NARUC
National Association of Regulatory Utility Commissioners

Electric Vehicle Interoperability
Considerations for Public Utility Regulators

An addendum to the NARUC report, *Electric Vehicles: Key Trends, Issues, and Considerations for State Regulators* (2019)

Prepared by Christopher Villarreal, Plugged In Strategies

Summer 2022

Acknowledgments and Disclaimers

This issue brief was prepared by Christopher Villarreal of Plugged In Strategies and is based on work supported by the U.S. Department of Energy under Award Number DE-OE0000925. The author thanks the following reviewers for their comments and insights, which helped to improve the paper:

- **Ed Pike**, California Public Utilities Commission
- **Jasmine McAdams**, NARUC
- **Bill Erlich**, Tesla
- **Danielle Sass Byrnett**, NARUC
- **Francesca Wahl**, Tesla

Contents

Introduction

Electric vehicles (EV) are an increasingly important component of many state and federal efforts to decarbonize both the electric and transportation systems. According to one forecast, by 2030, EVs are expected to account for nearly 30 percent of all new car purchases.[1] Although this adoption will not be uniform across the country and some states will move faster than others, the need for charging infrastructure will be vital to the widespread adoption of EVs. As cars are driven across utility service territories and state borders, ensuring that EV owners can charge their vehicles reliably is critical. To enable widespread charging for customers and a consistent and reliable experience across vehicle manufacturers, charging station developers, and utility territories, it is essential to adopting industry standards that emphasize interoperability by all actors.

States and the federal government have enacted a series of policies to encourage faster adoption of EVs, such as rebates for EV purchases and for the installation of electric vehicle service equipment (EVSE), as well as the costs associated with installing the EVSE. The recently adopted federal Infrastructure Investment and Jobs Act (IIJA) allocates $7.5 billion to the charging infrastructure necessary to support widespread adoption of EVs and provide funding to states through their departments of transportation and energy. Among other requirements for electric vehicle infrastructure, the IIJA directs the U.S. Departments of Transportation and Energy to "develop minimum standards and requirements related to: (1) the installation, operation, or maintenance by qualified technicians of electric vehicle charging infrastructure" and "(2) the interoperability of electric vehicle charging infrastructure."[2] In addition, the Inflation Reduction Act of 2022 (IRA) provides tax credits for purchasing a clean vehicle, which includes electric and plug-in hybrid vehicles.[3]

Electric utilities play a significant role in the growth of EVs in a state and service territory, whether necessitated by IIJA and IRA, state policies, or customer needs. As a result, public utility commissions are involved in reviewing utility investment costs and locations for enhanced distribution grid infrastructure, 'make ready' or utility-owned charging station equipment, metering, and rate design and tariff options related to EV charging (e.g., time-of-use rates and managed charging programs). Utility regulators ensure that utility programs are capable of meeting the goals identified in any program or statute, which typically include supporting customer adoption and facilitating a good customer experience.

Interoperability creates a more efficient ecosystem: rather than having multiple, private networks that only work with a limited number of vehicles and require duplicative infrastructure, industry standards can reduce redundancy and costs in and across the system, thereby promoting more cost-efficient expansion of networks and adoption by customers.

Interoperability is a foundational component of efficiently implementing utility programs, enabling customer or third-party owned EVSEs, and allowing for rapid growth in numbers of EVs, including fleets and transit. If a customer must drive from EVSE to EVSE looking for the right equipment to charge, it results in unnecessary expense and could curb EV adoption. Interoperability creates a more efficient ecosystem: rather than having multiple, private networks that only work with a limited number of vehicles and require duplicative infrastructure, industry standards can reduce redundancy and costs in and across the system, thereby promoting more cost-efficient expansion of networks and adoption by customers. Additionally, utilities must plan for the addition of new load and consider the provision of price signals to help integrate EVs seamlessly onto the grid. To accomplish this effort, policies are needed to support EV charging during non-peak hours and standardized messages and capabilities are needed to ensure that the EV and EVSE are responsive to the price signals controllable by the utility, a third party, or market operator.

---

1 EVAdoption, EV Sales Forecasts, https://evadoption.com/ev-sales/ev-sales-forecasts/.

2 135 Stat. 1424.

3 H.R. 5376, Sec. 13401, P.L. 117-169.

This issue brief, published as an addendum to the 2019 NARUC report *Electric Vehicles: Key Trends, Issues and Considerations for State Regulators*, provides an overview of EV interoperability benefits and opportunities and a snapshot of recent state public utility commission actions to ensure interoperability in charging infrastructure.

