

August 15th Workshop on EVSE Interoperability

Introductory Comments

Leslie Baroody (California Energy Commission [CEC])
Elise Keddie (California Air Resources Board [ARB])
Commissioner Janea Scott (CEC)
Randall Winston (Governor's Office)

First Presentations

Richard Lowenthal (Chargepoint)

- Membership-based charging networks offer several traits that cannot be achieved with pay-as-you-go charging. Among these: (1) the ability to make advance reservations for charging stations; (2) authentication of identity at private chargers (e.g. workplace chargers); (3) drivers' remote monitoring of their charging via smart phone; (4) fewer credit card swipes and thus fewer credit card fees.
- Open Charge Point Protocol (OCPP) and network interoperability are two different things, but both are important. OCPP helps station owners by ensuring that electric vehicle service equipment (EVSE) hardware can use a variety of software. Network interoperability helps drivers by ensuring that they can use any participating EVSE using their existing membership account.
- ChargePoint seeks funding from the CEC to expand Collaboratev, a clearinghouse for EVSE networks, as a way of supporting network interoperability. The funding would total approximately \$390,000, with 50 percent match.

Jason Wolfe (Collaboratev)

- Main focus should be how EV drivers can access all available chargers, locate them and charge their vehicles. Providing simplicity for the EV driver by letting the driver choose the network and mobile app they would like to use.
- Having a central database is a critical element in authenticating and authorizing drivers to charge. Provide the ability to verify the data in real-time and collect charge spot data.
- Ecotality and ChargePoint both support broader use of Collaboratev. Together, they represent 80 percent of California EVSE, but a real solution will need to include all players. Every EVSE provider wants to move beyond the problem of roaming, but no one can (and wants to) do it alone.
- For future EVSE funding solicitations, don't restrict network interoperability options. Rather, in the near-term, California should focus on efforts to address the roaming problem via direct funding support.

Brett Hauser (Greenlots)

- Proprietary networks and technology pose the risk of stranded assets. With vendor lock in, site hosts can't switch networks since they have proprietary protocol. Want to avoid using additional funding to replace possibly stranded assets. Situation already exists, and one way to avoid this is to use open standards.

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- Subscription models can be limited as they require users to sign up ahead of time and may require roaming fees, increasing costs to consumers. We need to appreciate what consumers might prefer, such as a simpler credit card model.
- OCPP is a desirable open standard, given that it has no royalty fees, it is already mandated in the European Union, and it has already been adopted by several EVSE providers.
- A single clearinghouse for EVSE networks entails some risks. What if the clearinghouse goes under financially, or if it goes down temporarily?

Cal Lankton (ABB)

- ABB is a global manufacturer of electronics equipment with EV charging a small component of the business. Focus on connection of hardware and network. Provide charger manufacturer functionality.
- Royalty free Application Program Interface (API) available via the internet. Meets global and relevant ISO standards for security. Needs to be more secure than a credit card transaction, which is what OCPP currently offer.
- Push for open standards ultimately benefit the consumer. OCPP benefits the station owner, and ultimately trickles down to the consumer. Increased choice at station owner level can drive down costs. More open standards in general are a good solution. Agree that State does have a role in mandating use of OCPP in the future.

Rajit Gadh (UCLA Smart Grid Research)

- OCPP is one standard to support, but there are other standards available. Need to look at where technology will be in five to ten years. For example, Wi-Fi from ten years ago would cost thousands to put in place, but today can be put in affordably.
- Need to look at interoperability at the following levels: mobile applications, communications, data gathering, hardware power systems, parking garages, architecture, and infrastructure. Still in the early stages, so some research and demonstrations are needed.
- More technology can be brought to the table giving the opportunity to innovate new ways to encourage interoperability through research and demonstrations.

