Time proof Electricity grids by Power Quality improvement of Electric Vehicles



Multi-MW charging systems for application in different markets dr. ir. Thomas Gerrits Heliox Research and Innovation Manager

Agenda

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- Heliox company introduction
- Implemented MW scale solutions in automotive
- Multi-MW charging systems
- On-road electrification: MCS
- Off-road electrification
- Questions



Company introduction

Vision

We believe in a **sustainable world** where a seamless charging experience is the standard for each **electric transportation** method and this transforms the way we power our everyday.

Mission

Heliox provides world-class **chargers**, smart **energy management** solutions, and **services** that are tailored and **scalable** within a fast-changing e-mobility landscape ready to electrify each method of transportation.

Strategy

Providing flexible **turn-key implementations** based on combinations of proven **high-quality products** and **standard communication** methods



The numbers 2009 Heliox Founded **250+** Industry experts **20+** Partners **2000+** Chargers shipped **20+** Active Countries **10k** Power Modules **10+** Research projects





Company introduction



PUBLIC TRANSPORT Global Market Leader in opportunity & depot charging



PORT EQUIPMENT Fully automized charging of AGVs in port and industrial site



COMMERCIAL VEHICLES CCS, MCS (in development) and automated charging systems for Forecourts and Distribution Centers



MINING EQUIPMENT Automated and manual Charging Systems



Marine - HIGH FREQUENT FERRIES Automated Charging Systems



Passenger vehicles Public / semipublic AC and DC charging HPC



EVSE - EV interoperability



What standard chargers do we offer

MOBILE 40kw

FLEX 180kW / 360kW

ULTRA FAST 450kW / 600kW

RAPID 50/100/150/300 kW







A strong starting point for all vehicle types. No fixed installation needed



A flexible solution for both DC and OC, for single or multiple vehicles





Opportunity Charging for Ultra-FAST charging for multiple vehicles.





Futureproof, value for money chargers for fleets and public charging



Implemented MW scale charging solutions in automotive markets

- Amsterdam: 31 MW
- Eindhoven: 4 MW
- Glasgow: 12 MW
- Rotterdam: 6 MW
- Oslo: 9 MW
- Groningen: 13 MW
- Wiesbaden: 6 MW







VIDEO LINK





Multi-MW charging systems

Trend in power is up!

Different markets asking for MW charging per dispenser:

- Truck, Bus (MCS)
- Aviation
- Energy stations (forecourt)
- Mining
- Marine





Mega-Watt charging systems (MCS)

CharIn taskforce initiative with 100+ partners

Standardization ongoing of plug, safety, communication, current levels Standardized plug for use in different markets (truck/marine/aviation) Physical communication layer will be changed w.r.t. CCS

The envisioned MCS current ratings are:

- Level 1: 350 A DC (uncooled cable) for berth parking
- Level 2: 1000 A DC (cooled cable) for medium duty EV
- Level 3: **3000** A DC (cooled cable) for **heavy** duty EV





Source: CharIn e.V.



Source: insideEVs.com



Mega-Watt charging systems (MCS)



Black curve: charger DC output current, voltage and power limits **Grey area**: possible operating points

MCS standardisation



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Timeline and key milestones of international groups involved in MCS standardization.



specification and standardization MCS

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Mega-Watt charging systems (MCS)

MCS solution Heliox:

- Modular charging system that can be scaled to multi-MW power rating
- In combination with a power router, the DC power can be routed from one dispenser to another in between charge sessions
- Output power tailored to requirements per dispenser (CCS & MCS)
 - 1 MW: 6x 180 kW FLEX (1 kA max/dispenser)
 - 2 MW: 12x 180 kW FLEX (3 kA max/dispenser)
 - 3 MW: 18x 180 kW FLEX (3 kA max/dispenser)

Number of DC outputs per MW	1	2	3	6
Rated DC power per output [kW]	1000	500	360	180
Maximum current per output [A]	1000	700	500	250





Line positioning 6x FLEX 180 kW Per cabinet: W x D x H = 703 x 803 x 2324 mm



Heliox involvement in MCS projects (1)

HOCHLEISTUNGSLADEN LKW (HoLa, Germany)

- Route: Berlin Dortmund (German A2)
- 4 charging locations with each: 2x CCS (2x 500 kW) and 1x MCS (1 MW) per site. Heliox to provide 2 stations
- Heliox solution: modular charging system with power routing to supply all 3 charge points, BESS assisted







Heliox involvement in MCS projects (2)

Mijnbouw/

grondstoffen

Batterii waardeketen Cel-

Green Transport Delta (GTD, Nederland)

- Prototype modular MW charging system with 1x MW, 3x 360 kW and 6x 180 kW DC dispenser outputs
- Thermal measurements of prototype in climate chamber at TNO automotive, Helmond
- Use-case Albert Heijn; Distribution centre with 1x MW and 6x 180 kW dispenser outputs, BESS assisted
- Use-case van Kessel; Forecourt with 1x MW and 3x 360 kW, BESS assisted







Multi-MW off-road electrification

- Requests for multi-MW solutions to charge a single vehicle/vessel (2-40 MW DC)
- No standardization in these sectors and high EV variety (1:1 solutions)
- Automated connections required for minimum time loss
- CCS/MCS automotive safety approach not possible anymore:
 - Voltages higher than MCS limit (1250 V DC)
 - System Y-cap limit infeasible (2.5 µF/side/pole)
- Conductive charging standard has hard limitation in DC voltage (<1500 V DC), currents will be too high at that level
- Typically, remote sites with limited power capacity, local storage integration needed





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<7 min

90 minutes

Marine implementation - Arriva Copenhagen



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Heliox involvement in Marine project

HYPE Devered vessel battery charging system

Hyper-power vessel charging (HYPOBATT)

- End-to-end E-ferry connection
- German Wadden Sea islands
- Heliox: develop and deploy 10 kV grid supplied 1-5 MW DC modular charger (2 MW)
- Marine charging standardisation regulatory framework proposal
- Main goals project:
 - Fast turn around time
 - Scalable and reproducible solution
 - > 95% up-time reliable



Main-land side charger



Heliox involvement in Mining project

Charge On Innovation Challenge (Shell)

- 220 tonnes haul truck charging
- 400 kWh of traction energy in 4 minutes
- Fast and automated connection crucial:
 - No people allowed around haul truck
 - Cabling way too heavy for manual connection
- Heliox: develop and deploy 10 kV grid supplied 5-11 MW DC modular charger
- Mining charging standardisation taskforce involvement





Questions?

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