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VIA ELECTRONIC MAIL

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RE: UD Electric Vehicle R&D Group's Public Comment on the NJ 2019 Draft Energy Master Plan

Introduction

We commend Governor Murphy and New Jersey's leadership and commitment to transitioning to clean and efficient energy. The draft Energy Master Plan (EMP) exemplifies an appreciation of the need for a diverse and comprehensive approach to this transition, capitalizing on the variety of technologies available including Vehicle-to-Grid (or V2G) technology. However, it lacks specific policies known to be needed to allow V2G technology to participate fully and fairly in the market.

V2G technology is a unique resource. V2G-enabled EVs can export energy from their batteries and can therefore provide valuable services to the electric grid. These services include smoothing the variability of solar and wind, stabilizing the continual fluctuations of supply and demand, and reducing the need for expensive natural gas plants by offsetting peak loads.

The income from these services reduce the cost of vehicle ownership, thereby enabling more New Jerseyans to drive EVs and promoting EV adoption – a stated goal of the NJ EMP and EO28. Simultaneously, these services reduce the cost of electricity to all ratepayers by reducing the need for new electric system infrastructure development, therefore also enabling greater power distribution for EV adoption. Finally, as grid-integrated vehicles, or GIVs, act as storage that responds to grid demand, they promise to be a low-cost method of achieving the EMP's energy storage deployment goal.

V2G projects conducted across the globe (including Delaware, California, Denmark, France and the Netherlands) show that this technology is already economically viable, with around $100/electric vehicle (EV)/month of revenue. A University of Delaware (UD) V2G project registered in PJM began operating in January 2019 and, as of July 2019, generated $6,000 in revenue for frequency regulation. Factory-original buses with V2G from Bluebird and Lion Bus are now available. PSE&G has a filing requesting to use these buses for grid support, and a second NJ utility has expressed interest in such a program. In addition to the bus OEMs, Honda, Mitsubishi and Nissan have announced V2G cars.

Despite these projects, the draft EMP (and the New Jersey Energy Storage Analysis performed by Rutgers University) describe V2G as if it were a mid- or long-term option. Given its demonstrated market viability, the EMP should incorporate known policies and vetted regulatory code to remove barriers to near-term incorporation of V2G into New Jersey's energy transition.

Our policy recommendations to address these barriers fall into five categories:

A. Clarify and broaden V2G technology in EMP storage definition
B. Addressing insufficient safety standards
C. Addressing inadequate interconnection processes
D. Allowing for equal credit-for-export
E. Evaluating the accounting options now allowed by FERC Order 841

For nearly 20 years, the University of Delaware's EV Research and Development Group (EV R&D Group; alternatively, the EV Group") has investigated EV market penetration and performed analyses of the policies necessary to allow for V2G integration. The EV Group's Principal Investigator, Dr. Willett Kempton, founded the V2G concept and the EV Group has demonstrated and licensed V2G technology. The recommendations made here are therefore based on extensive experience within this field.

The recommendations in this public comment concern changes to two texts:

1. Proposed modifications of the draft EMP regarding V2G, and
2. Proposed modifications to the New Jersey Administrative Code Title 14, Chapter 8 to allow for V2G technology integration.

All proposed amendments to both texts are in red text and underlined.

1. Proposed Modifications of Draft EMP Language

A. Clarify and broaden V2G technology in EMP storage definition

We support the draft EMP's language that already includes V2G technology in storage-related text. However, some of the language surrounding V2G is ambiguous and could hinder its potential.

In **Goal 2.3.5**, for example, there appears to be a distinction made between storage and V2G technology. While they are different, it should be clarified that they do not differ in their use. V2G can provide ancillary services, demand response, peak power reduction, shifting load, increased local energy resiliency, and other grid services, exactly as traditional batteries can do. Projects conducted in Delaware, California, France, Denmark and the Netherlands demonstrate these services. V2G should therefore also be included in the classification of "storage."

The draft EMP also implies that the potential for V2G technology is restricted to fast charging stations. This is inaccurate. V2G can be implemented in both AC and DC charging stations. The UD project of 33 charging stations demonstrates that frequency regulation is possible with AC charging stations. Our analysis shows that using AC charging for V2G is considerably more cost-effective; the EMP should be technology-neutral as to which type of charging is used.

We suggest modifying language throughout the EMP to acknowledge V2G technology as a type of storage, that it can provide an array of grid services, and that it is available for immediate deployment. This includes:

1. Adding a paragraph in **Goal 2.1.5** that states:

"Interconnection requirements were made when distributed energy storage was not available and therefore do not incorporate them in interconnection language. Storage, including both stationary batteries and grid-integrated charging systems, must be incorporated into the same regulatory code for interconnection applications and review to which other distributed energy resources have access."

2. Changing the last paragraph of **Goal 2.3.5** to read:

"A great synergy could come with Goal 1.1, Electrify the Transportation Sector, and the energy storage goals, thanks to V2G and vehicle to home (V2H) technologies. V2G, being already mature and economically viable, can be deployed with any charging station regardless of the type (AC or DC) or the level of charging. In addition to the already quoted benefits of storage technology such as V2G (with the help of an aggregator in order to have sufficient capacity size), distributed energy storage could be used to flatten demand charge."

B. Addressing insufficient safety standards

While the draft EMP appropriately calls for updating the interconnection processes in **Goal 2.1.5** and directs the strengthening of building and energy codes and appliance standards throughout **Goal 3.3**, it is silent on updating interconnection standards for the variety of technologies the EMP demands. We therefore recommend adding language that authorizes

interconnection of EVs via standard SAE J3072, specifically developed for the interconnection of EVs with V2G capabilities using AC charging stations.

The New Jersey interconnection regulations for small resources (Levels 1 and 2) were designed with solar in mind. They require compliance with an inverter safety standard, UL 1741, that is not applicable to the most commonly used type of GIV system, the AC charging station. In such systems, the inverter is on board the EV instead of permanently installed on site, as is assumed by the UL standard.

