

Issue 23 – draft for Nuvve

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Introduction

From Gridworks: The first meeting will frame the issue, identify key questions/considerations, provide background knowledge, create an initial proposal and identify points of conflict.

Issue 23: Should the Commission consider issues related to the interconnection of electric vehicles and related charging infrastructure and devices and, if so, how?

Nuvve’s Initial Proposal:

1. Clarify in Rule 21 that load only / V1G inverter-based systems are **excluded** from Rule 21¹.
2. Clarify that the requirements of Rule 21 apply for EVSE configured for bidirectional operation, including those for Smart Inverters with language similar to the following:
 - a. “Electric Vehicle Supply Equipment (EVSE) that conforms² to section Hh and is certified to have been tested in accordance with UL 1741-SA and passed may otherwise interconnect under Rule 21.”
3. Coordinate with Issue 22 (IOU interconnection application portal improvements) to accommodate interconnection of V2G systems otherwise approved to interconnect, minimally with a single check box on the online Interconnection Application Form.
4. Recommend the Commission address other issues related to V2G, particularly the interconnection and operations of AC EVSE and vehicle on-board inverters configured for bidirectional operation (V2GAC), as well as specifically identify the appropriate forum where additional time can be allocated to create the record and address these complex issues.

¹ This proposal is for clarification, as load-only assets are already excluded from Rule 21. Rule 21 applies to Generating Facilities, defined as those there “for the purpose of producing electric power, including storage” – and unidirectional systems clearly do not

² “Conforms” here indicates that an enabled inverter is present

Issue Framing:

To date, most EVs and related charging infrastructure have been installed as load only / unidirectional, and therefore not required to interconnect. These projects connect to the grid like other loads, and subject to those rules such as 15 & 16. DC EVSE (“Fast Chargers”) with internal stationary inverters may require similar technical certifications, such as UL 1741, but when used in unidirectional charging systems they are not subject to Rule 21 interconnection requirements. Therefore, **Rule 21 interconnections should not be required for standard / unidirectional EV charging systems.**

EVs and related charging infrastructure using **Vehicle to Grid, or “V2G”³ technologies allow bidirectional operation of the inverters** to enable those systems to discharge energy stored in EV batteries, therefore operating those systems as grid-connected energy storage. When this capability is enabled, an interconnection process is needed to ensure safety and reliability.

Under the current Rule 21, it is possible to interconnect a compliant V2GDC system, however the process would benefit from regulatory clarity and establishment of a clear process for this type of resource. This proposal recommends that a clarifying statement is added to Rule 21 to enable the needed adjustments to be made to the interconnection application portals (Issue 22) that will allow compliant DC EVSE to be interconnected without delay.

Rule 21 does not currently allow for V2GAC systems to interconnect. Nuvve recognizes that there are multiple issues stakeholders will need to address in order to accommodate V2GAC systems, and **recommends that the Commission address them either in a new subgroup in Working Group 4, in its new Transportation Electrification Rulemaking R.18-12-006, or in another combination of specifically-identified venues and in coordination with the Vehicle-Grid Integration Roadmap update**, where they can be given adequate time for resolution. In addition, the proposal recommends the IOUs work with parties on current projects to better understand the issues related to V2GAC interconnections, and to further build a record on that topic in R.18-12-006.

Automotive manufacturers and their OEMs need regulatory certainty (or something as close as possible to it) that V2G systems will be allowed to interconnect, and therefore justify the R&D investment and incremental vehicle costs involved. Providing the automotive industry with clear guidance on both V2GAC and V2GDC systems will encourage investment and innovation.

Key Questions / Considerations

Key Questions

Key Question 1: *What EV and/or related charging infrastructure and devices (collectively, Electric Vehicle Supply Equipment or EVSE) is subject to rule 21?*

Only EVs and related charging infrastructure and devices that are to be configured for bidirectional (V2G) operation may be subject to Rule 21 interconnection requirements, including Smart Inverter requirements. Stationary inverters internal to DC EVSE configured for unidirectional operation only are subject to service requirements under existing Rules 15 and 16, but not Rule 21.

³ For simplicity’s sake in this document, the term “V2G” is used to generically describe a system that discharges energy stored in an electric vehicle battery to a home, building, microgrid, or utility grid.

