BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Consider Streamlining Interconnection of Distributed Energy Resources and Improvements to Rule 21.	Rulemaking 17-07-007 (Filed July 13, 2017)

COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE TO THE VEHICLE TO GRID ALTERNATING CURRENT INTERCONNECTION SUBGROUP REPORT WORKSHOP

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In accordance with Rules of Practice and Procedure of the California Public Utilities Commission ("Commission"), the California Energy Storage Alliance ("CESA") hereby submits these comments to the workshop held on December 17, 2019 on the *Final Report of the Vehicle to Grid Alternaving Current Interconnection Subgroup* ("Final Report"), submitted by CESA on behalf of the Vehicle-to-Grid Alternating Current ("V2G AC") Interconnection Sub-Group on December 11, 2019. Pursuant to the *Joint Administrative Law Judges' Ruling Establishing Subgroup and Schedule to Develop Proposal on Mobile Inverter Technical Requirements for Rule 21 and Noticing Workshop* ("Ruling") issued on August 23, 2019, CESA is timely submitting these comments on January 6, 2020 in Rulemakings ("R.") 17-07-007 and 18-12-006.

I. INTRODUCTION.

CESA commends the Commission for taking proactive action in R.17-07-007 and R.18-12-006 to assess and begin the process of tackling one of the key technical barriers to the deployment of electric vehicles ("EVs") with mobile inverters built onboard the vehicle, functioning essentially as "mobile storage" resources, by granting CESA's motion to form a focused technical subgroup. Considering the insufficient time available in the Rule 21 Working

Group 3 process and forum to discuss these rather technical issues, the subgroup efforts were instrumental in familiarizing stakeholders of the existing standards in place to potentially enable the interconnection of a mobile inverter, hereafter referred to as V2G AC resources, and in identifying the key gaps that need to be addressed to enable their interconnection in the future. To CESA's knowledge, there is no other jurisdiction in the United States where such innovative proposals and thought leadership were generated to enable the interconnection of mobile inverters, and so the Commission should be commended for advancing the state's vehicle-grid integration ("VGI") objectives and for leading the nation in enabling V2G AC interconnections. CESA also appreciates the collaborative and creative spirit of the subgroup in producing the Final Report.

In these comments, CESA focuses on potential paths forward for the Commission to take in light of the key findings and takeaways from the Final Report and workshop. The subgroup was not able to discuss in detail such paths, so CESA offers our potential recommendations to ensure that this Final Report does not "remain on the shelf" and is put to good use to allow for V2G AC interconnections in the very near future. In particular, CESA recommends a phased approach to be taken to establish a "minimum viable product" for V2G AC interconnections that address certain key safety and reliability requirements while deferring the application of more dynamic smart inverter capabilities as technologies, platforms, and regulatory requirements evolve. Some stakeholders, for example, view the future of the electric grid to include dynamically responsive and operationally flexible distributed energy resources ("DERs") working in conjunction with the investor-owned utilities' ("IOU") distributed energy resource management system ("DERMS"), along with V2G AC resources that are able to move across jurisdictions and state lines to deliver different operational needs when connected to different distribution grids. CESA shares this view and seeks to push the state toward more of a "plug-and-play" infrastructure

with DERs being dispatched or responding dynamically to various signals; however, at this early stage of the market, CESA seeks to create an initial pathway for V2G AC interconnections and to support their widespread deployment before considering how standards and interconnection requirements can evolve for V2G AC resources to enable such "future grid" capabilities. In doing so, the Commission will also support pathways and strategies for feasible and cost-effective VGI, consistent with Senate Bill ("SB") 676.[1]

II. AN INITIAL PHASE OF V2G AC INTERCONNECTIONS COULD LEVERAGE UL 9741 FOR THE EVSE AND SAE J3072 FOR THE ELECTRIC VEHICLE WITH THE APPROPRIATE MODIFICATIONS AND UPDATES TO THOSE STANDARDS.

