The Electric Vehicle Infrastructure

New Opportunities in Learning, Certification, and Human Development in the EV Charging Industry

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A White Paper by Samantha Ortega, ChargerHelp! and Frank Menchaca, SAE International, Sustainable Mobility Solutions

Introduction

ChargerHelp! and SAE International's Sustainable Mobility Solutions have partnered to author this white paper. Our objective is to share knowledge and best practices related to workforce development, catalyzed by the rapid construction of an infrastructure for electric vehicles (EVs). This includes the emergence of new job categories, such as EV Supply Equipment Technician, for which skills can be taught and knowledge certified. Such roles, moreover, can form the basis for careers with good pay and social value, accessible to people typically under-represented in technology jobs, including Women, African Americans, Latinos/as, and people without college degrees and others. In this paper, we will:

- Define these new roles and their industry context;
- Consider how to build, test, and certify knowledge and skill;
- Explore career pathing, lifelong learning, and upskilling.

About ChargerHelp!

ChargerHelp! is a technology company that enables on-demand maintenance and repair of electric vehicle charging stations. ChargerHelp! operates at the intersection of clean technology and workforce development with the mission to remove barriers for people in disadvantaged communities to have access to opportunities in the operations and maintenance of the electronic equipment repair industry. ChargerHelp! has partnered with workforce development agencies throughout the United States to recruit candidates from all skilled backgrounds and train them to become industry experts as EV Supply Equipment Technicians and to help solve the issues that EV Supply Equipment owners and EV drivers experience on a daily basis and to promote economic mobility by providing good paying jobs.

By utilizing technology, ChargerHelp! has enabled trained local EV Supply Equipment Technicians to identify core issues, capture data, and centralize it to help solve those issues. In partnership with charging companies, ChargerHelp! has surveyed the functionality of over 20,000 EV charging

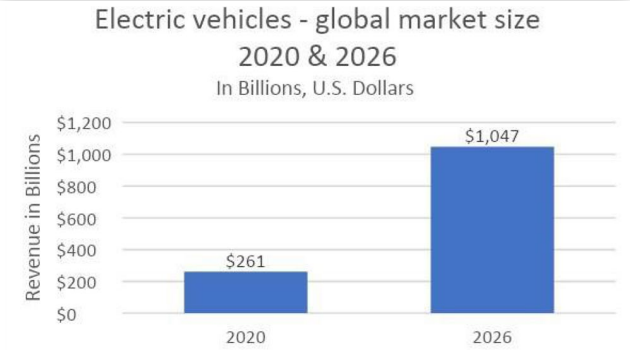
stations in a multitude of environments and climates. ChargerHelp! has found that the vast majority of concerns of downed EV chargers reported is due to the absence of consistent maintenance and reliability plans across different communities. For this reason, EV Supply Equipment original equipment manufacturers (OEMs), network providers, and utilities trust ChargerHelp! to deliver practical solutions that will support the evolution of electric vehicle charging technology.

About SAE International and Sustainable Mobility Solutions

SAE International is the oldest and largest organization for engineers in aerospace, automotive and commercial vehicle industries. Founded by Henry Ford in 1905 and merged with the Society for Aeronautic Engineers in 1915, SAE has played a key role in the development of modern transportation through consensus-based standards, professional and pre-professional education, information and events. SAE's mission is to advance mobility knowledge and solutions for the benefit of humanity. In support of that mission, it founded Sustainable Mobility Solutions, a business unit which serves as the technically-informed source for initiatives that help lead industries to a net zero emissions future for transportation.

The Industry Context

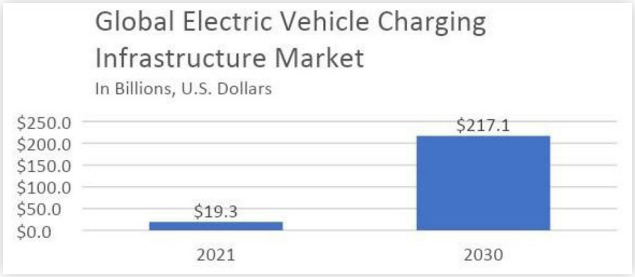
Between 2020 and 2026, the size of the global electric vehicle market is expected to increase over four-fold to reach an estimated global market size of some one trillion U.S. dollars by 2026. This translates to a notable compound annual growth rate (CAGR) of more than 23 percent between 2021 and 2026.



