10 years of electric buses with IPT® Charge

Wireless Charging for Electric Vehicles

31.05.2012

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Introduction

For urban local public transport in particular, the electric bus is the mode of transport of the future. With respect to the total cost of operation over its entire service life, it is far more economical to run than CNG-powered buses, hybrids or purely diesel-engined buses. The electric drivetrain is a compelling solution first and foremost due to its excellent energy balance: a recent comparison from the USA has revealed that the electric buses selected consume about $9,000 worth of energy in a year, whereas a comparable diesel bus burns fuel worth some $50,000. The acquisition costs of an electric bus, which are still higher at present, pay off by the fourth year of operation at the latest. In China this insight is no longer being called into question, but instead is being put into practice on a large scale – for example in rapidly growing cities such as Shenzhen.

To boost the profitability of a bus fleet, however, it is not just a matter of the drivetrain: you also need the right charging technology. Due to regular interim charging, fleet operators can buy cheaper buses with smaller batteries in which the cell chemistry is kept healthy by more-frequent, but shorter charging cycles, meaning that the cells have a longer service life[1]. With the operational concept termed opportunistic

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charging, much less weight needs to be carried around and no special journeys to battery exchange stations are needed. This has a positive effect on the overall cost and on system efficiency. And that's without even factoring in the tax benefits, or the fact that there are no emissions levies to pay and that the maintenance costs are lower.

Conductix-Wampfler has been demonstrating for many years how well inductive charging of batteries can work in the context of local public transport: there are about 30 electric buses in Genoa and Turin that have been using the company's IPT® technology since 2002. Ten years on, the Italian public transport companies AMT and GTT deem the application of this technology under everyday conditions to have been a success. The buses in Turin reliably travel 200 kilometres a day without needing to stop anywhere for a prolonged period or having to return to the depot for charging.

However, the bus routes with the IPT® charging systems haven't only proven themselves from the economical point of view, but also because they are so quiet and produce zero emissions. As the chargers can be integrated invisibly, they neither compromise the cityscape nor detract from the tourist attractions. There's nothing for people to get hurt by tripping over, and there are no secondary costs due to vandalism or rodent damage.

Technology and vehicles

The idea is as simple as it is clever: 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, which is connected to the electricity grid via an infeed converter, and a pickup coil integrated in the floor of the bus. This technology permits an efficient, automatic, contactless transfer of energy.

IPT® is convinced that short but regular charging is the way to go. The battery is fully charged overnight and then topped up as necessary and as possible over the course of the day at suitably equipped stops, generally by about 10–15%, depending on how long it stays at the stops.

The topping-up of the batteries, e.g. at terminals, railways stations or

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hubs, ensures that the buses have sufficient range, so that the energy they need to store can be kept to a minimum. This allows the capacity of the batteries to be reduced by as much as 75%, assuming a vehicle without IPT® Charge is even able to carry enough energy storage to complete a whole day's operations. This greatly reduces the purchase price and weight of the vehicles and does not impinge on the size of the passenger compartment.

The number of charging stations is individually adjusted to suit the size and the operating situation of the bus fleet: the more buses there are in a fleet and the more charging stations there are, the more flexible the system and the shorter the charging cycles can be. The acquisition and operating costs are spread over several buses. The buses can be charged with 60 kW or 120 kW at bus stops or at route termini while passengers embark and disembark. While charging, the current collectors on the bus take up a position about 40 mm from the charging coil in the ground, facilitating an extremely efficient energy transfer: 95% of the energy taken from the electricity grid is stored in the battery during normal operation. This makes the IPT® technology, in a direct comparison, virtually as efficient as charging via a charging cable with very good battery chargers available today, and in many cases superior to low-priced plug-in battery chargers.

Increased comfort and safety

While the electric bus is automatically recharged inductively during short stops at bus stops, the driver can keep an eye on the charging process from his seat via a conveniently positioned monitor in the vehicle cockpit. In fact, Conductix-Wampfler has now launched the second generation of its charging technology on the market: the system is even easier to integrate in existing systems. Its enhanced diagnostic functions and improved network connectivity mean greater operational transparency for the user.