Key Question 2: *Why do EVSEs need to be specified in Rule 21?*

Efforts to interconnect V2G systems in SDG&E and SCE service areas have produced inconsistent results, in part because the forms, agreements, and Rules do not specifically address EVs or EVSE.

Key Question 3: *What are the two basic architectures for V2G?*

V2GDC uses a DC Fast charger with a stationary inverter enabled for bidirectional operation, connecting to the vehicle via a direct current connection (CCS Combo or CHAdeMO).

V2GAC uses a mobile (i.e. on-board the vehicle) inverter enabled for bidirectional operation, connecting to the vehicle using a standard J1772 alternating current connection.

Key Considerations for IOUs:

Key Consideration 1: Most individual V2G EVs' discharged electricity will be used behind the meter to reduce demand and energy charges, optimize use of renewables, provide emergency backup power.

Key Consideration 2: V2G services will be enabled through Service Providers who aggregate / virtualize individual vehicles into larger resources which could participate in retail/IOU programs and wholesale markets.

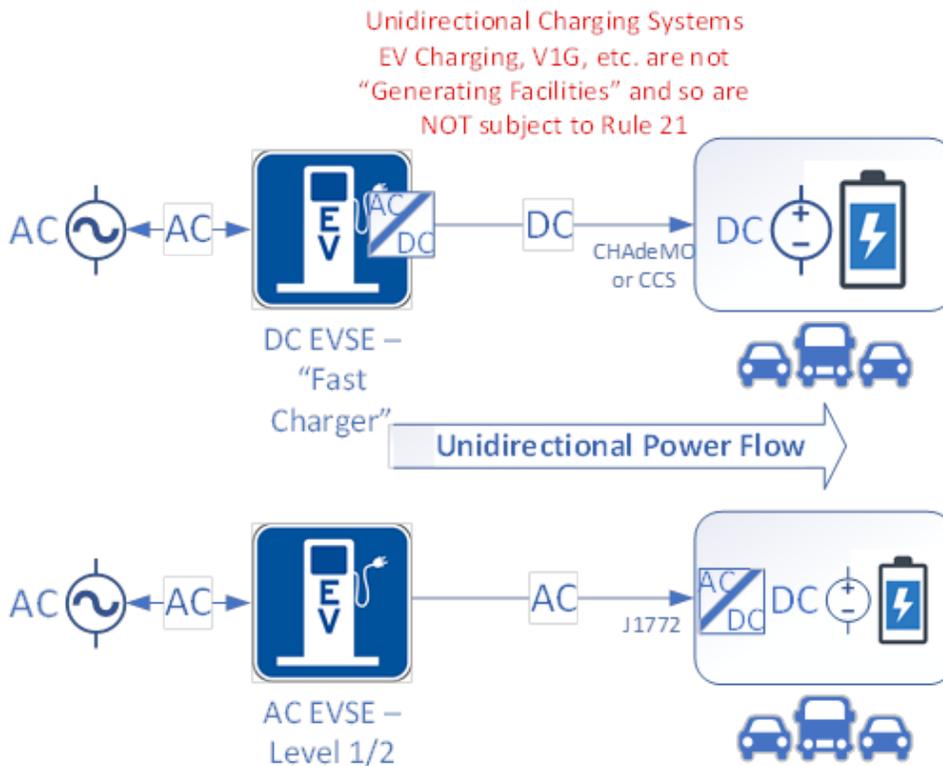
Key Consideration 3: A V2G system without the vehicle (battery pack) attached is similar to other zero-output generating sources (like a PV inverter at night).

Key Consideration 4: V2GAC systems – like all other vehicle subsystems – do not typically have UL or other Nationally Recognized Testing Lab (NRTL) certification.

Background Knowledge

“**V1G**”, or “**managed charging**” (via controls or dynamic pricing), is a **load only** system that can be used to reduce (demand response) or increase (load shifting) the power and energy demands of electric vehicle charging. Because they do not meet the definition of “Generating Facility” to which Rule 21 applies, **unidirectional charging systems are not subject to Rule 21 requirements.**

Figure 1: Unidirectional Charging Systems Are Not Generating Facilities



V2G, or Vehicle to Grid, enables EV batteries and **bidirectional** charging equipment (EVSE) to power homes, businesses, microgrids, and to participate on the grid as a distributed energy resource (DER).