In order to ensure the safety and reliability of AC GIV systems, the Society of Automotive Engineers has developed standard SAE J3072. This standard requires that the GIV and charging station be in compliance with both the National Electrical Code (NEC) and IEEE 1547, as required by New Jersey regulations, and adds other safety features. Notably, the SAE standard adds a unique safety feature: the stationary components act as a protective gatekeeper, allowing only certified car models (and their inverters) to interconnect.

New Jersey regulations require that interconnection equipment be "tested and listed by an OSHA-approved nationally recognized testing laboratory." However, federal OSHA regulations specifically exclude "automotive vehicles" from the purview of these labs (known as NRTLs). To resolve this issue, the University of Delaware proposes that compliance with SAE J3072 be determined (and attested to) by the vehicle manufacturer or the supplier of the on-board inverter and other charging equipment. If NRTL testing is needed, the relevant standard is UL 2594, which applies to the stationary components of the GIV system.

Under Strategy 2 of the feedback requested by the committee, the following question is listed: "Which states or cities have successfully implemented stronger-than-average building and energy codes?" SAE J3072 has been successfully incorporated into the interconnection standards by the State of Delaware through the near-unanimous passing of SB12 through the 150th General Assembly and signed into law by Governor Carney in June 2019[1]. Following the example language already written in Goal 3.3.7, we recommend citing Delaware's SB12 as a model and encouraging the adoption of SAE J3072 to strengthen New Jersey's interconnection and appliance standards.

A such, we suggest adding the following to the paragraph addition suggested previously in **Goal 2.1.5**:
"Current standards for interconnection are not appropriate for AC charging stations and therefore NJBPU should adopt SAE J3072 as it allows AC charging stations to interconnect without hindering safety. This standard is already in use in Delaware."

C. Addressing inadequate interconnection processes

Though **Goal 2.1.5** addresses the importance of opening currently restricted interconnection pathways to new technologies, it still restricts storage because the level 1 interconnection pathway is limited to only Class I renewables. As such, we recommend adding language that

[1] Delaware code, Title 26, Chapter 10, Section 1014 (e)(5), https://delcode.delaware.gov/sessionlaws/ga145/chp212.shtml#TopOfPage. Online code not yet updated as of 17 July 2019.

supports V2G as storage (as well as V2G as DER) to the list of technologies that can apply for interconnection using the level 1 interconnection pathway.

Additionally, **Goal 2.1.5** directs the appropriate agencies to raise interconnection limits, without suggesting a limit. We recommend raising the first level interconnection limit to at least 25kW as is recommended by the Interstate Renewable Energy Council's (IREC) 2017 report[2]. This raise does not impact grid reliability nor general safety, and there are already several States which have adopted this measure (Oregon, Massachusetts and Utah)[3]. We say "at least 25 kW" because some states recommend higher limits, like California with an upper limit of 30kW and Montana with 50kW[4].

We suggest adding the following to the end of the second paragraph of **Goal 2.1.5**:
"Following the recommendation of the Interstate Renewable Energy Council 2017 report on Interconnection standards, the upper limit of level 1 interconnection should be raised to 25kW as it does not present a safety issue."

D. Allowing for equal Credit for Export

We agree with current language in the draft EMP that states compensation schemes for market participation are needed and they must be fair and equitable. However, the language that addresses this concern in **Goal 2.1.6** is vague. We suggest a more concrete recommendation than to "consider how to design utility tariffs to encourage DER deployment." Such mechanisms have been promulgated and tested in the market in other jurisdictions.

Specifically, we recommend adding text within **Goal 2.1.6** that encourages the NJBPU to work with utilities to adopt a model credit-for-export utility tariff that recognizes the unique nature of DERs such as V2G. Such a tariff would ensure EV owners are billed for consumption and credited for export. An example of a tariff mechanism allowing for credit-for-export was adopted in Delaware in 2009 and has been used for V2G successfully throughout the state.

Storage is a unique resource, acting as both generator and load. A GIV system only exports when doing so provides a benefit to the grid: either in response to price signals or when sent a dispatch signal. Behind-the-meter GIV systems that provide grid services should be allowed to compete on an even playing field with transmission-connected storage systems. These larger systems pay for their charging energy, and receive credit for export, within the same (wholesale) rate scheme.

Crediting GIV systems for the energy they return to the grid (not, of course, for energy consumed in the course of driving) at the retail level, is already in effect in Delaware. In the policy framework used in DE, utilities provide retail GIV customers with a credit against their

[2] Interstate Renewable Energy Council, «Priority Considerations for Interconnection standards : A quick reference guide for utility regulators,» 2017.
[3] National Renewable Energy Laboratory, «Updating Small Generator Interconnection Proceduresfor New Market Conditions,» 2012.
[4] National Renewable Energy Laboratory, "Review of Interconnection Practices and Costs in the Western States," 2018.

monthly bill in dollars, at the rate per kWh in effect at the time of export. Thus, like transmission-connected storage, they are buying and selling within the same rate scheme. In addition to fairness, this mechanism has the advantage that no new metering nor accounting need be done; the existing utility meter is used for kWh as before and a meter in the charging station is used for PJM reconciliation.

Note, however, that with this mechanism the transmission-connected systems are still at an advantage: they effectively pay wholesale rates for their unavoidable electrical losses, while GIV customers will pay higher retail rates.

We recommend that New Jersey enact similar regulations to permit retail crediting when exports provide grid services. Given the uniqueness of these systems and the way in which they operate, code amendments for such a revenue scheme are inappropriate for existing subchapters within N.J.A.C. §14:8 and therefore may require a new subchapter to be created.

We specifically suggest adding the following between the second and the third paragraphs in **Goal 2.1.6**:
"NJBPU will also consider designing utility tariff for credit-for-export to be used by customers using behind-the-meter storage, including both stationary battery and grid-integrated charging systems."

