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May 14, 2019

Vermont Public Utility Commission
Attn: Judith Whitney, Clerk of the Commission
112 State Street
Montpelier, VT 05620-2701

Re: Case No. 18-2660-INV – Final Comments

Dear Clerk Whitney,

Attached for electronic filing in the above-referenced matter, please find comments on behalf of ChargePoint, Inc. Please let me know if you have any questions.

Respectfully,

Kevin George Miller
Director, Public Policy
ChargePoint

Case No. 18-2660-INV: Final Comments
Comments by ChargePoint – May 14, 2019

I. INTRODUCTION

ChargePoint is pleased to offer these final comments in response to the Order issued by the Vermont Public Utility Commission ("the Commission") on March 22, 2019. Our final recommendations are indexed to the specific reporting requirements identified in Act 158, Section 25.

II. BACKGROUND ON CHARGEPOINT

ChargePoint is the nation's leading electric vehicle ("EV") charging network, with charging solutions for every charging need and all the places EV drivers go: at home, work, around town and on the road. With more than 65,000 independently-owned charging spots, ChargePoint drivers have completed more than 53 million charging sessions and driven more than 1.3 billion gas-free miles. More than 400 of our charging spots are deployed in Vermont.

ChargePoint designs, develops, and deploys residential and commercial AC Level 2 ("L2") and DC fast charging ("DCFC") electric vehicle charging stations, cloud-based software applications, data analytics, and related customer and driver services aimed at creating a robust, scalable, and grid-friendly EV charging ecosystem.

ChargePoint sells EV charging supply equipment ("EVSE") and network services that enable EV charging station owners to provide charging services. In almost every case, ChargePoint does not own or operate the equipment. ChargePoint sells charging solutions to a wide variety of customers, including residential EV owners, employers, commercial and industrial businesses, cities and public agencies, ports, schools, public transit, delivery truck fleet operators, and multi-unit dwelling owners. ChargePoint offers a broad array of products and services that can serve light, medium or heavy-duty electric vehicles.

The site host network services offered by ChargePoint enable customers to manage their charging infrastructure using cloud-based software tools. These tools provide the station owner or operator with everything needed to manage and optimize utilization of their charging stations, including online management tools for data analysis, billing and payment processing, load management and access control. Stations connect to ChargePoint over a secure, cellular data network (or Wi-Fi in the case of single-family residential) allowing station owners to manage all their charging operations from a single dashboard. Maintenance and customer service are a priority for our company. ChargePoint offers a comprehensive set of support services, including: a 24/7/365 hotline for station users, parts and labor warranty, site qualification, installation and validation services, and a helpline for site host specific questions.

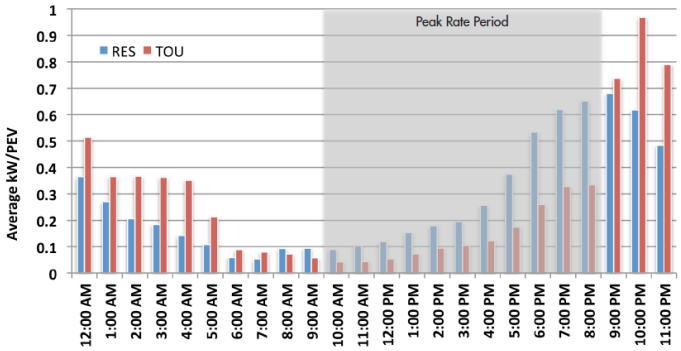
III. FINAL RECOMMENDATIONS

1. **Analysis and recommendations on each of the following issues related to the role of electric distribution utilities:**
    a. *Removal or mitigation, as appropriate, of barriers to EV charging, including strategies, such as time-of-use rates, to reduce operating costs for current and future EV users without shifting costs to ratepayers who do not own or operate EVs;*

There are many ways that the Commission can consider residential rate design and load management to reduce the operating cost of EVs without shifting costs to ratepayers who do not own EVs. Before implementing time of use ("TOU") rates, it is important to evaluate whether such tariffs will actually have an impact on EV charging behavior. In a study commissioned by the Electric Power Research Institute on EV charging behavior in Duke Energy's service territory, customers that were

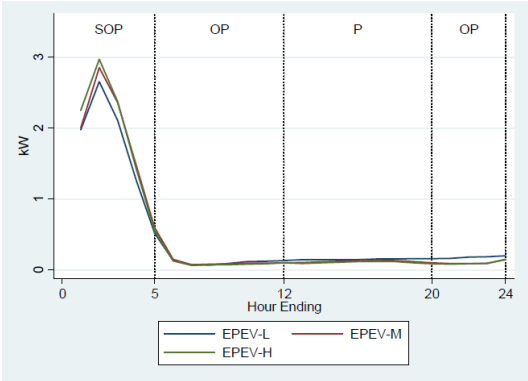
already on a whole-house TOU rate charged their EVs 50% less during on-peak weekday hours compared to customers who were not on a whole-house TOU rate.

Fig. 1. EV load profile for standard residential vs. whole-house TOU rate[1]



There are opportunities to more precisely shape charging behavior by creating additional TOU periods (i.e., peak, off-peak, and super off-peak). A study of three experimental TOU rates offered by San Diego Gas & Electric showed that the vast majority of all charging took place during a super off-peak period. The three experimental TOU rates were designed to test low, medium and high price ratios between the on-peak and super off-peak periods. Figure 2 shows that roughly 80% of all charging behavior for three TOU took place during the super off-peak period, specifically between 12AM and 2AM. Charging patterns that begin during super off-peak periods can be facilitated using technologies such as connected EVSE, which can automatically defer charging until specified times despite regardless of when the vehicle is plugged in.

Fig. 2. Average daily EV load shapes for customers on experimental TOU rates[2]



TOU rates are not the only means by which residential charging loads can be managed. For example, Green Mountain Power's managed home charging program includes demand response and an off-peak charging plan that leverages embedded metering within the EVSE.

