

# **PC44 Interconnection Workgroup**

## **V2G Regulation Proposal**

**October 30, 2024**

## Proposed Regulations - Vehicle to Grid Interconnection

*Note: All changes are in regulatory mark-up style with bracketed items [...] deleted and italicized items added. Footnotes are explanatory and will not be included in the final regulations.*

### Add Regulation Section 20.50.02.02

.02 Acceptable Standards<sup>1</sup>.

Unless otherwise specified by the Commission, the utility shall use the applicable provisions in the latest revised version of the incorporated by reference publications listed below as standards of accepted good engineering practice in this subtitle:

*M. Interconnection Requirements for Onboard, Grid Support Inverter Systems, SAE J3072, Revision 3, June 10, 2024<sup>2</sup>*

*N. Electric Vehicle Supply Equipment, UL 2594, Edition 3, December 15, 2022<sup>3</sup>*

*O. Electric Vehicle Power Export Equipment, UL 9741, September 29, 2023<sup>4</sup>*

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<sup>1</sup> Several related standards are already referenced in COMAR 20.50.02.02 Such as: E.) Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces, IEEE 1547-2018; F.) Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces, IEEE 1547-2018 Amendment 1 (IEEE Std. 1547a-2020); G.) Errata to Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces, IEEE 1547-2018; H.) IEEE 1547.1-2020, Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces; and I.) UL Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy. Some related standards are not yet published and can't yet be referenced. The UL 1741 standard is being updated to include Supplement SC (UL 1741-SC) for V2G-AC and UL1741 would include UL1741-SC when published. After UL 1741 SC is published, the PC44 Interconnection Workgroup will need to reconvene to formally adopt UL1741-SC.

<sup>2</sup> SAE J3072 establishes requirements for a grid support inverter system function that is integrated into a bidirectional electric vehicle which connects in parallel with an electric grid through an EVSE. This standard also defines the communication between the EV and the EVSE required for the EV onboard inverter function to be configured and authorized by the EVSE for discharging at a site. The requirements herein are intended to be used in conjunction with IEEE 1547 and IEEE 1547.1.

<sup>3</sup> UL 2594 applies to conductive EV supply equipment with a primary source voltage of 1000 V ac or less, with a frequency of 50 or 60 Hz, and intended to provide AC power to an electric vehicle with an on-board charging unit.

<sup>4</sup> UL 9741 applies to off-board unidirectional and bidirectional equipment rated 1000 Vac and 1500 Vdc or less, that transfers electrical energy between an electric vehicle and off board loads as well as operating in parallel with an electric power system, such as the electric utility grid, using a permanently attached vehicle connector. Equipment that has optional bidirectional functionality serves as both Electric Vehicle Power Export Equipment (EVPE) and electric vehicle supply equipment (EVSE). Note: UL 9741 is applicable as a method of demonstrating compliance with IEEE 1547.1 for certain specific equipment and pairs of equipment; typical use is for pairs of equipment tested together, it is not really applicable to general open systems of interconnection of equipment from different manufacturers.

## Add Regulation Subsections 20.50.09.02B

.02 Definitions.

B. Terms Defined.<sup>5</sup>

(1) *“AC EVSE” means supply equipment that passes alternating current to the EV, with conversion between AC and DC accomplished onboard the EV.*

(2) *“Bidirectional electric vehicle” has the meaning stated in Public Utilities Article, § 7-1001(c), Annotated Code of Maryland.”<sup>6</sup>*

(3) *“DC EVSE” means supply equipment that passes direct current to or from the EV, with the EVSE accomplishing conversion between AC and DC.*

(4) *“Electric vehicle” or “EV” means a vehicle that employs electrical energy as a primary or secondary mode of propulsion and is capable of charging the onboard battery from an external supply of electricity.*

(5) *“Electric vehicle supply equipment” or “EVSE” means a device or system designed and used specifically to transfer electrical energy between an electric vehicle and the electric grid.*

(6) *“Technical interconnection requirement” or “TIR” means a public-facing document available on an electric company’s website that specifies interconnection technical review criteria and distributed energy resource functional settings.*

(7) *“VIG, or managed charging” means a range of approaches from utility programs and rate design to incentivize ratepayers for varying the time or rate at which an electric vehicle is charged.*

(8) *“VIG Ready EVSE” is an EVSE that is capable of controlled charging rate operation but is either not certified for or is certified for but not programmed or configured for bidirectional operation.*

(9) *“V2G, or vehicle-to-grid” means the ability for an EVSE connected to a bidirectional electric vehicle to operate in parallel to the grid and both receive and feed power to the point of interconnection between the EVSE and the grid.*

(10) *“V2G Ready EVSE” is an AC EVSE or DC EVSE, is certified for and programmed or configured for bidirectional operation as part of a V2G system in parallel with the electric grid.*

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<sup>5</sup> The numbering of these definitions will be changed when the final regulations are submitted for Administrative, Executive and Legislative Review (AELR) prior to publishing in the Maryland Register.

