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Utility Electric Vehicle Infrastructure End-Goal — Industrial Sustainability

White Paper

According to new research by Accenture, electric vehicles (EVs) will create a two trillion dollar opportunity for utilities. Utilities stand to make significant competitive gains by bundling services for EV owners, and they are building out infrastructure to charge EVs and encourage the adoption of EVs[1]. Now that utilities have some years of experience with EV infrastructure buildouts and turnkey networks, utilities are discovering unexpected limitations. In early pilots and initial deployments of infrastructure programs some of the challenges introduced included proprietary charging hardware and software, lack of scalability, and the associated binding contracts. Those disadvantages are causing a reevaluation of stakeholder needs and shift toward sustainable industry practices. The new goal for utilities, and any new infrastructure buildout, should be rapid but sustainable growth of an industry that benefits both rate payers and the broader society.

The key to sustainable industry growth is a value-to-cost ratio of greater than one. This may be a somewhat subjective measurement, but consumers are the bellwether of sustainability. Consumer behavior is an indicator of whether or not that value is equal to or greater than cost. When consumer-perceived value becomes more attractive, adoption of EVs increases along with the construction of supporting infrastructure and services. Consumers perceive value in an array of purchased features. The value of the hardware is not just servicing a vehicle that will benefit the environment, a vehicle with reduced maintenance costs, a vehicle on the cutting edge of technology, but also a vehicle that comes with lower energy and fuel costs. When value is greater than cost, consumers are more willing to pay higher EV upfront costs while saving over the life of the vehicle. Consumers also perceive greater value in the more intangible advantages of clean air and reduced environmental impact. For utilities, the value proposition is a substantial improvement of three of their major challenges: slowing load growth, customer engagement, and the uptick of distributed energy resources.[2]

What forces prevent the industry from growing sustainably?

Stumbling blocks. Major stumbling blocks to sustainability are: One, lack of standardization, specifically for the purposes of enabling interoperability and scalability; Two, middlemen adding cost to the buildout; and Three, A lack of deployed smart infrastructure.

Lack of standardization, interoperability, and scalability. OCPP (Open Charge Point Protocol) serves as a basis for enabling functions, such as authorization, payment, and load management in EV charging applications. When equipment is selected that is not based on OCPP, several issues become apparent, like lack of scalability of infrastructure and interoperability of all chargers. An extra effort on the firmware design or an adapter to the software backend may be required when challenged with interoperability in equipment or backends which have not been verified to work with at least two independent technology providers.

Having open standards offers several benefits for both the utility and the end-user. Interoperability is a prime example, that allows information to be shared among a variety of devices and software. Communication standards can be replicated across equipment to prevent obsolescence, security can be replicated and made uniform across a large customer base to prevent malware and viral attacks, and anything less may not be certified. Open standards ensure scalability and interoperability with other hardware and software, and the highest equipment utilization, which lowers cost and increases value. Critically, open standards make the infrastructure future-proof and vendor agnostic – if customers don't have a choice, will suppliers have the customer's best interest in mind?

Open standards, interoperability, and scalability encourage competition, reduce costs, and increase the value proposition for both utilities and end-user customer's. See chart below.

Siemens Supporting a Hardware and Software Ecosystem and EV Adoption[3]

Proprietary protocols. One example of proprietary technology in the EV market is Tesla. Tesla's battery management systems, patents, and proprietary plugs are unlikely to be adopted industry wide. Their networks can only be used by Tesla owners—the network is owned and controlled only by Tesla. Today Tesla uses a proprietary charging plug, so vehicles with different plugs cannot use a Tesla-specific, level two or three

	Hardware/software	Supporting open standards	Proprietary networks
Interoperability and scalability	L1, L2, L3 chargers for light, medium, heavy duty vehicles, and off-road solutions	• Meeting a wide range of vehicle charging needs, Siemens hardware works seamlessly with any other OCPP compatible hardware/software; consequently, encouraging competition, driving Total Cost of Ownership down, and supporting EV adoption.	Lack of interoperability and scalability: • Creates barriers to competition and works to keep Total Cost of Ownership high, discouraging EV adoption. • Adds a greater risk of stranded assets.
Easy to operate UI	Standardization of UIs	• Intuitive, easy to operate UIs that can accommodate RFIDs & charge card readers.	• Proprietary networks present the customer with a variety of UIs to learn each time they charge with a different network, and typically do not accommodate charge card readers.
Savings	Delay, pause, stop functions	• Off-peak charging savings through a billing-accurate submeter by setting delays.	• Back-end system integration is unique each time increasing customer cost.
Communications, software compatibility, and network	Control the charger by using a Smart-Phone with either iOS or Android System	• Communications capabilities • Network provider can be easily changed to any other OCPP compliant network. • Meter IT integration into backend systems, customers can control and access their systems.	• A separate application and account must be kept on a customer's SmartPhone for each network utilized. • Network provider is difficult to change due to hardware incompatibility and contracts.
Software and hardware security	Communications and software standards are rigorously maintained in a cloud network and lower risk of viruses/malware.	• Secure cloud network is maintained, and hardware can be easily locked.	• Multiple protocols require more software to adapt for connecting infrastructure, increasing risk of a security breach.
Standardization of connectors	A wide range of vehicles will have standard connectors that work with a variety of charging hardware.	• Hardware standardization will make it easier for the consumer to find a charging station.	• Proprietary networks reduce wide acceptance of EVs and increases customer range anxiety.
Authentication	OCPP 1.6, and Standard 15118 (enable authentication and billing services)	• All of Siemens hardware is focused on OCPP and will interconnect with any OCPP compliant hardware/software.	• Proprietary networks have fought against acceptance of credit card readers. • Each network requires the customers have a separate account and RFID card/key fob to charge.
Hardware operation and maintenance contracts	Network choice	• Siemens chargers are compatible with any OCPP compliant network making it easy for the owner to move to any OCPP compliant network for any reason.	• Contracts are barriers to a customer moving their account, are roadblocks to competition, and risk stranded assets for the provider.