E. Evaluating the accounting options now allowed by FERC Order 841

The recent FERC Order 841, when implemented, will create a second crediting possibility. FERC's new order applies to all electric storage systems that participate in wholesale markets, whether they interconnect at the distribution or transmission level. GIV customers will be able to purchase at wholesale rates the portion of their charging energy that is later to be resold in wholesale markets. But this model can't be employed unless utilities agree to track what portion of a customer's bill is retail load, and what is wholesale charging energy. (FERC calls this accounting process "netting out.")[5]
We fully support the language already incorporated into the draft EMP, particularly the language in **Goal 2.1.6** that calls for the development of a mechanism to compensate DER for its full value stack at the regional and federal level. Still, added direction to the BPU to have utilities evaluate the feasibility of netting out accounting, as described by FERC 841 and perhaps as part of the "submission of integrated distribution plans by the EDCs," is recommended. If netting out is found to not be feasible, or if more deliberation is required,

[5] "Each RTO/ISO must specify that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets must be at the wholesale locational marginal price…To the extent that the host distribution utility is unable…or unwilling to net out any energy purchases associated with a resource using the participation model for electric [continued next page] storage resources' wholesale charging activities from the host customer's retail bill, the RTO/ISO would be prevented from charging that resource using the participation model for electric storage resources electric wholesale rates for the charging energy for which it is already paying retail rates….We find that efficiency losses are charging energy and therefore not a component of station power load. Accordingly, the charging energy lost to conversion inefficiencies should also be settled at the wholesale LMP as long as those efficiency losses are an unavoidable component of the conversion, storage, and discharge process that is used to resell energy back to the RTO/ISO markets." FERC Order 841 (2018).

then we strongly recommend the retail credit-for-export described previously as a simple, immediate measure to enable V2G.

We therefore recommend the addition of the following language in **Goal 2.1.6:**
"Upon the implementation of FERC Order 841 by PJM Interconnection, supplier/providers and EDCs should evaluate the feasibility of netting out any energy purchases from the grid-integrated charging system's retail bill that a grid-integrated charging system purchases at wholesale rates and sells back to wholesale markets under the participation model described in Order 841. They shall submit a report on this evaluation to the Board by six months from the implementation of Order 841 by PJM Interconnection."

2. Proposed Modifications to N.J.A.C. 14:8 Regulatory Code

Beyond the above language changes needed within the EMP, below we recommend changes to the New Jersey Administrative Code to incorporate this technology. The final EMP should direct the NJBPU to review and adopt these following proposed amendments as appropriate – perhaps as added text direction in **Goal 2.1**.

We suggest the following specific modifications, to Title 14 Chapter 8 "Renewable Energy and Energy Efficiency." This is based on our discussions with relevant utilities and our experience in other states (DE, CA, NY) and within PJM.

First, we define new terms to be added to N.J.A.C. 14:8, and then present the necessary changes regarding interconnection categories and safety standards in Subchapter 5. Due to the uniqueness of the technology, the addition of Credit-for-Export tariff should be in a new Subchapter as it is a separate revenue design from net-metering.

New Definitions to Add

"Grid-integrated electric vehicle'' means a battery-run motor vehicle that has the ability for two-way power flow between the vehicle and the electric grid.

"Grid-integrated charging system" means a charging station and its associated equipment that have the ability to allow two-way power flow between a grid-integrated electric vehicle and the electric grid, as well as the communications hardware and software that allow for the external control of the vehicle's battery charging and discharging by an electric distribution company, electric power supplier, PJM Interconnection or a distributed resource aggregator.

"Distributed resource aggregator'' means any person or entity who contracts with an electric distribution company, electric power supplier or PJM Interconnection to provide energy services from grid-integrated electric vehicle systems.".

"Export" means to deliver power to an electric distribution system from a grid-integrated charging system behind a customer meter.

"AC charging station" means site-installed equipment using alternating current to carry power to electric vehicles with on-board charger-inverters.

"DC charging station" means site-installed equipment, including an inverter, used to carry direct current to electric vehicles for charging.

Subchapter 5. Interconnection of Class I Renewable Energy Systems and grid-integrated charging systems

§ 14:8-5.1 Interconnection definitions

The following words and terms, when used in this subchapter, shall have the following meanings, unless the context clearly indicates otherwise. Additional definitions that apply to this subchapter can be found at N.J.A.C. 14:3-1.1 and 14:8-1.2.
"Applicant" means a person who has filed an application to interconnect a customer-generator facility or grid-integrated charging system to an electric distribution system.
[…]
"Interconnection agreement" means an agreement between a customer-generator or a customer using grid-integrated charging system and an EDC, which governs the connection of the customer-generator facility or grid-integrated charging system to the electric distribution system, as well as the ongoing operation of the customer-generator facility or grid-integrated charging system after it is connected to the system. An interconnection agreement shall follow the standard form agreement developed by the Board and available from each EDC.

"Interconnection equipment" means a group of components connecting an electric generator or grid-integrated charging system with an electric distribution system and includes all interface equipment including switchgear, inverters or other interface devices. Interconnection equipment may include an integrated generator or electric source.
[…]

§ 14:8-5.2 General interconnection provisions

- (a) Each EDC shall provide the following three review procedures for applications for interconnection of customer-generator facilities and grid-integrated charging systems:
    - **1.** Level 1: An EDC shall use this review procedure for all applications to connect inverter-based customer-generator facilities and grid-integrated charging systems, which have a power rating of ~~10~~ 25 kW or less, and which meet the certification requirements at N.J.A.C. 14:8-5.3. Level 1 interconnection review procedures are set forth at N.J.A.C. 14:8-5.4; …
    - 2. Level 2: An EDC shall use this review procedure for applications to connect customer-generator facilities and grid-integrated charging systems with a power rating of two MW or less, which meet the certification requirements at N.J.A.C. 14:8-5.3. Level 2 interconnection review procedures are set forth at N.J.A.C. 14:8-5.5; and
    - 3. Level 3: An EDC shall use this review procedure for applications to connect customer-generator facilities and grid-integrated charging systems that do not qualify for either the level 1 or level 2 interconnection review procedures. Level 3 interconnection review procedures are set forth at N.J.A.C. 14:8-5.6.
- (b) Each EDC shall designate an employee or office from which an applicant can obtain basic application forms and information through an informal process. On request, this employee or office shall provide all relevant forms, documents, and technical requirements for submittal of a complete application for interconnection

review under this section, as well as specific information necessary to contact the EDC representatives assigned to review the application.