Not only does this do away with the need for handling heavy charger cables, but also the danger of electrical accidents in rain, snow or hail. As a negative example in this respect, just take the operating instructions that one renowned manufacturer supplies with electric vehicles in the USA: they warn explicitly against touching the plug with wet hands or standing in a puddle or in snow while charging. As the bus

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driver doesn't need to leave the bus for recharging or never comes into any kind of contact with the charging accessories, there is no need for service staff with electrical engineering training. The stray magnetic fields remain restricted to the immediate vicinity of the coil.

Summary and outlook

Other pilot and test projects have been or will be equipped according to the same technological and operating approach as that used in Turin, Genoa and industrial projects in local public transport scenarios in Japan, Lucerne (Switzerland), Lörrach (Germany), Rotorua (New Zealand), Utrecht (Holland) as well as Los Angeles and Chattanooga (USA).

There are currently no real alternatives to the electric drivetrain in city buses. It's only a matter of time before we are hit by the next acute oil price rises, to which the price of natural gas is tied. The zero-emission buses are also highly recommended in the light of international legislation, too: in California it is already mandatory for 15% of all urban transportation to be zero-emission, and there are also restrictions on diesel in a number of megacities in Asia already. Based on the assumption that the price of the vehicles and batteries will continue to fall, the TCO models will come out in favour of electric buses with opportunistic charging much sooner than one might expect. And once the increasing emissions offset costs of diesel and hybrid buses are included in the equation, the result of any comparison will be very conclusive.

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Bombardier Begins Operation of the First Inductive High Power Charging Station for PRIMOVE Electric Buses

September 10, 2013 — Berlin
Transportation, Press Release

- **Milestone for practical implementation of the *PRIMOVE* e-mobility solution**
- **World's first inductive charging pad for 200 kW in the public area**
- **Wireless charging solution for electric trams, buses and cars breaks new ground in clean, flexible and convenient urban transport**

1 of 5 : PRIMOVE bus at Mannheim bus depot

At a world premiere in Braunschweig, Germany, Bombardier Transportation launched the first high power inductive charging station for *PRIMOVE* electric buses together with the local transport operator Braunschweiger Verkehrs-AG. In the presence of Rainer Bomba, State

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Low Resolution (77 KB) High Resolution (5 MB)

Secretary in the German Federal Ministry of Transport, Building and Urban Development, and Braunschweig's Lord Mayor, Dr Gert Hoffmann, the *PRIMOVE* electric bus was charged in a real time demonstration via the world's first inductive fast charging pad at Braunschweig main station.

From December this year, Braunschweiger Verkehrs-AG in partnership with Bombardier will change the service on the inner-city circular bus line M19 over to clean electric operation. Passenger service will initially commence with a 12 metre long electric solo bus. Shortly afterwards, 18 metre articulated e-buses from the manufacturer Solaris will follow. This is a significant event as it marks the first time that electric buses will replace conventional buses.

The electric buses will each be equipped with the wireless *PRIMOVE* fast charging system and the new *PRIMOVE* high power batteries. Bombardier is at the forefront of innovation and the world's first inductive charging system with an output of 200 kW will be used in Braunschweig to charge electric buses.

To ensure safe operation, Bombardier is working closely with TÜV SÜD, the organisation that audited the *PRIMOVE* wayside infrastructure and approved the *PRIMOVE* electric bus demonstrated today for passenger operation on public roads. The latter was already successfully tested in April over a four-week period during passenger service in Mannheim, Germany.

As the world's leading rail technology provider, Bombardier has a clear vision of the cities of tomorrow. The company imagines cities where all vehicles are electric, where mass transit vehicles do not alter the landscape but seamlessly integrate to provide quiet and emission-free urban mobility. With the *PRIMOVE* portfolio, Bombardier is smoothing the transition of transport providers and vehicle manufacturers to electric mobility for all electric vehicles – from trams and buses to commercial vehicles and cars. The commissioning of the first *PRIMOVE* fast charging station for electric buses in Braunschweig impressively demonstrates that this vision is no longer just a dream but is becoming a reality.

