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**MULTI-STATE ZEV TASK FORCE AND
NORTHEAST CORRIDOR STEERING COMMITTEE**

ELECTRIC VEHICLE CHARGING INTEROPERABILITY RECOMMENDATIONS FOR STATE POLICY MAKERS

INTRODUCTION

In the context of the electric vehicle (EV) charging ecosystem, the term "interoperability" broadly refers to the compatibility of key system components that allow vehicles, charging stations, charging networks, and the grid to exchange information, communicate effectively and work together as part of a seamless charging system. Interoperability is essential to the optimal functioning of the charging network. As a whole, however, the nation's existing charging network is not interoperable.

Recognizing the importance of achieving system-wide interoperability, the Multi-State Zero Emission Vehicle Action Plan[1] and the Northeast Corridor Regional Strategy for Electric Vehicle Charging Infrastructure[2] both recommended that states convene a multi-state workgroup for the purpose of developing state consensus around charging system interoperability policy. This document is the product of the workgroup's effort and offers recommendations for state policy makers to promote widespread interoperability through state electric vehicle supply equipment (EVSE) grant and procurement contracts or the development of market-wide requirements for public chargers.

BENEFITS OF CHARGING SYSTEM INTEROPERABILITY

Interoperability, as it relates to several distinct aspects of EV charging system operations, furthers a strong state interest in maximizing driver access to public charging stations; simplifying payment and billing; ensuring that EVSE owners do not get locked in to a single network; and promoting effective vehicle-to-grid communications for smart charging and demand response programs. These overarching goals, which are

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Key Terms as Used in this Document

- *Electric Vehicle Supply Equipment (EVSE):* The physical equipment and software that delivers electricity to charge an EV battery.
- *EVSE Provider:* A company that sells and installs EVSE.
- *Back-end Network:* A software platform to which a networked EVSE connects that provides billing and other ancillary services.
- *Network Service Provider.* A company (often an EVSE provider) that provides a back-end network for EVSE
- *EVSE Site Host.* An entity that hosts, and often owns, EVSE on their property.

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[1] ZEV Task Force, "Multi-State ZEV Action Plan: 2018-2021." 2018. Available at: https://www.nescaum.org/topics/zero-emission-vehicles/multi-state-zev-action-plan-2018-2021-accelerating-the-adoption-of-zero-emission-vehicles
[2] NESCAUM, "Northeast Corridor Regional Strategy for Electric Vehicle Charging Infrastructure 2018-2021." May 2018. Available at: https://www.nescaum.org/documents/northeast-regional-charging-strategy-2018.pdf/

shared by many automakers, EVSE providers, network service providers and utilities, promote an open, transparent, efficient and user-friendly charging system. The discussion below provides contextual background and recommendations for state policy makers to promote system-wide interoperability in these key areas by making award of public funds for EVSE contingent on universal roaming, the ability of site host owners to switch networks, and adoption of a protocol to facilitate vehicle to grid communications.

MAXIMIZING CONSUMER ACCESS THROUGH UNIVERSAL ROAMING

Open access – that is, the ability of an EV driver to initiate and conveniently pay for a charging session at any public charger – is necessary to maximize system utilization and reliability, as well as consumer convenience and confidence in the charging network. One approach to broadening consumer access would allow an EV driver to use any public charger with a single credential the driver already has, regardless of network membership, and use a ubiquitous form of payment (i.e., a credit or debit card) to pay for a charge. For example, California has adopted regulations requiring all public networked chargers to be equipped with credit card chip readers that accept one of three major credit cards starting in 2022.[3]

The other approach to broadening consumer access is universal roaming, which allows charging network providers to seamlessly and securely share billing information with each other. Universal roaming is analogous to the use of automated teller machines (ATMs), which give a consumer access to bank funds through the use of ATMs associated with multiple different banking institutions worldwide. Similarly, universal roaming allows an EV driver that is a member of a single network to access and pay for charging at *any* public EV charger using the interface of the driver's network (i.e., RFID fob, smartphone app). Charging network providers in the United States are demonstrating a preference for universal roaming over a credit/debit card payment option.[4]

Universal roaming requires billing interoperability. For EV charging, this means: (1) the back-end networks must have the ability to exchange data with each other to transfer consumer billing information; and (2) competing network providers must reach business agreements with each other to share the billing information of EV drivers in their networks.