Over the course of the sub-group and workshop process, a potential near-term pathway was identified for V2G AC interconnections, contingent on several updates and modifications to existing standards to address the gaps identified in the report. Specifically, this pathway would essentially leverage an updated and modified SAE J3072 to define the mobile inverter and deliver the smart inverter functionalities combined with the utilization of an updated UL 9741 to certify electric vehicle supply equipment ("EVSE") to serve as a gatekeeper for safe and reliable smart inverter functionalities, all under a single onboard inverter configuration to avoid the matched-pair certification issue identified in the report (Gap 7) and align with the utilities' process for third-party certification for safe interconnection of distributed energy resources ("DERs") and automotive manufacturers ("OEMs") norms for self-certification of their vehicles (Gap 8). Under this initial pathway, the EVSE would serve not only as the gatekeeper to maintain grid interconnection safety and reliability but also to serve as the key "interface" to the IOU to be sure

[1] Public Utilities Code Section 740.16(c)

that V2G AC resources adhere to the smart inverter functionalities like all other DERs – *e.g.*, being pre-programmed to Rule 21 default settings.

First, SAE J3072 represents an existing model that defines the "inverter requirements of a V2G AC resource [that] would be enabled through the operationalization of the EVSE and PEV as the DER," where "the smart inverter functionalities are executed by the PEV (see Section 3.11) [and] the EVSE provides the site settings and authorizes the PEV for discharge." J3072 is not only flexible for different automotive OEMs to structure their "inverter components" with their own unique combination of software and hardware to deliver the smart inverter functionalities[2] but also may accommodate different communication protocols that may be used by automotive and EVSE OEMs – a key source of complexity, as discussed in the subgroup, to ensure that the interconnection requirements and standards are technology and business model neutral. Specifically, the IOUs currently interface with all DERs using IEEE 2030.5 and they expressed the preference to keep "one way of doing it" for all DERs, though they did not express that they cared about the EVSE to EV interface so long as communication protocols are specified in J3072, which currently only specifies IEEE 2030.5. As such, to accommodate different OEMs that use different communication protocols, J3072 could be updated to handle all such EVSE to EV communications and allow for the use of IEEE 2030.5 in addition to others, such as ISO 15118 or those related to telematics and/or energy management systems ("EMS").

Granted, J3072 would have to be updated in accordance with Gaps 2 and 3 as well, particularly around defining an EVSE design standard to work in conjunction with the J3072-certified EV to ensure that their discharge capabilities are only allowed when connected to an EVSE that is either pre-programmed prior to installation to or able to receive the applicable default

[2] Final Report at 26.

settings. Since the EVSE would be the component "passing along" the Rule 21 default settings to the EV, the Final Report discussed two options to address Gap 3 where any J3072 updates must include an EVSE design standard. Among the two options, CESA believes that "Option 1" appears to be the best path forward in this initial phase of V2G AC interconnections (more on this later). Overall though, SAE representatives indicated that they plan to be complementary and point to the appropriate IEEE standards and EVSE design standard.

Second, UL 9741 could serve a "gatekeeper function" that ensures safe and reliable interconnections and provides the EVSE design standards that were identified as a critical gap in the Final Report, which would require J3072 to reference UL 9741 certified EVSEs as an applicable pairing. As such, many of the important interconnection safety requirements such as anti-islanding and frequency/voltage synchronization could be covered by UL 9741, via updates and modifications as identified in Gap 6 of the Final Report, and ensure that the EVSE can "shut it down" or "trip" if it senses that the EV discharge would create safety issues.[3] Additionally, the use of UL 9741 for grid interconnection safety could represent a win-win path forward for the IOUs to have a DER (*i.e.*, EVSE) with third-party certification to verify these safety and reliability features (*e.g.*, anti-islanding) while maintaining the self-certification norms of automotive vehicles (more on this later). With the most important safety and reliability features of V2G AC resources verified through UL 9741 third-party testing, CESA believes it is reasonable to allow for V2G AC resources to be self-certified to J3072 in this initial phase of V2G AC interconnections.

Related to Gap 3 of the Final Report, CESA believes that it is reasonable to allow V2G AC interconnections if UL 9741 is updated to set an EVSE design standard that ensures that the EVSE is pre-programmed at manufacture to the appropriate smart inverter default settings of the specific

[3] Final Report at 33-34.

jurisdiction (Option 1 to address Gap 3).[4] In California, such default settings are defined in Section Hh of Rule 21, and CESA understands that default settings may be specified differently in different states and jurisdictions, creating a possible balkanization of settings and standards by which EVSEs must be manufactured to. EVSE OEMs likely prefer a single applicable or national standard, which would be enabled through the ability of EVSEs to dynamically receive default settings from "external systems" that can pass along these jurisdiction-specific settings to the EVSE, and then from the EVSE to the EV (Option 2), such that a single EVSE design could be manufactured to be installed in any jurisdiction and still allow for V2G AC interconnections. Furthermore, some stakeholders in the subgroup have argued that a more universal and dynamic standard would prepare EVSE resources to be able to accommodate a future grid scenario where utilities pass along smart inverter settings that are differentiated by location and time (*e.g.*, season, month).