David Peterson (Nissan)

- Focus is on dealer, community, and workplace charging. Want to increase the range confidence with EV drivers. Benefits of interoperability include competition amongst EVSPs, improved product offering, and lower costs.
- Would like to see more point-of-sale device flexibility and increase in product diversity. Drivers have to carry multiple RFID (Radio Frequency Identification) cards to be able to charge at different charging stations. Have to think about stakeholder and consumer needs.

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- In the long-term, there needs to be a low cost for switching EVSE networks, as well as competition to attract and retain both drivers and site hosts.
- There are currently site hosts with multiple networks. Mandating site hosts to stay with one network poses the problem of bearing costs to upgrade legacy EVSEs. EV drivers should not have to bear any of these costs. Important to not lock into one solution preventing the industry from providing the best charging experience.

First Q&A Session (Abridged)

Richard Lowenthal

- 97 percent of charger transactions have been via RFID, even though consumers have the option of using credit cards or cell phone accounts.

Brett Hauser

- No costs or fees for using OCPP technology. The EVSE network provider will be able to set their own pricing policies. If the site owner doesn't care for those policies, you can switch to another and leave the station intact.

Paul Stith (Plug-in America)

- Does ChargePoint have any OCPP compatible stations in the California market?
 - Richard Lowenthal: Not yet in California, but in Europe. Current OCPP Version 1.2 doesn't support all services that can be offered to drivers.

Bill Boyce (Sacramento Municipal Utility District)

- Point-of-sale transactions are familiar to customers that aren't early adopters, in a way that RFID cards aren't. What can be done to make the latter more convenient and comfortable for customers?
 - David Peterson: Flexibility should be built in, especially when it comes to different charging contexts (e.g. workplace).
 - Richard Lowenthal: Drivers need to feel more connected to their charging experience compared to gasoline refueling, which is why anonymous credit card transactions aren't as preferable for the consumer. Additionally, credit card transaction costs can eat into a thin revenue margin (maybe \$250).

Second Presentations

Mike Tinskey (Ford Motor Company)

- Focus to keep costs down so consumers are willing to charge at a charging station than fuel at a gas station. Support for public infrastructure. Encourage all installation infrastructures to be connected. Have to have network capability to have more interoperability.
- MyFordMobile app allows customers to map their trip and see available chargers along the path. Bearing the costs to integrate stations into their apps with multiple APIs. Propose PlugShare, an existing aggregator, to be able to use only one API on their vehicles.

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- One aggregated application programming interface (API) from multiple network operators can allow for avoiding a duplication of efforts among automakers.
- Dynamic data should be provided to all automakers at no cost to increase public station convenience charging (and thereby increase electric miles driven).

Matt Zerega (San Diego Gas & Electric [SDG&E])

- Future stations should allow for billing without membership or subscription requirements, and allow for locating and reserving a charging space. They should also be able to change networks without having to replace or retrofit EVSE.
- Cash or credit card payment should be acceptable as forms of point-of-sale payment. Transaction costs of 1.5% to 2% plus \$0.10 to \$0.20 are common. Card readers cost \$25-\$35 per month to rent or as little as \$10 to purchase outright. Should also require point-of-sale to display total charges before charging PEVs.
- There are currently 6,331 publicly available stations in the US, according to the US Department of Energy (DOE) website. The DOE makes location data and interaction with the system available. Anyone can use that data, so there's potential interoperability here. Need to fully consider existing methods we already have in place and see if we can leverage current DOE-sponsored EVSE location systems before developing new ones.
- The price must be shown to the customer prior to charging.

Data from chargers should be published with all raw data in a standardized format, but without any individual identifiable information about PEV drivers.

- Some questions remain regarding reservations, including:
 - Which reservation methods are workable and equitable?
 - Will non-urgent reservations take precedent over urgent unplanned needs?
 - How will reservations be enforced?