BILLING INTEROPERABILITY BUSINESS MODELS

There are two billing interoperability business models in use today: "peer-to-peer" and "hub and spoke." The success of the peer-to-peer model depends on all network service providers reaching

[3] https://ww3.arb.ca.gov/regact/2019/evse2019/15dayatta.pdf

[4] "*EV Industry Sees Problems with California's Proposal to Mandate Credit Card Readers for Public Chargers*," Charged Electric Vehicles Magazine, April 5, 2019, accessible at https://chargedevs.com/features/the-ev-industry-sees-problems-with-californias-proposal-to-mandate-credit-card-readers-for-public-chargers/; "*Electrify America & ChargePoint Enter into Roaming Agreement*," Clean Technica, June 11, 2019, accessible at https://cleantechnica.com/2019/06/11/electrify-america-chargepoint-enter-into-roaming-agreement/; "*EVgo and Electrify America Make Charging Easier with New Roaming Agreement*," Clean Technica, August 22, 2019, accessible at https://cleantechnica.com/2019/08/22/evgo-electrify-america-make-charging-easier-with-new-roaming-agreement/.

individual roaming agreements with each other to share customer information for billing purposes. This approach typically utilizes an open communications protocol for back-end data and information sharing. In the past year, most of the major network service providers in the United States have entered into peer-to-peer roaming agreements with each other using the Open Charge Point Interface (OCPI) as the communications protocol.[5]

In contrast, the hub-and-spoke model involves a single neutral party acting as an intermediary data clearinghouse (the hub), which contracts with each individual network service provider (the spoke). This obviates the need for multiple individual contracts between all network providers. The clearinghouse charges a small fee for every transaction that is processed through its system and uses a back-end proprietary communications protocol for data sharing. This business model has the advantage of facilitating the entry of new and smaller EVSE providers into the market. Hubject, a centralized clearinghouse in Europe, has recently expanded operations to North America with the announcement of its partnership with Blink.[6]

RECOMMENDATIONS

Without implementation of policy or regulatory requirements, widespread open access, whether through use of ubiquitous forms of payment or universal roaming, is entirely reliant on the voluntary cooperation of the EVSE industry at a pace that may not be optimal and may not be inclusive of new or smaller EVSE and network providers. States can elect from the following policy and regulatory actions to promote industry-wide adoption of universal roaming, either as it relates to publicly funded EVSE deployments or to broader regulation of all networked public chargers:

- As an initial step and interim solution to increase open access, require ubiquitous payment options for all *publicly funded or all public* networked chargers. The Task Force has developed state model grant and procurement contract provisions for open access and payment that are discussed in a separate whitepaper accessible on NESCAUM's website.[7] These recommendations will need to be reevaluated as the technology and market evolve.

- Mandate universal roaming for all networked *public* chargers, or only those that are publicly funded, by requiring EVSE compliance with OCPI or other equivalent open communications protocol and roaming agreements between EVSE network service providers. Eligibility for public grants and contracts could be made contingent on roaming agreements with all EVSE network providers. Regulatory action would likely be needed to impose this requirement on all public chargers.

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[5] "*Electrify America & ChargePoint Enter into Roaming Agreement*," Clean Technica, June 11, 2019, accessible at https://cleantechnica.com/2019/06/11/electrify-america-chargepoint-enter-into-roaming-agreement/; "*EVgo and Electrify America Make Charging Easier with New Roaming Agreement*," Clean Technica, August 22, 2019, accessible at https://cleantechnica.com/2019/08/22/evgo-electrify-america-make-charging-easier-with-new-roaming-agreement/.

[6] https://markets.businessinsider.com/news/stocks/blink-and-hubject-form-partnership-increasing-access-to-electric-vehicle-charging-networks-in-the-u-s-1027665826.

