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## 12-meter Electric Bus in Regular Service with Inductive Opportunity Charging

**Field trials in the Netherlands: 12-meter electric bus is going to run 288 km a day in regular service with inductive opportunity charging.**

The first ever field trials of a 12-meter electric bus charged wirelessly by induction are currently underway in the Netherlands. Green power makes the electric bus, a converted Volvo diesel bus, absolutely zero-emission at the local level, and with the right electricity mix it can even be operated completely climate-neutrally. The charging technology IPT® (Inductive Power Transfer) allows the electric bus to run reliably for 18 hours, covering some 288 kilometers a day, without the need to stop for prolonged periods or return to the depot to recharge. The project, which is currently in the final phase of vehicle testing, has come at just the right time, as stricter emissions standards are due to come into effect in the EU in 2014. Commercial vehicles such as buses will then be required to cut their nitrogen oxide emissions by 80 percent and their particulate emissions by 67 percent, relative to the current Euro V standard. Demand for climate-neutral vehicles for local public transport has already risen sharply. Although 2013 will witness the launch of a few diesel and hybrid buses that are capable of meeting the new standards with a great deal of cost and effort (e.g. exhaust post-processing), why not just go completely CO<sub>2</sub> neutral right away? Electric buses are an economically attractive proposition, as they generate just a fraction of the energy costs of diesel buses. In combination with the right charging technology, their total cost of ownership will be lower in the medium term, in spite of currently higher purchase costs. Depending on the size of the fleet and the number of charging points, the purchase of a bus that uses inductive charging can pay for itself within as little as three or four years.

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### The IPT® Charging Concept

Inductive Power Transfer – or IPT® – is an energy transfer system for electric vehicles that works by magnetic resonance coupling. The system consists of two main components: a primary coil in the road, which is connected to the power grid via a converter, and pickup coils fitted in the road and underneath the bus. IPT® is based on the principle of short but regular charging during operation. The battery is fully charged over night and then topped up as necessary and as possible over the course of the day at suitably equipped stops, usually by about 10–15%, while the passengers board and alight or when the bus stands still for longer at a hub or at each end of the route. Conventional electric buses are almost exclusively recharged overnight by cable. IPT® offers the possibility of additional cable-free topping-up of the batteries over the course of the day, which can extend their range by up to five times: this means that instead of being on the road for maybe four hours, a bus can run potentially all day long, given the necessary charging infrastructure. Powering a 12-meter electric bus for a whole day would normally require a very large battery, which would make the bus expensive and heavy. Charging the bus briefly and quickly by induction at bus stops while the passengers get on and off, and at other suitable points along its route, may allow to reduce the size of the batteries by as much as 75% best case.

### Innovation

Conductix-Wampfler already has a long track record of demonstrating just how well the inductive charging of batteries can work in cars and public transport. In Italy, 7.5-metre electric buses have already been in operation using IPT® charging for the past ten years. Now, wireless inductive power transfer is being tested on a 12-meter public bus for the first time. This is particularly significant given that the vast majority of buses operating in

Europe are in the 12 to 14 meter range. In the Netherlands the bus receives a 120 kW opportunity charging within the space of a few minutes while at a bus stop. One of the key features of IPT® is its convenience and safety: the bus driver monitors the charging process from his seat on a monitor in the vehicle cockpit. Tripping hazards and electrical accidents are ruled out from the start with this invisible technology, as are vandalism and metal theft. The higher vehicle availability and the potential for greatly reduced energy storage capacity, as well as the lower running costs, send a clear economic message. An extensive testing program now aims to prove that this bus is capable of meeting all of the requirements made on a bus of this size and that it can be operated safely and reliably. The test has already attracted a lot of interest, both in the Netherlands and abroad.

### Partners

There are five other partners involved in the project, besides the town of s'Hertogenbosch (Den Bosch): Bluekens Bus & Truck (building and supplying the bus), Conductix-Wampfler (supplying and erecting the inductive charging solution), Heijmans (installing the charging points), Arriva (driver training and bus operation) and Enexis (connection of the charging system).

### Prospects

With just the first preliminary tests in the Netherlands completed so far, it can already be tentatively said that it will be possible for more electric buses to be used in public transport in the future and that they will be an economically viable alternative to diesel buses. This is the first time that an electric bus of this size with wireless inductive charging is in test in regular service, but the signs are clear enough. Other pilot and test projects with the same technological and operational approach are already scheduled in Europe and the USA, for example in Milton Keynes in the UK,

where eight electric buses will go into regular service in mid-2013. The fact that the concept of opportunity charging for electric buses opens the door to a successful future is demonstrated by operator models such as that of the firm PROOV, which recently won an award in the Netherlands for the best e-mobility business concept.

### Short Profile of Conductix-Wampfler

Conductix-Wampfler is the world's leading supplier of mobile energy supply and data transmission systems.

With own companies and several partners Conductix-Wampfler is present in nearly all relevant countries.

### Pictures:



**Caption:** The e-bus recharges invisibly at a bus stop in s'Hertogenbosch (Conductix-Wampfler)



**Caption:** Automatic lowering of the pickup coils to the primary coil in the asphalt (Conductix-Wampfler)



**Caption:** Barrier-free, inductive charging station at the bus stop in s'Hertogenbosch (Conductix-Wampfler)

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