Higher-power charging at Direct Current ("DC") fast charging stations, which can deliver anywhere from 50-500kW, merit special consideration. Typically, utilities use peak demand charges as part of large commercial rates to allocate costs based on the required electrical facilities and to ensure they have adequate capacity available for all customers. Demand charges to customers are typically based on the highest average 15 minutes in a monthly billing cycle. However, DC fast charging stations are currently characterized by having a low load factor, with sporadic instances of high energy use due

[1] Electric Power Research Institute. Duke Energy: Charging Demos Inform PEV Readiness Planning. 2013.
[2] Nexant. Evaluation for San Diego Gas & Electric's Plug-in Electric Vehicle TOU Pricing and Technology Study. 2014.

to a limited number of vehicles in the market that will use these stations in the near term. This can subject fast charging site hosts to significant demand-based charges in conjunction with low utilization, making it impractical for site hosts to provide fast charging solutions during the critical phase of early adoption. Increasingly-powerful DC fast chargers will be necessary to meet the needs of the evolving EV market but will only exacerbate this issue, especially as transit buses and other medium/heavy duty vehicles also transition to electric drive.

Eventually, the anticipated large-scale adoption of electric vehicles and associated higher utilization of DC fast chargers will mitigate the impact of demand charges, but low utilization in the early years makes ongoing costs a significant barrier. ChargePoint recommends that the PUC consider alternative rate design options that are more conducive to sustainable, long-term growth in the EV and EV charging markets. Alternative options that would allow utilities reasonable and prudent recovery of costs while also encouraging sites to deploy DC fast chargers include:

- Replacing or pairing demand charges with higher volumetric pricing to provide greater certainty for charging station operators with low utilization. This rate could be scaled based on utilization or load factor as charging behavior changes over time.
- A monthly bill credit representing a percentage of the nameplate demand associated with installed charging infrastructure behind a commercial customer's metered service.
- A retroactive and variable credit based on the difference of the effective blended per kWh distribution charge, including demand charges, and an agreed upon target blended rate, multiplied by the volumetric energy throughput in a given billing cycle for commercial customers with dedicated EV charging stations. (e.g. Long Island Power Authority's proposal in Matter Number 14-01299: *PSEG Long Island Utility 2.0 PLAN*)
- The bank of charging stations could separately-metered with a unique "EV charging" rate.

ChargePoint recognizes that the Commission may be concerned about providing EV charging technology with a distinct rate during an initial period of low adoption. To assuage this concern, we recommend that the Commission consider that, provided EV charging rates are cost-based and are set above marginal costs, the resulting load will benefit all ratepayers by providing a major new load and source of revenues to reduce rates for all ratepayers. An example of an alternative rate structure is a recent proposal by Pacific Gas & Electric ("PG&E") to the California Public Utilities Commission that replaces demand charges with a lower rate based on the installed capacity to which a charging customer is willing to subscribe, subject to a significant overage charge, as well as a time of use component.[3] PG&E's proposal is designed to be revenue neutral, track revenues and costs, and effectively reduce operating cost barriers for most system profiles. Another example is a mechanism included in all Xcel Minnesota's general service rates which forgive a portion of billed demand when the customer has a low load factor.

Should the PUC wish to formally address demand charges and commercial charging rates, ChargePoint recommends doing so in a manner that allows utilities flexibility in overcoming relevant barriers. Massachusetts is currently considering legislation to this effect:

> *Within 180 days after the effective date of this act, each distribution company, as defined in section 1 of chapter 164 of the General Laws, shall file one or more commercial tariffs utilizing alternatives to traditional demand-based rate structures to facilitate faster charging for (i) light-duty, (ii) heavier-duty, and (iii) fleet vehicles. Each tariff shall evaluate*

[3] CPUC Application No. A1811003

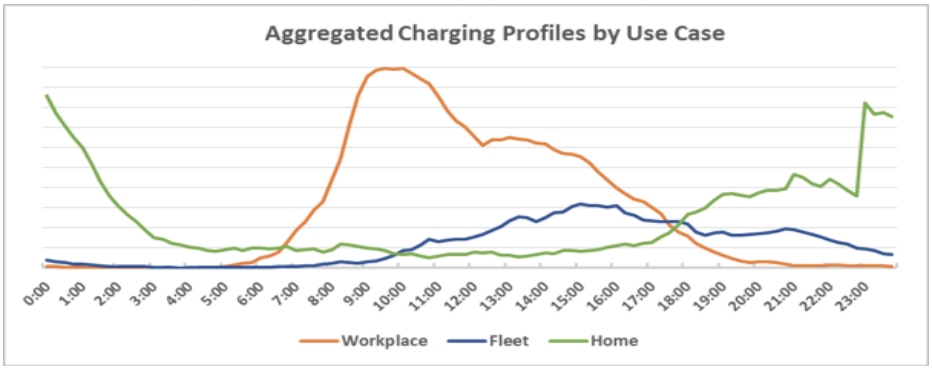
> *the relative costs, benefits, and ancillary related benefits associated with various faster charging rate designs, and do so for multiple scenarios where each predicts a different rate of electric vehicle adoption.*
>
> *The department of public utilities shall, after notice and opportunity for public comment, approve, modify, or reject the tariffs.*[4]

b. Strategies for managing the impact of EVs on and services provided by EVs to the electric transmission and distribution system;

ChargePoint encourages the Commission to consider the relative efficacy of managing load for EV charging in different market segments. As will be discussed in 1.D. and 2.A., it is critical that EV charging site hosts have the ability to incentivize turnover at the EV charging station, irrespective of load management programs that are utilized.

The types and levels of benefits to the grid from EV charging taking place under an energy management program will vary greatly by EV charging use case, as illustrated in Fig. 3. We encourage the Commission to "right-size" the rate design and load management approach for each use case weighing factors such as potential coincidence with peak load, absolute proportion of charging in such use case, EV driver's flexibility in charging time and requirement, program complexity, and alignment of incentives throughout the EV charging ecosystem.