<sup>6</sup> Note: Bidirectional electric vehicle is defined in PUA §7–1001(C) per the DRIVE Act to mean “an electric vehicle that is capable of both receiving and discharging electricity.”

*(11) “V2G System” is a combination of hardware and software in or around the EVSE and EV for the purposes of communication with and programmed flow of energy into and out of the vehicle battery in support of electrical loads or systems offboard the EV, including the electric grid.*

Add Regulation Section 20.50.09.06S

.06 General Requirements.

*S. Vehicle to Grid Interconnection.*

*(1) A V2G System shall meet the following requirements:*

- a. The interconnection customer for a V2G system shall submit an interconnection request pursuant to Regulation .04<sup>7</sup> of this Chapter.*
- b. A V2G system interconnection shall be valid only at a single point of interconnection<sup>8</sup> specified in the interconnection agreement. Additional locations shall require additional interconnection reviews and associated interconnection agreements.*
- c. An electric company shall consider a V2G system to be an energy storage device pursuant to Regulation .02B<sup>9</sup> of this chapter for the purpose of evaluating the electrical performance requirements applicable to an interconnection request.*
- d. Characteristics of energy storage systems that do not and cannot apply to the use of EVs as connected energy storage units shall not be required of V2G systems operated as energy storage.*
- e. A V2G system shall not be authorized in bidirectional mode while in parallel operation<sup>10</sup> with the local electric power system unless an interconnection agreement is in place between the interconnection customer<sup>11</sup> and the relevant electric utility and the interconnection customer has received a permission to*

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<sup>7</sup> Note: Specific requirements for interconnection requests are listed in 20.50.09.04 (i.e., Regulation .04 of this Chapter).

<sup>8</sup> Point of interconnection is defined in 20.50.09.02 and is the same as point of common coupling, which means where the V2G system “is electrically connected to the electric distribution system.”

<sup>9</sup> “Energy storage device” in COMAR 20.50.09.02B means a piece of equipment that captures energy produced at one time, stores that energy for a period of time, and delivers that energy as electricity at a future time.

<sup>10</sup> COMAR 20.50.09.02B states that “Parallel operation” means the sustained state of operation over 100 milliseconds which occurs when a small generator facility is connected electrically to the electric distribution system, and thus has the ability for electricity to flow from the small generator facility to the electric distribution system.

<sup>11</sup> Interconnection customer is a defined term in COMAR 20.50.09.02B and “means an entity that proposes to interconnect or has interconnected a small generator facility to an electric distribution system.”

*operate from the electric company.*

- (2) *An electric company may delay interconnection of a V2G system to provide adequate time to ensure electric distribution system safety and reliability in advance of vehicle-to-grid interconnections pursuant to applicable requirements in Regulation .09 of this Chapter for Level 1 Review; Regulation .10 of this Chapter for a Level 2 Review; Regulation .11 of this Chapter for a Level 3 Review; and Regulation .12 of this Chapter for a Level 4 Review.*<sup>12</sup>
- (3) *To ensure safety, reliability and V2G functionality for DC EVSE V2G Systems, the interconnection agreement shall require adherence to UL 1741 incorporated by reference in COMAR 20.50.02.02(I)*
- (4) *To ensure safety, reliability and V2G functionality for AC EVSE V2G Systems there are two acceptable certification pathways for which only one certification pathway shall be required in an interconnection agreement:*
- a. *Certification pathway 1 is:*
    - i. *UL 1741<sup>13</sup> incorporated by reference in COMAR 20.50.02.02(I) and UL 2594 incorporated by reference in COMAR 20.50.02.02(N) for a V2G Ready EVSE*
    - ii. *SAE J3072 incorporated by reference in COMAR 20.50.02.02(O) for a bidirectional electric vehicle:*
  - b. *Certification pathway 2 is:*<sup>14</sup>

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<sup>12</sup> This regulation is needed to comply with PUA §7-1004(A)(2).

<sup>13</sup> Specifically, UL 1741 SC.

<sup>14</sup> The Workgroup recommends this pathway as an alternative to the UL 1741 SC/SAE J3072 approach for three reasons: (1) A core component of UL 1741 SC is that it enables the EVSE to authorize the EV to discharge based on the vehicle's compliance to SAE J3072. This is important in cases where several V2G capable vehicles may be plugging into the EVSE, and the EVSE needs to perform this check. However, in cases where only one V2G capable vehicle will be plugging into the EVSE (e.g., a single-family residential setting), the UL QIKP certification pathway is sufficient to ensure grid interconnection/performance certification. In summary, QIKP works for a single installation site with a single defined EV; (2) While the Workgroup supports the incorporation of UL 1741 SC as an option for V2G AC systems within these regulations, the UL 1741 SC working group has not yet published the standard and has pushed back publication a few times. Allowing for the QIKP pathway creates a hedge against further delays to UL 1741 SC, and enables Maryland to achieve the vision set forth in the DRIVE Act; and (3) Original Equipment Manufacturers (OEMs) of V2G systems may choose different pathways. As long as those pathways can ensure safety and reliability through UL certification, including both the fire/shock safety evaluation and the grid interconnection/performance functionality, then these pathways should be open to OEMs. This is particularly important while the V2G system market is still relatively nascent. We must ensure the core safety and reliability of the grid, which both pathways accomplish, while not being too prescriptive over the path that OEMs take.

