

Berlin, Germany – November
18, 2025

From mines to ports: How CharIN's MCS standardization is revolutionizing heavy-duty electrification

Today, CharIN, the global leader in charging standards, shared major updates on its work with the Megawatt Charging System (MCS). New advancements in mining and marine applications are helping industries reduce emissions, enhance efficiency, and scale up electrification, thereby supporting global climate goals and addressing real-world operational needs.

Mining sector: Revolutionizing high-power charging for heavy-duty operations



The mining industry's move toward electrification is gaining momentum, with haul trucks accounting for 30% to 80% of a mine's energy use, leading the effort. CharIN, in partnership with the ICMM, has collaborated with the industry on several activities to establish a harmonized approach for aligning charging solutions across different use cases.

Key achievements:

- The first publication was a Dynamic Charging Interface (DCI) White Paper outlining technical requirements for standardized, in-motion charging solutions. This innovation supports battery-electric haul trucks, reducing downtime and increasing surface and underground mining operational efficiency. [The Dynamic Charging Interface \(DCI\) White Paper is now available.](#)



- Ruggedized Megawatt Charging System (R-MCS): Designed for durability in harsh mining environments, R-MCS enhances voltage capacity, chemical resistance, and automation for seamless coupling. The [R-MCS White Paper is now available](#).
- Extreme Megawatt Charging System (X-MCS): Engineered to meet the demands of the largest and most energy-intensive mining vehicles, X-MCS delivers higher power capabilities, enhanced safety, and adaptability to extreme conditions. The [X-MCS White Paper is now available](#).



Haul trucks are essential for surface mining operations, but they account for 30 to 80 percent of direct emissions at mine sites. Decarbonizing these and other mining vehicles is vital for achieving global climate goals and ensuring a sustainable future for the mining industry. This transition faces several challenges, including technical bottlenecks in charging infrastructure and interoperability, operational complexities of incorporating battery-electric vehicles into existing fleets, infrastructural needs for high-power charging systems capable of withstanding harsh mining conditions, and cultural shifts needed to adopt new technologies and practices.

The Innovation for Cleaner Safer Vehicles initiative offers a collaborative platform for industry leaders, such as mining companies, OEMs, technology providers, and standardization bodies like CharIN, to tackle these challenges. The aim is to develop interoperable, high-power charging solutions customized to meet the specific demands of the mining sector.

A key part of the initiative is the partnership between CharIN and ICMM, which concentrates on solving the issue of charging interoperability. Through the CharIN Mining Taskforce, this collaboration has established technical requirements for ruggedized and dynamic charging systems, created industry White Papers to guide **MCS and CCS adoption**, and supported pilot projects to test solutions in real-world mining conditions.

The initiative focuses on operational efficiency, infrastructural readiness, and cultural change. Battery-electric haul trucks are designed to perform at or above

diesel levels, supported by scalable, interoperable charging infrastructure, and complemented by training and knowledge-sharing programs that promote industry-wide acceptance.

By establishing standard technical guidelines and promoting global standardization, CharIN and the initiative enable mines to reduce emissions, lower operational costs, and accelerate the transition to zero-emission fleets, thereby ensuring a sustainable future for the mining industry.

Marine sector: Charting the course for global maritime electrification



CharIN's Marine Task Force is at the helm of advancing MCS and CCS standards for the maritime industry. Building on the success of the MCS Vessels Project collaboration with Crowley, Black & Veatch, and ABS, funded by the US Maritime Administration (MARAD), the Task Force is defining technical requirements for MCS-compatible shore power solutions. These solutions will support battery-electric and hybrid vessels, enabling technical development, cost efficiencies, and global scalability.

Marine Task Force achievements:

- Standardization leadership: The Task Force will establish guidelines for interoperability and harmonized technologies, ensuring seamless integration of MCS and CCS in marine applications.