charger. This reduces the adoption of EVs and competition. Proprietary technology is in E-Mobility market service models—there are backend operators for billing, authentication, and collecting status information who have not complied with the true interoperability that open standards offer. These aberrations allow certain hardware that are either manufactured by the same company, or hardware with a software translator installed which can communicate this proprietary protocol. Such proprietary networking protocols are neither scalable, interoperable, nor can a customer easily leave the network provider because contracts lock the customer into that network. Software that is not interoperable has a built-in lack of standardization, which increases the difficulty of moving to another vendor, as well as adding complexity and confusion to implementation. Often referred to as turnkey or simple to deploy, networks typically have control of hardware, software and, potentially, installation.

Middlemen. Whether it's installation or make-ready equipment, middlemen add cost that reduces the value proposition. The drivers of hardware costs are charging level and amperage rating, charging ports, types of mounting systems, as well as additional features, like communications, network fees, [and] access control."[4] Solution providers that can provide comprehensive Plug-to-Grid offerings can support the customer from project inception to selection of hardware, software, energy storage, all the way through the project lifecycle. Such providers, when combined with an open standards approach, also offer more attractive benefits than companies focused on a specific business model. As a partner, comprehensive solution providers can help manage cost drivers by bundling products and services, such as electrical distribution 'make-ready' hardware, chargers, energy storage, software solutions, and more. Siemens' comprehensive PlugtoGrid™ solution offers the customer savings because of established relationships with contractors who have extensive experience with Siemens' hardware for the eMobility® market. Maintenance and repair are services that can add cost and headaches to the infrastructure owner. Solution providers enable maintenance services to be provided as part of an overall package – high-quality equipment is ensured, since the service provider is the supplier of the equipment.

It is critical to have a partner with experience in "right-sizing" the hardware and software management features. The wrong charger and amperage, or too many charging ports, can create stranded or underutilized assets. The wrong features can cause customer loss or unnecessary high upfront cost. The right partner will have hardware and software knowledge and solutions combined with a demonstrated competency in guiding the customer through the myriad of decisions to create cost recovery and profit, minimizing the total cost of ownership.

Smart Infrastructure/Grid. The term "smart grid" includes ecosystems that transmit information between utilities and charging stations. This communication aids in creating additional capacity and enables consumers to manage their energy costs. The right smart grid ecosystem creates a better and more useful user experience. It also offers an opportunity to future-proof a new building, manage energy costs, and design for a customer-centric market enabling consumers to become prosumers. By adding open communications hardware, load management software, and potentially using EVs as distributed energy assets, cost savings are captured by both commercial customers and end-users. A smart grid offers customers greater control over grid management and their customers have greater control over energy costs. Whether or not utilities take advantage of the new market along with the savings,

> ...vendors of all manner of devices and services—drone deliveries to autonomous vehicles, demand management of electricity, ubiquitous public Wi-Fi stations—are going ahead with their own programs.[5]

What is needed is guidance, experience, and regulatory support. Cost must be balanced against value to create sustainable growth, but there is no "one size fits all" solution, even with open standards.