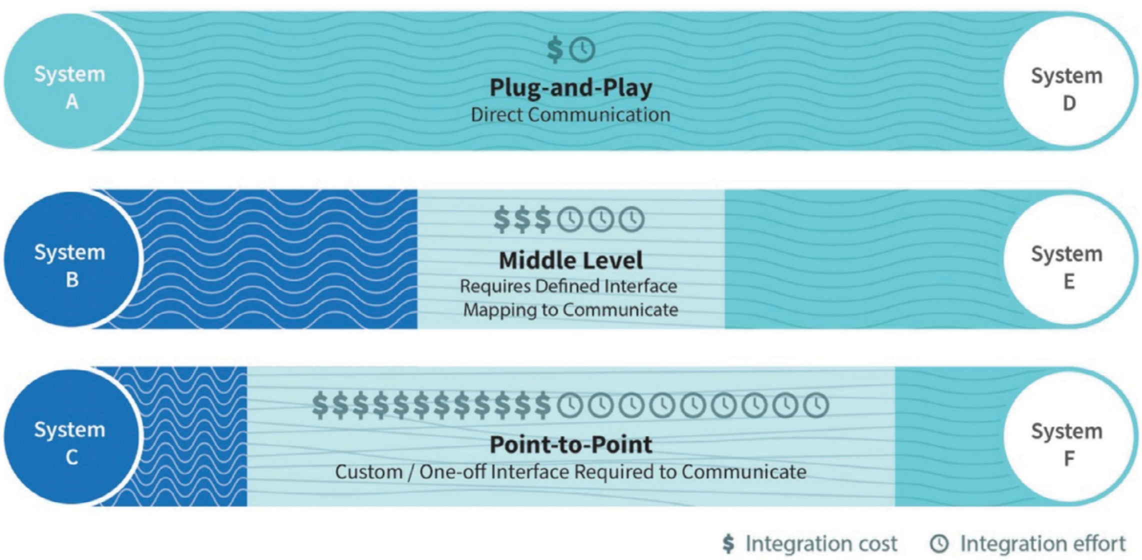
What is Interoperability?

As defined by the National Institute of Standards and Technology (NIST), interoperability is:

> *"The capability of two or more networks, systems, devices, applications, or components to work together, and to exchange and readily use information — securely, effectively, and with little or no inconvenience to the user… different systems will be able to exchange meaningful, actionable information in support of the safe, secure, efficient, and reliable operations of the grid. As the number of devices and systems used on the electrical grid continue to multiply, the interoperability requirements become more complex and the path to achieving interoperability becomes more challenging."*[4]

In practice, this definition means that if a customer installs an EVSE that communicates in a particular standard (e.g., Open Charge Point Protocol), they should expect that their EVSE can work with other equipment also operating in the same standard. Interoperability is analogous to the capability that allows a person to know that their computer's WiFi will connect and communicate via any other WiFi system around the world. As shown in **Figure 1**, there are levels of interoperability that range from not very interoperable —where a customer must add interfaces to allow systems to communicate — to a plug-and-play architecture, such as WiFi. These levels of interoperability also come with a cost — a system that is less interoperable will be more expensive to operate, as the utility and customer need to invest in technology to bridge the differences between systems.

Figure 1. Levels of Interoperability



Multiple options may be available for a standard's implementation, but these options may not necessarily be interoperable. A standard may include, for example, multiple communication options. If one implementer using a standard uses communication option A, but another implementer using the same standard uses communication option B, the options are not interoperable. This situation can first be addressed by relying on testing and certification programs, which ensure that any implementation is using the standard as envisioned and is certified by an independent entity for its implementation. If a standard does not yet have a testing and

4 Avi Gopstein, Cuong Nguyen, Cheyney O'Fallon, Nelson Hastings, David Wollman, *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 4.0 at 3*, National Institute of Standards and Technology (February 2021). https://doi.org/10.6028/NIST.SP.1108r4.

certification program in place, then it may be premature to rely upon that standard because there is no quality assurance or check that it is being implemented properly.

A second step that further enhances interoperability is to develop an interoperability profile. An interoperability profile is "a description of a well-defined subset of the standard that has been agreed upon by a user community, testing authority or other standards body."[5] The elements of a profile include physical performance specifications, communications protocols, and information models.[6] An entity, such as a trade association or other standard development organization, crafts a profile that takes one or more standards, minimizes the options of those standards, and develops a profile that crafts standards together into one implementation for each standard. This enables testing and certification to apply to one specific profile and ensures that if a technology is certified to that profile, then all other technologies, also certified to that profile, will work consistently. The Smart Electric Power Alliance (SEPA) recently released a managed charging profile to assist utilities and charging companies who are seeking to implement such programs.[7]

Why is Interoperability Important?

Interoperability allows for an EV or EVSE to communicate with the utility — via the AMI or other communication technology — and have the capability to respond to a price or grid signal, or relay to the utility that the EV and EVSE are charging. If these actions are not interoperable, then the utility, customer, and EVSE vendor are not working in tandem and can accumulate additional costs to be responsive to any signals. For example, Washington state in its legislative statute recognizes the necessity for interoperability standards to provide reliable, accessible, and competitive markets for EVSE and requires supportive regulatory action. For those regulatory entities that are considering implementing EV rates, EV demand response programs, and DER programs, interoperability is a key component to success. As such, regulatory entities have a significant interest in promoting and enabling interoperability, including defining standards, practices, and, where appropriate, interoperability profiles to support widespread adoption of EVs and EVSEs at least cost.

