

E-MOBILITY



# Hamburg goes *electric*

With Hamburg planning to complete its e-mobility transition by 2030, **Toralf Müller**, Managing Director of Northern Germany's second-largest transport operator, Verkehrsbetriebe Hamburg-Holstein GmbH (VHH), details the determination and passion for innovation required to achieve this Herculean task.



**TORALF MÜLLER**

Müller has been Managing Director of Verkehrsbetriebe Hamburg-Holstein GmbH since 2013. He previously worked for Deutsche Bahn from 2002 to 2013 in the Group Strategy department and has been managing director of a number of bus companies.

**T**HE city of Hamburg has set its transport operators the target of purchasing only emissions-free buses starting as early as 2020, and VHH is embracing e-mobility in order to achieve this.

VHH's intention is to switch over to newer propulsion technologies in a way that is both sustainable and cost-efficient. The approach is to use buses operated solely by batteries, charged at their depots. VHH currently has two e-buses but has completed the procurement process for

a further 16, and has open tenders for another 34 to be supplied in 2020. In accordance with the targets set by the City of Hamburg and the EU Clean Vehicle Directive, VHH plans to exchange the entire fleet in Hamburg and the surrounding districts for e-buses over the course of the next 10-15 years. The project is top of the agenda for VHH.

VHH is currently working at full capacity to prepare the essential infrastructure for stable day-to-day e-bus operations. This includes new bus depots and suitable infrastructure, as well as



a suitable fleet management system, smart charging management system, and the wide-ranging digitalisation of many company processes.

### First milestone: the new e-bus depot

The first milestone was achieved in summer 2018, when one of the first e-bus depots in northern Germany went into operation in Hamburg-Bergedorf. VHH invested around €10 million in the modern bus depot facility, which is specifically set up for the maintenance and repair of e-buses. The approximately 2,700m<sup>2</sup>, 10m-high bus depot has five individual bus lanes, each at a length of 44m. These bus lanes can hold more than one bus each – either three 12m standard-sized buses or two 18m articulated buses. The lanes are wide enough to meet the occupational safety requirements for work on high-voltage systems. Roof workstations and a crane track also allow for work on electrical roof components. Each workstation is designed in such a way that a mobile charger can be connected and the bus can be earthed if necessary. The Bergedorf bus depot is the first VHH depot to be updated to meet the needs of ultra-modern transportation systems. It serves as a template for the 11 remaining VHH depots, which will also be upgraded over time.

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### Installation of charging infrastructure

While construction work in the Bergedorf bus depot has been in progress, VHH has simultaneously been installing the necessary charging infrastructure for 137 buses. This is new territory for VHH, which has set itself the target of quickly establishing clear technical guidelines and standards to align its infrastructure and operations. The charging concept is based on a modular, scalable charging infrastructure design, meaning it can be expanded as VHH procures new vehicles, and it can also be applied to other VHH bus depots. The electricity supply in the depot is based on a redundant ring circuit, which is connected to the Hamburg power grid via a substation. Modular standard transformers (1,600 KVA) are connected to this ring circuit, which then supply power to up to 16 buses. Quick charging via direct current (DC) is carried out via Combo2 connectors, standardised across Europe, and takes between three and eight hours.

Following a thorough review of the operational processes and taking Hamburg's structural preconditions into account, VHH decided to use an overnight charging system. A maximum charging capacity of 150kW per bus and charging point can be supplied using the infrastructure already in place. The average charging time is assumed to be four to five hours. The charging equipment itself consists of a converter unit and corresponding wall boxes for connecting the buses. It is designed so that the overall efficiency exceeds 90 per cent – even in partial-load ranges.

Owing to cost, the vehicles are not parked in a covered area, which means that they must be sufficiently preconditioned. Existing charging standards do not yet offer a satisfactory solution, and so VHH has resolved to work on improving the relevant standards. The German Federal Ministry of Transport and Digital Infrastructure is contributing €1.8 million to support the project.

