March 1, 2019

Ms. Judith C. Whitney, Clerk
Vermont Public Utility Commission
112 State Street, Drawer 20
Montpelier, VT 05620

Re: Case 18 – 2660
Information response relative rate design and grid management

Dear Ms. Whitney;

At the request of the Vermont Public Utility Commission ("Commission"), the City of Burlington Electric Department ("BED") and Vermont Public Power Supply Authority ("VPPSA") submit the following information responses relative to rate design and grid management. Specifically, this filing responds to the five questions included in the Commission's Order of February 4, 2019.

1) **Planned or currently available EV-specific rate offerings for both home charging and service to public charging stations, how they will be or are being implemented, how successful the offerings are expected to be or have been, and any difficulties expected to be encountered or that have been encountered in offering such rates**

Response:

In our February 15 filing, BED and VPPSA provided a detailed description of BED's recently announced residential electric vehicle ("EV") rate program and an overview of BED's publicly available EV charging service. Also, the filing included a description of Swanton's publicly available EV charging services. For more details on these offerings and how they are being implemented, please refer to that filing.

As noted, BED recently launched its residential EV rate program on January 22, 2019. As of March 1, 2019, eight customers have enrolled. Since this program has only

been available for one month, it is too early to determine how successful the program will be at encouraging customers to charge their vehicles during off peak hours. Nevertheless, BED has high expectations that as customers transition to electric vehicles over time, more customers will sign up to save money. As noted in our press release announcing the program, the cost of charging EV's during off peak hours is equivalent to filling up the tank of a traditional car for $0.60 per gallon. We believe this type of a discount will resonate with customers, especially since EV drivers are expected to charge at home most of the time.[1]

With respect to the challenges associated with implementing the residential EV program, BED has already had to address several issues. We anticipate others may arise over time.

The first major issue, which is likely to persist for a long time, is the participating customer's upfront capital cost to install an approved level 2 charging device. Approved level 2 chargers cost today between $500 and $700 each. The cost of installing the device is more variable but is expected to range between $300 and $1,000 for a typical household. Electrical installation costs will largely depend on whether the home owner has a readily available 240 volt outlet in the vicinity of where the EV will be parked overnight. If one is not available, EV owners will need to have their electrician install a new circuit from their electric panel to the garage. For these reasons, BED is providing an additional $400 incentive as a means to encourage customers to install an approved level 2 EV charger and enroll in the program. BED recognizes that even with the additional $400 incentive, EV owners may opt to charge their EV with an existing 120volt outlet in their garage and not participate in the program.

A second major issue is data management. As noted in our February 15th filing, managing the stream of data pulled from approved EV chargers is – at this time – only partially automated. What has not been automated is the process of transcribing the daily data downloads into our billing system in order to present earned credits on customer's bills. Given the current volume of customers, BED does not anticipate that

[1] Studies indicate that EV owners charge their vehicles at home 80 -85 percent of the time.

this manual process will be a challenge. Over time, however, this process will also need to be automated to the greatest extent possible. BED is currently evaluating alternatives to automate this process within the context of a larger IT project that has been underway for the past two years.

A third major issue is data ownership. The EVSE manufacturers that BED has worked with thus far assert ownership over the customer data (i.e. kWh consumption) generated by their device in the EV owner's home. The effect of this assertion means that BED does not have ownership rights over the data for billing purposes. To address this issue, BED has had to negotiate individually with each of its approved EVSE manufacturer's to ensure uninterrupted access to the EV data generated by the approved level 2 device. The contracts that we have successfully consummated thus far ensure that BED can reliably gain ownership rights to the kWh consumption data for billing, data verification and reporting purposes. The contracts also prevent EVSE manufacturer's from cancelling the terms of the contract, and thus BED's access to the data, on short notice. It is also important for BED and VPPSA to note that not all EVSE manufacturers have indicated to us that they are willing (or able) to enter into these types of contractual arrangements that would allow for unfettered access to data in a format that is compatible with our billing systems. Tesla, for example, has not confirmed with BED that its level 2 chargers have the necessary capabilities to present us with EV consumption data in a format BED can use for billing purposes.