Interoperability also reduces the risk of vendor lock-in, which is where an implementer, such as a utility, is dependent only on one vendor's equipment and technology. This situation increases risks from potential future failure, higher costs, and less interoperability as only that one vendor's equipment can work with the utility implementation. Such approaches would increase costs to the customer and cultivate dissatisfaction with the utility service. Because regulators review utility costs and programs, addressing interoperability becomes a core function of their process, especially as technology evolves much faster than regulatory processes can respond, and an increasing share of EVSEs are owned by the customer or a third-party company.

Interoperability standards provide safeguards to consumers and support access to electric vehicle supply equipment. In order for Washington to have reliable, accessible, and competitive markets for electric vehicle supply equipment that are necessary for the movement of goods and people by electric vehicles, interoperability standards that align with national and international best practices or standards are necessary.

Washington RCW 19.94.570

5 Cuong Nguyen, *Overview of Cast Study and Interoperability Profile, National Institute of Standards and Technology* (July 9, 2018), https://www.nist.gov/system/files/documents/2018/08/06/case_study_interoperability_profile.pdf.

6 Ibid.

7 Interoperability Profile for Electric Vehicle Fleet Managed Charging: Utilizing IEEE 2030.5-2018, Smart Electric Power Alliance (June 2022), https://sepapower.org/resource/interoperability-profile-for-electric-vehicle-fleet-managed-charging/.

EV and EVSE Interoperability Interfaces

One method of visualizing the scope of interoperability and the extent of regulatory authority is to identify the areas, types, and number of interfaces for the EV/EVSE business case, as shown in **Figure 2**, developed by Shell Recharge Solutions (formerly Greenlots).