Fig. 3: Normalized EV Charging Utilization by Use Case



We recommend that the Commission keep two key questions in mind when considering the relative value of energy management programs in different EV charging use cases: (i) what will be the impact on driver experience, and (ii) is this the best use case for energy management?

- **Residential charging** is perfectly suited for demand-side management programs due to the long dwell times available for charging, the ability to shift charging within that time period, and the EV driver typically serving as their own "site host". EV drivers charge their vehicles at home 64% of the time.[5] As previously noted, numerous studies have shown that residential charging is very responsive to TOU rates.

[4] Massachusetts House Bill 3629, Sec. 4

[5] Smart, John. *Lessons Learned About Workplace Charging in the EV Project*. Idaho National Labs. 2015.

- **Fleet charging** is an ideal use case to support demand-side management and smart charging of EVs. This is due to long dwell times, certainty around vehicle operational needs, and the direct relationship between the vehicle's owner and the charging station's owner.

- **Workplace** charging presents opportunities to shape charging during the day due to the extended dwell times and repeat users of such charging stations. Workplace charging can be incentivized to avoid early morning peaks or to serve as a "sponge" for overgeneration of solar in the middle of the day.

However, publicly-available charging is the least optimal use case for demand-side management programs for a few key reasons. First, a very small percentage of total EV charging is, or will be, conducted at publicly-available stations. Only 2-3% of charging taking place outside of home and workplace.[6] Such charging is often randomized and occurs throughout the day. While publicly-available charging will likely grow as vehicles begin to support longer-distance travel, the majority of all charging will continue to take place at longer dwell-time, more predictable locations.

Second, there is an inherent difficulty in aligning the incentives between the site host (customer of record for the utility), the transient EV driver, who may or may not be a native utility customer, and the utility. Site hosts are in the best position to align those price signals and incentives.

Finally, drivers that plug into publicly-accessible EV charging stations are often relying on a quick charge to get back on the road. Any load curtailment or interference with their "refueling" would result in a poor driver experience and significantly impede EV adoption.

c. Electric system benefits and costs of EV charging, electric utility planning for EV charging, and rate design for EV charging; and

Investments in EVSE can exert a downward pressure on unit energy costs that can benefit all utility customers regardless of EV ownership. However, this is predicated on the EV load not resulting in excessive new investments in distribution infrastructure costs and avoiding high cost "peak" generation and/or distribution time periods. The associated benefits of additional EV load to all utility customers could be significantly increased and grid infrastructure risks lowered by leveraging connected, smart charging infrastructure as well as developing smart charging programs to encourage wise charging behaviors as early as possible.

d. The appropriate role of electric distribution utilities with respect to the deployment and operation of EV charging stations;

Utilities have very important roles to play in supporting transportation electrification in Vermont. First and foremost, utilities are ideally situated to ensure that the associated new load is incorporated in a safe, reliable, and efficient manner. ChargePoint is proud to be a partner of utilities around the country in deploying utility-supported charging infrastructure and pilot programs that incorporate capability for load management. We believe that there is a vital role for utilities in supporting efficient integration of EV load and that the right program design can encourage the installation of more charging stations around the state in a manner that complements, and does not duplicate or conflict with, the private market.

[6] *ibid*.

There are several ways in which ratepayer-funded investments in EV charging can expand access to charging while also complementing the competitive EV charging market. It would be valuable for any of these options to be evaluated by the Commission based on a set of criteria that ensure that programs lead to widespread grid benefits and complement the competitive EV charging market.

Make Ready Programs

"Make-ready" refers to the line extension on the distribution side of the meter as well as wiring, conduit, and sub-panels that are often needed to provide power to EVSE located in a site host's parking lot on the customer side of the meter. Make-ready infrastructure is essentially an extension of distribution system infrastructure, except that most of it is located behind the site host's meter and so would usually be considered the responsibility of the site host. However, deploying and maintaining distribution system infrastructure is one of a utility's core competencies. Accordingly, one of the most effective ways for a utility to support EVSE is for it to support make-ready deployments. A make-ready program could take the form of a rebate or upfront payment to a site host to use toward make-ready costs, or the utility could use existing personnel and resources to construct the make-ready for interested site hosts. Either way, the utility can receive valuable charger utilization information by providing this consideration and prepare for future load management programs to better integrate vehicles and the grid.

One advantage of make-ready programs is that the utility effectively leverages the private capital of the site host to purchase the actual EVSE. When site hosts share in the total cost of installing the EVSE, program dollars can go further. A make-ready program also has the advantage of focusing the utility on one of its core competencies – long-lasting distribution infrastructure – and allowing the site host to choose the charging equipment and network services that best meet its needs and support its own goals for installing the EVSE.

As long as the utility spends funds prudently in a way that minimizes costs and maximizes benefits to ratepayers and meets criteria established for the program by the Commission, a utility should be allowed to recover the full cost of a make-ready program from ratepayers, including administration costs. Program criteria should be established in advance and be based on the principles we discuss below. Because make-ready is essentially the extension of distribution infrastructure, a utility should be allowed to recover make-ready costs in the same manner as it recovers the cost of distribution system investments made in the ordinary course of business, namely, by putting the value of the make-ready investments into its rate base. Recovering make-ready costs in this manner would allow a utility to earn its authorized rate of return on the value of these investments, thereby incentivizing and rewarding a utility for supporting the deployment of public EVSE and helping it maintain visibility in to this new and unplanned load.

Utility Rebates

A rebate program would work similarly to a utility's demand-side management rebate programs in that it would offer a specific dollar amount to site hosts for installing qualifying EVSE. It is important that the utility create a list of equipment that qualifies for the rebate to ensure that any EVSE that is installed meets functional requirements and supports the goals of the program, such as providing an open network and managed charging capabilities. The utility should also update the list of qualifying equipment regularly to keep up with the pace of innovation and allow site hosts to install the newest products.