- (c) Upon request, the EDC shall meet with an applicant who qualifies for level 2 or level 3 interconnection review, to assist them in preparing the application.
- (d) An application for interconnection review shall be submitted on a standard form, available from the EDC. The application form will require the following types of information:
    - 1. Basic information regarding the customer-generator or customer using grid-integrated charging system and the electricity supplier(s) involved;
    - 2. Information regarding the type and specifications of the customer-generator facility or grid-integrated charging system;
    - 3. Information regarding the contractor who will install the customer-generator facility or grid-integrated charging system;
    - 4. Certifications and agreements regarding utility access to the customer-generator's or grid-integrated charging system's property, emergency procedures, liability, compliance with electrical codes, proper operation and maintenance, receipt of basic information; and
    - 5. Other similar information as needed to determine the compliance of a particular applicant with this chapter.
- (e) An EDC shall not be responsible for the cost of determining the rating of equipment owned by a customer-generator or customer using grid-integrated charging system, or of equipment owned by other local customers.
- (f) An EDC shall not require a customer-generator or customer using grid-integrated charging system whose facility meets the criteria for interconnection approval under the level 1 or level 2 interconnection review procedure atN.J.A.C. 14:8-5.4and5.5to install additional controls or external disconnect switches not included in the interconnection equipment, to perform or pay for additional tests or to purchase additional liability insurance, except if agreed to by the applicant.
- (g) If the interconnection of a customer-generator facility or grid-integrated charging system is subject to interconnection requirements of FERC or PJM, the provisions of this subchapter that apply to interconnection apply to that facility only to the extent that they do not conflict with the interconnection requirements of FERC or PJM.
- (h) If an applicant for interconnection disagrees with an EDC's determination of fact or need regarding matters covered in this subchapter, or if any person has a complaint regarding matters covered in this subchapter, the applicant or other person may file an informal complaint with the Board underN.J.A.C. 14:1-5.13, or may file a petition with the Board underN.J.A.C. 14:1-5.
- (i) Once a customer-generator or customer using grid-integrated charging system has met the level 1 interconnection requirements atN.J.A.C. 14:8-5.4, or has met the level 2 interconnection requirements atN.J.A.C. 14:8-5.5, the EDC shall notify the customer-generator or customer using grid-integrated charging system in writing that the customer-generator or customer using grid-integrated charging system is authorized to energize the customer-generator facility or grid-integrated charging system, as follows:
- 1. The EDC shall send the authorization to the e-mail address, and to the U.S. Postal Service mailing address that is listed on the customer-generator's or customer using grid-integrated charging system's submitted interconnection application form; and

- 2. The EDC shall not condition the authorization to energize on the EDC's replacement of the customer-generator's or customer using grid-integrated charging system's meter.
- (j) The applicant shall not operate the customer-generator facility or grid-integrated charging system until the EDC's application and inspection process is completed. Unauthorized system interconnection and operation will result in no payment for excess generation credits.

§ 14:8-5.3 Certification of customer-generator or grid-integrated charging system interconnection equipment

- (a) In order to qualify for the level 1 and the level 2 interconnection review procedures described at N.J.A.C. 14:8-5.4 and 5.5, a customer-generator's or customer's grid-integrated charging system interconnection equipment shall have been tested and listed by an OSHA-approved nationally recognized testing laboratory for continuous interactive operation with an electric distribution system in accordance with the following standards, as applicable:
  - 1. IEEE 1547, Standard for Interconnecting Distributed Resources with Electric Power Systems (published July 2003), which is incorporated herein by reference, as amended or supplemented. IEEE Standard 1547 can be obtained through the IEEE website at www.ieee.org; and
  - 2. UL 1741 Inverters, Converters, and Controllers for Use in Independent Power Systems (November 2005), which is incorporated herein by reference as amended or supplemented. UL 1741 can be obtained through the Underwriters Laboratories website at www.ul.com.
- (b) Interconnection equipment shall be considered certified for interconnected operation if it has been submitted by a manufacturer to an OSHA-approved nationally recognized testing laboratory, and has been tested and listed by the laboratory for continuous interactive operation with an electric distribution system in compliance with the applicable codes and standards listed in (a) above.
- (c) If the interconnection equipment has been tested and listed in accordance with this section as an integrated package, which includes a generator, grid-integrated electric vehicle or other electric source, the interconnection equipment shall be deemed certified and the EDC shall not require further design review, testing or additional equipment.
- (d) If the interconnection equipment includes only the interface components (switchgear, inverters or other interface devices), an interconnection applicant shall show that the generator, grid-integrated electric vehicle or other electric source being utilized with the interconnection equipment is compatible with the interconnection equipment and consistent with the testing and listing specified for the equipment. If the generator, grid-integrated electric vehicle or electric source being utilized with the interconnection equipment is consistent with the testing and listing performed by the OSHA-approved nationally recognized testing laboratory, the interconnection equipment shall be deemed certified and the EDC shall not require further design review, testing or additional equipment.

- (f) For a grid-integrated charging system incorporating an AC charging station, N.J.A.C. 14:8-5.3 (a) through (d) do not apply; rather (f) (1) and (2) below are applicable to such systems:
    - 1. It shall qualify for the level 1 and the level 2 interconnection review procedures described at N.J.A.C. 14:8-5.4 and 5.5 and be considered certified for interconnected operation if:
        - i. Its components located permanently on-site have been tested and listed by an OSHA-approved nationally recognized testing laboratory for continuous interactive operation with an electric distribution system in accordance with UL 2594 Standard for Electric Vehicle Supply Equipment (2016), and UL 2231-2 Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems (2012), as applicable, which are incorporated herein by reference as amended or supplemented. UL 2594 and UL 2231-2 can be obtained through the UL website at www.ul.com.
        - ii. The system has been tested and found to be in compliance with SAE J3072 Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems (2015) and IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems (2003), as applicable, which are incorporated herein by reference as amended or supplemented. Such compliance shall be determined (and attested to) by the vehicle manufacturer and/or supplier of on-board charging equipment.
    - 2. If the grid-integrated charging system has been found to be compliant with the standards stipulated in (f).1.ii, then the interconnection equipment shall be deemed certified and the EDC shall not require further design review, testing or additional equipment.