Figure 2. Points of Interoperability with EVSE – Greenlots

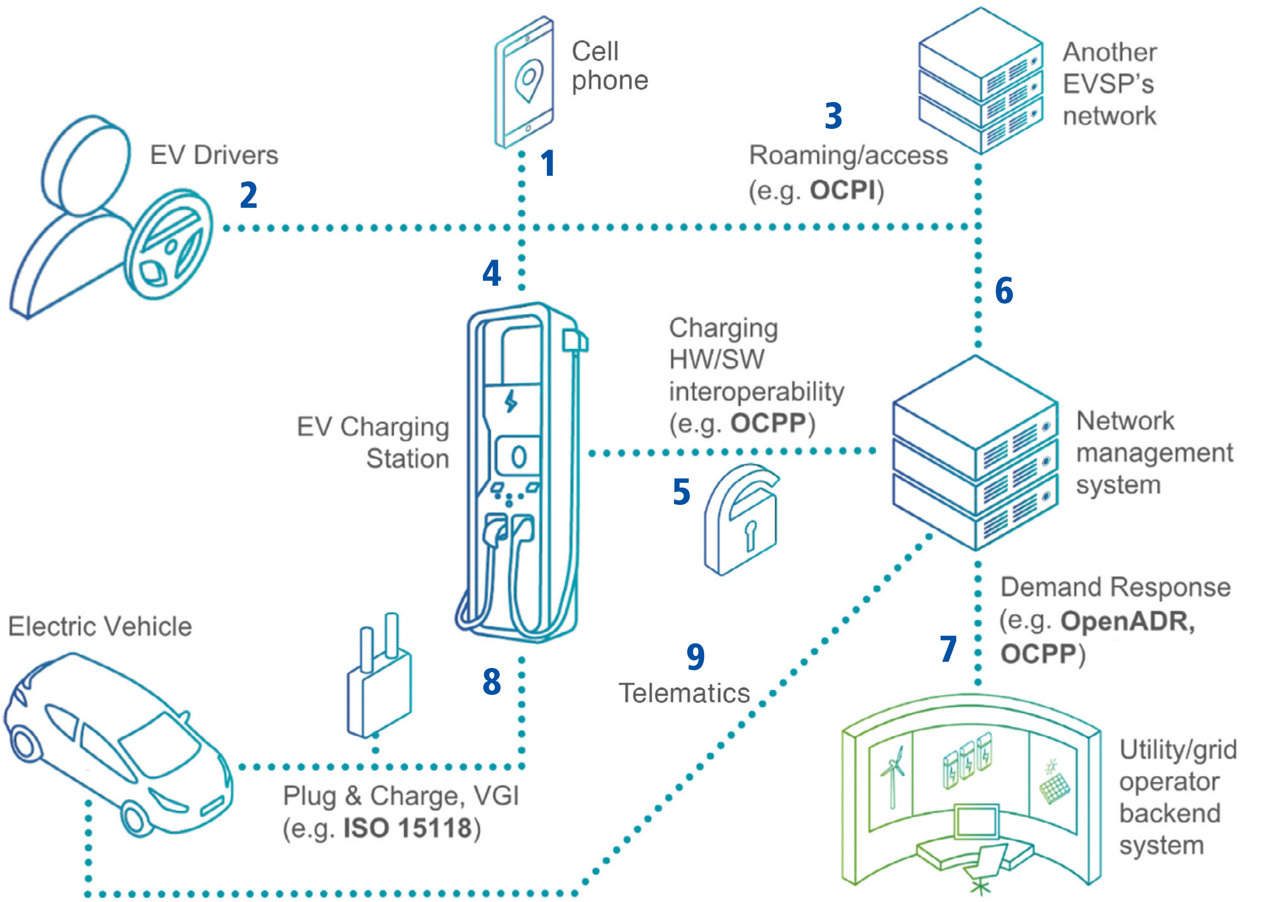


Figure 2 identifies nine interfaces, and each interface is a combination of multiple standards, data and communication needs, and actions. It also provides a visual to help identify the interfaces where a regulator may have a direct impact, an indirect impact, or no impact at all. For example, any interface that directly interacts with a utility network would be affected by regulatory action. On the other hand, where those interfaces do not interact with utility networks, regulatory action may have little to no impact. The interfaces are:

1. Driver to Phone
2. Driver to EVSE
3. Phone to EVSP Network
4. Phone to EVSE
5. EVSE to Network
6. Network to Network
7. Utility Network to Network
8. Car to EVSE
9. Car to Utility Network

The last interface, car to utility network, uses vehicle telematics to receive messages directly from the utility, and bypassing the EVSE, is an emerging use case. Such communications that leverage a vehicle's telematics may include communications through an app that could interface directly with utility systems.

The interfaces where the utility regulator is involved include all communications with utility equipment in front of the customer's meter, such as the EVSE's utility meter communicating upstream with the utility's network management system or billing system. For a utility to successfully communicate directly with an EVSE, it will need to be able to communicate over a network or may have this communication pathway enabled through some type of intermediary. An investment in the communication equipment to ensure the utility equipment can communicate using a standard would be included in a utility filing, such as in a rate case. If the standard is a consensus-based industry standard (see next section), this investment will enable communication with multiple EVSE providers and provides an important level of future-proofing. Conversely, if the utility is requiring communication via a proprietary or non-public standard, the type of EVSE equipment that could be installed in the territory will be limited. Utility communication directly with EVSE is not typical today and most of the utility communication comes via price signals related to either time-of-use rates, critical peak pricing events, or demand response programs.

Existing Standards

What follows is an initial list of standards that might be relevant to utility EV filings. This is not a complete list of standards, nor should this list be viewed as a static set of standards. Standards are constantly under development and finalization and may always demonstrate sufficient industry interest. Unfortunately, not all of these standards have testing and certification programs in place, as noted. If a standard does not have a testing and certification program in place, it will be challenging for a supplier or utility to demonstrate implementation and adherence to the standard.

- **Open Charge Point Protocol (OCCP)** is an open-source communication standard for EV charging stations and charge point management systems developed by the Open Charge Point Alliance. It allows them to integrate freely with one another and provides robust features to all stakeholders in the EV charging supply chain. For more information, visit https://www.openchargealliance.org/.
- **Open Charge Point Interface (OCPI)** supports connections between eMobility Service Providers who have EV drivers as customers, and Charge Point Operators who manage charge stations. OCPI aims to accelerate the market for EV drivers and improve mobility services. The goals of OCPI are to simplify, standardize, and harmonize. For more information, visit https://evroaming.org/.
- **ISO 15118** defines a communication protocol between EVs and charging stations. The protocol enables plug & charge, a feature which allows the EV driver to authorize, pay for, and start a charging station simply by plugging in the charge cord. ISO 15118 also supports communication for a wide range of grid-integration use cases such as managed charging and bidirectional charging interface (i.e., vehicle-to-grid), the EV identifies itself to the charging station, allowing for instant authorization for and the initiation of charging. ISO 15118-20 is the most recent standard in the ISO 15118 series and is a future-proof communication standard. It is an extension of ISO 15118-2 and specifies messages the EV and charging station exchange to control AC and DC charging sessions and it supports wireless power transfer.[8] It is essential that this standard is supported by a Public Key Infrastructure (PKI), which authenticates the participants in a charging session and establishes and maintains secure communications between the EV and EVSE.[9] Unlike the other standards, ISO 15118 is still finalizing its testing and certification requirements, which means there are no equipment, at this time, that are certified to ISO 15118. For more information, visit https://www.iso.org/standard/69113.html.

---

8 https://www.switch-ev.com/blog/new-features-and-timeline-for-iso15118-20

9 ChargePoint, Practical Considerations for Implementation and Scaling ISO 15118 into a Secure EV Charging Ecosystem (May 14, 2019), https://www.chargepoint.com/files/15118whitepaper.pdf.