As with make-ready programs, if the utility spends funds prudently in a way that minimizes costs and maximizes benefits to ratepayers and meets the program's criteria, a utility should likewise be allowed to recover the full cost of a rebate program for customers, including both the cost of rebates and administration costs. Such costs can be recovered similar to how the utility recovers costs for its DSM programs. Alternatively, the Commission could consider allowing a utility to treat the rebate program costs as a regulatory asset and earn its authorized rate of return on the amortized amount. While rebates are not typically included in a utility's rate base, doing so provides an efficient and effective mechanism to reward and incentivize the utility for supporting the nascent transportation electrification market and promote efficient grid integration of EV load.

Similar to the Commission's role supervising a utility's investments in its distribution system or administration of a DSM program, the Commission's role in a make-ready or rebate program is to review, approve, or modify the utility's proposal and supervise the utility's implementation of the approved program. Prior to a utility proposing a transportation electrification program, the Commission should consider establishing standards and guidelines for any utility proposal leveraging industry best practices and input from industry stakeholders.

Utility Ownership

There may be some justifiable use cases where full utility ownership and responsibility of all capital costs are warranted, such as environmental justice and LMI communities. It is important to note that, even in such situations, the local site host participant can still play an important role in the selection and operation of the station. For example, the site host can still be the customer of record for the utility, paying the standard commercial tariff rates, while also setting the driver pricing for those stations. The utility, through ownership of the station, is able to fully cover the capital costs to deploy the stations and can provide the necessary maintenance and monitoring to ensure the station remains operational.

For example, the Commission could ensure that such programs include local site host choice of networking solution vendors and control over the pricing to the EV driver. In doing so, market forces can still be in play, private market actors will be encouraged to invest their own capital and local site hosts will be able to maximize station utilization and optimize the driver experience. Examples of such programs that include utility ownership with local site host choice and control include San Diego Gas & Electric "Power Your Drive" and Pacific Gas & Electric's EV Charge Network in California.

Examples and Evaluative Framework

Utilities around the country have successfully initiated EV charging programs that complement and support the competitive market. The following examples include utility programs that are structured as rebates, make-ready, direct utility-ownership, and "portfolio" approaches that combine some or all of these elements. These following examples allow for customer choice in hardware and network services and ensure that site hosts have operational control over pricing and access to stations, regardless of how the EVSE deployment is incentivized:

- DTE Energy (MI): 2,300 commercial and residential ports via rebates
- Eversource Energy (MA): 4,167 ports via utility make ready investments
- National Grid (MA): 1,278 ports via rebates for EVSE and site-host owned make ready
- San Diego Gas & Electric (CA): 3,500 ports via utility-ownership
- Southern California Edison (CA): 1,500 ports with utility make ready and customer rebates

Another example is Duquesne Light Company (DLC) in Pennsylvania, which received approval for its "EV Charge Up Pilot" Program by the Pennsylvania Public Utilities Commission (Docket No. R-2018-3000124). While the program design changed over the course of the proceeding, its original ownership-model was designed around six "Guiding Principles":

1. **Support state and local EV policies and goals**
    - The Company [DLC] will engage with its customers, such as the City [of Pittsburgh] and the … [Port Authority of Allegheny County], to help them meet their vehicle electrification goals and help facilitate the connection of … [transportation electrification] to the electrical distribution system.
2. **Support a competitive charging market while maintaining market neutrality**
    - The Company will engage with the competitive charging industry, foster competition, innovation and equipment and network choice without picking winners and losers.
3. **Maintain site host choice and control**
    - The Company will promote customer-site host equipment choice and charging control and enable customer-site hosts to choose how or if to bill EV drivers for charging services.
4. **Ensure equipment is installed safely and maintained efficiently**
    - The Company will require customer-site hosts participating in the Pilot to contribute financially to help ensure equipment is deployed safely and utilized and maintained effectively.
5. **Require detailed data from program participants**
    - The Company will require participating customer-site hosts and authorized equipment and network providers to provide detailed data, such as:
        - load profiles including interval data covering charging event duration and site specific charging load management strategies;
        - equipment performance data including but not limited to reliability and percent utilization; and
        - driver experience data including price signals, access to user apps, and 24/7 call center support information.
6. **Manage program operations and costs**
    - The Company will leverage its project management resources to administer the Pilot and track program costs. [7]

Guiding principles such as those identified by DLC facilitate the development of utility programs that accelerate sustainable and scalable growth in the EV and EV charging markets. ChargePoint recommends that the Commission consider adopting similar principles or directing the utilities to adopt these principles in any utility EVSE program proposals. Several jurisdictions have already established criteria for regulators to evaluate EV charging programs proposed by utilities. In addition to traditional cost-recovery considerations, these criteria often evaluate issues that are specific to the EV and EV charging markets, e.g.:

- California PUC Code 740.12 (a)(2)(b) as amended by SB 350 of 2015 (Sec. 32): "Programs proposed by electrical corporations shall seek to minimize overall costs and maximize overall benefits";

[7] The testimony of DLC Witness Joseph DeMatteo can be found in Statement No. 6 and is available at: http://www.puc.pa.gov/about_puc/consolidated_case_view.aspx?Docket=R-2018-3000124.

- Utah SB 115 of 2016: "54-20-103. Electric vehicle incentive program. (1) The commission shall, before July 1, 2017, authorize a large-scale electric utility to establish a program that promotes customer choice in electric vehicle charging equipment and service…";
- California PUC Code 740.12 (a)(1)(F) as amended by SB 350 of 2015 (Sec. 32): "The commission shall approve, or modify and approve, programs and investments in transportation electrification, including those that deploy charging infrastructure, via a reasonable cost recovery mechanism, if they are consistent with this section, do not unfairly compete with nonutility enterprises as required under Section 740.3, include performance accountability measures, and are in the interests of ratepayers as defined in Section 740.8."
- In Massachusetts, the Department of Public Utilities established a clear set of criteria for evaluating whether utility EVSE investments are eligible for cost recovery without any direction by the Massachusetts General Court (state legislature). *See* D.P.U. Docket No. 13-182-A, Final Order.

