The year 2025 is to mark the end of air-pollution caused by high-emission vehicles in Amsterdam’s inner city traffic. The city administration is mainly focusing on city buses, trucks, and vans. Even today vehicles that are too loud or emit too much pollution are mostly barred from the center – with the exception of a narrow time slot for deliveries. The ambitious project is already showing initial signs of success. Currently more than 20 electrically driven trucks can be seen on the streets around the center of the Dutch capital. One already drives for Heineken. The Dutch brewery is in the process of switching its beer trucks over to electric. The trucks are supplied by Dutch vehicle maker Ginaf, which has opted for the Mobile system by Lenze Mobile Drives for the technology inside. The compact combined devices, consisting of inverters and DC-DC converters, drive two auxiliary units and provide the on-board power supply.

While discussions are still afoot elsewhere, in the Netherlands electric vehicles are fast becoming part of daily life, especially in Amsterdam, which is taking the lead. This is reflected in the growing number of electric vehicle registrations and dense network of charging stations. The target is 4000 by 2018. The Dutch capital is forging ahead with electric mobility through funding schemes and regulations, ably supported by the corporate world. The Heineken brewery has been delivering beer to inner city customers with a fully electric vehicle since November 2014. It was designed and retrofitted by another Dutch company, truck builder Ginaf. The company refitted a standard Mercedes Benz truck for Heineken: an electric drive of around 400 HP drive replaces the diesel engine and a lithium-ion battery is used instead of a fuel tank. It consists of 188 series-connected cells, each with a voltage of 3.2 V – or approximately 600 V in total.

**One inverter for two units**

Ginaf uses a combination of inverter and converter, type DCU/PSU 30/5.6 by Lenze Schmidhauser. A mobile dual solution, the inverter converts the 600 VDC into three-phase AC with a peak output of 30 kW – thus driving the motor with a dual clamp for two auxiliary units: the hydraulic unit...
support power steering and the pneumatic pump for air pressure. While the hydraulic unit runs continuously to support the power steering, the compressor is only activated over an electromagnetic coupling if the system pressure drops. As the compressor in particular is only actuated on demand, Ginaf thus reduces energy consumption. In addition, the Lenze Schmidhauser DC-DC converter with 200 A and an output of more than 5,6 kW provides the entire on-board power supply. The energy-efficient operation of the auxiliary units and on-board power supply bring a crucial advantage: increased range. Ginaf specifies up to 200 km. Heineken's drivers by no means take this performance to the limit, they cover merely 50 km to 60 km on their daily tours.

These comparatively short distances are due to the general logistics concept of only going all-electric for the famous ‘last kilometer’ from the logistics warehouse on the outskirts of the city. So the aim is not to cover long distances, but to increase delivery flexibility with the electrically driven truck. As Amsterdam's city administration only permits truck deliveries to city stores and restaurants between seven and eleven in the morning, Heineken's logistics partner is left with a time slot of just four hours – which means more drivers and tours, because the city center is only accessible for half the day.

As these restrictions do not apply to electrically driven trucks, more tours per day are possible. A crucial factor in ROI calculations, especially as the Ginaf vehicle costs twice as much as a conventional truck with a diesel engine. According to the company's CEO André Molengraaf the drive concept means that the fleet has fewer vehicles as more tours can be completed per day. Moreover, delivery and service availability are improved to the satisfaction of customers. As Molengraaf sums up: "Cost per kilometer thus accounts for just a fraction of the supply chain expenses – especially when you take wage costs into account".

The drivers are also very happy with the vehicle – even if the electric drive demands a completely different driving style because only one pedal is effectively used for acceleration and braking. The vehicle's ergonomics and quietness in the driver's cabin are often praised, says the company. Many drivers in conventional trucks complain about the absence of ear protectors. In view of the good experience, further electrically driven trucks are to replace Heineken's diesel fleet within its distribution operations: eight are to follow in Amsterdam and Rotterdam in 2016. Truck builder Ginaf in turn aims to establish electric drive technology in trucks with higher payloads. Here the key emphasis is on the use of established technology on a modular basis with standardized interfaces and untapped output potential.

These aspects played a decisive role in the selection of a system partner. "We were looking for a manufacturer capable of converting 600 V into three phase AC with a rugged modular system and the appropriate interfaces", recalls Dirk Inia, software developer at Ginaf. Components can only be integrated into a truck's existing network with a sufficient number of appropriate interfaces on board. Despite the conversion of the diesel engine to an electric solution, the full 24 V on-board power supply is retained for all consumers. So the powertrain must be as easy to integrate as possible. Lenze Schmidhauser's Mobile system therefore offers PublicCAN communication with the CAN J1939 protocol as standard – it is the standard bus in the automotive industry. And all the different solutions use the same housing, which also saves space for integration into vehicles as they are stacked. No matter whether inverters, DC-DC converters or a combination of the two are used: the engineering software for Mobile parameter setting is always the same, saving software developers like Dirk Inia a lot of time on engineering as only one tool is used. In addition, projects can be recycled for future assignments. André Molengraaf concludes: "quality and safety are what matter to us" and is pleased that Heineken's expectations of the first vehicle were exceeded by far.

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Figure 2: The DCU/PSU inverter-converter unit is equipped with water cooling for increased power density (Photo: Lenze Schmidhauser)

Figure 3: The author of this article, Jonas Schuster talking to Dirk Inia and André Molengraaf (left to right) (Photo: Lenze Schmidhauser)