DOT or DOE facilitate the national VGI Collaborative with support from a third-party consultant.

- 2. Encourage transportation electrification investments made through the EV Charging Program to include VGI capabilities where and when it makes sense. This could include opportunities for applicants to increase or set aside funding for V2X-capable devices (especially for non-DCFC chargers).** VGI stands to offer substantial public benefits as EV deployment scales up. However, for these benefits to be fully realized, it is critical that VGI capabilities be considered and built into infrastructure investments as they are deployed, rather than after-the-fact. VGIC recognizes that a large share of the infrastructure deployed through the EV Charging Program may be in the form of DCFC chargers along designated corridors, which are unlikely to be well-suited for VGI in most instances (including both managed charging and V2X). However, to the extent that funds are used for other purposes (e.g., L2 chargers in states where corridors are fully built out, or community grants under the Charging and Fueling Infrastructure Program) – or that some sites along designated corridors may present the appropriate conditions – there may be significant opportunities to incorporate VGI capabilities. This likely needs to be evaluated on a case-by-case basis. Thus, VGIC recommends that DOT allow states sufficient flexibility to encourage VGI capabilities in EV Charging Program investments where and when it makes sense. For example, states could elect to offer a higher level of funding for bidirectional charging infrastructure and/or set aside a portion of their overall budget for this purpose. Bidirectional EVs and chargers can support grid reliability and community resiliency in the face extreme weather events. The incremental costs of deploying and enabling bidirectionality thus can create a significant public benefit that should be should be considered under the EV Charging Program.

One potential model worth considering for this supplemental funding for VGI projects would be the Smart Grid Investment Grant Program (SGIG) and the Smart Grid Demonstration Program (SGDP), as part of the American Recovery and Reinvestment Act (ARRA). These programs implemented over 100 smart grid projects across the U.S. These projects, selected and overseen by the Department of Energy (DOE) Office of Electricity (OE), deployed

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<sup>2</sup> For example, the collaborative could work to develop strategies for interoperability such that chargers stay operable well into the future regardless of the original provider.

thousands of smart grid devices. Case studies of increased grid reliability and resilience, job creation, and electricity customer savings are posted in a DOE OE maintained repository on [smartgrid.gov](http://smartgrid.gov). Utilities and state regulators gained confidence in smart grid technology to provide infrastructure and public value as a result of these case studies.

It is also worth noting that incorporation of VGI technologies is not limited to physical infrastructure, but extends to communications and control architecture, as well. For example, stakeholders should consider the potential benefits of leveraging in-vehicle telematics to enable certain VGI use cases. VGIC believes both charging station and EV-based VGI solutions should be enabled through the new EV Charging Program. Together with the physical layer, the communication and control architecture needed to unlock VGI constitute the guardrails of VGI business models. VGIC recommends infrastructure investments remain open to supporting various EV aggregator business models, as it is too early – and not the federal government’s role – to pick winners and losers in the VGI market. However, VGI-related activities should still be an eligible option for any infrastructure investments that states choose to pursue.

Lastly, other infrastructure investments – for example those catalyzed by the DOE – intended to support the reliability and resilience of the electric grid (e.g., microgrid investments and stationary energy storage or other distributed energy resources or “DERs”) should account for the value of VGI. DOT should collaborate with the DOE on integration of these sites with renewables and flexible loads. VGIC believes the new joint DOT-DOE office may be a good venue for this work.

- 3. Conduct a comprehensive, real-world study on the latent potential for EVs to serve as a grid resource.** A unique aspect of a federal program such as EV Charging Program is its ability to systematically gather data and information on customers interactions with technologies across many different jurisdictions and market environments. VGIC believes the VGI industry in particular would benefit from a comprehensive, large-scale study on the availability and dependability of EVs as a grid resource. Such a study could analyze EV availability factors across different customer types and regions using real-world data from pilots, demonstrations, as well as full-scale programs and markets. This could be modeled after the Department of Energy’s *Customer Acceptance, Retention, and Response to Time-Based Rates from the Consumer Behavior Studies* conducted as part of the Smart Grid Investment Grant Program.<sup>3</sup> An EV availability study should conduct randomized controlled trials, assessing the impacts of different rate structures and programs across different utilities and customers. It should also record which technologies were deployed and analyze the dataset to produce recommendations that can inform future programs and rates. Such a study could include 15 or more different partnering utilities, and several different customer types per region. The end result would be a robust dataset that could be open to the public for additional review and future study. This would also provide grid operators with greater confidence that the overall EV fleet can be counted upon (statistically speaking) as a robust and reliable grid resource, even if a single EV