ChargePoint respectfully urges the Commission to recommend establishing evaluative criteria for utility investments based on the following principles: utility transportation electrification programs must maintain customer choice, encourage innovation, and stimulate competition; leverage matching payments from site hosts, whenever possible; support site host access and control over pricing; avoid island networks and ensure open access for EV drivers; support equitable access to electric transportation options; and encourage smart charging behavior to enable widespread grid benefits.

Maintain Customer Choice, Encourage Innovation, and Stimulate Competition

Utility transportation electrification programs should incorporate a customer-centric approach by allowing a commercial site-host to choose the type, number, and brand of EV charging stations that are installed on the site-host's property, as well as the EV charging network service associated with those stations. Different site-hosts install EVSE for different reasons and with different goals in mind. The EV drivers that will use a site-host's EVSE are also the site-host's customers, employees, tenants, or constituents, so the site-host is best positioned to assess their needs and provide the optimal charging solution. Further, some site-hosts will look for the most cost-effective option while others will be more interested in offering the most advanced features to EV drivers, in addition to cost considerations.

When site-hosts can choose the EVSE that best meets their needs, EVSE vendors strive to develop the most innovative products and compete to meet site-hosts' needs. In other words, a thriving competitive market that offers a wide variety of innovative products at competitive prices depends on a site-host's ability to choose the right product. By contrast, utility programs that rely on procurement of a charging solution through traditional RFP methods may result in a "one-size fits-all" approach that is set for several years and is not able to provide choice and flexibility to participating site hosts and EV drivers. RFPs that result in one single hardware or network offering will also essentially exclude other providers from actively participating in the service territory, making it harder for a self-sustaining market to develop and grow over time. However, RFP processes can be supportive of continued market innovation if they are used to pre-qualify multiple hardware and network service options based on minimum functional criteria that support the site host, EV drivers, and the utility's needs. This ensures that charging solutions meet minimum specifications without picking winners and losers.

Leverage Private Funding

The most impactful and cost-effective utility EVSE programs do not rely exclusively on ratepayer funding. Instead, effective EVSE programs require site-hosts to have some "skin-in-the-game" by sharing

in the cost of the EVSE that is deployed. For make-ready and rebate programs, skin-in-the-game typically means that a site-host will pay for any upfront costs of the EVSE, including installation costs, not covered by the utility's make-ready program. Site-hosts can also contribute to overall EVSE costs by providing signage and giving up a portion of their parking lot for EV charging.

Leveraging private funding has two major benefits. First, when site-hosts contribute to the total upfront cost of EVSE, the ratepayer funds dedicated to the program go further and lead to the deployment of more EVSE than they would if the utility were covering 100 percent of the costs.

Second, when site-hosts share in the cost of EVSE, they are motivated to maximize the value of their investment. In practice, maximizing the value of an investment in EVSE means that a site host will try to maximize the utilization of the EVSE by experimenting to find the most effective fee structures, providing visible signage to attract EV drivers, enforcing parking policies so that non-EVs do not block the EVSE, and generally ensuring that the EVSE remains functional and in good repair. By contrast, if a commercial site host has no financial responsibility or vested interest in the station operations they may not be motivated to maximize EVSE utilization, promote awareness, or have any consideration of the driver experience.

Support Site-Host Access and Control Over Pricing

In order to fulfill its own unique goals for hosting EVSE, a site host must be able to access the EVSE's back-end network and have control over pricing of the EV charging services to the drivers. When a site-host has access to the EV charging network, the site host gains valuable insights into how the EVSE is used, such as learning how many charging sessions have occurred, what time of day the EVSE is most often used, the average duration of charging sessions, among other key utilization insights. When a site host can understand and measure how its EVSE is being used, it can manage the EVSE accordingly to maximize the value it provides both to itself and to EV drivers.

Further, a site host must be able to adjust pricing to drivers as it sees fit because different pricing schemes can help site-hosts achieve their various goals. For example, a big-box retailer may want to offer free charging for the first hour to encourage EV drivers to shop in its store, but then charge a fee to encourage drivers to move their vehicles. A MUD owner may want to offer free or discounted charging as a benefit to residents, but charge guests a fee. A convenience store may want to vary the fee it charges throughout the day to encourage charging and attract customers during slower times. Whatever the site host's goal, various pricing structures can help the site-host achieve that goal. As with the skin-in-the-game principle, when a site-host is invested in the success of the EVSE, drivers reap the benefits and ratepayers benefit from a higher utilized grid.

Avoid Island Networks and Ensure Open Access for EV Drivers

Any EVSE program should be designed with EV drivers in mind. Over the long term, transportation electrification efforts will only be successful if EV drivers' overall experience of EV ownership, including public charging, is positive. To ensure positive experiences, an EV driver should be able to charge her vehicle at any publicly available EVSE that is supported by ratepayer dollars regardless of the driver's make of vehicle or membership in an EV charging network. Many EV drivers may choose to join an EV charging network for the convenience that it provides, but membership should not be a requirement to use a charging station. Similarly, EVSE must not be restricted to customers of the utility that supported the deployment of the EVSE. Finally, publicly available EVSE should accept multiple forms of payment, which is discussed in greater detail in 2.E.

Avoiding creating island networks – in which there are networks that only certain drivers can use and which make it difficult for members of the island network to use other charging stations – is crucial to the value proposition for drivers considering purchasing an EV. Island networks make it difficult for EV drivers to travel or move to new cities or in and out of specific utility territories. By contrast, protecting open access for EV drivers ensures a seamless, hassle-free experience that encourages other drivers to purchase EVs.