About the *PRIMOVE* pilot project in Braunschweig

Under the name "emil" ('Elektromobilität mittels induktiver Ladung', electric mobility via inductive charging), in addition to Braunschweiger Verkehrs-AG and Bombardier, the Braunschweig Technical University and the energy provider BS | Energy are involved as partners in the innovative project in Braunschweig. The project is supported by the German Federal Ministry of Transport, Building and Urban Development.

The electric buses from the manufacturer Solaris are fully charged overnight in the bus depot. Recharging the batteries during a 10 minute stop at the terminus is sufficient to provide smooth operation of the 12 metre solo e-bus over the 12 km route. The 18 metre articulated e-buses require more energy and will therefore be additionally charged for a few seconds at two intermediate bus stops. This customised charging concept ensures maximum service life of the batteries and uninterrupted operation on the existing bus route with a clean e-mobility solution.

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The *PRIMOVE* system will remain invisible to passengers. The *PRIMOVE* high power charging pad is cast in concrete and installed beneath the surface of the road. Even the wayside electrical installation is integrated underground at the bus stops. The cooling units for those power electronics have been cleverly integrated into an advertising pillar at the Braunschweig central station and into the bus stop.

If you want to get an overview of how the PRIMOVE system works and how it differs from diesel buses, please follow this link: http://www.youtube.com/watch?v=U5aDCetbWjc

About the *PRIMOVE* portfolio

With the flexible *PRIMOVE* portfolio, Bombardier offers the world's only one-stop shop for true e-mobility: The completely integrated system for electric rail and road vehicles allows cities and the transportation industry to easily incorporate electric mobility. The complete package comprises the inductive *PRIMOVE* fast charging system, the light, long-life *PRIMOVE* batteries and the efficient *PRIMOVE* propulsion solution.

Other *PRIMOVE* projects

Bombardier is also currently working on the implementation of the *PRIMOVE* system for electric buses in Mannheim and Berlin, Germany, and in the city of Bruges in Belgium. Trams are being equipped with the light, long-life *PRIMOVE* batteries for the booming Chinese metropolis of Nanjing.

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Bombardier Transportation, a global leader in rail technology, offers the broadest portfolio in the rail industry and delivers innovative products and services that set new standards in sustainable mobility. *BOMBARDIER ECO4* technologies – built on the four cornerstones of energy, efficiency, economy and ecology – conserve energy, protect the environment and help to improve total train performance for operators and passengers. Bombardier Transportation is headquartered in Berlin, Germany, and has a very diverse customer base with products or services in more than 60 countries. It has an installed base of over 100,000 vehicles worldwide.

About Bombardier

Bombardier is the world's only manufacturer of both planes and trains. Looking far ahead while delivering today, Bombardier is evolving mobility worldwide by answering the call for more efficient, sustainable and enjoyable transportation everywhere. Our vehicles, services and, most of all, our employees are what make us a global leader in transportation.

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Bombardier is headquartered in Montréal, Canada. Our shares are traded on the Toronto Stock Exchange (BBD) and we are listed on the Dow Jones Sustainability World and North America Indexes. In the fiscal year ended December 31, 2012, we posted revenues of $16.8 billion. News and information are available at bombardier.com or follow us on Twitter @Bombardier.

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100% e-bus line with wireless charge

March 20, 2015

Starting in summer 2015, passengers on the city center bus line 204 will be able to enjoy a quiet and zero-emission ride through Germany's capital city. A wireless charging system and a compact battery system will be provided by Bombardier under the brand Primove. The German Federal Ministry of

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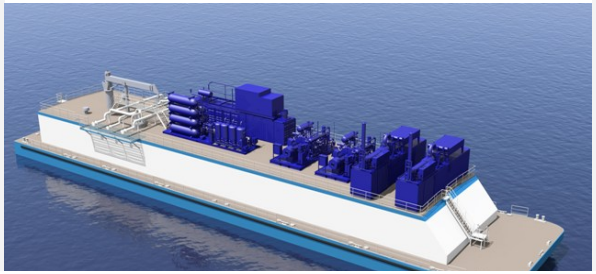

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Transport and Digital Infrastructure (BMVI) is supporting the project in the context of the “International Showcase Program for E-mobility Berlin Brandenburg”. The new fleet will save around 260 tons of CO_2 per year.