(Statista, Electric Vehicles Worldwide, 2022: Modor Intelligence, February 2022.)

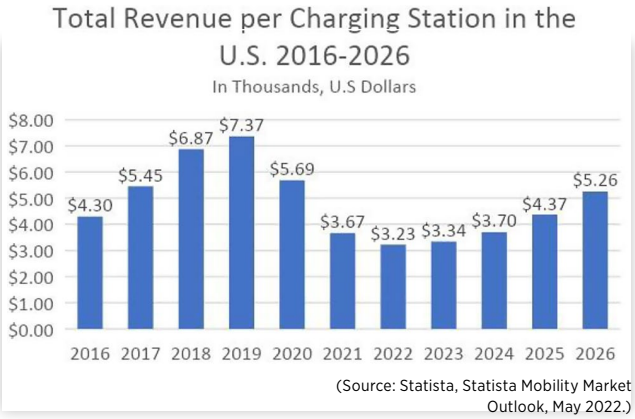
This growing number of EVs will require a robust and reliable infrastructure to function. Stephanie Pollack, Deputy Director of the Federal Highway Administration, during the rollout of the National Electric Vehicle Infrastructure Formula Program (NEVI) standards in June 2022, compared this challenge to nothing less than the creation of an interstate highway system under the Eisenhower administration in 1956.

The global electric vehicle charging infrastructure market is forecast to be large and growing. Valued at $19.26 billion U.S. dollars in 2021, it is expected to reach $217.06 billion U.S. dollars by 2030 growing at a CAGR of 30.6% during the forecast period.



(Source: Grand View Research, Electric Vehicle Charging Infrastructure Market Intelligence Study, April 2022.)

In 2021, the revenue generated per charging station for electric vehicles in the U.S. amounted to approximately $3.67 thousand U.S. dollars. According to estimates of the Statista Mobility Market Outlook, despite 2021-22 pandemic and supply chain decreases, revenue is expected to increase in the coming years reaching an estimated value of $5.26 thousand U.S. dollars in 2026.



(Source: Statista, Statista Mobility Market Outlook, May 2022.)

The Bipartisan Infrastructure Law (BIL), enacted as the Infrastructure Investment and Jobs Act, Pub. L. 117-58 (Nov. 15, 2021), has catalyzed this growth with the commitment of $5 billion in U.S. dollars to build a national network of 500,000 electric vehicle chargers and an additional $2.5 billion in discretionary funds. Further, the U.S. Department of Energy and Departments of Energy and Transportation Joint Office has additionally prioritized the reliability and

long-term operations and maintenance and uptime of the software and hardware of the EV chargers.

New Roles

Both ChargerHelp! and SAE Sustainable Mobility Solutions have witnessed the emergence of new roles—and associated needed skills—in the dynamic, fast-growing area in the technical field of electronics repair known as EV Supply Equipment operations and maintenance (O&M). EV Supply Equipment O&M includes a range of responsibilities within the EV chargers software, firmware, and hardware. The responsibilities include: commissioning, diagnostics, data collection, communications and cell signal testing, software trouble-shooting, calibrating, upgrades, parts replacement and reprogramming, preventative maintenance and restoration, among other responsibilities.

EV chargers occupy an interesting intersection where it becomes inevitable to ask the questions, Who should take care of the chargers if they break down? Is it the responsibility of EV Supply Equipment OEMs? Network Providers? Part assemblers? Software or Electronics Engineers? Electricians? IT, or Computer Technicians?" There is only so much that adjacent industry participants are capable of doing when it comes to maintenance and repair of EV Supply Equipment, understanding coding, firmware, and aggregating the data is necessary to inform the EV charging industry and government on the myriad of issues that plague it on a regular basis.