A forth issue with respect to implementing the residential EV program relates to the limitations of BED's legacy customer information systems. Initially, BED's program planners proposed to create a separate residential end use rate for EV charging (i.e. separated from non EV related kWh consumption). A separate end use rate and bill presentation for EV charging however could not be programmed into the CIS. Due to this limitation, several compromises, or work-arounds, needed to be created. In the end, the compromises allowed for a bill credit to be presented on a participating customer's bill, which had the effect of reducing EV charging to approximately $0.08 per kWh, as reflected in the approved EV rate tariff. Despite these compromises, BED still needs to transcribe the consumption data captured from the approved EVSE into our CIS for

final billing to the participating customer. As noted above, BED is working to automate this process as well.

With respect to services rendered to public charging stations, BED and VPPSA provided an overview of such services in our February 15th filing. That filing also highlighted the myriad difficulties we expect to encounter if required to expand service to nonutility owned EVSE stations that do not also have a utility – owned, revenue – grade meter.

2) **Demand charges and DC fast-charging stations, including the effects of demand charges on the deployment of such stations and how such effects can be mitigated or eliminated without undue impact to electric ratepayers;**

As noted in our November 5, 2018 filing, BED and VPPSA recommend that the Commission uphold long-standing precedent with respect to cost recovery. In accordance with such policies, the cost causer pays for costs the utility incurs to serve them to the greatest extent possible. In this way, other electric ratepayers are held harmless and would not subsidize nonutility EVSE station owners. Unless otherwise directed, BED and VPPSA would automatically provide service to a requesting nonutility station owner of a high capacity DC fast charger (25kW+) under existing tariffs. These tariffs include a flat customer charge, an energy charge and demand charge. Such demand charges are typically based on a set percentage of the maximum demand during the year. The table below is illustrative of a typical bill a BED customer would receive. Under this scenario, we assume consumption of 4,000 kWh per month and a maximum demand of 50 kW in the month of August.[2]

[2] The table excludes state and local taxes.

50 kW DCFC	Billing determinates	Qty		Amount
Customer Charge	41.04	1	$	41
Demand (kW)	20.03	50	$	501
Energy (kWh)	0.083003	4000	$	332
EEC (kW)	1.2683	50	$	63
EEC (kWh)	0.00499	4000	$	20
Total Monthly Bill			**$**	**957**
Total Annual Bill			**$**	**11,486**

BED and VPPSA recognize that the current tariff structure may not be conducive to expanding publicly available DC EVSE charging. The current tariff structure is, however, a reflection of the major determinates that drive wholesale power costs (i.e. energy, capacity and transmission) that distribution utilities need to recover from their retail customers in an equitable manner, even though distribution utilities are informed by ISO – NE of the peak wholesale charges well after such charges have been incurred as a result of their retail customer's energy consumption (including, in this case, nonutility EVSE station owners). Although the existing tariff structure may present nonutility EVSE station owners' with a short-term economic challenge, BED and VPPSA believe in the fundamental principles of cost recovery for services rendered. Otherwise, non EV drivers and other customers of our utilities would subsidize nonutility EVSE station owners and their EV drivers.

As noted in previous filings, BED and VPPSA remain committed to exploring alternative billing arrangements that would include – at a minimum – dynamic demand control capabilities. We believe that if nonutility EVSE owners were to provide such control over their EVSE stations, the economic challenges associated with the current tariff structure would be reduced significantly. However, it has been BED's experience thus far that nonutility owners of publicly available EVSE are unwilling to provide dynamic demand controls over their systems. We understand that curtailing usage at publicly available EVSE may be inconvenient to some EV drivers. And, we recognize that when curtailment does occur it may reflect badly on nonutility EVSE station