§ 14:8-5.4 Level 1 interconnection review

- (a) Each EDC shall adopt a level 1 interconnection review procedure. The EDC shall use the level 1 review procedure only for an application to interconnect a customer-generator facility or grid-integrated charging system that meets all of the following criteria:
    - 1. The facility is inverter-based;
    - 2. The facility has a capacity of ~~10~~ 25 kW or less; and
    - and
    - 3. The facility has been certified in accordance withN.J.A.C. 14:8-5.3.
- (b) For a customer-generator facility or grid-integrated charging system described at (a) above, the EDC shall approve interconnection under the level 1 interconnection review procedure if all of the applicable requirements at (c) through (g) below are met. An EDC shall not impose additional requirements not specifically authorized under this section.
- (c) The aggregate generation or export capacity on the line section to which the customer-generator facility or grid-integrated charging system will interconnect,

including the capacity of the customer-generator facility or grid-integrated charging system, shall not contribute more than 10 percent to the distribution circuit's maximum fault current at the point on the high voltage (primary) level that is nearest the proposed point of common coupling.

- (d) A customer-generator facility's or grid-integrated charging system's point of common coupling shall not be on a transmission line, a spot network, or an area network.
- (e) If a customer-generator facility or grid-integrated charging system is to be connected to a radial line section, the aggregate generation or export capacity connected to the circuit, including that of the customer-generator facility or grid-integrated charging system, shall not exceed 10 percent (15 percent for solar electric generation) of the circuit's total annual peak load, as most recently measured at the substation.
- (f) If a customer-generator facility or grid-integrated charging system is to be connected to a single-phase shared secondary, the aggregate generation or export capacity connected to the shared secondary, including the customer-generator facility or grid-integrated charging system, shall not exceed 20 kilovolt-amps (kVA).
- (g) If a single-phase customer-generator facility or grid-integrated charging system is to be connected to a transformer center tap neutral of a 240 volt service, the addition of the customer-generator facility or grid-integrated charging system shall not create an imbalance between the two sides of the 240 volt service of more than 20 percent of nameplate rating of the service transformer.
- (h) An applicant shall submit an Interconnection Application/Agreement Form for level 1 interconnection review. The standard form is available from the EDC, and includes a Part 1 (Terms and Conditions) and a Part 2 (Certificate of Completion).
- (i) Within three business days after receiving an application for level 1 interconnection review, the EDC shall provide written or e-mail notice to the applicant that it received the application and whether the application is complete. If the application is incomplete, the written notice shall include a list of all of the information needed to complete the application.
- (j) Within 10 business days after the EDC notifies the applicant that the application is complete under (i) above, the EDC shall notify the applicant that:
    - 1. The customer-generator facility or grid-integrated charging system meets all of the criteria at (c) through (g) above that apply to the facility, and the interconnection will be finally approved upon completion of the process set forth at (k) through (o) below; or
    - 2. The customer-generator facility or grid-integrated charging system has failed to meet one or more of the applicable criteria at (c) through (g) above, and the interconnection application is denied.
- (k) If the EDC notifies the customer-generator or customer using grid-integrated charging system under (j)1 above that the facility will be approved, the EDC shall, within three business days after sending the notice under (j)1 above, do both of the following:
    - 1. Notify the applicant by e-mail or other writing of whether an EDC inspection of the customer-generator facility or grid-integrated charging system is required prior to energizing the facility; or that the EDC waives inspection; and

- 2. Return to the applicant Part 1 of the original application, signed by the appropriate EDC representative.

- (l) Once an applicant receives Part 1 of the application with the EDC signature in accordance with (k) above, and has installed and interconnected the customer-generator facility or grid-integrated charging system, the applicant shall obtain approval of the facility by the appropriate construction official, as defined atN.J.A.C. 5:23-4.1.
- (m) The customer-generator or customer using grid-integrated charging system shall submit documentation of the construction official's approval to the EDC, along with a copy of Part 2 of the application, signed by the customer-generator or customer using grid-integrated charging system.
- (n) If inspection of the customer-generator facility or grid-integrated charging system was waived under (k)1 above, the EDC shall, within five business days after receiving the submittal required under (m) above, notify the customer-generator or customer using grid-integrated charging system of authorization to energize the facility. The notice to the customer-generator or customer using grid-integrated charging system shall be provided in the format required underN.J.A.C. 14:8-5.2(i).
- (o) If inspection of the customer-generator facility or grid-integrated charging system was not waived under (k)1 above, the following process shall apply:
  - 1. The customer-generator or customer using grid-integrated charging system shall submit the construction official's approval and signed Part 2 as required at (m) above, and inform the EDC that the customer-generator facility or grid-integrated charging system is ready for EDC inspection;
  - 2. Within five business days after the customer-generator or customer using grid-integrated charging system notifies the EDC under (o)1 above that the facility is ready for inspection, the EDC shall offer the customer-generator or customer using grid-integrated charging system two or more available four-hour inspection appointments (for example, February 4th from noon to 4:00 P.M. or February 6th from 10:00 A.M. to 2:00 P.M.);
  - 3. The appointments offered under (o)2 above shall be no later than 10 business days after the EDC offers the appointments (that is, within 13 business days after the customer-generator or customer using grid-integrated charging system submittal under (m) above);
  - 4. The customer-generator or customer using grid-integrated charging system shall notify the EDC which of the offered inspection times the customer-generator or customer using grid-integrated charging system prefers, or shall arrange another time by mutual agreement with the EDC;
  - 5. Within five business days after successful completion of the EDC inspection, the EDC shall notify the customer-generator or customer using grid-integrated charging system that it is authorized to energize the facility. The notice shall be provided in the format required underN.J.A.C. 14:8-5.2(i); and
  - 6. The applicant shall not begin operating the customer-generator facility or grid-integrated charging system until after the inspection and testing is completed.
- (p) If an application for level 1 interconnection review is denied because it does not meet one or more of the applicable requirements in this section, an applicant may

resubmit the application under the level 2 or level 3 interconnection review procedure, as appropriate.