From SAE's perspective, the aggregation, analysis, and communication of data related to EV Supply Equipment performance are particularly important. In late 2021, Sustainable Mobility Solutions convened a group of thought leaders from EV Supply Equipment OEMs, Network Providers and government to address what they saw as the most pressing issues connected to EVs. The group overwhelmingly identified charging infrastructure performance as the greatest obstacle to EV adoption.

According to some estimates, EV Supply Equipment and sessions in the U.S. fail or are inoperable approximately 30% of the time. The reasons for these failures are various and difficult to document and therefore to diagnose and fix: charging session error codes lack a standard taxonomy and analysis practice. As one charger provider industry leader put it: "There are many problems to be solved to enable the shift to electric vehicles. If we don't solve this one—giving customers a consistent, reliable charging experience—we won't achieve the public acceptance that will allow us to scale."

The SAE group determined to aggregate charge session failure data with the view to creating a consistent data dictionary and analysis practice. Adopting agile work practices, it is studying these data, shared by group members, testing, and iterating its solution with the objective of producing a technical report in approximately half the time required in normal standardization. The resulting document, *EV Charging Infrastructure: Charging System Performance Reporting*, in draft form at the time of this writing, is informing work by the U.S. Department of Energy and Departments of Energy and Transportation Joint Office and others.

Diagnostics and data collection in the technical field of electronics, is one area of responsibility within an EV Supply Equipment Technicians role. Beyond the data collection, EV Supply Equipment Technicians resolve integrated issues among software, firmware, communications, and hardware. Because technology has evolved and different programs are continuously introduced in the market, the needs have shifted to onsite testing, repairs, and monitoring that require knowledge of software, coding, programming, fire and electrical safety awareness, and hands-on repair of the equipment.

SAE sees data collection and analysis as key aspects, among many others, of the EV Supply Equipment O&M and as critical aspects of the roles ChargerHelp! is evolving in those areas. This is why training workers, and certifying their skills, is key to the future success of EVs and the infrastructure that supports them.

Building, Testing, and Certifying Knowledge and Skill

ChargerHelp!, with the support of EV charging and software companies have developed a curriculum designed specifically for the maintenance and repair of the software an d hardware of the EV Supply Equipment of both Alternative Current (AC) and Direct Current (DC) charging equipment. Including training in the electronic equipment's incidental low-risk electrical functions, as is required in commercial industries, to shut off or isolate power in order to commence work on the EV Supply Equipment.

ChargerHelp!, with the support of safety training centers, have identified three (3) fundamental training requirements that any person interested in operating and maintaining AC charging equipment, also known as Level 2 chargers, and DC fast chargers (DCFC) must complete as first steps to becoming an EV Supply Equipment Technician. These trainings include in-person or online OSHA 10-Hours for General Industry, including Lock Out Tag Out (LOTO), and NFPA 70E for General Industry.

If an EV Supply Equipment Technician is interested in operating more complex equipment and higher powered DCFC or similar, in addition to the three (3) fundamental trainings listed above, OSHA 30-Hours for General Industry and high voltage safety training are the most appropriate. Though an EV Supply Equipment Technicians work does not involve electrical work, these courses are administered to limit any unintentional onsite exposure to electrical and chemical hazards. All these incidental low-risk electrical training courses could generally be completed in an average of two (2) weeks.

Once the fundamental safety training is completed, candidates may take EV Supply Equipment operations and

maintenance training for software and hardware through an EV Supply Equipment OEM and Network Providers. Candidates may also receive training with a company like ChargerHelp!, who teach their technicians a robust curriculum on the wide range of parts and software complexities such as Open Charge Point Protocol (OCPP)[1], Open Charge Point Interface (OCPI)[2], and the International Organization for Standardization (ISO)[3].

Because the basis of operating internal electronic components is easy to learn and is low risk, it is imperative this line of work remains open to the public, limit additional prerequisites, and limit creating bottlenecks for people in low income, disadvantaged communities, or a community of people transitioning from industries like nuclear, coal, oil, gas, and even traditional automotive mechanics into the clean tech industry.