CESA does not dispute such concerns or foreclose on these possibilities, but in this initial phase of V2G AC interconnections, it is reasonable to more efficiently enable V2G AC interconnections using Option 1 given that: (1) the California IOUs currently only require default settings to be pre-programmed at manufacture for all other DERs; (2) the California IOUs have not indicated any near-term plans at this time to send dynamic settings to inverters that differentiate by time and location; and (3) California is the fifth largest economy in the world and represents a large enough market to have some leeway to play a "market pulling" role and make it worthwhile for EVSE manufacturers to produce to a California-specific standard. Considering the requirements in place for other DERs with stationary inverters, there is no need to establish incrementally higher requirements for EVSEs at this time. While a more universal and dynamic

[4] Final Report at 38-39.

EVSE interconnection standard to enable V2G AC resources may position these resources for future, more complex grid operations, there is too much uncertainty at this time to design a standard to a future that has not yet played out. Furthermore, while understanding that mobile inverters pose different challenges since EVs are mobile and can cross jurisdictions (*e.g.*, cars going from California to Nevada and charging), CESA does not have grid safety or reliability concerns for such resources at this time because EVSE deployment is relatively less in many other jurisdictions and since UL 9741 could be designed to be California specific and prevent any unauthorized discharge if an EV is connecting outside a Rule 21 jurisdictional location. Given these mitigated risks and the potential for California to be positioned as the national leader of V2G AC resource interconnections, Option 1 represents an incremental but also the most efficient approach that is appropriate given the status quo of DER interconnections.

Finally, the use of SAE J3072 and UL 9741 represents a high-potential near-term pathway for V2G AC interconnections because SAE has the ability to update the J3072 standard to address the gaps identified in the report by mid-year in 2020, as outlined in Appendix D. Similarly, since UL 9741 is not an American National Standards Institute ("ANSI") standard, UL representatives indicated that they can move quickly and issue a Certification Requirement Decision ("CRD") within a few months after some preliminary review and comments. By contrast, UL 1741 is a consensus standard that would require review by the appropriate technical standards committeees to be updated with a CRD in the short term to accommodate EVs. UL 9741, with reference to UL 1741, also represents the most efficient and clean path forward for V2G AC interconnections as it keeps one standard (UL 1741) as the grid interconnection standard for inverter systems, thereby avoiding the need to re-educate each authority having jurisdiction ("AHJ") on differentiating grid interconnection standards by inverter-based technologies.

Taking all of the above into account, CESA understands that the Commission may not have any direct actions to take at this time. However, any Commission guidance, affirmation, or statement regarding this path would be helpful in guiding the standards development to address the identified gaps in the Final Report. Particularly, with the potential pathway discussed above, CESA encourages the Commission to strongly consider an incremental approach when assessing the aforementioned SAE J3072 and UL 9741standards when this group of stakeholders reconvene upon the completion of updates and modifications to enable V2G AC interconnections.

III. THIS SUBGROUP SHOULD BE RECONVENED WHEN THE NECESSARY UPDATES AND MODIFICATIONS HAVE BEEN MADE TO THE STANDARDS DISCUSSED IN THE FINAL REPORT BUT EV TESTING RESULTS SHOULD NOT BE ATTACHED AS A PRECONDITION.

To avoid losing progress made in knowledge sharing and collaborative discussions through this subgroup and Final Report development process, CESA sought to ensure that there is an opportunity for this subgroup to reconvene and continue to advance the path for V2G AC resources to be able to interconnect. While the Final Report indicated a July 2020 timeline to reconvene the subgroup, CESA believes that the Commission can be flexible as the July 2020 timeline was discussed as an initial marker by which the subgroup could reconvene at the earliest, given the standards update and modification timeline as indicated by UL and SAE. In recognition of the time and resources and competing priorities of the Commission and IOU staff, as well as that of other stakeholders, the subgroup should be reconvened once UL and SAE have indicated that draft standards, which have been updated and modified to address gaps identified in the Final Report, are ready for review by subgroup participants. As such, rather than an automatic trigger in July 2020 for the subgroup to reconvene, CESA suggests that the Commission could reconvene the subgroup upon a party in R.17-07-007 and/or R.18-12-006 informally notifying the Commission staff affirming that UL and SAE have draft standards ready for review.