[7] Found here: http://www.nescaum.org/documents/model-contract-provisions-for-public-evse-5-24-19.pdf/.

The difficulty with this approach is that it would require states or a third party to keep track of all new market entrants to achieve true system-wide interoperability. Under a "hub-and spoke" approach, the centralized clearinghouse could perform that function. Requiring publicly funded or public chargers to be networked to a centralized "hub-and spoke" clearinghouse that has agreements with all other network service providers would likely solve that problem. With Hubject's expansion to North American markets, this option is now available.

ENSURING THE ABILITY OF EVSE SITE HOST OWNERS TO SWITCH NETWORKS

In order to foster a truly competitive market and protect against price gouging and stranded assets in the event a charging provider goes out of business, EVSE site hosts should have the ability to change network service providers without having to replace charging equipment. This is generally referred to as "back end" network interoperability. Achieving "back end" interoperability requires widespread utilization of an open communications protocol between the charging equipment and multiple network service providers.

The Open Charge Point Protocol (OCPP) is currently the only available open communication protocol for "back end" network communications. Ideally, if all network service providers are compliant with OCPP, EVSE should be able to function with any back-end network, allowing EVSE site hosts to switch network providers. In practice, however, compliance with OCPP does not guarantee this outcome.

The reasons for this are two-fold. First, network service providers can layer additional communication protocols on top of the standardized OCPP protocols, rendering communication between their chargers and other network providers incompatible. Second, network service providers can include additional software in the chargers that requires modification to enable functionality with other network providers. A network provider that refuses to modify the software essentially "locks" the equipment into that provider's back-end network.

RECOMMENDATIONS

- States should promote "back end" interoperability in the EV charging ecosystem by including the following provision in state EVSE grant and procurement contracts: "All networked charging stations must be compliant with OCPP or other equivalent open standard protocol and must be capable of switching networks without technological, contractual, or other unreasonable restrictions."

- As an alternative to *requiring "back end" interoperability*, states could require EVSE providers to disclose the following in writing: whether the charging station is compatible with other networks, and if so, which ones; under what circumstances the EVSE owner has the option to change network service providers; and whether there are any fees associated with changing network service providers or early termination of the contract.

- For market-wide application to all networked public chargers, adoption of a generally applicable statutory or regulatory requirement would likely be necessary.

VEHICLE GRID INTEGRATION

Managed charging – the ability of an electric utility or third-party aggregator to remotely control vehicle charging – is one way to maximize the grid benefits of transportation electrification. Managed charging relies on communication signals sent by a utility or aggregator to a vehicle or charging station to turn charging up, down, or off to meet grid needs. As the number of EVs on the road increases, this component of interoperability will become increasingly more important.

OpenADR 2.0 is a common platform that utilities can utilize for household appliance demand response programs and could also be used to facilitate vehicle grid integration. Many network service providers have already integrated OpenADR 2.0 into their platforms.

RECOMMENDATION

- In order to facilitate vehicle grid integration as the EV market continues to expand, states should require network service providers for all publicly funded EVSE to be compliant with OpenADR 2.0

VEHICLE-TO-EVSE – PLUG & CHARGE

Widespread adoption of ISO 15118 could set the stage for introduction of another advance in charging technology known as "Plug & Charge," an international communications protocol that allows the vehicle to authenticate a charging session without use of any credentials. An EV driver could initiate and pay for a charge by simply plugging the vehicle into the charger. While this would provide unparalleled convenience for the EV driver, it requires all components of the market to be aligned.

Currently, there is no industry consensus on whether ISO 15118 should be the open communication protocol used to facilitate Plug & Charge. For ISO 15118 to function properly, it needs to be integrated in both the charger and the vehicle. Some EVSE providers have integrated the protocol into their charging equipment, but most automakers have not. Industry generally agrees that it is not currently appropriate to mandate compliance with ISO 15118.

RECOMMENDATION

- We recommend that states refrain from requiring compliance with ISO 15118 at this time and continue to monitor market developments with ISO 15118 and "Plug & Charge."