On the occasion of the installation of the inductive charging pad at Berlin’s first charging station the project partners BVG (Berlin public transport authority), Berlin Technical University and Bombardier Transportation invited representatives from the BMVI, the City of Berlin and media to inform them about the technical details of the wireless charging technology, the current project status and the further project milestones. The charging pad weighs seven tons, is five meters long, two meters wide and 25 centimeters thick.

Bombardier’s innovative Primove system charges the Berlin buses’ batteries at 200 kW in the very few minutes of dwell time spent at the end stations. This allows the buses to serve the 6.1 km long bus line back and forth – without additional stops or battery changing for an entire day. As with an electric toothbrush, charging works without a cable connection. As soon as the bus is positioned over the underground charging pad, the pick-up coil mounted on the underside of the vehicle lowers.

Starting in April 2015, additional Primove charging stations will be installed at the route’s second end stop as well as at BVG’s bus depot where the four e-buses will be based. The 12 meter long vehicles will be built this spring by the Polish manufacturer Solaris. The delivery of the first bus to the Bombardier site in Mannheim, Germany, for final coordination of the technical components is planned for May 2015. Following this, the vehicles will be delivered to Berlin for approval and commissioning.

Source: Bombardier

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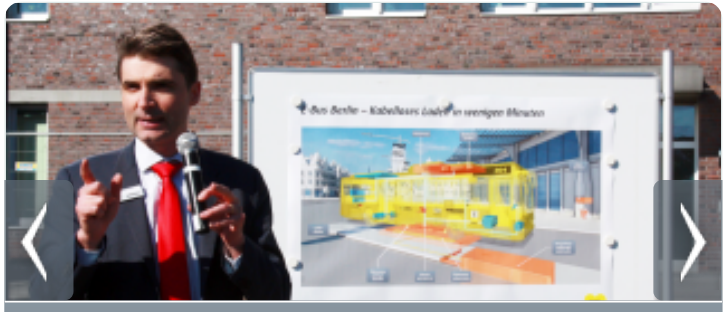
BOMBARDIER PRIMOVE to Provide Wireless Charging and Battery Technology to Berlin

March 18, 2015 — Berlin
Transportation, Press Release

- **Installation of first *PRIMOVE* charging station in Berlin begun**
- **Passenger revenue service to start in summer 2015**
- **Expected CO2 savings of around 260 tons per year**



1 of 5 : Jérémie Desjardins, Business Leader PRIMOVE at Bombardier Transportation explains fast inductive charging with the PRIMOVE system in Berlin

Berlin will be the first capital city to turn a complete bus line into an eco-friendly route using e-buses with the wireless *PRIMOVE* charging system and the compact *PRIMOVE* battery system. Starting in summer 2015, passengers on the city centre bus line 204 will be able to enjoy a quiet and zero-emission ride through Berlin. The

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German Federal Ministry of Transport and Digital Infrastructure (BMVI) is supporting the project in the context of the "International Showcase Programme for E-mobility Berlin Brandenburg".

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On the occasion of the installation of the inductive charging pad at Berlin's first charging station today, the project partners Berliner Verkehrsbetriebe (BVG; Berlin public transport authority), Technical University (TU) Berlin and Bombardier Transportation invited representatives from the BMVI, the City of Berlin and media to inform them about the technical details of the wireless charging technology, the current project status and the further project milestones. At the event, guests had the rare opportunity to inspect the charging pad, which will be invisibly embedded under the ground in just a few days. The precast charging pad weighs seven tons, is five meters long, two meters wide and 25 centimetres thick.

Bombardier's innovative *PRIMOVE* system charges the Berlin buses' batteries at 200 kW in the very few minutes of dwell time spent at the end stations. This allows the e-buses to serve the 6.1 km long bus line back and forth – without additional stops or battery changingfor an entire day. As with an electric toothbrush, charging works without a cable connection. As soon as the e-bus is positioned over the underground charging pad, the pick-up coil mounted on the underside of the vehicle lowers. The inductive energy transfer begins, generating an electromagnetic field. This poses no danger to drivers, passengers or pedestrians – or even to people with pacemakers. With the optimization of the transfer frequencies and advanced shielding, the charging system falls well below the very strict European limit values for electromagnetic emissions.