- **Open Automated Demand Response (OpenADR 2.0b)** standardizes the message format used for automated demand response so that dynamic price and reliability signals can be delivered in a uniform and interoperable fashion among utilities, ISOs, and energy management and control systems. For more information, visit https://www.openadr.org/. One caveat to OpenADR 2.0b is that OpenADR 2.0b is only required if the utility is going to send demand response price signals and is not required for the utility to communicate time-of-use or critical peak price signals. OpenADR 2.0b should only be required in conjunction with an active demand response program.
- **IEEE 2030.5** is standard for communications between the smart grid and distributed energy resources. Information exchanged using the standard includes pricing, demand response, and energy usage, enabling the integration of devices such as smart thermostats, meters, plug-in electric vehicles, smart inverters, and smart appliances. IEEE 2030.5 further defines a framework to support these applications to enable a secure, interoperable, and plug-and-play ecosystem of smart grid consumer devices. For more information, visit the IEEE Webstore, https://standards.ieee.org/ieee/2030.5/5897/.
- **IEEE 2030.1.1TM-2015 (CHAdeMO)** is one of the original DC Fast Charging protocols to support early EV deployment, primarily for cars produced by Japanese car manufacturers. Older EVs may support CHAdeMO, but newer, non-Tesla EVs are more likely to use J1772 Combined Charging Systems (CCS). For more information, visit https://www.chademo.com/.
- **IEC 61850** is a standard to support communications for networks and systems. Traditionally, this standard was used for substation automation, but is increasingly being used for other purposes, including DER and EVs. This standard also includes a data semantic model, or Common Information Model, that ensures messages and data sent between two or more systems is in a common language. For more information, visit https://iec61850.dvl.iec.ch/.
- **IEEE 1815** is a standard, also known as DNP3, that supports utility communications across its distribution network. For more information, visit https://standards.ieee.org/ieee/1815/5414/.
- **SAE J1772** supports the charging of EVs across charging speeds. This is increasingly the most common non-Tesla charging plug in the United States. For more information, visit https://www.sae.org/standards/content/j1772_201001/.
- **SunSpec Modbus** defines common parameters and settings for monitoring and controlling DERs and their capabilities, such as voltage regulation, setting power factor, and power export limiting, as well as identifying data structures. For more information, visit https://sunspec.org/sunspec-modbus/.
- **Tesla Connector:** Tesla vehicles and charging stations use a proprietary connector with a different geometry than the SAE J1772 standard.
- **ENERGY STAR** is a program managed by the U.S. EPA to provide information to the public on the efficiency of appliances and technologies. A technology with an ENERGY STAR symbol means that the EPA has tested and measured the energy consumption of that appliance and it is consistent with or below benchmarks that can save customers money by using less electricity. In March 2021, EPA released Version 1.1 of its certification and testing specification for EVSEs.[10] At the time of this writing, more than 90 EVSE products have been ENERGY STAR certified.[11] For more information, visit https://www.energystar.gov/.

10 Energy Star, Electric Vehicle Supply Equipment Version 1.1, https://www.energystar.gov/products/spec/electric_vehicle_supply_equipment_version_1_1_pd

11 ENERGY STAR Product Finder: Electric Vehicle Chargers, https://www.energystar.gov/productfinder/product/certified-evse/results?formId=058-72-49-6-8093439&scrollTo=3720&search_text=&product_type_filter=&brand_name_isopen=0&max_nameplate_output_current_a_isopen=0&markets_filter=United+States&zip_code_filter=&product_types=Select+a+Product+Category&sort_by=partial_on_mode_input_power_w&sort_direction=asc&page_number=0&lastpage=2

- **Applicable Cybersecurity and Payment** standards are standards that support a variety of credit card banking services and programs to ensure that personal information and credit card numbers are adequately protected. Standards in this section include PKI, which is a common method of securing data transfers on the Internet as encryption and authentication is managed, which ensures trustworthy, secure communication online, and Payment Card Industry (PIC) standards that set the technical and operational requirements for organizations accepting or processing payment transactions, and for software developers and manufacturers of applications and devices used in those transactions.

Metering

The accuracy of utility metering is determined by a series of standards adopted by the American National Standards Institute (ANSI). These standards, in the ANSI C.12 package, ensure that any meter is accurately measuring the amount of electricity consumed at that location.[12] The meter on the site of a premise is tested to ANSI C.12-20 which provides three levels of accuracy – 0.1, 0.2, and 0.5 percent. In other words, for a meter to be approved at 0.1 percent accuracy, the meter must be tested and certified to that level of accuracy. Generally speaking, meters installed by electric utilities are testing to 0.2percent level of accuracy. Accurate measuring of electricity means that the customer is billed for the electricity consumed at the premise without significant under- or over-collections, which has an impact on revenue collected by the utility.

As it applies to EVs, there is a need to measure the amount of electricity consumed by the EV. However, customers may have a choice to either allow the EV demand to be measured as part of the overall premise's demand or have it metered separately (or sub-metered). If a customer chooses to have the demand from the EV charging at its premise metered separately, many utilities require the customer to install a second meter, along with all other needed equipment, such as running an extension from the service drop to the EV charging location and a separate panel. These costs can affect the overall costs of owning an EV and result in a longer payback period versus the costs of a gasoline-powered vehicle. One way to address these costs is to consider using the EVSE as a meter. Many EVSEs come with metering capabilities that are tested and certified to ANSI C.12 (though to a different level of accuracy) or can be measured and tested against other measures, such as NIST Handbook 44, which includes details on requirements for weighing and measuring devices.[13] NIST Handbook 44, however, has a lower accuracy threshold than ANSI C.12-20 at 1 percent in labs, 2 percent in the field. This poses a dilemma.