V2G technology enables simultaneous growth in transportation electrification (TE) and energy storage capacity through the use of electric vehicle (EV) batteries as a grid resource that is similar in function to stationary energy storage systems. **V2G is a true dual / multiple use application** - it can provide capacity, energy and ancillary services to the grid, such as frequency regulation, while meeting the EV charging energy (transportation fuel) needs of drivers. V2G supports the major energy policy goals of California, including GHG reductions, ZEV adoption, and the RPS. At scale, it will provide significantly sized Preferred Resources - in the thousands of megawatts – to help CA reach it’s zero carbon goals.

V2G is an eligible energy storage technology for AB 2514 targets, per the CPUC’s Energy Storage Decision (D.13-10-040 COL35) and their approval of SCE’s 2014 Energy Storage Procurement Plan (.65 MW @ LAAFB).

V2G technology is quickly developing among multiple major automotive manufacturers, and innovative technology companies like Nuvve. However, **clear regulatory signals from the CPUC are not yet sufficient to commit the auto industry to make the investments required to scale V2G to meaningful levels.**

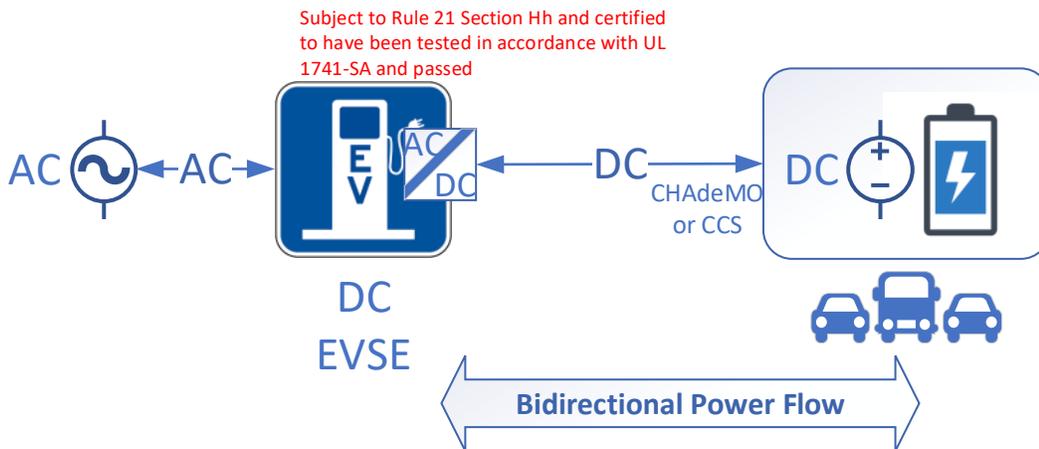
Vendors with announced or available V2x vehicles include those producing light duty passenger vehicles, as well as medium & heavy duty vehicles including school and transit buses.

Current V2G projects in California are EVSA (Electric Vehicle Storage Accelerator, an NRG EVGo settlement funded project), INVENT (INtelligent VEHicle INTegration), a school bus pilot in Rialto, and others. IOUs are encouraged to monitor and/or participate in these projects in order to better understand issues interconnecting V2G.

V2G is currently in commercial operation in Denmark and in various stages of development and demonstration at projects worldwide. Nuvve recommends parties look at the [“V2G Global Roadtrip: Around the World in 50 Projects”](#) report⁴ for additional information on V2G projects.

