The future of EV charging lies in intelligent charging solutions, where networked chargers are linked seamlessly with the grid.

By Cal Lankton.

Electric Vehicles Are On the Move

Within a very short period of time, electric vehicles have moved from the category of curiosities, science projects and concept cars, into a fully commercialized market with an entire industry of automakers and energy giants supporting it.

The billions of investment dollars spent by so many big players makes it clear that vehicles powered by the grid will comprise a significant transportation segment that may eventually rival traditional gas combustion technology to move people and goods from city to city, in an economically viable, energy independent and sustainable way.

Recent Developments

Looking at the most recent developments in the Electric Vehicle (EV) industry, it is apparent that, despite slower than expected initial sales and questions about economic viability, this market is still gaining momentum as both supply and demand of EVs continue to rise. In the US, for 2012 alone, Nissan sold almost 10,000 all-electric Leafs, and General Motors sold over 23,000 plug-in hybrid Chevrolet Volts; for comparison, the Toyota Prius sold about 15,000 units in its first full year of availability.

Additionally, there are current and expected offerings from nearly all the major auto manufacturers, such as Ford, BMW, VW, Daimler, Mitsubishi, as well as newer entrants like Tesla Motors and Coda Automotive, many of which were featured at the 2013 Detroit Auto Show. Finally, with attractive lease pricing schemes offered by both GM and Nissan, and the recent announcement of a very significant price decrease for the 2013 Leaf, average consumers are being pulled ever closer to electric transportation affordability.

Electric vehicles may be a solution to managing our domestic energy issues, but like their foreign oil dependent siblings, they still need to refuel. As such, a whole service industry has emerged to serve the recharging needs of electric vehicle drivers. Like a new board game, this new industry has new players, a new set of rules, and a new playing field.

Thus, it is crucial that the spread of EVs and EV chargers is managed in a responsible way, to minimize impact on the electric grid, while still providing consumers with the wide array of recharging options necessary to move the market beyond the early-adopter phase. This article discusses how charging networks and their interaction with the grid are evolving, and how the first major steps now are being taken to ensure that charging network growth is managed in a manner that can be beneficial, overall, to the existing electrical grid infrastructure.
Intuitively, the EV charging value chain will make use of the existing value chain for electricity production and distribution as a foundation, but will require two new, consecutive elements: the infrastructure owner and the charging station operator. Together, these players will form a new value chain, which is highly modular and does not convey a tangible product. These new value chain elements will allow consumers to configure, instantly, how they would like their vehicle to be recharged, such as which energy source to use, which producer, which distributor, and so on.

Three Keys to EVs

To enable this rapid configuration and adapt to new and emerging business models, the future of EV charging lies in “intelligent charging solutions,” where networked chargers are linked seamlessly with the grid and the charging system operators. This shift towards intelligent and adaptable solutions is demonstrated most clearly in the ongoing market division into three key functional segments: (1) Charger Functionality, (2) Electric Grid Functionality, and (3) Consumer Functionality.

Key #1: Charger Functionality

Charger functionality consists of the physical hardware necessary to recharge the vehicle, most commonly referred to as Electric Vehicle Supply Equipment (EVSE), coupled with embedded and cloud-based software systems to manage the operation and maintenance of the local charger networks. This functionality is being served by established industrial players such as ABB, Eaton, and Schneider Electric, as well as a range of start-ups focused on the EV market.

Key #2: Grid Functionality

Grid functionality is the more traditional operation of the electric grid, including electricity supply and distribution, as well as more advanced features commonly associated with the Smart Grid, such as Demand Response and Distributed System Management. This functionality is being served by all of the key traditional players in electricity supply and demand, such as Investor-owned utilities (IOUs), and a wide array of new suppliers focused on advanced grid features and management.

Key #3: Consumer Functionality

Finally, the third key industry component is consumer functionality, or the driver’s experience. In execution, this is the newest segment of the three, leveraging current payment and subscriber management industries. However, there are new features needed that are tailored specifically for the EV industry, including detailed reporting on individual usage, location-based services, and customer reward and loyalty programs. This segment has thus far been led by new entrants like ChargePoint (formerly Coulomb Technologies) and ECOtality, but is increasingly gaining the interest of traditional players in the payment processing and subscriber functionality domains from the credit card and telecom industries.

These three segments are linked across multiple levels, but the most significant industry evolution is that these interfaces are shifting more and more to software interfaces at the remotely hosted server level, or more colloquially referred to as “the cloud.” These cloud-based interactions are thus becoming the virtual glue that hold all three elements together, and the successful players in the new market will be the ones that can leverage these distributed networks – both in

The figure above shows the collaborate energy value chain for the evolving electric vehicle charging industry.

An electric vehicle charging at an EV station in Estona, where ABB has installed 170 DC fast chargers that connect the whole nation to fast, electric fuel.
geographical and operational terms – into connected ecosystems. This connectivity is what will enable the future functionality of both the electric grid and the charger networks.

To deal specifically with the transition to cloud-based networks, a broad array of existing and emerging standards is being used. Additionally, there has been a recent shift towards adopting existing open standards, such as Auto ADR and Open ADR 2.0 for demand response, with new standards emerging specific to the EV industry, such as the Open Charge Point Protocol (OCPP), which can be used for communication between a charger network and a central control system and is already seeing widespread adoption in Europe.

As detailed above, the mutual interaction of all three segments is crucial to driving both vehicle adoption and industry innovation. Yet, the most significant recent advances are being made in the integration of charging systems with the operational grid. This shift has been precipitated by both the growing number of charging stations in operation, as well as the increased engagement of utilities and other power providers in the operation and management of charging stations.

One of the best examples of these advances is seen in the growing application of demand response technology to EV charging networks. Demand response – a mechanism to control remote loads and manage consumption at times of peak demand – has a clear application to EV charging networks, where each charger, whether residential or commercial, can be a significant load on the distribution network. A key challenge has been achieving the successful aggregation of this demand into a load large enough to make a demand response transaction commercially viable in the power markets.

**Rise of the Machine**

Fortunately, the rise of intelligent charging systems is overcoming this challenge. By connecting chargers to a central server, and subsequently connecting this server to either a utility network or a third-party hosted platform, a charger network that is geographically fragmented can be managed by one network operator with aggregated demand shared to either the IOU or Independent System Operator (ISO).

In this manner, the network operator is able to monetize the charger network through a demand response load reduction mechanism while the grid operator is able to maintain an overall view of charger-specific demand across its operating region. Many pilots are in the early stages of development and commercialization, with research institutions such as the University of Delaware; grid operators like the Hawaiian Electric Company; and even the United States military, leading the charge. This kind of mutually beneficial interaction is what will continue to break down barriers to the expansion of EV charging networks.
Conclusion

As the industry continues to evolve and the number of charging stations and their frequency of use continues to climb, the future lies in the active, responsible management of charging platforms by advanced operators. By leveraging many of the systems that have become commonly associated with the Smart Grid, along with tools specifically designed for the EV industry, major industry players hold the key to sustainable and streamlined adoption of charging infrastructure. These systems will also ensure flexibility in expanding business models, and allow the EV charging infrastructure market to go from a niche-application looked upon with caution and trepidation, to a mainstream, integral part of our transportation and power markets that can serve millions of customers, from the road to the grid.

Author Profile

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