§ 14:8-5.5 Level 2 interconnection review

[Note: the only modification in this section is expanding "generation/ing/or" to, e.g., "generation or export."]

- (a) Each EDC shall adopt a level 2 interconnection review procedure. The EDC shall use the level 2 interconnection review procedure for an application to interconnect a customer-generator facility or grid-integrated charging systems that meets both of the following criteria:
  - 1. The facility has a capacity of two megawatts or less; and
  - 2. The facility has been certified in accordance with N.J.A.C. 14:8-5.3…
- (c) The aggregate generation or export capacity on the line section to which the customer-generator facility or grid-integrated charging systems will interconnect, including the capacity of the customer-generator facility or grid-integrated charging systems, shall not cause any distribution protective equipment (including, but not limited to, substation breakers, fuse cutouts and line reclosers) or customer equipment on the electric distribution system, to exceed 90 percent of the short circuit interrupting capability of the equipment. In addition, a customer-generator facility or grid-integrated charging systems shall not be connected to a circuit that already exceeds 90 percent of the short circuit interrupting capability, prior to interconnection of the facility.
- (d) If there are posted transient stability limits to generating units or grid-integrated charging systems located in the general electrical vicinity of the proposed point of common coupling (for example, within three or four transmission voltage level busses), the aggregate generation or export capacity (including the customer-generator facility or grid-integrated charging systems) connected to the distribution low voltage side of the substation transformer feeding the line section containing the point of common coupling shall not exceed 10 MW.
- (e) The aggregate generation or export capacity connected to the line section, including the customer-generator facility or grid-integrated charging systems, shall not contribute more than 10 percent to the line section's maximum fault current at the point on the high voltage (primary) level nearest the proposed point of common coupling.
- (f) If a customer-generator facility or grid-integrated charging systems is to be connected to a radial line section, the aggregate generation or export capacity connected to the electric distribution system by non-EDC sources, including the customer-generator facility or grid-integrated charging systems, shall not exceed 10 percent (or 15 percent for solar electric generation) of the total circuit annual peak load. For the purposes of this subsection, annual peak load shall be based on measurements taken over the 12 months prior to the submittal of the application, measured at the substation nearest to the customer-generator facility or grid-integrated charging systems.
- (g) If a customer-generator facility or grid-integrated charging systems is to be connected to three-phase, three wire primary EDC distribution lines, a three-phase or

single-phase generator or grid-integrated charging system shall be connected phase-to-phase.

- (h) If a customer-generator facility or grid-integrated charging systems is to be connected to three-phase, four wire primary EDC distribution lines, a three-phase or single-phase generator or grid-integrated charging system shall be connected line-to-neutral and shall be effectively grounded.
- (i) If a customer-generator facility or grid-integrated charging systems is to be connected to a single-phase shared secondary, the aggregate generation or export capacity on the shared secondary, including the customer-generator facility or grid-integrated charging systems, shall not exceed 20 kilovolt-amps (kVA)…
- (*l*) If a customer-generator facility's or grid-integrated charging system's proposed point of common coupling is on a spot or area network, the interconnection shall meet all of the following requirements that apply, in addition to the requirements in (c) through (k) above:
    - 1. For a customer-generator facility or grid-integrated charging systems that will be connected to a spot network circuit, the aggregate generation or export capacity connected to that spot network from customer-generator facilities or grid-integrated charging systems, including the customer-generator facility or grid-integrated charging systems, shall not exceed five percent of the spot network's maximum load
    - 2. For a customer-generator facility or grid-integrated charging systems that utilizes inverter based protective functions, which will be connected to an area network, the customer-generator facility or grid-integrated charging system, combined with other exporting customer-generator facilities or other grid-integrated charging system on the load side of network protective devices, shall not exceed 10 percent of the minimum annual load on the network, or 500 kW, whichever is less. For the purposes of this paragraph, the percent of minimum load for solar electric generation customer-generator facility shall be calculated based on the minimum load occurring during an off-peak daylight period; and/or
    - 3. For a customer-generator facility or grid-integrated charging system that will be connected to a spot or an area network that does not utilize inverter based protective functions, or for an inverter based customer-generator facility or grid-integrated charging systems that does not meet the requirements of (l)1 or 2 above, the customer-generator facility or grid-integrated charging system shall utilize reverse power relays or other protection devices that ensure no export of power from the customer-generator facility or grid-integrated charging system, including inadvertent export (under fault conditions) that could adversely affect protective devices on the network.
- (m) An applicant shall submit an Interconnection Application/Agreement Form for level 2 interconnection review. The standard form is available from the EDC, and includes a Part 1 (Terms and Conditions) and a Part 2 (Certificate of Completion).
- (n) Within three business days after receiving an application for level 2 interconnection review, the EDC shall provide written or e-mail notice to the applicant that it received the application and whether the application is complete. If

the application is incomplete, the written notice shall include a list of all of the information needed to complete the application.