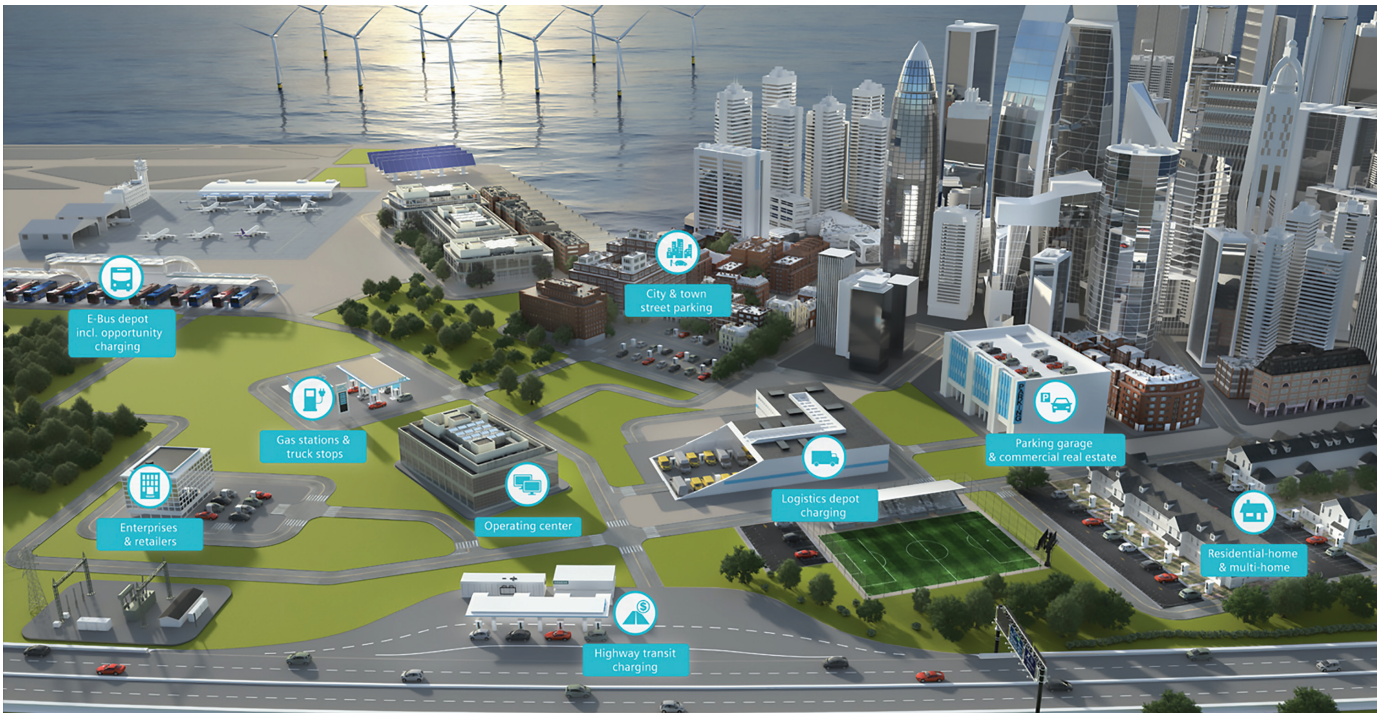
As technology improves and changes, utilities will need to respond to customer needs and wants. Companies with the value proposition of locking customers into a charging network may not be motivated to comprehensively support these investments. In short, such companies are not motivated to create a sustainable infrastructure as they drive up costs, and create inconveniences for drivers who, in today's market, are juggling accounts with every network they use to recharge.

Driving Sustainable Growth

Driving sustainable growth requires customer choice. What is needed to provide the greatest amount of choice to the customer is software and hardware interoperability to drive network, vendor, and services competition and reduce costs to the customer. The implementation of a direct OCPP connection between the charger and the backend network should always be considered in projects. Interoperability can help drive network choice and competition. When proprietary protocols are used, suppliers are not motivated to be competitive, consequently, costs do not decrease through competitive pressure.

Sustainable growth also requires cost reduction by managing network operations through centralized networking software, as well as load management to improve reliability and reduce infrastructure buildout costs. Both improve the value proposition of the investment and reduce costs.

Balancing both cost and customer choice improves the customer's experience and creates sustainability. Options to improve customer experience range from providing a variety of pricing options for customers, such as bundling services, hardware owning options, charger installation rebates, and charger software management to meet the end-customer's needs.



A turnkey infrastructure with open standards, scalability, and no proprietary hardware or software

Siemens is committed to helping drive a sustainable future. With the breadth of experience in hardware, software, and more than 165 years of electrification experience, Siemens can support a project from plug to grid, throughout any point of a project's lifecycle. All of Siemens hardware and software is built on open standards and can operate with any OCPP hardware/software. The PlugtoGrid offering includes a full spectrum of make-ready hardware, chargers from L1, L2, L3 and high-powered plug-in to high-powered pantograph solutions, energy storage, managed services, cloud monitoring and control, billing and load management, support services, and regulatory support.

Footnotes

[1] "EV Adoption to Unlock a US$2 Trillion Opportunity for Utilities," T&D World, https://www.tdworld.com/electrification/ev-adoption-unlock-us2-trillion-opportunity-utilities , (April 3, 2019)

[2] Kari Lydersen, "Study: Utilities should get in the driver's seat on electric vehicle infrastructure," Energy News Network, https://energynews.us/2017/10/27/midwest/study-utilities-should-get-in-the-drivers-seat-on-electric-vehicle-infrastructure/ (October 27, 2017).

[3] "Electric Vehicle Charging," MJB&A, https://mjbradley.com/sites/default/files/MJB%26A%20Interoperability%20Issue%20Brief%20May%202019.pdf, (May 13, 2019).

[4] "Costs Associated with Non-residential Electric Vehicle Supply," US Department of Energy, (November 2015).

[5] John Macomber, "Smart Cities are Complicated and Costly: Here's How to Build Them," Harvard Business School, https://hbswk.hbs.edu/item/smart-cities-are-complicated-and-expensive-here-s-how-to-build-them (April 4, 2018).

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