- i. *UL 9741<sup>15</sup> incorporated by reference in COMAR 20.50.02.02(M) for V2G Ready EVSE*
- ii. *UL 1741 SB under the QIKP Grid Interconnection Performance Certification<sup>16</sup> for a bidirectional electric vehicle and V2G Ready EVSE*

*(5) If applicable certifications pursuant to Regulation S(4) are not available or safety, reliability and V2G functionality cannot be ensured, the utility may require reasonable alternative methods such as protective relaying equipment, a power control system, or other alternative methods in an interconnection agreement.<sup>17</sup> If safety, reliability and V2G functionality cannot be ensured through certifications or reasonable alternative methods, an electric company shall deny the interconnection request.*

*(6) A V1G System shall meet the following requirements:*

- a. *An interconnection request, interconnection agreement and an electric company permission to operate is not required for a V1G Ready EVSE provided that the V1G Ready EVSE is configured to only allow V1G operation in compliance with relevant standards.<sup>18</sup>*
- b. *A V2G System that operates as a V1G Ready EVSE shall be accepted by an electric company using a method for notification form submittal as determined by the electric company.<sup>19</sup> The notification form used by the electric company shall only require information required to attest to V1G operation and not duplicate an interconnection request.*
- c. *A V1G Ready EVSE shall not be changed to a V2G Ready EVSE without first receiving an interconnection request and permission to operate from the utility.*
- d. *Only the EVSE manufacturer or a manufacturer approved third party entity may reprogram or reconfigure an EVSE to bidirectional operation.<sup>20</sup>*

<sup>15</sup> Specifically, the examples for grid-parallel V2G AC found in UL 9741 Section 1.4.(H), 1.4.(J) and 1.4.(L).

<sup>16</sup> Utilities can check Grid Interconnection Performance Certifications (QKIP) for V2G AC, UL 1741 SB using the UL Product iQ database @ [UL.com/PiQ](https://www.ul.com/PiQ).

<sup>17</sup> This regulation is needed due to a general lack of AC ESVE standards. Power control systems devices that electronically control the power output of generating facilities may be an alternative method to protective relaying for controlling power export. The UL 1741 PCS CRD from March 2019 or coming successor standard UL 3141 (currently complete outline of investigation, full technical committee forming for consensus and balloting) to prove current control and ability to set “charge-only mode” may also be applicable. These standards have specific provisions to prove this capability to utilities and some DC EVSEs already have obtained the certification for this use case.

<sup>18</sup> Interconnection request, interconnection agreement and permission to operate are all defined in COMAR 20.50.09.02B.

<sup>19</sup> The determination of whether a bidirectional electric vehicle is operating in V1G mode has to be attested to the electric company and the Workgroup determined not to get more prescriptive in regulations on what would be acceptable proof.

<sup>20</sup> This requirement exists in California’s Rule 21.

Modify Regulation Section 20.50.09.14C as follows:

C. A utility shall file not later than April 1 of each year a report entitled “Annual Small Generator Interconnection Report” to the Commission containing the following information for the preceding calendar year:

- (1) The total number of and the nameplate capacity of the interconnection requests received, approved, and denied under Level 1, Level 2, Level 3, and Level 4 reviews;
- (2) The number of evaluations of interconnections requests approved and denied using any alternate process under Level 1, Level 2, Level 3, and Level 4 reviews;
- (3) The fuel type, or energy storage type, total number, and total nameplate capacity of small generator facilities approved in each of the following categories:
  - (a) Net metering;
  - (b) Emergency standby capable of operating in parallel;
  - (c) Behind the meter load offset;
  - (d) Combined heat and power;
  - (e) Energy storage devices; [and]
  - (f) *V2G Systems – DC EVSE*
  - (g) *V2G Systems – AC EVSE<sup>21</sup>; and*
  - [(f)](h) Other;

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<sup>21</sup> Although a V2G system is considered to be an energy storage device for interconnection reviews, the Workgroup desires annual reporting for bidirectional electric vehicles to be separate from energy storage. This reporting should also be for both AC and DC systems separately, as this will help determine if/when additional interconnection regulation updates are needed, and may inform other DRIVE Act implementation efforts.