- (o) Within 15 business days after the EDC notifies the applicant that the application is complete under (n) above, the EDC shall notify the applicant by e-mail or in writing of one of the determinations at (o)1 through 4 below, as applicable. During the 15 business days provided under this subsection, the EDC may, at its own expense, conduct any studies or tests it deems necessary to evaluate the proposed interconnection and arrive at one of the following determinations:
    - 1. The customer-generator facility or grid-integrated charging system meets the applicable requirements in (c) through (l) above. In this case, the EDC shall:
        - i. Notify the applicant, by e-mail or other writing, that the interconnection will be finally approved upon completion of the process set forth at (p) through (r) below; and
        - ii. Within three business days after the notice in (o)1i above, the EDC shall return to the applicant Part 1 of the original application, signed by the appropriate EDC representative;
    - 2. The customer-generator facility or grid-integrated charging system has failed to meet one or more of the applicable requirements at (c) through (l) above, but the EDC has nevertheless determined that the customer-generator facility or grid-integrated charging system can be interconnected consistent with safety, reliability and power quality. In this case, the EDC shall:
        - i. Notify the applicant by e-mail or other writing that the interconnection will be finally approved upon completion of the process set forth at (p) through (r) below; and
        - ii. Within five business days after the notice in (o)2i above, the EDC shall return to the applicant Part 1 of the original application, signed by the appropriate EDC representative;
    - 3. The customer-generator facility or grid-integrated charging system has failed to meet one or more of the applicable requirements at (c) through (l) above, but the initial review indicates that additional review may enable the EDC to determine that the customer-generator facility or grid-integrated charging system can be interconnected consistent with safety, reliability and power quality. In such a case, the EDC shall:
        - i. Notify the customer-generator or customer using grid-integrated charging system of, and offer to perform, additional review to determine whether minor modifications to the electric distribution system (for example, changing meters, fuses or relay settings) would enable the interconnection to be made consistent with safety, reliability and power quality. The EDC notice shall provide to the applicant a nonbinding, good faith estimate of the costs of such additional review, and/or such minor modifications;
        - ii. If the customer-generator or customer using grid-integrated charging system notifies the EDC that the customer-generator or customer using grid-integrated charging system consents to pay for the review and/or modifications, the EDC shall undertake the review or modifications within 15 business days after this notice from the

customer-generator or customer using grid-integrated charging system; and
- iii. Within 15 business days after the review or modifications are complete, the EDC shall return to the customer-generator or customer using grid-integrated charging system Part 1 of the original application, signed by the appropriate EDC representative; or

- 4. The customer-generator facility or grid-integrated charging system has failed to meet one or more of the applicable requirements at (c) through (l) above, and the initial review indicates that additional review would not enable the EDC to determine that the customer-generator facility or grid-integrated charging system could be interconnected consistent with safety, reliability and power quality. In such a case, the EDC shall:
  - i. Notify the customer-generator or customer using grid-integrated charging system in writing that the interconnection application has been denied; and
  - ii. Provide a written explanation of the reason(s) for the denial, including a list of additional information and/or modifications to the customer-generator's facility or grid-integrated charging system, which would be required in order to obtain an approval under level 2 interconnection procedures.

- (p) Once a customer-generator or customer using grid-integrated charging system receives Part 1 of the application with the EDC signature in accordance with (o)1, 2 or 3 above, and has installed and interconnected the customer-generator facility to the EDC's distribution system, the customer-generator shall obtain approval of the facility or grid-integrated charging system from the appropriate construction official, as defined atN.J.A.C. 5:23-1.4.
- (q) At least 10 business days prior to starting operation of the customer-generator facility or grid-integrated charging system (unless the EDC does not require 10 days notice), the customer-generator or customer using grid-integrated charging system shall:
  - 1. Provide the EDC with documentation that the interconnection has been approved by the appropriate construction official;
  - 2. Submit Part 2 of the application, signed by the customer-generator or customer using grid-integrated charging system; and
  - 3. Indicate to the EDC the anticipated start date for operation of the customer-generator facility or grid-integrated charging system.
- (r) The EDC may require an EDC inspection of a customer-generator facility or grid-integrated charging system prior to operation, and may require and arrange for witness of commissioning tests as set forth in IEEE standard 1547 (published July 2003) in accordance with the following:
  - 1. The customer-generator or customer using grid-integrated charging system shall submit the construction official's approval and the signed Part 2 under (q) above and inform the EDC that the customer-generator facility is ready for EDC inspection;
  - 2. Within five business days after the customer-generator or customer using grid-integrated charging system informs the EDC under (r)1 above that the customer-generator facility or grid-integrated charging system is ready for

inspection, the EDC shall notify the customer-generator or customer using grid-integrated charging system of three or more available four-hour inspection appointments (for example, February 4th from noon to 4:00 P.M., February 6th from 10:00 A.M. to 2:00 P.M., or February 7th from 1:00 P.M. to 5:00 P.M.);

- 3. The appointments offered under (r)2 above shall be no later than 15 business days after the EDC offers the appointments, (that is, within 20 business days after the customer-generator or customer using grid-integrated charging system submittal under (r)1 above);
- 4. The customer-generator or customer using grid-integrated charging system shall notify the EDC which of the offered inspection appointments the customer-generator or customer using grid-integrated charging system prefers or shall arrange another time by mutual agreement with the EDC;
- 5. Within five business days after successful completion of the EDC inspection, the EDC shall notify the customer-generator or customer using grid-integrated charging system that it is authorized to energize the facility. The notice shall be provided in the format required underN.J.A.C. 14:8-5.2(i); and
- 6. The applicant shall not begin operating the customer-generator facility or grid-integrated charging system until after the inspection and testing is completed.

- (s) If an application for level 2 interconnection review fails to meet the requirements as described at (o)3 or 4 above, or is denied because it does not meet one or more of the requirements in this section, the applicant may resubmit the application under the level 3 interconnection review procedure.

§ 14:8-5.7 Interconnection fees

- (a) An EDC or supplier/provider shall not charge an application or other fee to an applicant that requests level 1 interconnection review. However, if an application for level 1 interconnection review is denied because it does not meet the requirements for level 1 interconnection review and the applicant resubmits the application under another review procedure in accordance withN.J.A.C. 14:8-5.4(p), the EDC may impose a fee for the resubmitted application, consistent with this section.
- (b) For a level 2 interconnection review, the EDC may charge fees of up to $ 50.00 plus $ 1.00 per kilowatt of the customer-generator facility's or grid-integrated charging system's capacity, plus the cost of any minor modifications to the electric distribution system or additional review, if required underN.J.A.C. 14:8-5.5(o)3 or 4. Costs for such minor modifications or additional review shall be based on EDC estimates and shall be subject to case-by-case review by the Board or its designee. Costs for engineering work done as part of any additional review shall not exceed $ 100.00 per hour.
- (c) For a level 3 interconnection review, the EDC may charge fees of up to $ 100.00 plus $ 2.00 per kilowatt of the customer-generator facility's capacity, as well as charges for actual time spent on any impact and/or facilities studies required underN.J.A.C. 14:8-5.6. Costs for engineering work done as part of an impact study or facilities study shall not exceed $ 100.00 per hour. If the EDC must install facilities in

order to accommodate the interconnection of the customer-generator facility, the cost of such facilities shall be the responsibility of the applicant.

