

eHighway – the backbone for electrified freight transport by road

In order to reach the ambitious climate goals that have been set, CO₂ emissions from trucks must be substantially reduced. Since it isn't possible to shift a large share of freight transport to rail, reliable and environmentally compatible trucks must be used to handle the bulk of the freight. The eHighway developed by Siemens Mobility is an efficient, safe and sustainable solution for trucking freight on heavily used routes and has already reached a high degree of product maturity.

The technology developed by Siemens Mobility supplies hybrid trucks with electricity from an overhead line via a pantograph. The system not only slashes energy consumption by half, but also substantially reduces local air pollution. Siemens Mobility has been demonstrating the innovative system on public highways in pilot projects in Sweden and, since May 2019, in Germany as well.

By 2050: 200 percent more freight transport by road worldwide

The volume of freight transport is steadily growing worldwide: The World Business Council for Sustainable Development (WBCSD) estimates that the global freight volume will triple between 2000 and 2050. Only around one-third of this additional volume can be shipped by rail. As a result, CO₂ emissions from trucked freight are expected to double by 2050. In view of this scenario, ensuring that these emissions are reduced as quickly as possible must be given high priority.

Reduce CO₂ emissions by electrifying a network of main freight routes

The electrification of Germany's main freight routes, totaling around 4,000 kilometers, would reduce CO₂ emissions with 10-12 million tons (Source: Machbarkeitsstudie zur Ermittlung der Potentiale des Hybrid-Oberleitungs-Lkw , Federal Ministry of Transport and Digital Infrastructure, Germany) . The eHighway would provide an electrified network backbone for efficient freight transport without

local emissions. The technology is compatible with other drive technologies used by trucks and can also be used with innovative transport systems such as automated high-capacity trucks. As a result of its flexibility and compatibility, the system can quickly help reduce emissions and support the development of future technologies.

The principle: combine a hybrid drive with a pantograph

The core element of the system is an intelligent pantograph combined with a hybrid drive. Semi-trailer or other types of trucks equipped with the system draw electricity to run their traction motors and charge their batteries from overhead lines along the eHighway and operate without local emissions. Passing other vehicles on the highway or taking evasive maneuvers is possible using the truck's battery. The battery pack can be adapted in capacity to meet operational requirements. When running on non-electrified highways, the truck uses a hybrid engine. The system can be configured in a wide variety of ways: Serial or parallel hybrid systems with various internal combustion engines or fuel cells can be used, as well as purely electric drives. A sensor system enables the pantograph to extend and contact the overhead line or retract at speeds up to 90 kmh. This is a technical innovation compared to electric trolley buses and hybrid trucks such as used in open-pit mines: the traditional system limits operation to directly beneath the overhead line.

Catenary and intelligent pantographs

- Since electricity from the overhead line directly powers the truck's electric drive, optimal efficiency of over 80 percent is possible.
- Braking and accelerating trucks can exchange energy with one another via the overhead line, such as on downhill and uphill sections. Electric braking energy can be fed back into the truck's battery or the power grid.
- The intelligent pantograph finds, makes or breaks contact with the overhead line automatically at speeds up to 90 kmh.
- The technology's safety has been demonstrated by the long and widespread use of overhead power lines for systems like electric trolley buses and trams.
- Experience gained from railway and tram operations confirm the long service life of the system's infrastructure, which has relatively low maintenance and repair costs.
- The technology can easily be integrated into existing traffic systems and the trucks can operate without restricting other vehicles.

Hybrid drive

- The truck's hybrid drive, such as a diesel generator combined with a relatively small battery and electric drive, ensures the truck's flexibility, enabling it, for instance, to pass other vehicles or operate on non-electrified routes.
- Compared with traditional combustion engines, the hybrid drive is significantly more efficient, has a longer service life and requires less maintenance.
- The system can be used with various hybrid configurations, such as power from hydrogen produced in fuel cells, if the route is not electrified.

Costs and benefits of the eHighway

A study published by the Federation of German Industries (BDI) concludes that the electrification of a large share of the country's truck transport would be realistic only with trucks operating with overhead lines. Despite the investment required by such a system, the technology is currently the most cost-effective solution. According to calculations made by the Ifeu Institute, two-thirds of the heavy freight transport mileage on a 4,000-km core network could be managed economically with an eHighway. A study on behalf of the Federal Ministry of Transport and Digital Infrastructure in Germany concludes that, once the core eHighway network is available, it would make economic sense for 85 percent of all new trucks to be equipped for electric operation.

Pilot projects in Sweden and Germany

The first eHighway installation on a public highway began operation in Sweden in June 2016. Siemens Mobility installed an overhead line system for trucks along a two-kilometer section of the E16 motorway north of Stockholm for a pilot project. The two diesel hybrid trucks manufactured by Scania for the test were adapted for use with the overhead line in cooperation with Siemens Mobility.

The Swedish transport authority Trafikverket and the District of Gävleborg collected data and evaluated practice with the eHighway to see if it would be suitable for future long-term commercial use and further expansion. Sweden has set an ambitious environmental goal of making its transport sector independent of fossil fuels by 2030.

The eHighway system is also being tested in Germany. The system's operational maturity has already been proven by Siemens Mobility on a private test track in Templin Groß Dölln. To test the eHighway under everyday road conditions, two test sections were installed on the A5 autobahn in the state of Hesse (between Weiterstadt and Frankfurt) and on the A1 autobahn in the state of Schleswig-Holstein (between Lübeck and Reinfeld) with the financial support of the Federal Ministry for the Environment, Conservation and Nuclear Safety. A total of 15 trucks built by Scania will be used on the two test sections. The first two trucks are already in operation, and the remaining 13 will follow by the end of 2020 and in early 2021.

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