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<sup>3</sup> US DOE Electricity Delivery and Energy Reliability. *Customer Acceptance, Retention, and Response to Time-Based Rates from the Consumer Behavior Studies*. November 2016. [https://www.energy.gov/sites/prod/files/2016/12/f34/CBS\\_Final\\_Program\\_Impact\\_Report\\_Draft\\_20161101\\_0.pdf](https://www.energy.gov/sites/prod/files/2016/12/f34/CBS_Final_Program_Impact_Report_Draft_20161101_0.pdf)

may not be available for grid services 100% of the time. Similar to the opt-in structure proposed above in Recommendation 1, VGIC suggests the EV Charging Program include opportunities for applicants to participate in such a study as part of submitting their plan.

- 4. Prepare for the coming wave of commercially-available VGI offerings by educating fleets, homeowners, workplaces, and other customer groups as well as regulators and policy-makers.** The increasingly rapid deployment of electrified transportation across the US represents a paradigm shift and moving customer thinking from “mpg” to “kWh” requires considerable outreach and education. In particular, education and outreach to fleets is critically needed to inform fleet managers of the potential value of switching to electric transportation. For many fleets, converting to electrified transportation is a significant undertaking that lies outside of their existing expertise. Given the potential complexity of VGI, more policy support is needed to direct funding toward educating fleets – as well as other customer types – not only of the benefits of electrification in general, but the enhanced value proposition that VGI technologies can offer. These value propositions include new potential revenue streams from grid services, reduced charging infrastructure costs, reduced charging energy costs, new bill management options, and enhanced resilience of critical facilities. VGIC recommends the EV Charging Program require applicants to include a robust marketing, education, and outreach plan to ensure fleets and other customer groups understand the opportunities and challenges of electrification, as well as their choices for implementing VGI strategies from the outset. The EV Charging Program should guide applicants to partner with OEMs and EV service providers to ensure existing customer relationships and customer education expertise are adequately leveraged. In addition to customer education and outreach, it will also be important to educate regulators and policy makers who may play a key role in overseeing the development of VGI programs and rules by local utilities or government agencies.
- 5. Facilitate streamlined interconnection policies across the country to support advanced VGI opportunities.** In California, VGIC and other stakeholders have collaborated closely with utilities and their regulators to advance V2G functionality, including both V2G Direct Current (“V2G-DC”) and V2G Alternating Current (“V2G-AC”) configurations. This has ultimately led to the creation of a permanent V2G-DC interconnection pathway, and a temporary V2G-AC interconnection pathway. Despite this progress, it is not guaranteed that V2G systems can easily interconnect across the country since interconnection rules are governed individually at the state level and each utility typically has its own process. Meanwhile, original equipment manufacturers (“OEMs”) must design products for a national marketplace and must contend with the possibility of a patchwork of interconnection rules and processes. VGIC strongly recommends the DOT facilitate efforts to streamline V2G interconnection pathways across the U.S., which may include clarifying how V2G systems can interconnect under existing interconnection rules. This could be one potential function of the VGI Collaborative Forum described above.

Additionally, there is a growing need to align utility distribution service connection and utility DER interconnection approaches, such that customers are subject to a streamlined experience. VGIC recommends the EV Charging Program guidance require electric utilities to align distribution service connection and DER interconnection approaches, such that customers are subject to a streamlined experience. For example, V2G interconnection approval (under current DER interconnection processes) has historically been a lengthy process relative to the time it

takes to connect and begin operating EV chargers in load-only mode. Customers should not be prohibited from operating bidirectional chargers in load-only mode while they await approval to operate in bidirectional mode. Similarly, customers wishing to deploy co-located renewable generation and/or stationary energy storage on-site with the EV charging infrastructure should experience a streamlined interconnection process.

The pathways established in market-leading California could serve as a blueprint for other states to follow and refine as necessary. However, in some cases existing interconnection pathways may already be sufficient and could be leveraged to streamline the process. VGIC believes the development of a national V2G interconnection blueprint could be a high-priority item for the national VGI Collaborative we propose in Recommendation 1. VGIC envisions a future where EVs move across utility service territories – and even states – with the ability to seamlessly charge and discharge energy. This is only possible if states follow a common framework, which the DOT could help establish through facilitating the development of a simplified customer experience for interconnection.