However, for Recommendation 1, the IOUs held the position that EV testing results to the currently applicable standards (*i.e.*, UL 1741, IEEE 1547) are needed as a precondition to reconvene the subgroup, seeking data on the specific sections of the current standards. However, as discussed in Section 5.A and Appendix E of the Final Report, the automotive OEMs have indicated that many elements of UL 1741 are not applicable to EVs, and CESA is unclear on how such EV testing would advance the purposes of creating a future interconnection pathway for V2G AC resources. Given the inapplicability of many sections of UL 1741, CESA believes that such pre-qualification development and testing of the EV would require new test specifications to be defined to even enable such testing, which would cause automotive OEMs to incur significant expenditures to design equipment and develop new software, firmware, and hardware, not to mention the significant time required even as UL and SAE will likely be working toward more applicable draft standards for V2G AC resources for Rule 21 interconnection. CESA does not believe that these EV testing reports to inapplicable standards are necessary when this subgroup has identified a potential pathway for interconnection using more applicable standards that, if updated and modified, will create an interconnection and testing pathway that is more workable for V2G AC resources, particularly since UL 9741 will likely make references to UL 1741.

IV. A COMMISSION PROCEEDING SHOULD CONSIDER THE JURISDICTIONAL QUESTION AROUND INTERNAL CERTIFICATION AND FURTHER REVIEW THE MANUFACTURER'S INTERNAL TESTING PROCESS.

Section 7.D.1 of the Final Report provides important insights into the automotive vehicle design, testing, and production process that highlights how EVs with mobile inverters are fundamentally different from stationary inverters used for solar, storage, and other "traditional" installed DERs. Whereas stationary inverters are traditionally single-function widgets designed specifically to meet smart inverter requirements, mobile inverters are wholly integrated into the

software, firmware, and hardware of the vehicle, which may play many different functions beyond those for smart inverters. Furthermore, the design, testing, and production process is long and entails constant adjustments such that third-party certification poses challenges for a mobile inverter in a vehicle that is being designed and constructed to serve many other non-grid-related functions as well. Any small change to vehicle design and production would thus require retesting even though they may not be related to its mobile inverter capabilities, which risk significant delays to the production and deployment cycles of V2G AC resources. Instead of subjecting V2G AC resources to lengthy third-party certification and testing requirements, CESA believes it is reasonable to allow automotive OEMs to self-certify their vehicles to J3072 while addressing third-party certification and testing needs for the grid interconnection safety and reliability needs of the utilities through the EVSE, which plays a key gatekeeper role in the V2G AC resource in providing DER functions. Furthermore, the Commission should keep in mind the importance of maintaining a quality customer experience to encourage EV adoption, including for those capable of V2G AC bidirectional charge and discharge, considering this is a key state policy objective.

To further advance knowledge sharing and affirm a path forward for V2G AC interconnections, CESA and other industry stakeholders recommended in the Final Report that the Commission may wish to consider the jursidctional question regarding OEM self-certification, possibly in R.18-12-006, given that this subgroup was constituted of technical, not legal or regulatory, experts. Considering the unique mobile characteristics of vehicles that can span jurisdictions, and the state/local jurisdictional nature of distribution-grid interconnections, CESA seeks to explore whether and how third-party testing and certification would apply to V2G AC resources, which may raise legal and policy questions around interconnection policy and interstate commerce. CESA thus encourages such discussions to occur in the appropriate policymaking

proceedings, as one of the potential pathways discussed above hinges on third-party certification of the stationary EVSE to UL 9741 and self-certification of the mobile inverter in the EV to SAE J3072.

Moreover, CESA believes that the Commission and other stakeholders may benefit from assessing the internal testing procedures of the automotive OEMs and potentially create an alternative pathway to assess these validated internal test results that preserve self-certification while providing some additional assurances to the Commission and stakeholders, even though UL 9741 will provide third-party certification and testing to ensure safe and reliable interconnections through the EVSE. In addition to building understanding of the internal testing procedures, the Commission and utilities may wish to consider the development of "validation certificates" that confirm compliance of internal testing to the applicable standards. The criteria and details of these certificates may need to be discussed in the appropriate proceeding.

V. CONCLUSION.

CESA appreciates the opportunity to submit these comments to the Final Report and workshop and looks forward to collaborating with the Commission and stakeholders in this proceeding.

Respectfully submitted,

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