The California Public Utilities Commission (CPUC) issued a decision in August 2022 adopting a submetering protocol for EVSE's based on NIST Handbook 44, as developed by the California Department of Food and Agriculture, Division of Measurement and Standards (CDFA-DMS).[14] This decision allows for third-party and customer-owned EVSEs to be used as a submeter, provided they meet "submeter accuracy standards of 1 percent accuracy tolerance and 2 percent maintenance for AC EVSE submeters."[15] Furthermore, the CPUC decision specified testing requirements for these submeters including that such testing be done at "Nationally Recognized Testing Laboratory" and that an approved list of EVSE submeters be maintained by the utilities.[16]

California's actions in the EVSE submetering space is part of its recognition of "the vital importance of national standardization in keeping equipment costs down," and noting ongoing efforts in other states to also look at alternatives to ANSI C.12 to support EV adoption.[17] Ensuring that demand is accurately measured is important

12 See, Brad Kelechava, ANSI C12.20-2015 – Electricity Meters – 0.1, 0.2, and 0.5 Accuracy Classes, May 8, 2017, https://blog.ansi.org/2017/05/ansi-c1220-2015-electricity-meters-accuracy-classes/.

13 https://www.nist.gov/pml/weights-and-measures/publications/nist-handbooks/handbook-44-current-edition

14 Public Utilities Commission of the State of California, *Order Instituting Rulemaking to Continue the Development of Rates and Infrastructure for Vehicle Electrification*, D.22-08-024, August 5, 2022, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M496/K419/496419890.PDF.

15 *Id.* at 15.

16 *Id.* at 16-17.

17 *Id.* at 15.

to generate an accurate bill, however, as states are examining, certain use cases may not require adherence to historically applied standards but that other industry standards may work. As the CPUC notes, "Submetering accuracy standards of 2 percent in the field and 1 percent in the laboratory would provide accurate billing and transparency and would lead to lower hardware costs compared to other options considered."[18]

Examples of Regulatory Action

Several states have taken action to consider interoperability in the development of their EV policy development, including California, Connecticut, New York, and Washington.

California

California has been at the forefront of developing EV and EVSE policies, including the development of standards to support interoperability such as EV plug, communication, and billing standards. OpenADR, which is an identified standard, is used to send pricing for demand response and other grid signals to EVSEs and directs that equipment to respond to those signals. A key consideration for California in their focus on standards and interoperability is their role to support market growth for EVs to achieve state policy.

The Air Resources Board (ARB) released its final rules for EVSEs in 2020, establishing labeling, payment, network roaming, and reporting standards.[19] Included in their rulemaking is a list of requirements for public Level 2 and DC Fast Charging equipment installed in California and a set of test procedures for EVSEs to implement the California Open Charge Point Interface profile.[20]

Certain chargers installed using public funds through the California Energy Commission[21] or ratepayer funds authorized by the CPUC[22] are subject to minimum interoperability requirements. Requirements include the use of standardized connectors such as J1772 or CCS, ISO 15118 capability, and compliance with OCPP.

In an August 2022 decision, the CPUC adopted EVSE communication protocols informed by prior work done at the CPUC, as well as at ARB and CEC which "promote interoperability and open standards."[23] Specifically, the CPUC ordered:

1. All AC-conductive EVSE deployed on or after July 1, 2023, for light-duty use cases in ratepayer-funded, or utility-administered, behind-the-meter transportation electrification infrastructure programs must be equipped with an SAE J1772 connector;
2. All DC-conductive EVSE deployed on or after July 1, 2023, for light-duty use cases in ratepayer-funded, or utility-administered, behind-the-meter transportation electrification infrastructure programs must be equipped with a CCS connector;
3. All ratepayer-funded, or utility-administered, behind-the-meter transportation electrification infrastructure programs implemented on or after July 1, 2023, communications and controls between a network service provider and the EVSE shall be capable of operating on OCA OCPP 1.6 or later, and similar communication standards may be implemented in addition to OCPP; and

continued

18 *Id.* at 38, Finding of Fact 10.

19 California Air Resources Board, Attachment A: Final Regulation Order, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/evse2019/fro.pdf.

20 California Air Resources Board, California Open Charge Point Interface Test Procedures for Networked Electric Vehicle Service Equipment for Level 2 and Direct Current Fast Charge Classes, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/evse2019/attbtestprocedure.pdf.

21 EnergIIZE Commercial Vehicles, https://www.energiize.org/irc.

22 Public Utilities Commission of the State of California, *Resolution E-5175, Southern California Edison Requests Approval to Authorize the Processes for Qualifying Electric Vehicle Supply Equipment (EVSE) Under the Charge Ready 2 Program's Site-Host and Utility-Ownership Models*, November 18, 2021, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M414/K980/414980923.PDF.