Adam Langton (California Public Utilities Commission [CPUC])

- Three categories of charging interoperability identified: (1) vehicle interoperability with different coupler standards for charging; (2) software interoperability with different types of software can be used with different types of hardware and vice versa; (3) billing interoperability with different payment methods and roaming. There should be a fourth category for communication we want to enable between the different entities involved.
- NRG settlement did address interoperability; however, these requirements were specific to the settlement, and don't represent official policy. Among other things, credit card swipes would be required.
- Need to determine where a standard is needed, and where interoperability is needed. Could dictate a standard, but want to avoid a "California-only" standard, as it could become outdated only to be replaced with a new national standard. When there are multiple standards, avoid picking one until there is market consensus.

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Paul Stith (Plug-in America)

- SB454 would give EV drivers open access to charging. This will help to accomplish a lot of the goals of the ZEV Action Plan from the driver's point of view. The State should have a role in encouraging data access. No matter who has the data, need to know where the stations are and if they are available. Mapping and driver locations are important, but open access is the number one priority.
- Consumers are thinking about how much it costs to get home and get to work. Home charging is the easiest and most economical choice. However, infrastructure options reduce risk of PEV ownership. Having workplace charging will enable more electric vehicle miles, especially for Multi-Unit Dwelling (MUD) drivers who may not have access to a garage or charge port.
- Small/medium businesses face the costs of workplace charging. Would encourage new commutes using all electric, however the success of Level 2 chargers may lead to oversubscription causing anxiety and arguments at work over parking spaces.
- Business models will evolve to meet drivers' needs, and we don't need to pick winners. Driver feedback suggests it is too early for the state to invest in the rollout of roaming network solutions.

John Halliwell (Electric Power Research Institute [EPRI])

- The key interfaces for public charging: (1) consumer interface that authenticates the user and enables payment information; (2) network interface that exchanges the data between the charging station and network operator; (3) inter-network interface; (4) real-time information that enables mapping applications and station reservations.
- Need to consider if all public EVSEs need to be on a network. With proprietary networks, site hosts are limited to choice of equipment. Installed charge stations are locked to only those networks they can support. Linking networks would allow consumers to roam across networks, and not need multiple accounts with different network providers. Hawaii's experience highlights the dilemmas that can result.
- If a collaboration site (like Collaboratev) is going to be used by some, it should be used by all in the future. It can be very useful in centralizing and distributing live data, such as reservations or station status.
- Collaboratev (or other collaboration site) can help connect cars to chargers, connect network service providers, and connect network service providers to mapping and real time data.

Second Q&A Session (Abridged)

Various, on EVSE Cost

- Matt Zerega: Our workplace chargers cost \$500 from EVSE provider.
- Paul Stith: Sub-\$500 EVSEs are indeed here. They are Level 2; but, you may get 5 KW.

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- Mike Tinskey: Agreed that EVSE prices are dropping, but installing a second meter can still be cost prohibitive.

Network Needs

- Adam Langton: There are still questions about whether the charging station will communicate with the utility directly, or if it will do so via a network. Until this is fleshed out in the market, it might be unwise to mandate a standard.
- Jason Wolf: Can we not trust site owners to make decisions about providers, in regard to proprietary networks?
- John Halliwell: Bottom line is, we need site hosts to understand that there are consequences to choosing a network. Open protocols can mitigate this to some extent.

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Panel #1

Roaming and Network Interoperability Standards

Richard Lowenthal:

- ChargePoint at its current position is better off without roaming because it will force customers to go to them.
- Restricting proprietary networks as a means of avoiding vendor lock-in will have broad negative consequences, as this would eliminate a major business model. It's too early to pick a winner.
- Fully embrace that drivers should be able to charge everywhere, have clear pricing, and find station locations.
- Need encouragement if this is going to be the State's requirement. Hard to justify spending money on something that encourages current customers to use other people's equipment.
- SB 454 will eventually mandate this, but state funds would be helpful in accelerating and expediting it. State funding should be competitive.
- ANSI, on behalf of NEMA, is developing interoperability standards pertaining to several parts of EVSE. These standards are about $\frac{3}{4}$ completed. Collaboratev is building toward these standards.