To ensure that EV drivers have access to EVSE, site-hosts must also be empowered to oversee parking spaces that are restricted to EVs while actively charging. Site-hosts should be allowed (and perhaps required) to install signage restricting parking spaces and permitted to tow vehicles that park in designated parking spots but do not use the EVSE. Such enforcement policies are crucial to ensure that EVSE is accessible to EV drivers when they need it.

Support Equitable Access to Electric Transportation Options

The transition to electric transportation should not leave any groups behind. Utility EVSE programs should include and even emphasize environmental justice and economically disadvantaged communities, perhaps through increased incentives, targeted technical assistance, and encouraging electrification of public transit and/or ride-hailing services to provide solutions to those who do not own their own vehicle. These communities can often benefit the most from transportation electrification through reduced emissions and increased transportation options. The Commission should ensure that any utility transportation electrification proposals account for the unique needs of these communities and include them in their programs.

Encourage Smart Charging Behavior to Enable Widespread Grid Benefits

EVs can be more than simply new load for utilities. As discussed previously, with the right policies, rate structures and incentives, EVs can be beneficial loads. ChargePoint recommends that the Commission encourage utilities to consider programs and pilots that can enable such grid benefits through the use of networked charging solutions capable of smart charging and provided detailed charging data. In practice, that means that EVSE must have embedded metering, two-way communications, and have smart charging capabilities including compliance with OpenADR2.0.

2. **Analysis and recommendations on each of the following issues related to EV charging stations owned or operated by persons other than electric distribution utilities:**
    a. *How and on what terms, including quantity, pricing, and time of day, such charging stations will obtain electric energy to provide to EVs;*

Please see comments in 1.A. and 1.B.

    b. *What safety standards should apply to the charging of EVs;*

EVSE should be installed in compliance with local, state, and national safety codes.

    c. *The recommended scope of the jurisdiction of the Commission, the Department of Public Service, and other State agencies over such stations;*

ChargePoint supports the Commission's previous recommendation on this issue.

d. Whether such stations will be free to set the rates or prices at which they provide electric energy to EVs, and any other issues relevant to the appropriate oversight of the rates and prices charged by such stations, including the transparency to the consumer of those rates and prices; and

Networked, or "smart," EV charging stations provide site hosts with the ability to set pricing for EV charging services in many ways. These dynamic pricing tools allow site hosts to incentivize driver behavior, which is essential given that EV charging is a combination of vehicle refueling and parking. Flexibility in pricing allows site hosts to tailor pricing to the unique needs of the site, including, but not limited to:

- A free charging session;
- A fixed rate for the session, for which the driver pays a set fee for the entire session;
- An energy rate, for which the driver pays for the energy consumed on a per kilowatt-hour (kWh) basis;
- An hourly rate, for which the driver pays per hour, similar to how a parking meter operates;
- Length-of-Stay pricing, for which one price is charged during the first x hours and another price is charged for every hour afterwards;
- Time-of-Day pricing, for which one price is charged during peak hours and another during off-peak hours.
- A minimum and/or a maximum fee per session;
- A combination of the above, in which, for example, a flat session fee followed by an hourly rate, an hourly rate followed by per kWh pricing, a minimum session fee followed by an hourly rate, or a free period of time followed by per kWh pricing; and
- Driver groups, for which station owners may set unique policies for different classifications of drivers (e.g. employees vs. visitors) using the options above.

Site hosts in Vermont set pricing to drivers by considering many factors, including attractiveness to drivers, projected utilization of charging stations, desired charging behaviors, comparable services from other competitors, and effective utility rates. Pricing to drivers is inherently connected to the success of charging deployments, as it is used to align site circumstances and achieve site host goals. ChargePoint believes that in order to maintain a level playing field among all market participants, regulation over charging station pricing to the driver must continue to be outside of commission jurisdiction for all charging station providers. Regardless of the entity owning or operating charging infrastructure, all charging station providers must respond to the same market forces and conditions in setting pricing to drivers. To the greatest extent possible, government and regulated entities should avoid setting EV charging pricing to drivers in a manner that is anti-competitive to the broader market. Given that non-government/non-regulated entities cannot socialize risk and costs for such investments, the private market will be discouraged from further investment if they must compete against attracting such entities and pricing to attract EV drivers.

It is appropriate and beneficial for utilities to continue sending price signals through electricity rates from the utility to site hosts, who are the utility's customer of record. Site hosts can choose to pass on fluctuating electricity rates or to determine another fee structure that will better optimize station utilization. Site hosts have a direct relationship with visitors to their locations and are better suited to meeting the interests of their customers (i.e., EV drivers).

ChargePoint cautions against excluding site hosts from determining fees for EV charging services or limiting EV usage fees to only a utility's pass-through electricity rates. A study of over 400,000

charging sessions found that a strict "per kWh" price for EV charging services leads to the least efficient usage of EVSE.[8] On the other hand, charging stations are used more efficiently when the site host is able to set pricing through a combination of either hourly or kWh pricing, along with a time-based fee to incent turnover once charging is complete.

The Agency of Agriculture, which oversees statewide Weights & Measures issues, would be the most appropriate state entity to adopt requirements to verify the accuracy of EVSE. The National Institute of Standards and Technology's (NIST) Handbook 44 Section 3.40 includes a Tentative Code for Electric Vehicle Fueling Systems. Section 3.40 includes specifications on elements including but not limited to operating requirements, design of measuring elements and measuring systems, and type evaluation. ChargePoint recommends that the Agency of Agriculture's Metrology Lab be afforded sufficient opportunity and resources to review tentative code language and research and acquire suitable test equipment for type evaluation in order to support the implementation of type evaluation and testing, as necessary.

e. The recommended billing and complaint procedures for such charging stations

ChargePoint recommends that the Commission consider adopting Open Access requirements for publicly available EV charging infrastructure. Such requirements have been adopted by statute in Connecticut, New Hampshire, Massachusetts, and California.