23 D.22-08-024 at 39, Finding of Fact 26.

4. All EVSE deployed on or after July 1, 2023, for ratepayer-funded, or utility-administered, behind-the-meter transportation electrification infrastructure programs must be ISO 15118 ready. ISO 15118-ready chargers are equipped with onboard hardware that enable high-level communications with the vehicle using ISO 15118. An ISO 15118-ready charger is capable of, at minimum, the following: a) powerline carrier based high-level communications as specified in ISO 15118-3; b) secure management and storage of keys and certificates; c) Transport Layer Security (TLS) version 1.2, with additional support for TLS 1.3 or subsequent versions recommended to prepare for future updates to the ISO 15118 standard; d) receiving remote updates to activate or enable ISO 15118 use cases; e) connecting to a back-end network; and f) selecting the appropriate communication protocol used by the vehicle.[24]

Connecticut

In 2021, the Connecticut Public Utilities Regulatory Authority (PURA) completed a month-long working group process to identify the role of interoperability in supporting EV development policies in the state, and specifically explored how interoperability can help the development of a utility-led program to fund EV infrastructure. The EVSE interoperability workshop sessions investigated interoperability as it relates to open access, payment methods, and charger to network, network to network, and vehicle to network communications to inform baseline standards and protocols for EV charging stations that utilities were to incorporate into procurement specifications under an RFP.[25] This effort was initiated as PURA recognized "the statewide deployment of EV charging infrastructure poses numerous interoperability considerations that require further examination."[26] A summary of stakeholder comments and recommendations is available in the docket.[27]

New York

As part of its overarching EV investigation, the New York Public Service Commission (PSC) created a technical standards working group that was tasked with considering how to incorporate emerging technical standards and best practices.[28] This working group was formed to allow the New York PSC to gather more experience with specific technical standards before the New York PSC would incorporate specific language into other programs or adopt specific standards.[29] The technical standards working group is ongoing, and is intended to inform the mid-point review of the Make-Ready Program, which will begin no later than October 2022. Staff anticipates that meetings will increase in frequency in the run-up to the review. Department of Public Service staff shared goals and standards of initial interest in a previous meeting and the working group will likely identify specific standards that are advanced enough to modify the eligibility requirements for the make-ready program in 2022.

Washington

A 2021 law was passed directing the Washington State Department of Agriculture to initiate a process to establish requirements for EVSEs to consider non-proprietary interoperability standards for Level 2 and DC Fast Charging. The Department's process is leading to the issuance of a final rule to govern the interoperability requirements for EVSEs that operate in the state of Washington. This work is still active.[30]

---

24 *Id.* at 29.

25 *PURA Investigation into Distribution System Planning of the Electric Distribution Companies – Zero Emission Vehicles*, Decision, Docket No. 17-12-03RE04 at 37 (July 14, 2021), http://www.dpuc.state.ct.us/2nddockcurr.nsf/8e6fc37a54110e3e852576190052b64d/eb6c28c81c508b208525875200799494/$FILE/171203RE04-071421.pdf.

26 *PURA Investigation into Distribution System Planning of the Electric Distribution Companies – Zero Emission Vehicles*, Decision, Docket No. 17-12-03RE04 at 37 (July 14, 2021), http://www.dpuc.state.ct.us/2nddockcurr.nsf/8e6fc37a54110e3e852576190052b64d/eb6c28c81c508b208525875200799494/$FILE/171203RE04-071421.pdf.

27 Working group report available at: http://www.dpuc.state.ct.us/dockcurr.nsf/8e6fc37a54110e3e852576190052b64d/efc86a82714dbf5785258764005b3409/$FILE/NARUC%20CT%20Case%20Study%20on%20EV%20Interoperability-submission.pdf

28 *Proceeding on Motion of the Commission Regarding Electric Vehicle Supply Equipment and Infrastructure*, Notice Announcing Technical Standards Working Group, Case 18-E-0138 (October 5, 2020).

29 Proceeding on Motion of the Commission Regarding Electric Vehicle Supply Equipment and Infrastructure, Order Establishing Electric Vehicle Infrastructure Make-Ready Program and Other Programs, Case 18-E-0138, at 111 (July 16, 2020).

30 Washington State Department of Agriculture, Chapter 16-662, Weights & Measures - Electric Vehicle Supply Equipment, https://agr.wa.gov/services/rulemaking/wac-16-662-electric-vehicle-supply-equipment

continued

Observations Across Commissions

Commissions are increasingly being asked to review and approve EVSE investments. A utility regulator may confront the question of whether it is appropriate for ratepayer funds to be used for proprietary, non-public infrastructure which limits users only to those products of a single manufacturer. If the regulator is not considering interoperability in its program review or review of utility costs, then it runs the risk of not having an interoperable EV/EVSE ecosystem. In reviewing these actions, there are some commonalities and differences across the efforts:

1. Payment Methods

A common question raised in these examples is how the customer should pay for the charging time. For example, both Connecticut and Washington identified specific components to support customers' ability to pay for EVSE usage. In Washington's draft rule, it would require that the EVSE have at least one payment method by credit card "by use of the card number, magnetic strip, or EMV chip."[31] Connecticut also requires that EVSEs provide multiple payment mechanisms to be eligible for funding under the utility program.[32] With the development of chip technology embedded in credit cards, as well as RFID cards and paying via cell phones, a question that is raised is whether EVSEs should only accept chip/RFID-based "touch-and-go" interfaces or whether the EVSE should also include a magnetic stripe swipe reader. For projects funded under the National Electric Vehicle Infrastructure formula program, the proposed rules issued by the U.S. Department of Transportation require that charging stations provide for "secure payment methods, accessible to persons with disabilities, which at a minimum shall include a contactless payment method that accepts major debit and credit cards, and Plug and Charge payment capabilities using the ISO 15118 standard."[33] Credit card payments via app are another option for consideration. It is worth noting, however, that including multiple credit card payment mechanisms may increase the cost of the EVSE and result in higher maintenance costs.

2. Communications with the EVSE

Each state recognizes the importance of communicating with the EVSE, but this also highlights the nascent stage of EV adoption and EVSE implementation across the United States. It is certainly important for the EVSE to communicate with the vehicle as well as with the utility. Emerging standards, such as ISO 15118, are still being developed to support this important interface, but as of April 2022, robust testing and certification methodologies remain to be finalized and adopted for the U.S. market. This gap means that relevant standards are not yet mature enough for widespread adoption and implementation. As such, it is important for each state to recognize the penetration level of EVs in its jurisdiction as that will help determine when it is important to act in adopting standards.

3. Proprietary vs Open Standards

In these state conversations, each state will navigate existing and widespread private charging networks tied to a specific vehicle compared to open, public, non-proprietary EVSEs for all other EVs. A state may decide that its jurisdiction only applies to public, non-proprietary equipment and installations thereby leaving private networks outside of the rules. Additionally, to the extent a state implements specific incentive programs, such as managed charging programs or rebate programs, a state would need to determine whether private networks should be eligible for such funding.

4. Which Agency is Leading

Whereas the utility regulator oversees the utility's programs and rates, certain EVSE requirements may be determined by a different state agency. There may be several different state agencies that play a role in addressing standards and interoperability in a jurisdiction.

---

31 Washington State Department of Agriculture, Draft EVSE Regulations, WAC 16-662-210, https://cms.agr.wa.gov/WSDAKentico/Documents/AdminRegs/Rule%20Making/EVSE%20Stakeholder%20Input/EVSE-2nd-version-Draft-Rule-Language-Jan202022.pdf

32 PURA Interim Decision at 37.

33 Federal Highway Administration, Proposed Rule: National Electric Vehicle Infrastructure Formula Program, *Federal Register*, June 22, 2022, https://www.federalregister.gov/documents/2022/06/22/2022-12704/national-electric-vehicle-infrastructure-formula-program.

- For example, in California, CPUC, ARB, CEC, and CDFA all have generated rules and policies related to standards, such as communication and metering.
- In Washington, the Department of Agriculture is the lead agency developing specific rules.
- In many states, the responsibility for ensuring that gas pumps are accurate is held by an agency responsible for weights and measures, such as a division or office of weights and measures. To the extent that EVSEs fall within that statutory structure, some interoperability requirements may be developed by such an agency; however, in other states, the weights and measures agency is the utility regulator (e.g., Oklahoma Corporation Commission).

Resources for More Information

Avi Gopstein, Cuong Nguyen, Cheyney O'Fallon, Nelson Hastings, David Wollman, National Institute of Standards and Technology (February 2021). *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 4.0 at 3*, https://doi.org/10.6028/NIST.SP.1108r4.

Cuong Nguyen, National Institute of Standards and Technology (July 9, 2018). *Overview of Cast Study and Interoperability Profile*, https://www.nist.gov/system/files/documents/2018/08/06/case_study_interoperability_profile.pdf.

Smart Electric Power Alliance (June 2022). I*nteroperability Profile for Electric Vehicle Fleet Managed Charging: Utilizing IEEE 2030.5-2018*, https://sepapower.org/resource/interoperability-profile-for-electric-vehicle-fleet-managed-charging/.

ChargePoint, (May 14, 2019). *Practical Considerations for Implementation and Scaling ISO 15118 into a Secure EV Charging Ecosystem*, https://www.chargepoint.com/files/15118whitepaper.pdf.

ENERGY STAR (April 2022). Electric Vehicle Supply Equipment Version 1.1,

https://www.energystar.gov/products/spec/electric_vehicle_supply_equipment_version_1_1_pd

Federal Highway Administration (June 22, 2022). *Federal Register: Proposed Rule: National Electric Vehicle Infrastructure Formula Program*, https://www.federalregister.gov/documents/2022/06/22/2022-12704/national-electric-vehicle-infrastructure-formula-program.

NARUC
National Association of Regulatory Utility Commissioners

1101 Vermont Ave, NW • Suite 200 • Washington, DC 20005
www.naruc.org • (202) 898-2200