



CASE STUDY



1 | Challenge : **The electrification of shunting locomotives to reduce fuel and CO₂ consumption**

Europe's first hybrid shunting locomotive for freight and factory traffic, which is also approved for use on main lines, runs on traction batteries from the Sauerland region. In cooperation with Alstom, HOPPECKE is equipping the shunting locomotives with innovative rail traction solutions.

Customer satisfaction is the prerequisite for sustainable growth in rail transportation. The requirements for safety, quality, reliability and environmental sustainability are the top priorities. Pollutant-free mobility is currently the challenge facing rail vehicle manufacturers in order to enable a sustainable energy transition on the railroads as well. Furthermore, it is also important to arouse interest through innovations.

The operation of shunting locomotives in construction train service as well as in medium-heavy freight train service is characterised by short operating phases. The resulting waiting times are bridged by idling or switching off the engine. Both results have disadvantages. An idling engine consumes fuel, and shutting down the train engine delays

the achievement of the required operating temperature. Higher fuel consumption, higher pollutant emissions and reduced engine service life are the result.

To meet increased customer requirements, HOPPECKE is setting another sustainable milestone in the energy transition. After equipping Germany's first shunting locomotive with a nickel-cadmium traction battery, the battery system was converted to a lithium-ion battery solution in very close cooperation with the French train manufacturer Alstom. This makes the Alstom Prima H3 to the first hybrid shunting locomotive in Europe that can be used on the main lines of the rail network. The Alstom Prima H3 locomotive can run at speeds of up to 100 km/h in battery-only mode.

Reduction of pollutants
through modern mobility

High fuel consumption
during waiting times

Reduced engine life
due to on/off switching

Demanding areas of application
industry, ports, railroads



"By using a lithium-ion battery system, our customer was able to reduce fuel consumption by 50% as well as exhaust and particulate emissions by up to 70%."

Hans-Peter Czernietzki
HOPPECKE Rail

1.5 t
Total weight of the battery system

50%
Reduction of fuel

70%
Lower exhaust and particulate emissions

100 km/h
Approval on main lines

2 | Solution: Innovative and powerful lithium-ion battery system

With the further development of the rail traction battery, HOPPECKE offers a powerful solution for the increased demand for fuel-saving and low-emission drives for shunting operations.

With the goal of zero-emission mobility, the Alstom Prima H3 was equipped with HOPPECKE nickel-cadmium traction batteries starting in 2011. The vehicle mass increased by 6.5 t as a result of the conversion. This solution was used for the first 40 locomotives produced. Since 2019, new Prima H3 locomotives have been equipped with high-power lithium-ion batteries from HOPPECKE. A significantly higher performance and service life can be achieved with the same energy content. For this purpose, the weight of the complete battery system has been reduced to 1.5 t.

The highly engineered battery system of the locomotive consists of high-power modules connected in series and in parallel, resulting in an installed energy content of 92 kWh at a nominal voltage of 666 V. Thanks to a discharge capacity of 340 kW, the lithium-ion battery system provides enough power to the drive.

With an average charging power of 275 kW, it can be recharged in a very short time. In the process, the hybrid locomotive consumes up to 50% less fuel. Its exhaust and particulate emissions are up to 70% lower. In addition, noise pollution is significantly reduced as the locomotive runs for the most part in battery-only mode. This makes it ideal for work in sensitive areas such as factory halls or tunnels. Depending on requirements, the Prima H3 can be driven in battery-only mode, with diesel genset only, or combined in hybrid mode. The system power in hybrid mode is up to 700 kW.

For the approval of the Alstom Prima H3 including the battery system, HOPPECKE was able to support its partner with the required expertise. In order to meet the high safety requirements, the HOPPECKE energy experts have developed a comprehensive safety concept that complies with the high standards of the railroad world. Among others, HOPPECKE proves the safety standards EN-45545, EN-50129 and IEC-62928 for its battery systems.

Alstom has now delivered 50 hybrid shunting locomotives to rail transport companies. The battery systems can be monitored cloud-based. This gives customers the opportunity to monitor their vehicle systems in real time via a dashboard in order to ensure reliable operation through preventive fault detection.

Key Benefits

- Increased performance and increased service life with the same energy content
- Optimisation of battery system weight to 1.5 t
- Reduced fuel consumption by up to 50%
- Reduced exhaust and particulate emissions by up to 70%
- Versatile use in light to medium shunting service
- Optimum usability in sensitive areas like halls or tunnels
- Reduced emission and noise pollution
- Immediate operational readiness due to battery operation
- Safety standards EN-45545, EN-50129, IEC-62928

3 | Products :

- ▶ Lithium energy and performance for all rail applications
- ▶ Full-service contracts for lifetime optimisation
- ▶ Real-time online monitoring portal
- ▶ Individual consulting for optimal battery utilisation



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