- Industry collaboration: The Task Force is actively engaging with shipbuilders, ports, and energy providers to promote best practices and accelerate the adoption of MCS and CCS standards.
- Technical synergies: By leveraging existing infrastructure and communication protocols, such as **Ethernet 10Base-T1S**, TF Marine is reducing costs and increasing the feasibility of marine electrification.

“Standardized shore charging connections are crucial for marine electrification. By harmonizing MCS and CCS interfaces, we can reduce integration complexity and expedite cost-effective deployment. This strategy not only guarantees global scalability but also promotes collaboration among ports, shipbuilders, and energy providers, making sustainable maritime operations a feasible reality.”

— Palemia Field, ABB and CharIN’s Task Force Marine lead

The Marine Task Force is advancing the development and adoption of MCS standards for the maritime industry. Building on the success of the MCS Vessels Project, which was jointly funded by Crowley, Black & Veatch, and ABS, and supported by MARAD, the Task Force has held its first two meetings to address key topics. To strengthen collaboration and expertise, it has created subgroups for Electrical Safety, Port Electrification, Use Case and Operations, Communication, and Testing and Classification. These teams will focus on specialized areas to accelerate the deployment of CCS and MCS standards.

MCS testing at CharIN Festivals: A core focus

CharIN’s Festivals remain a signature event for testing and validating MCS technology. Moving beyond controller testing, these events now focus on fully integrated MCS systems, ensuring interoperability, reliability, and performance in real-world conditions. In June 2025, CharIN successfully conducted MCS testing with Advantics, Scania, and Stäubli, marking a significant milestone in validating MCS for heavy-duty applications. Since 2025, MCS testing has become part of CharIN’s core interoperability testing events, with more sessions planned for upcoming CharIN Festivals.

CharIN expands into aviation: Addressing the challenges and opportunities of electrification



The aviation industry stands on the brink of a transformative era, as electrification reshapes the possibilities of flight. With the rise of electric vertical take-off and landing (eVTOL) aircraft and sustainable ground operations solutions, the demand for standardized, high-power charging infrastructure has never been greater. Recognizing this pivotal moment, CharIN is launching its groundbreaking efforts in the aviation sector, marking the beginning of a new chapter in the industry.

CharIN's mission in aviation is to champion CCS and MCS as the global standard for aviation charging, ensuring interoperability and scalability. It works to close critical gaps in current standards while supporting innovation and collaboration across the aerospace ecosystem. CharIN is also developing clear implementation guidelines to speed the global **adoption of electrified aviation**. Although aviation electrification is still in its early stages of development, CharIN is leading the effort by setting standards, filling gaps, and accelerating industry progress.

From mines to skies: CharIN's vision for a fully electrified future

CharIN's leadership in high-power charging is transforming industries, from the rugged landscapes of mining to the dynamic ports of the marine sector, and now, to the boundless potential of aviation. By standardizing MCS and CCS, CharIN



is breaking barriers, fostering collaboration, and driving the global transition to sustainable, interoperable electrification.

As we stand at the dawn of this electrified era, CharIN invites industry leaders, innovators, and stakeholders to join us in shaping the future.

About CharIN e.V.

CharIN is a global association of vehicle manufacturers, energy providers, component suppliers, and charging station developers united by a shared mission: to establish the Combined Charging System (CCS), the Megawatt Charging System (MCS), and the North American Charging System (NACS) as the global charging standards for charging all types of battery-electric vehicles. Together, CharIN members drive the development of interoperable charging solutions to ensure a reliable, seamless, and user-friendly charging experience.

Representing over 300 leading e-mobility stakeholders across the entire EV value chain, CharIN invites participation from all interested parties. With a strong global presence and offices around the world, CharIN is in charge of shaping the future of e-mobility.

www.charin.global

Press Contact:

Charging Interface Initiative e. V.

EUREF-Campus 10-11

D- 10829 Berlin

Germany

Tel.: +49 30 288 8388-0

E-Mail: info@charin.global