HYPOBATT

Hyper powered vessel battery charging system

Introduction

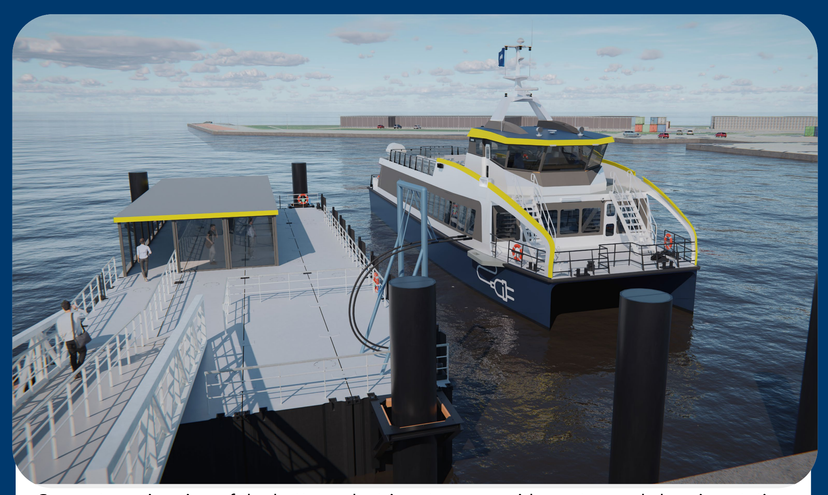
To pursue the challenging environmental targets set at international and European level for the shipping sector, electrification with shore power supply is one of the solutions to reach this target. The market for electrified ships is large and shore power can be used to plug into the local electricity grid and supply the ship demand while in port, leading to less CO_2 and other pollutant emissions up to 98% (depending on the mix of energy sources). Electrification is also an important step towards decarbonization of maritime transport and is successfully used in hybrid and fully electric vessels in short-sea shipping. Over the last 6 years, several short-distanced ferries and vessels for coastal transportation have been developed or planned for operating purely on batteries. Such ferries operate in a tight schedule with limited time for shore charging between the trips. In addition, the capacity and range of electric vessels are rising and the battery cost for maritime application has decreased rapidly in the last few years.

New business models of electric ships need to be developed considering high availability, reduced maintenance, and fast turnaround. To do so, fast charging with high charging power and an adequate shore electrical supply-based infrastructure are required in ports or ferry terminals. However, fast charging involves high current rates and high temperatures and may affect the battery's performance due to accelerated aging. In addition, the development of such infrastructure to enable multi-MW charging increases the costs to deploy electric shipping services, and the choice of system configuration can have significant impact on the energy transfer efficiency from the grid to the vessel. Besides that, to connect vessels to shore power at different ports of call, it is critical that standardized interfaces and components be established.

State of play

Limitations of multi-MW battery charging systems for marine applications

- Vessels with large battery systems have been in operation for more than a decade
- Vessels of different size and type require different battery and appropriate charging systems
- Marine charging systems require high charging power (1.2-4 MW) which is significantly higher than for road electric vehicles (600 kW)
- Marine charging systems require the integration of a quayside charging equipment (plug-in or pantograph) and a shipside receptacle
- Different standards are available, none of them are fully suitable for DC marine charging applications
- The lack of standards and modular solutions is penalizing the marine market: incompatibility of different systems, higher costs, no interchangeability



Computer animation of the battery-electric catameran with ponton and charging station

The Vessel

Length	32.3 m
Width	9.6 m
Draught	1.2 m (even keel, full load)
Hull shape	Catamaran (minimum draught and flow resistance)
Passengers	150 (max capacity)
Travel time	30 min (11 km Norddeich to Norderney)
Propulsion	2x600 kW electric motor-driven propellers; 2x75 kW electric bow thrusters
Speed	19 knots
Payload	11250 Kg
Charging time	28 min.
Enter in service	2024

HYPOBATT targets

HYPOBATT will develop comprehensive technologies beyond the state of the art, combining and leveraging their complementary innovative potential:

- **Modular multi-MW marine chargers** for fast and easy charging of larger battery systems, reducing turnaround times of electric ships
- **Automated marine charging connections** minimizing the connection time to less than 30 seconds after safe mooring
- **Reduced operation and maintenance costs** up to 20% by innovative charging architecture with little to none human effort
- **Standardized charging infrastructure** to facilitate interoperability and system compatibility with various vessel types
- **Optimized daily operation of the multi-MW charger** by using a digital twin platform
- **Minimized battery ageing and impact on the electrical grid infrastructure** by adaptive energy management strategies
- **Demonstrated performance of the charging infrastructure as a whole** in two European ports.

HYPOBATT Methodology

HYPOBATT will focus on technical development of the energy charging systems and on the definition of new market and business mechanisms.

HYPOBATT will test two systems in two European ports to demonstrate and confirm the validity of the results

Realistic environment of fast multi-MW charging

Demonstration flexibility

Waterborne transport market, integration of different electric ships

Port of Norddeich

Automated connection

Modular charging station

- Modularity
- Faster Turnaround
- Flexibility and standardization
- Fast charging
- Battery degradation, impact on material
- Cost reduction
- High availability of charger
- New business models
- Tidal/weather/Environmental influence
- Scalability

Use for an end-to-end service

Digital Twin of whole system

Operational and planning optimization of the charger integrated in a cloud platform

Control and energy management with smart fast charging algorithm

Comprehensive battery model coupled with aging mechanism

Port of Norderney

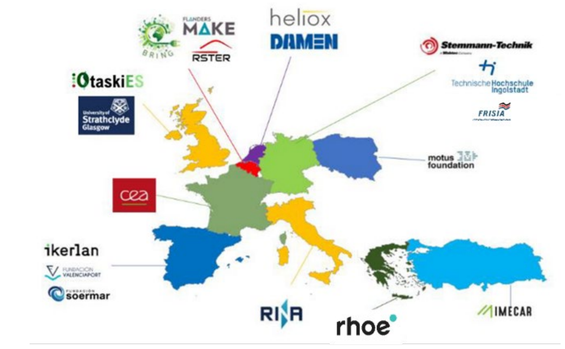
Impact on electrical grid (power quality)

Minimizing impact on battery and electrical grid infrastructure

Ease and required connection time

Employability

The consortium



Facts and Numbers

The consortium: 18 Partners from 10 european countries

Project coordinator: Ikerlan s. COOP / Endika Bilbao

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Duration: 42 months

Budget: 9.35 Meur

Mail: info@hypobatt.eu

Website: www.hypobatt.eu

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