owners. But, absent control over publicly available EVSE or, alternatively, the presence of effective onsite storage that the EVSE could rely on during peak demand events, it is imperative that the host utility be fully compensated for at least the marginal cost of energy, capacity and transmission services incurred. BED and VPPSA would also actively participate in efforts to develop an optional statewide EVSE specific tariff rate, so long as such a rate is fully compensatory to the host distribution utility. Both of the above-noted options could help to eliminate or mitigate undue impacts on the general body of ratepayers. One of the reasons for proposing a fully compensatory rate structure or dynamic demand control over publicly available EVSE is to adequately protect our retail customers from subsidizing nonutility EVSE station owners who in turn provide a deregulated product to its EV customers, many of whom reside outside of the host utility's service territory. Finally, VPPSA and BED are not certain that current tariff structures fully account for the poor load factors of EVSE, generally, and publicly available EVSE, in particular. Our experience, to date, has been that the energy usage of EVSE is extremely low relative to their demand for capacity on the system. Thus, it may be time to re-assess the kW level at which demand charges should be applied.

3) **Incorporation of growing EV charging load into the electric grid and issues associated with serving that new load;**

At this time, BED and VPPSA do not anticipate encountering major issues or challenges serving residential EV loads. However, isolated events could occur in the future that would need to be addressed. An example of one challenge would be if several households in a neighborhood each decided to buy an EV at the same time and they all charged their EVs simultaneously from the same circuit. On the non-residential charging front, the installation of one or more high capacity DC fast chargers (50kW+) located in an electrically congested area would be an issue. Both of these challenges would require upgrades to the grid in order to alleviate congestion and ensure reliability.

4) **Potential benefits of managed EV charging to the electric grid, including using EV batteries for purposes such as peak shaving and regulation, and the likelihood of realizing such benefits based on EV usage in Vermont and existing and expected technological capabilities**; and,

In Docket 18 - 2763[3], BED provided an analysis of the expected savings that customers could earn if they enrolled in BED's residential EV Rate program (i.e. $15 to $20 per month). In its filing with the Commission, BED also provided an assessment of the expected cost impacts to serve this new load. Based on current expected residential EV demand and program enrollment, BED remains confident in its original analysis that EV charging, pursuant to the terms of the approved program, would result in marginally lower costs overall relative to the cost to serve uncontrolled EV charging (i.e. absent an EV rate discount program).

With respect to using EV batteries for the purpose of peak shaving and regulation, neither BED nor VPPSA have conducted extensive research into this area so we are unable to provide an opinion. We have heard anecdotally that EV batteries have been tested for this type of use but that it is too early to determine whether using EV batteries in this manner would generate meaningful societal benefits. It is also unclear whether the use of the battery for peak shaving would invalidate the warranty.

As noted above, the potential demand implications of public fast chargers, coupled with the desire to not interrupt what is essentially a convenience service, might be addressable if nonutility EVSE station owners deployed storage to ride through utility curtailments. This would involve the EVSE owner evaluating the impact of potential utility demand charges against the cost of storage. Such an analysis may indicate that batteries are uneconomic relative to paying for services in accordance with existing tariffs. If such analysis does prove batteries to be uneconomic, it would not be reasonable to ask the regulated utilities to essentially provide electric service at a reduced rate, especially if the rate does not fully recover the utility's costs.