Open Access provisions stipulate that publicly available charging stations may not exclusively provide charging to drivers on condition of membership or subscription, though it does allow for subscriptions and membership models to exist alongside open access models. Such provisions also stipulate that multiple payment options must be provided that allow access by the general public, which increases access to charging while remaining flexible as payment technologies evolve.

ChargePoint urges the Commission to (i) ensure that drivers can use multiple forms of payment and (ii) avoid mandating one specific form of payment technology. Mandating a specific form of payment technology would put Vermont out of sync with other New England states:

State	Year	Citation	Payment Requirement
CT	2016	Public Act No. 16-135	The owner or operator of a public electric vehicle charging station, as defined in section 16-19f of the general statutes, as amended by this act, that requires payment of a fee *shall provide* ***multiple payment options*** *that allow access by the public*.
MA	2016	Ch. 448 of the Acts of 2016	The owner or operator of a public electric vehicle charging station *shall provide* ***payment options*** *that allow access by the general public.*
NH	2018	SB 575	The owner or operator of a public electric vehicle charging station that requires payment of a fee *shall provide* ***multiple payment options*** *that allow access by the public.*

[8] Wynn, Ryan. "Electric Vehicle Charging at Work: Understanding Workplace PEV Charging Behavior to Inform Pricing Policy and Investment Decisions." University of California – Los Angeles Luskin Center for Innovation. Available at: http://innovation.luskin.ucla.edu/content/electric-vehicle-charging-work.

Some states have begun to consider whether it would be appropriate to mandate that all EVSE utilize readers for magnetic swipe and chip credit card readers. For example, the California Air Resources Board ("CARB") recently proposed a regulation that would mandate all existing and future publicly available charging stations to be outfitted with physical credit card readers. While well-intentioned, this regulation would result in unintended consequences that are detrimental to the state's EV goals.

The proposed CARB regulation would require the nearly 20,000 existing public charging stations in California to be retrofitted and replaced at a cost of $6,000 per charger, according to CARB's own estimates.[9] This would cost nearly $120 million to retrofit existing infrastructure. It will also take valuable existing charging stations out of operation for consumers and reduce the availability of these stations. Moving forward, the mandate will at least double the cost of future charging stations.

Vermont is currently considering the best methods to incentivize additional investment in EV charging infrastructure through both public and private sources of funding. If Vermont were to mandate credit card readers, existing investments will have been in vain and future investments will only go half as far, undercutting the amount of infrastructure the state can deploy.

Payment technology trends are moving toward newer, more secure and reliable forms of technology, including mobile payments and contactless credit and debit cards. In the U.S. and around the world, consumers are increasingly using contactless payment technologies. Major financial companies including Chase, Capital One, and Visa already offer or will offer contactless forms of payment by 2019. For example, Visa has announced 95 percent of new point of sale terminals will be contactless-enabled. These trends are consistent with Europe and Canada, which are not mandating the use of credit card readers for EV charging stations. Europe is mandating that all point-of-sale terminals be contactless-enabled by 2020.

If the PUC recommends alternatives to Open Access precedent in New England, we urge consideration of the alternative model proposed in California's legislature. AB 1424 proposes an alternative to the credit card reader mandate that would provide uniform and equitable access to all publicly available electric vehicle stations and provide consumers with multiple payment options while avoiding the costly consequences of a credit card reader mandate

The requirements proposed in AB 1424 are stronger in terms of accessibility and choices for consumers than any existing Open Access statute or proposed alternative requirements. AB 1424 would require all charging stations to be equipped with a toll-free number for credit card payments taken over the phone, in addition to at least two of the following: RFID card payment, near field communication or other mobile technology payment (e.g., mobile applications such as Apple Pay, Google Pay, and other payment apps, vehicle telematics), and onsite capacity for credit card payment (including contactless).

3. Analysis and recommendations on each of the following issues:

a. Jointly with the Secretary of Transportation, recommended options to address how EV users pay toward the cost of maintaining the State's transportation infrastructure, including consideration of methods to assess the impact of EVs on that infrastructure and how to calculate a charge based on that impact, the potential assessment of a

[9] California Air Resources Board: Electric Vehicle Supply Equipment (EVSE) Standardized Regulatory Impact Assessment (SRIA), December 20 2018
http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/CARB_EVSE_SRIA_2018.pdf

charge to EVs as a rate per kilowatt hour delivered to an EV; varying such a charge by size and type of EV; and phasing in such a charge;

It is essential that Vermont's roads be maintained through sustainable funding sources, for which all drivers should pay a fair share. However, it is important to consider the manner by which this revenue would be generated to mitigate the negative impact on Vermont's EV and EV charging markets.

Generating transportation revenue through a fee that is assessed on drivers on a per-kWh basis raises several problematic issues. It would be difficult to ensure compliance with fees that are assessed on a per-kWh basis. The purpose of a per-kWh fee would be undermined if the existence of that fee incentivizes drivers to charge behind-the-meter or on non-networked stations, which do not readily facilitate revenue collection. While many commercial charging stations are capable of generating accurate revenue, it should be noted that drivers who rely on publicly-available charging (i.e., drivers without dedicated overnight parking) would pay higher costs for charging than drivers that can charge at home overnight.

Furthermore, ensuring compliance for this kind of policy could be costly given current regulatory requirements. Assessing a per-kWh fee on drivers would currently require the installation of additional utility meters at every EV charging station in the State, which would be cost prohibitive and restrict growth in the EV and EV charging markets.