### The North German Energy Revolution

VHH has been involved in the North German collective project known as 'Norddeutsche ▶



*VHH is very confident that the transition to e-mobility – managed in close cooperation with all relevant market participants – will succeed* ”

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### EXPERT VIEW

#### INIT

Mandates from governments and authorities around the world to deploy e-buses represent nothing less than a paradigm shift for public transport. The transition to e-mobility affects numerous operational processes, from planning and scheduling to fleet management and depot management. Many new requirements need to be considered, as well as concepts developed, infrastructure established and staff trained. Moreover, it is essential for the efficient management of e-bus fleets that public transport providers receive adequate support from operational information systems.

INIT developed an integrated solution that carefully takes into account all operational aspects of e-mobility in public transport. It allows public transport providers to implement e-mobility in a successful and cost-effective way.

INIT's e-mobility product suite comprises planning and dispatching as well as

fleet management, range prediction, depot management and charging management. Blocks are built by considering important parameters like an organisation's charging strategy, the weather conditions or route profile. The system provides real-time support to drivers to encourage an energy-efficient driving style. Moreover, it helps to identify the best deployment and charging concept for the individual transport company by simulating different scenarios. The ability to compare all conceivable alternatives allows public transport providers to make sound decisions to develop an e-mobility strategy that works for them.

INIT is very happy to have been chosen as Verkehrsbetriebe Hamburg-Holstein's (VHH) partner – one of the pioneers of e-mobility in German public transport. Our aim is to support them in integrating e-mobility into their fleet management system and continue to pave the way in the successful deployment of e-buses.

- Apply peak shaving to limit the maximum load and costs
- Ensure sufficient operational flexibility
- Ensure optimal charging to increase battery life
- Monitor functionality of the charging infrastructure
- Integrate different charging technology and vehicles.

VHH is working closely with the Hamburg energy grid to establish its charging management system, allowing VHH to benefit from the energy experts' experience in operating car charging stations and providing e-vehicles to logistics firms.

To guarantee smooth operation for passengers, it is crucial to monitor the remaining range of vehicles on route. Due to their volatile range, this is the only way to deploy them reliably in regular service. To resolve this issue, VHH's fleet management system MOBILE-ITCS is currently updated by its manufacturer, INIT. The update will provide the control center with a quick and comprehensive overview of the current charge level of individual buses along with their remaining range, and dispatchers will be alerted if the value falls below a set threshold. Another advantage for the dispatchers: before any dispatching measures are taken, the system automatically checks whether the affected vehicle's current remaining range is sufficient. In the future, control centre personnel will be able to monitor and manage all vehicle types via a single central system – the Intermodal Transport Control System MOBILE-ITCS.

Drivers will also receive the important charge level information via their on-board computer.

EnergieWende – NEW 4.0', which translates to 'The North German Energy Revolution – NEW 4.0' since the end of July 2018. The project aims to find solutions to support the next stage of the energy transition.

VHH is involved because the project also examines how electricity generated by wind turbines can be used to charge e-buses overnight. This will ensure buses are charged at precisely the times when there is excess (wind) energy being generated and is readily available for use. It could therefore be a quick and effective win for the transformation of the north German energy system.



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#### Reviewing IT systems

Public transport IT systems must also be re-examined in the face of the requirements of e-mobility. A smart and effective all-in-one operational e-bus control system should be able to predict energy demand, actively monitor vehicles' range on their routes, and make scheduling changes on the fly where necessary.

Charging management systems need to meet various requirements, in particular:

#### Understanding e-bus operations

It goes without saying that VHH staff receive training on e-mobility. Aside from familiarising themselves with new safety requirements and technology, they also need to deepen their understanding of how e-buses operate. A range of in-depth training courses have been introduced, and further training in emergency management is currently being coordinated with the Firefighting Academy of Hamburg.

#### Looking ahead

VHH hopes that future suppliers will offer shorter delivery times for e-buses and a range of at least 250km, but also that the battery technology will continually improve. The likely continued higher acquisition costs for e-buses will lead to an even more intense focus on availability. Easy and open access to a wide range of data generated by the bus is absolutely vital to ensure stable and predictable operation throughout its entire service life. VHH is very confident that the transition to e-mobility – managed in close cooperation with all relevant market participants – will succeed. ☑