Bill Kramer (NREL):

- Issues exist between charging stations and vehicles, sometimes to how the charger is going to be controlled.
- Want to increase penetration of PEVs/BEVs, but want to avoid a situation where a station goes bankrupt, and now EV drivers can't get to their destinations.
- Need a better definition of interoperability.

Brett Hauser:

- Two areas defined where interoperability is important: (1) roaming interoperability, (2) network interoperability. Want to enable people to upgrade or change networks.
- Don't have to change consumer behavior on how they purchase items, allow credit card use to continue.
- Concurs with Richard Lowenthal on the potential danger of restricting proprietary networks.

Jordan Ramer:

- State's role to figure out how to improve/maximize (ROI) for both the site owner and driver.

Bill Kramer:

- Interoperability is an issue, but priority should be to put more EVSEs on the road.

Risk of Stranded Assets

Paul Stith:

- If SB 454 goes through, drivers are able to charge without regard to which network they subscribe to.
- Will it make sense to require interoperability moving forward in terms of roaming? Have to consider if a station is down, driver should still be able to charge.

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- Also look at mapping capabilities that can be solved with software sooner. Make more data sets available to the State to understand planning infrastructure and behavior, to solve issues according to the market.
- The state should prioritize charging anywhere, anytime. Data sets and mapping capabilities are also important. After that, consider whether requiring interoperability still makes sense.

Jason Wolf:

- If limited to one type of requirement, will stop some types of innovations. May be too early to decide if it is a necessity to stop at one type of model.

Richard Lowenthal:

- In response to Leslie Baroody's question – If the State required all State funded EVSEs to not allow for vendor lock-in, would there be any consequences?
 - Since interoperability standards do not exist today that allows people to charge for charging, 30% of customers who charge money for charging couldn't do it. This would eliminate a business model.
 - Mandates that restrict the business model would eliminate a lot of customers from the EVSE market. Need to be cautious about mandates.

Brett Hauser:

- Will site host have the ability to pick a new network management solution or functionality? Or, are they locked in? This can put all involved stakeholders at risk, as suggested by the recent experience of Better Place and Ecotality.

Jason Wolf:

- If we're limited to one type of requirement, this will stop some types of innovations. Is there a necessity now to stop one type of model, or too early to decide?
- In Ecotality's case, there is nothing yet definitive regarding stranded assets. In the case of Better Place, a new private operator purchased the assets with the intent to replace the stations on its own, without further public money.

Matt Zerega:

- Open source doesn't mean least-cost alternative. Keep in mind that, even if a charging station needs to be replaced, the circuits and installation are still there. This means that about two-thirds of the asset's value can't actually be "stranded."
- State's priority should be focused on outcomes, not requirements for specific standards, business models, or specifications.

Jordan Ramer:

- Important for Commission to understand competition in the market when releasing solicitations. Open and flexible to how interoperability will be defined.

Criteria for future State EVSE solicitations require with regard to EVSE interoperability?

Rajit Gadh:

- Interoperability itself needs a clear definition. Still in the early stages of technology, so need plenty of scope for people to innovate. There should be room for new ideas and technology.

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- Encourage creative innovation in this early stage.
- Avoid being too prescriptive in solicitation requirements.

Richard Lowenthal:

- Address roaming issue today in the early stages, before more stranded assets become an issue. May not be the biggest issue on the list, but should still be addressed sooner.

Abdellah Cherkaoui:

- Interoperability might be key, but our first priority should be to get more infrastructure deployed.
- EV drivers demand more charging infrastructure, and having more charging infrastructure necessitates openness to multiple business models.

Other Comments

Matt Zerega:

- Risk of focusing on methods as opposed to outcomes. Don't overly focus on specific standards, business models, specifications, etc.

Mike Tinskey:

- Automakers shouldn't have to pay for data, since they are referring customers to the chargers. As an automotive manufacturer, concerned with be able to find public charging stations.