Generating transportation revenue through EV registration fees can also impact growth in EV markets if fees are set without considering the complexities of the transportation sector. In the event that Vermont opts to leverage EV registration fees, ChargePoint recommends that a portion of the funds be dedicated to programs to build out EV infrastructure in the State in perpetuity or for a multi-year phase. This approach has been successfully employed in Colorado, which adopted a $50 registration fee, of which $30 goes into the state's Highway Users Tax Fund and $20 is earmarked for state's Electric Vehicle Grant Fund, which pays for public charging stations and other infrastructure.[10]

b. The accuracy of electric metering and submetering technology for charging EVs;

In terms of accuracy, ChargePoint meets or exceeds the requirements set forth in the electricity-as-motor-fuel sections of NIST Handbooks 44, which is discussed further in 2.C. In utility terms, our charging stations meet the accuracy requirements of ANSI C12.1-2008 (1% class) as applied to embedded EVSE metering.

c. Strategies to encourage EV usage at a pace necessary to achieve the goals of the State's Comprehensive Energy Plan and its greenhouse gas reduction goals, without shifting costs to electric ratepayers who do not own or operate EVs; and

Please see responses to in 1.

d. Any other issues the Commission considers relevant to ensuring a fair, cost-effective, and accessible EV charging infrastructure that will be sufficient to meet increased deployment of EVs

[10] "42-3-304. Registration fees" in Colorado Revised Statutes as amended by HB 13-1110.

ChargePoint urges the Commission to recommend the adoption of "EV Ready" requirements for residential and commercial construction. Requiring new construction to be "EV Ready" will save money for property owners and future-proof Vermont's businesses, workplaces, retail properties, and homes for an influx of electric vehicles. "EV Ready" provisions typically require the installation of conduit and wiring and to ensure sufficient electrical capacity to support the future installation of EV chargers by site hosts, at their expense, at a later date. Examples of EV Ready codes are included in Attachment A.

Vermont's building codes should be updated to require that new construction include EV Ready and EV Capable spaces in single-family, multi-unit, and commercial buildings, with these definitions:

- "EV Ready" means a parking space supplied with a full circuit with minimum of 40-Amp 208 or 240 Volt capacity, including listed raceway, sufficient electrical panel service capacity, overcurrent protection devices, and wiring necessary for the future installation of a Level 2 EV charging station.
- "EV Capable" means service a parking space for which panelboard(s) shall have sufficient space to install a minimum of one 40-ampere dedicated branch circuit and overcurrent protective device that shall remain reserved for exclusive use by electric vehicle charging, as well as any needed conduit in areas that would be inaccessible after construction.

These definitions would apply to different types of buildings as follows:

- A one-to-three family home must have at least one electric vehicle ready parking space;
- A home for more than three families or a commercial building with between two and ten parking spaces must have at least fifty per cent of their spaces electric vehicle capable and at least twenty per cent electric vehicle ready, rounded to the nearest larger number; and
- A multi-unit residential or commercial building with at least eleven parking spaces must have at least forty per cent of their spaces electric vehicle capable, including twenty per cent electric vehicle ready, rounded to the nearest largest number.

IV. CONCLUSION

Thank you for the opportunity to participate in this proceeding. We appreciate the focus on the Commission on these important issues and look forward to participating in future proceedings to further expand Vermont's support for widespread transportation electrification.

Attachment A: Examples of North American EV Ready Building Codes

Statewide/city	Multi-family	Nonresidential	Single Family	EVSE Installation Requirements
Atlanta, GA	**20%** of parking spaces must be EV ready	**20%** of parking spaces must be EV ready	yes, 40 amp 240 Volt	NA
State-wide Mandatory CALGreen	panel capacity & installation of inaccessible raceways required at **3%** of parking spaces (plus conduit if only one space) - MF dwellings with 16 or less units exempt	panel capacity and conduit at **~6%** of spaces required for buildings with 10 or more parking spaces	panel capacity & conduit for one parking space at SF/dual family housing	NA
State-wide Voluntary CALGreen	same as mandatory, but percentage increased to **5%**	**8%** (Tier 1) or **10%** (Tier 2) with an applicability threshold as low as one parking space	install complete EV charging circuit	NA
San Francisco, CA	**10%** of spaces have full circuit; additional **10%** of spaces have panel capacity; inaccessible conduit required for all spaces without a full circuit		NA	NA
Oakland, CA	**10%** of spaces have full circuit; additional **10%** of spaces have panel capacity; inaccessible conduit required for all spaces without a full circuit	**10%** of spaces have full circuit; additional **10%** of spaces have panel capacity & inaccessible conduit	panel capacity & conduit for one parking space at SF/dual family housing	NA
New York, NY	enclosed lots must install 1-inch raceway sufficient to serve **20%** of parking spaces and must provide room to install panel 3.1 kW electrical panel capacity for each space; open lots must have 3.1 kW electrical panel capacity and 1 inch raceway/ capacity for 11.5 kVA sufficient to serve **20%** of parking spaces		NA	NA
Boulder, CO	**10%** of spaces must have 120 V and 240V EV charging circuits for buildings with more than 25 parking spaces	120 V and 240V EV charging circuits for **10%** of spaces at buildings with more than 25 parking spaces	240 V AND 120 V EV charging circuit and outlet for SF homes and townhouses (new homes and garage conversions to living space)	at least two spaces with dual port charger for new multi-family and commercial buildings with >25 parking spaces; also R-1 and R-2 buildings must have EVSE at **1%** of spaces and at least 2
Ontario, Canada	under consideration	**20%** full circuits; remaining spaces must be designed to support EVSE installation	200 amp minimum main panel capacity, empty conduit, outlet box	**20%** of spaces in non-residential buildings must have EVSE
Vancouver, Canada	40 amp electric circuit for **20%** of spaces; space in electrical room to install panel capacity to serve all parking spaces	40 amp electric circuit for **10%** of spaces	40 amp electric circuit; or conduit only if circuit would cause panel to exceed 200 amp	NA
Palo Alto, CA	one full circuit per unit; **25%** of guest spaces	**25%** conduit only or EVSE ready	full circuit; or 50 amps panel capacity and conduit (raceway)	**5%** of spaces for non-residential and MF guest parking