**Consideration 4:** *The need for publicly available EV charging infrastructure in rural corridors and underserved or disadvantaged communities;*

**VGIC supports making charging infrastructure as widely accessible as possible. One promising solution towards this goal may be to allow and incentivize optional Automated Load Management (ALM) in public buildings, charging depots for commercial vehicles and fleets, and other publicly-accessible and/or shared charging infrastructure that may benefit underserved and disadvantaged communities**

Many low-income and disadvantaged communities are served by outdated utility infrastructure (substations, transformers) that may require significant and costly upgrades to be able to accommodate EV charging load. The use of ALM can help mitigate these infrastructure upgrade costs by reducing the collective peak load at one site, therefore making charging infrastructure more affordable for disadvantaged communities. ALM is a VGI solution that is particularly well-suited for multi-charger sites such as publicly-accessible commercial buildings, shared fleet charging, workplace charging, multi-unit dwellings and other non-single family home sites, where low-income customers may be more likely to charge.

More specifically, ALM is the use of behind-the-meter technologies that allow for strategic sharing of charging capacity across multiple charging ports at the same charging site to help safely connect multiple charging ports whose total nameplate load would otherwise exceed the rated capacity of the customer connection. This in turn can avoid or defer the need to upgrade certain distribution system infrastructure to accommodate the new EV charging load. For example, if a multi-charger site seeks to deploy a charging station with 5 ports, each with a 10-kW capacity, the distribution upgrades would normally be sized to accommodate 50 kW of incremental coincidental charging demand, equal to all 5 ports charging at full capacity. However, ALM can lower the coincident charging demand to 30 kW, or 6 kW per port on average, when all 5 ports are occupied, thus reducing distribution system upgrades to what is required for only 3 ports. In this scenario, when only 3 or fewer ports are occupied, the EVs can still charge at full speed. Having ALM available to customers as an option can lead to significant savings and ensure that investments in transportation electrification are used efficiently. Pacific Gas & Electric has worked with EV service providers to implement ALM solutions at 20 workplace and multi-unit dwelling host sites

as of Q4 2020 and saved between \$30,000 and \$200,000 per project.<sup>4</sup> Southern California Edison also worked with EDF Renewables PowerFlex to implement ALM to deploy 168 charging stations at \$3,000 per port, significantly less than comparable deployments at \$10,000-\$15,000 per port without ALM.<sup>5</sup>

VGIC believes that ALM can stretch the EV Charging Program funds and ensure more chargers are installed in more places. We recommend the EV Charging Program promote the use of optional ALM to enable charger deployment at a site where doing so may otherwise be cost-prohibitive or space-prohibitive due to utility distribution system upgrades. Optional ALM solutions should be encouraged and incentivized when they are shown to be comparatively cost efficient versus traditional utility system upgrades. VGIC advises against mandating ALM requirements on charging infrastructure, as this may result in inequities by limiting charging capability for customers. Instead, VGIC recommends ALM be allowed and incentivized (i.e. a “carrot” rather than “stick” approach) for so that deploying ALM solutions become a viable option for those that wish to deploy, such as fleet operators. VGIC recommends that an optional, technology-neutral ALM incentive be included in the EV Charging Program.

**Consideration 11:** *What topics do you suggest that we address in guidance on project development of EV charging infrastructure and hydrogen, propane, and natural gas fueling infrastructure at the State, Tribal, and local levels to allow for the predictable deployment of that infrastructure?*

VGIC refers to our above recommendations related to Statutory Consideration 2 and 4, as we believe each recommendation for incorporating VGI into the EV Charging Program guidance is also entirely applicable to the implementation of the Charging and Fueling Infrastructure Program.

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<sup>4</sup> Pacific Gas & Electric. 2021. Presentation at CPUC ALM/EV EMS Workshop, Panel 2.

<sup>5</sup> EPIC Policy + Innovation Coordination Group. 2021. *Transportation Electrification Workstream Report*. [https://epicpartnership.org/resources/Transportation\\_Electrification\\_Workstream\\_Report\\_Final.pdf](https://epicpartnership.org/resources/Transportation_Electrification_Workstream_Report_Final.pdf)