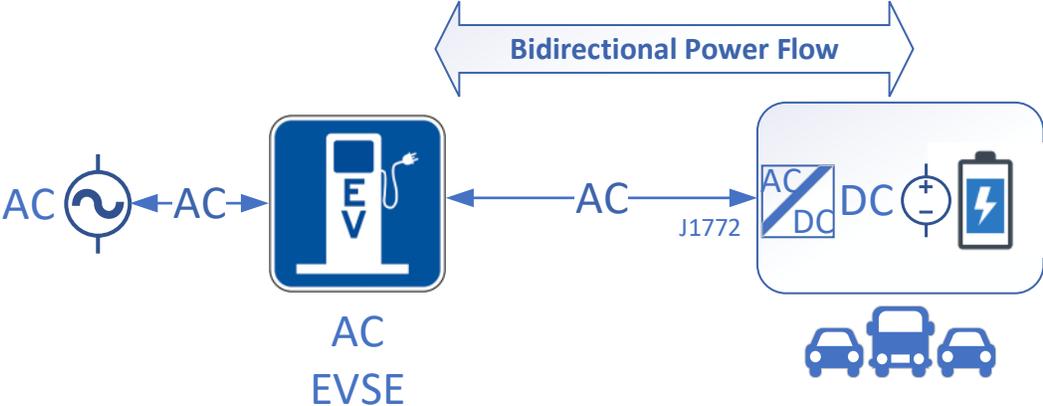
Rule 21 currently allows only for UL 1741 certified inverters in stationary EVSE (V2GDC). While this allows some V2G systems to successfully interconnect, because they not “standard” solar and/or energy storage inverters or system configurations, Nuvve’s experience to date is that those interconnections require significant manual effort.

Figure 2: A V2GDC System



⁴ <http://everoze.com/v2g-global-roadtrip/>

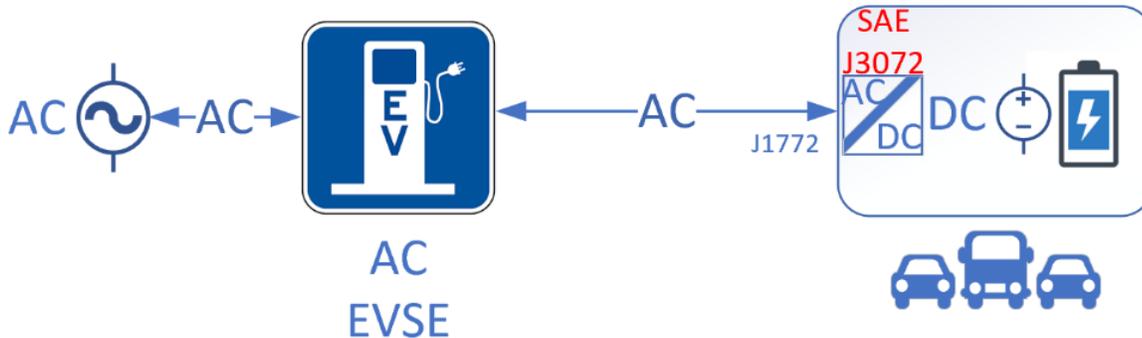
Figure 3: A V2GAC System



Additional Details:

Additional information about V2GAC:

Figure 4: V2GAC – SAE J3072 is a potential standard for certification



Nuvve believes that V2GAC systems can and should be interconnected under Rule 21, potentially by recognizing and incorporating harmonization with the Society for Automotive Engineers' (SAE) standard J3072, which addresses safety requirements for mobile inverters consistent with IEEE 1547. For example, under SAE J3072 each vehicle that plugs in to an EVSE under the V2GAC scenario must confirm its inverter is in compliance with the safety standards of IEEE 1547, specifically anti-islanding.

Vehicle OEMs have significant concerns with NRTLs' certification processes such as that for UL1741, because they are not the norm for the automotive industry, who generally self-certifies their equipment to automotive industry standards developed and maintained by SAE. This in no way compromises safety or reliability, both fundamental to modern automotive technology.

Integrating SAE J3072 into California's interconnection rules and processes would enable significantly more V2G capacity online, with IEEE 1547-compliant mobile inverter systems that provide vehicle owners and EVSPs with lower costs, and easier to use connectors and cables based on J1772, the US standard for level 2 residential and commercial vehicle charging.

The economics of V2G can be especially beneficial in some commercial applications, such as school and transit buses where there are extended park times and predictable driving schedules.

Potential Points of Conflict (PPC)

PPC 1: Provisioning / deprovisioning (see issue 22) of V2G resources on the distribution system, as they are intermittently connected.

PPC 2: Utilities only want NRTL certified equipment to interconnect, and auto manufacturers don't want NRTLs to certify vehicle subsystems, they prefer self-certification (usually to SAE standards). A compromise may be possible here, for example equipment that has been self-certified may be subject to 3rd party verification. Any compromise will require collaboration with both the automotive industry and electrical utilities.