As a leader in professional development in the transportation industry, SAE recognizes the need not only to provide training in these areas. It is adding to its own roster of training courses in the major standards and regulations, which include:

- SAEJ1772
- ISO 15118
- OCPP

Professional Credentialing

Certifying the knowledge and skill resulting from in-class education, training, and time on the job supports the professionalization of the EV Supply Equipment Technician and thus paves the way for career pathways in lucrative tech and green energy jobs. Certifications offer benefits for employers and employees alike. For employers, identifying and recruiting talent are made easier with clear, industry-validated certifications. For the workforce, they create clear, stackable credentials recognized across industry.

The SAE International Certified Mobility Professional (CMP) program operates as an independent certification body capable of creating industry-informed and desired professional credentials for talent working in the mobility sectors.

The Professional Certification

- Is aligned to specific, measurable criteria, including knowledge, skills and or competencies, (known as the Body of Knowledge) aligned to a specific job function or set of functions, and validated by industry
- Is measured through independently administered examinations
- Awards a credential certifying mastery of the Body of Knowledge and additional requirements, such as on-the-job experience

SAEI will work with ChargerHelp! and other industry and workforce representatives to create the CMP-EVSE Professional Credential program

Career Pathing in Cleantech and EV Infrastructure

The EV Supply Equipment Technician is just one role that has emerged as a result of the rapid development of the electrification of transportation. Both ChargerHelp! and SAE Sustainable Mobility Solutions believe an opportunity exists for short term and long term career pathing for which a scaffolding curriculum—and "stackable" credentials—can be adopted nationwide. With proper training and certification, EV Supply Equipment Technicians, as an area of specialization, could be adopted beyond the current training pathways provided by charging companies. Experience in the technical field of electronics, specifically for EV Supply Equipment, allows the opportunity for individuals to advance in their careers within the cleantech space. Practical careers expanding from experience with more complex equipment to different technology types; careers like Electronics or Automation Engineers, Electric Vehicle Service and manufacturing. This also includes advancement into leadership roles as trainers, project leaders, and other managerial positions.

It is worth noting, moreover, that ChargerHelp! has demonstrated that sourcing for these roles can be from communities typically under-represented in technology-forward jobs and for those transitioning from dissolving industries. Examples include:

- ***Community-Based Organizations and other green/technical companies,*** Partnering with these organizations allows for individuals from local communities to gain foundational knowledge about the technological structure of the EV Supply Equipment and learn about the skill set required to operate and maintain the EV charging infrastructure. Additionally, they learn about emerging innovative technology, and other opportunities existing in the green and cleantech industry, giving them the confidence to participate in jobs of the future.
- ***Workforce Development Agencies,*** Partnering and educating agencies in the opportunities existing in the clean tech space allows for the agencies to become versed in the ideal candidate and the skill sets required to fulfill positions in the market. This opportunity is not only for individuals new to the workforce but for those individuals that have lost employment due to

[1] https://www.openchargealliance.org/protocols/ocpp-201/
[2] https://evroaming.org
[3] https://www.iso.org/sites/outage/

the transition to electrification and need reskilling. ChargerHelp! has found that persons with prior hands-on commercial industry experience have safety awareness in operating commercial equipment. This allows for a seamless workforce transition.

- ***Technical Colleges,*** ChargerHelp! additionally partners with technical and community colleges in the training and certification process to build the workforce that is needed today while providing accessible, affordable, and practical pathways for local residents. Historically, technical colleges have demonstrated partnerships with employers to train, test and certify individuals in those areas a success. Technical colleges have the infrastructure to provide a structured capstone program necessary for the operations and maintenance of EV Supply Equipment.

Conclusion

With more electric vehicles on the road, charging companies are more committed to maintaining and reaching high EV charger reliability. The electric vehicle infrastructure we describe presents a strong opportunity to create a new class of cleantech jobs available to people typically not included in such areas: Women, African Americans, Latinos/as and people from under-served and remote communities. In addition, the roles to which this new infrastructure is giving rise are not only needed; they are also steps that can lead to an entire career within the EV charging equipment and beyond. SAE and ChargerHelp! believe it is important to understand and support these changes. They can lead to greater, more equal prosperity and help support the evolution to net zero transportation.