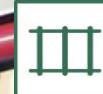




CASE STUDY



1 | Challenge: **System-wide, modular battery approach enables optimised and smooth operation of metros**

In a technically increasingly complex and regulated operating environment, rail vehicle manufacturers and operators of metros face major challenges. HOPPECKE provides supports with its many years of expertise as an energy system expert and industrial battery manufacturer.

With a population of around nine million, London is one of the largest capital cities in the world. Every day, almost five million people travel to work in central London and use the London Underground public transport system. The demand for trips on the Underground has risen sharply in recent years. London relies on its "Tube" as an important social and economic engine for the city.

Like London Underground operators, many rail transport services have very specific requirements for their metro trains. These are based on material or aesthetic preferences, infrastructural constraints, topographical or geographic features.

The focus of these requirements for operators is on reliability, optimised life cycle costs, ease of maintenance and safety.

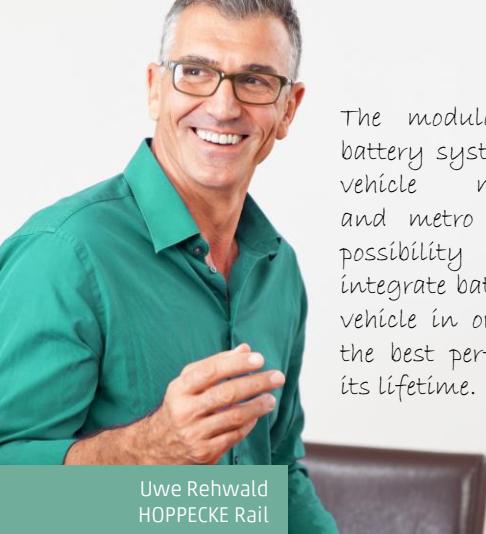
At the same time, operators rely on rechargeable onboard battery systems for emergency power. Both for critical onboard systems and for the comfort and safety of their passengers. To be able to perform these challenging tasks reliably and safely, special batteries are needed. They must withstand strong shocks and vibrations, as well as general physical and electrical abuse. In addition, these special batteries must be able to reliably deliver the best performance throughout their entire service life.

Reliability
emergency power supply

TCO
optimised life cycle costs

Standardisation
interchangeable battery systems

360° service
planning to recycling



Uwe Rehwald
HOPPECKE Rail

The modularity of the battery system offers rail vehicle manufacturers and metro operators the possibility to optimally integrate batteries into the vehicle in order to obtain the best performance over its lifetime.

Optimised operating costs
due to modular battery system

Easy maintenance
due to telescopic rails

Highest safety standards
due to innovative plug system

Many years of expertise
in the field of energy systems

2 | Solution: **Complete battery system approach due to modular battery kit**

With the development of an innovative and modular battery kit concept, HOPPECKE offers an on-board battery solution tailored to the challenges of rail vehicle manufacturers and operators of metros.

With a fully integrated battery system that is equally standardised and optimally matched to the application, HOPPECKE is following an important trend in the railway industry: the development towards a standardised approach for interchangeable battery systems that can fulfill a specific load profile suitable for the application and operating conditions.

Battery systems for metro applications are generally installed in the underfloor of the wagon. The battery cells are mounted in a stainless-steel tray which is mounted on telescopic rails in the metro underfloor container. For maintenance and repair purposes the tray can be pulled sideways out of the container by just one person. This can be done very easily thanks to the telescopic rails and the battery cells are thus easily accessible.

By pulling out the tray, a plug system automatically disconnects the tray from the on-board power supply. The time-consuming and manual removal of the connector plugs is no longer necessary. This optimises costs and significantly reduces life cycle costs. The selection of electrical components is limited to the essentials. In addition to a temperature sensor, a circuit breaker is used. The power cables are connected via simple bolt terminals.

This approach requires many years of technical expertise in the integration of energy, mechanical and monitoring functions. From project management to design and manufacturing to logistics, qualifications to all relevant international standards are required. HOPPECKE also offers a comprehensive recycling service for the collection and disposal of batteries at the end of their service life with its in-house certified metal smelter.

Through this sustainable, cost-optimised and easy-to-maintain concept, HOPPECKE makes a decisive contribution to reducing the total cost of ownership (TCO) of metro vehicles. In the meantime, HOPPECKE's tailor-made and reliable on-board battery systems are in use all over the world. They are now used by many of the world's largest metro operators to help ensure that passengers reach their destinations safely every day.

Key Benefits

- Cost optimisation due to modular battery system
- Optimal efficiency and performance
- High serviceability due to easy maintenance

- Fully integrated aesthetic battery system solution
- Highest reliability and safety standards
- Qualifications of all relevant international standards

3 | Products :

- ▶ Nickel-cadmium, lead-acid, lithium as auxiliary/ emergency power batteries
- ▶ Full-service contracts for lifetime optimisation
- ▶ Real-time online monitoring portal
- ▶ Individual consulting for optimal battery utilisation