- (d) An EDC shall not charge any fee or other charge for connecting to the EDC's equipment or for operation of a customer-generator facility for the purposes of net metering, except for the fees provided for under this subchapter.
- (e) An EDC shall not charge any fee or other charge for connecting to the EDC's equipment or for operation of a grid-integrated charging system for the purposes of credit-for-export, except for the fees provided for under this subchapter.

§ 14:8-5.8 Testing, maintenance and inspection after interconnection approval

- (a) Once a net metering interconnection has been approved under this subchapter, the EDC shall not require a customer-generator to test or perform maintenance on its facility except for the following:
  - 1. An annual test in which the customer-generator's facility is disconnected from the electric distribution company's equipment to ensure that the facility stops delivering power to the grid;
  - 2. Any manufacturer-recommended testing or maintenance; and
  - 3. Any post-installation testing necessary to ensure compliance with IEEE 1547 or to ensure safety.
- (b) When a customer-generator facility or grid-integrated charging system approved through a level 2 or level 3 review undergoes maintenance or testing in accordance with the requirements of this subchapter, the customer-generator or customer using grid-integrated charging system shall retain written records documenting the maintenance and the results of testing. No recordkeeping is required for maintenance or testing performed on a customer-generator facility or grid-integrated charging system approved through a level 1 review.
- (c) An EDC shall have the right to inspect a customer-generator's facility or grid-integrated charging system after interconnection approval is granted, at reasonable hours and with reasonable prior notice to the customer-generator or customer using grid-integrated charging system. If the EDC discovers that the customer-generator's facility or grid-integrated charging system is not in compliance with the requirements of this subchapter, and the noncompliance adversely affects the safety or reliability of the electric distribution system, the EDC may require the customer-generator or customer using grid-integrated charging system to disconnect the customer-generator facility or grid-integrated charging system until compliance is achieved.

§ 14:8-5.9 Interconnection reporting requirements for EDCs

- (a) Each EDC with one or more customer-generators or customers using grid-integrated charging system connected to its distribution system shall submit two interconnection reports per year, one covering January 1 through June 30 and one covering July 1 through December 31. The EDC shall submit the reports by August 1 and February 1, respectively.
- (b) The EDC shall submit the reports required by this section electronically, in PDF format, to oce@bpu.state.nj.us . In addition, the EDC may, at its discretion, submit a paper copy of the reports by hand delivery or regular mail to the Secretary, Board of

Public Utilities, 44 South Clinton Avenue, 9th Floor, PO Box 350, Trenton, New Jersey 08625-0350. The EDC may, at its discretion, submit the interconnection report together with the net metering report required underN.J.A.C. 14:8-4.5.

- (c) Each report shall contain the following information regarding customer-generator facilities and grid-integrated charging system that interconnected with the EDC's distribution system for the first time during the reporting period, listed by type of renewable energy technology:
  - 1. The number of customer-generators and customers using grid-integrated charging system that interconnected;
  - 2. The estimated total rated generating capacity of all customer-generator facilities and grid-integrated charging systems that interconnected; and
  - 3. The total cumulative number of customer-generators and customers using grid-integrated charging systems that interconnected between June 15, 2001 and the end of the reporting period, including the customer-generators in (c)1 above.
- (d) The information required under (c) above shall be listed by type of class I renewable energy for customer-generator, as set forth atN.J.A.C. 14:8-2.5(b), as follows:
  - 1. Solar PV technology;
  - 2. Wind technology;
  - 3. Biomass; or
  - 4. A renewable energy technology not listed at (d)1 through 3 above. In such a case, the report shall include a description of the renewable energy technology.

§ 14:8-x.x Crediting for Energy from Grid-Integrated Electric Vehicles Exported to the Grid

- (a) Grid-integrated charging systems shall be credited for exports from grid-integrated electric vehicles to the distribution grid for each kilowatt-hour exported at the full retail rate in effect at the time of export, up to the total amount of electricity used by that system during an annualized period. The EDC shall develop a tariff providing for this crediting on or before [date].
- (b) Upon the development of the tariff by the EDC on [date], the tariff shall continue to be in force until either 2 years of operation have been achieved or 5MW of V2G technology has been interconnected. Once one of these two conditions has been met, the EDC and the NJBPU may perform a review of the existing tariff to determine whether to continue its use for existing and new grid-integrated charging system interconnection applicants.
- (c) For accounts with grid-integrated charging system, the EDC shall provide a meter capable of recording the approved debits for load and credits for exports at the time of import and export. This meter shall be rate-based.
- (d) A supplier/provider or EDC shall provide the crediting defined in N.J.A.C. 14§14:8-x.x (a) at non-discriminatory rates that are identical, with respect to rate structure, retail rate components, and any monthly charges, to the rates that a grid-integrated charging system would be charged if not a grid-integrated charging system.
- (e) A supplier/provider or EDC shall not charge a grid-integrated charging system any fee or charge, or require additional equipment, insurance or any other requirement,

unless the fee, charge, or other requirement is specifically authorized under this subchapter, or the fee would apply to other customers that are not grid-integrated charging systems.

Conclusion

In short, in order for NJ to achieve their EMP goals, the State and the BPU in particular will need to take advantage of all existing and emerging technologies. V2G is a triple opportunity: it provides storage, cleans up transportation, and lowers ratepayer costs. Incorporating low-cost storage from V2G can make these goals more attainable and more cost-effective.

However, V2G's benefits can only be taken advantage of once these barriers are removed through NJBPU and utility action. This requires both the EMP language changes and the consequent direction to adopt the proposed N.J.A.C. code amendments presented in this public comment. These policy recommendations are necessary for the full and fair deployment of V2G technology in NJ.

UD's EV R&D Group has extensive experience in this field and has been a leader in researching and implementing V2G technology and EV policy. We offer to be available for additional discussion and questions regarding our analysis of existing barriers in NJ and ways to solve them, and related EV policies.

Respectfully,

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