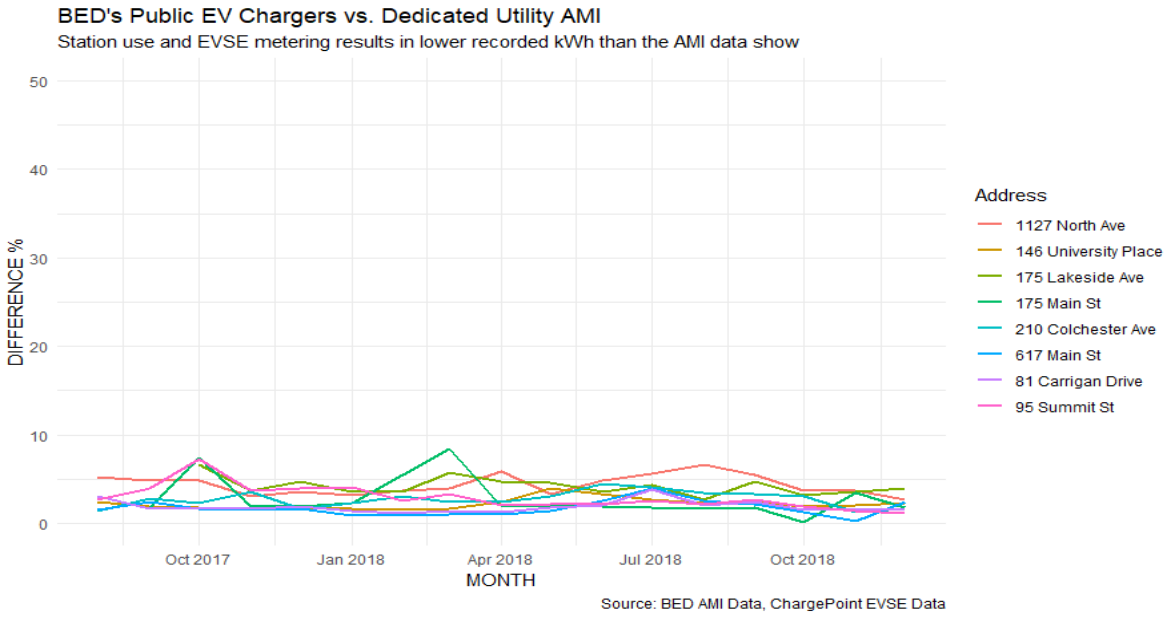
[3] See Order of 8/30/2018.

5) The accuracy of electric metering and sub-metering technology for charging EVs.

As noted in our November 11, 2018 filing, it is unclear to BED and VPPSA whether the metrology embedded in EVSE is comparable to that of utility owned, revenue-grade meters. It is our understanding that several EVSE manufactures assert that their EVSE metrology meets or exceeds current NIST standards.[4] We have no reason to dispute such assertions. It is our understanding however that nonutility EVSE stations typically measure kWh consumption on the port side of the EVSE; meaning that these EVSE stations are measuring only the electricity dispensed into the EV battery. As a result, these stations are not measuring, and thus not reporting, energy losses (i.e. electricity consumed by the electronics and communication technologies embedded in the EVSE). In the case of DC fast chargers, EVSE stations are also not measuring, and thus not reporting, energy losses associated with AC to DC conversions. The chart below indicates that the energy losses of level 2 chargers range between 2 and 8 percent. DC fast charger losses can range between 8 and 15 percent, depending on the age of the charger and the design.[5]

[4] NIST stands for national institute of standards and technology which is the

[5] BED's analysis of its DC chargers indicated that losses were much greater (15- 25 percent) than those experienced by other distribution utilities who own and operate DC chargers. One plausible reason for the higher losses may be due to the age of BED's DC chargers relative to the EVSEs that have recently been installed. Because of this discrepancy, we have omitted our analysis of BED's DC units as they may not be indicative of today's DC EVSE.



In the chart above, BED measured the kWh consumption of its Charge Point level 2 chargers, as reported by Charge Point through its web portal service, and compared that data to our AMI data, as measured by the utility revenue-grade meter. Although the above charts neither support nor detract from EVSE manufacturer's claims of metering accuracy, it does point out the importance of installing utility owned, revenue-grade meters at every EVSE station site for the purposes of determining and verifying the full cost to service.

BED and VPPSA appreciate the opportunity to provide this feedback to the Commission in the above referenced proceeding. Should you have any additional questions or concerns, please feel free to contact us directly.

Sincerely,

Thomas Lyle
Programs and Policy
Burlington Electric Department

Melissa Bailey
Legislative & Regulatory Affairs
Vermont Public Power Supply Authority