EV and Industrial Fast Chargers Driven by Power Semiconductor Component Advancements and Outsourced Production Expertise

RichardsonRFPD
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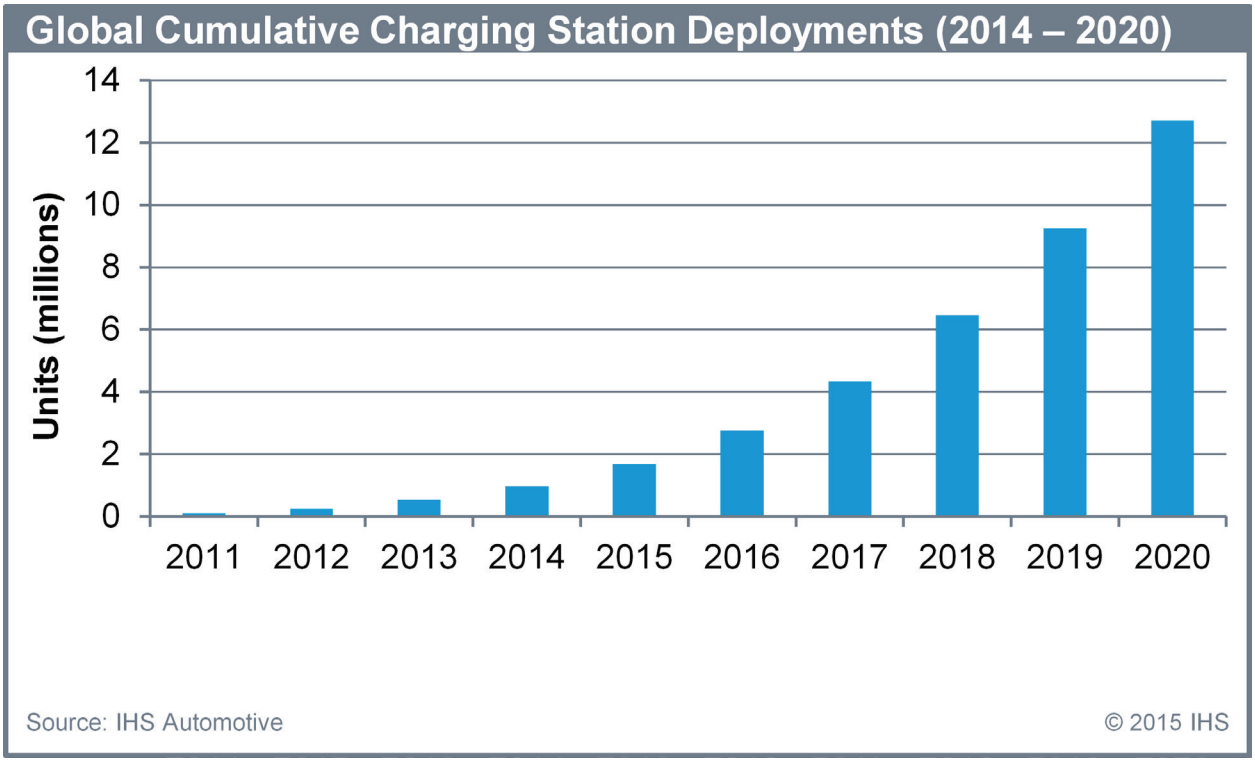
Advances in power electronics are creating breakthroughs for battery chargers, and this is certainly a boon for applications such as electric vehicles and industrial chargers. Specifically within the area of electric vehicles, there are many interesting developments taking place with almost every major car manufacturer actively working in this space.

According to a recent Electric Vehicle Charging Infrastructure report by IHS, the global Electric Vehicle Charger market is forecast to grow more than 12.7 million units in 2020. [1] Technavio's analysts forecast the Electric Vehicle (EV) market in the US to grow at a CAGR of 24.02% over the period 2014-2019. [2] Considering the fact that the transportation sector is one of the largest contributors to U.S. greenhouse gas (GHG) emissions [3], the widespread adoption of Electric Vehicles would significantly help in reducing these emissions—in addition to reducing our dependence on oil. Several countries around the world are also providing subsidies and tax benefits to car owners to encourage the use of electric vehicles.



Global cumulative charging station deployments (2014-2020). Image Credits: IHS Automotive

Battery chargers for electric vehicles can either be on-board or off-board. As the name implies, an on-board charger is located inside the vehicle, and it permits the vehicle to be charged wherever an appropriate power source is available. But on-board chargers have the disadvantage of possessing limited power due to constraints in size, weight and costs. [4]

Off-board chargers on the other hand are not limited by this constraint, and the level 3 charger (also known as DC Fast Charger) provides the fastest method for charging electric vehicles. Level 3 chargers use an input voltage between 200-600V and provide an output power of 25-60 kW. This enables the battery to be charged up to 80% of its capacity in less than 30 minutes. [5] Range anxiety is a common challenge faced by vehicle owners, and widespread deployment of level 3 chargers would play a great role in overcoming this challenge. [6]

Silicon carbide, a wide bandgap semiconductor, has attractive properties that make it useful in many power electronic applications, including battery chargers. In addition to improved overall performance and efficiency, it helps in reducing the size and weight of the power electronics involved. Wolfspeed, Microsemi and Vincotech are some of the market leaders in this space that are actively incorporating silicon carbide (SiC) technology into their product offerings. Wolfspeed recently introduced the industry's first 900V SiC MOSFET. This technology delivers low on-state resistance at higher temperatures, thereby reducing the size of thermal management system.

Successful introduction of any battery charger in the market is only possible by having the right combination of components, technology, assembly services and technical expertise. Innovation Plus Power Systems USA Inc., an allied partner of Richardson RFPD, provides power conversion assembly services and also uses its expertise to solve challenges faced by battery charger manufacturers.

Recently, its customer was using a bank of large film capacitors for 15 kW and 30kW chargers being built in-house for a power application, the fast-charging of fork lifts. The main switching device was an IGBT module along with a suitable heatsink. But the customer had a cyclical business and was having issues with production cycles: busy times meant hiring and training staff, who were then let go when business slowed down. Since the previously-trained employees were almost never available to rehire, the customer was constantly dealing with a large portion of its staff on a learning curve. The solution was to build an entire power stage using components for the IGBT, a free-wheel diode module, rectifier front end, and the heatsink.

Of course, a simple BOM-to-outsourced solution comparison cannot be the only means of evaluating the benefits of outsourcing a program. All internal costs – including material handling and labor – must be considered. Typically, involvement of a customer's finance team to review and compare all costs to produce units internally is imperative to understanding the resources allocated to a program. Production also considers the purchasing and management of materials most likely from multiple sources. This thorough evaluation presents a clearer picture for the customer to provide financial and strategic justification to outsource a complex program to a company such as IPPS.

References

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