Richard Lowenthal:

- Big piece of the Triangle is home charging, but many EV owners don't own a garage. EVSEs for Multi-unit dwellings (MUDs) becoming a significant problem. Could use the State's help on this market.

Bill Kramer:

- Need proper data to help with infrastructure planning. Want to extend range of EVs. Data sets can be pooled together to help put together a clear plan in terms of siting and where infrastructure needs to be placed.

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Panel #2

Advantages/Disadvantages of Hardware Interoperability

Brett Hauser:

- Disadvantages including the risk, functionality that proprietary standards has, not all customers will get that functionality until brought into open protocol.

Rajit Gadh:

- Advantages include price of products coming down, quality of technology due to competition, and when things become standardized, volume of product goes up.
- Disadvantages would be to put constraints in the early stages could stop innovation.
- Suggests inviting venture capitalists to participate in the discussion. Government shouldn't have to take the entire financial burden, and share some of the risks with venture capitalists.

Overlapping Issues with Network and Hardware Interoperability

Bill Kramer:

- Hardware interoperability goes past the charger, includes regulations for just charging the vehicles, for vehicle to grid, voltage or frequency regulations.
- Want to increase penetration of EVs on the grid. Quite a bit of research and work done in this area.
- When using public money to put towards public charging, there should be a simple way to replace the charger with something new. Also need some sort of physical hardware standards, but don't keep them so open that it's not safe.

Rajit Gadh:

- With hardware interoperability, we barely understand charging stations.
- There is no clear consensus of what interoperability means. More investigations needed at the hardware level before starting to box in on the innovations. Charging station technology is still behind.

Rajit Gadh:

- The number of available EVs on the market has tripled since a year ago. New EVs are more efficient, innovating at a rapid rate on their own. We want more charging stations that are faster, better, cheaper, and interoperable so they work with the cars.

Cal Langton:

- Industry shakeups are still happening and will continue to happen. If we want to enhance competition and future value, need to provide the openness in the networks.

Rajit Gadh:

- Owns both Apple and Android products and use simultaneously. Apple is completely closed, and Android is open. Have to keep in mind that these are both very innovative.

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Other Comments

Jennifer Allen:

- Lots of things to consider when putting together a solicitation. There are things that drive needs for EV charging other than just interoperability.
- At this point, is it too early to be adding interoperability to solicitations? Is this something that we should even be considering at this time today? The answer may be different in six months, but for right now, is it time to start putting it in or too early to even consider?

Brett Hauser:

- Yes, it's too early. There is still a lot of innovation ahead. Need flexibility to innovate. As the business evolves, site hosts need to be able to change.
- If initiative is not taken now to give them that flexibility, need to know today that these charging infrastructures will still be good 5 to 10 years from now.

Jennifer Allen:

- Certain things in interoperability we know we have to do. Need some basic things in order to make them usable.
- We can't predict what automakers are going to be making. We heard let the market decide while everything is "up in the air" or add in a little requirement so that there are not stranded assets in the future. Do we need to worry about those things that are "up in the air" in our solicitations?

Jason Wolf:

- In the past, invested in multiple items without knowing they were going to be the best choice. There are risks, but also rushing into something can create more problems. Can't mandate OCPP and roaming in solicitations yet, but shouldn't stop soliciting for these areas.

Bill Kramer:

- In the development of any standard, sometimes lose sight of process. It's the process of developing standards that brings people of different companies, education, disciplines an opportunity to stay current. It takes time to develop a standard, but don't slow down for innovation.

Craig Childers:

- To EVSPs, with OCPP and all other standards, they eventually evolve. Would solve the problem to make them universally applicable if something with wrong with a particular proprietary entity.
- "Couldn't we require just the ability to operate in a basic OCPP mode and allow for innovation in a separate mode, but that it reverts?"
- Solicitation that may require ability to run proprietary on top, but has to be able to revert to OCPP.