Starting in April 2015, additional *PRIMOVE* charging stations will be installed at the route's second end stop as well as at BVG's bus depot where the four e-buses will be based. The e-buses will be built this spring by the Polish manufacturer Solaris. The twelve meter long vehicles are equivalent to the Urbino 12 electric bus equipped with *PRIMOVE* charging and batteries, which has been in successful passenger operations in Braunschweig, Germany, since March 2014. The delivery of the first e-bus to the Bombardier site in Mannheim, Germany, for final coordination of the technical components is planned for May 2015. Following this, the vehicles will be delivered to Berlin for approval and commissioning. In summer 2015, passenger operations on route 204 will commence.

Berlin's new fleet of e-buses will save around 260 tons of CO2 per year. In order to achieve the same effect, around 250 private cars in Berlin, on the basis of normal driving behaviour, would have to be switched to electric mode.

Further material:

Can an electric bus compete with a diesel bus in daily operation? You'll find the answer in this video.

How cities already benefit from the convenient zero-emission PRIMOVE e-mobility solutions can be seen in this video about the PRIMOVE project in Braunschweig, Germany.

About the *PRIMOVE* Portfolio

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With its flexible *PRIMOVE* portfolio, Bombardier offers the world's only one-stop shop for true e-mobility: The fully integrated system for electric rail and road vehicles allows cities and the transport industry to easily incorporate electric mobility. The complete package includes the inductive *PRIMOVE* fast charging system, the lightweight, long-life *PRIMOVE* batteries and the efficient *PRIMOVE* propulsion.

Other *PRIMOVE* Projects

The first *PRIMOVE* 12 meter long e-bus has successfully served passengers in Braunschweig, Germany since March 2014. In December 2014, the world's first 18 meter articulated e-buses complemented passenger operations in Braunschweig. Bombardier is currently also working on implementing its *PRIMOVE* system for electric buses in Mannheim, Germany, and in Bruges, Belgium. For the booming Chinese city of Nanjing, trams have been equipped with lightweight and long-life PRIMOVE batteries. In addition, tests with a dynamically charged truck were successfully completed in Mannheim in January 2014.

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Bombardier Transportation, a global leader in rail technology, offers the broadest portfolio in the rail industry and delivers innovative products and services that set new standards in sustainable mobility. *BOMBARDIER ECO4* technologies – built on the four cornerstones of energy, efficiency, economy, and ecology – conserve energy, protect the environment and help to improve total train performance for operators and passengers. Bombardier Transportation is headquartered in Berlin, Germany, and has a very diverse customer base with products or services in more than 60 countries. It has an installed base of over 100,000 vehicles worldwide.

About Bombardier

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Bombardier is headquartered in Montréal, Canada. Our shares are traded on the Toronto Stock Exchange (BBD) and we are listed on the Dow Jones Sustainability World and North America Indices. In the fiscal year ended December 31, 2014, we posted revenues of $20.1 billion. News and information are available at bombardier.com or follow us on Twitter @Bombardier.

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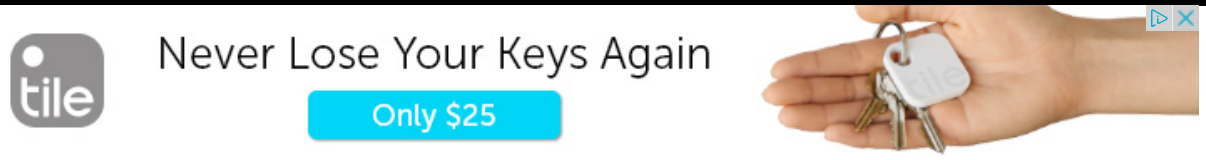
Brunswick Gets First Of Five Electric Buses With Wireless Charging



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12m Solaris battery-electric bus with the PRIMOVE inductive charging system from Bombardier

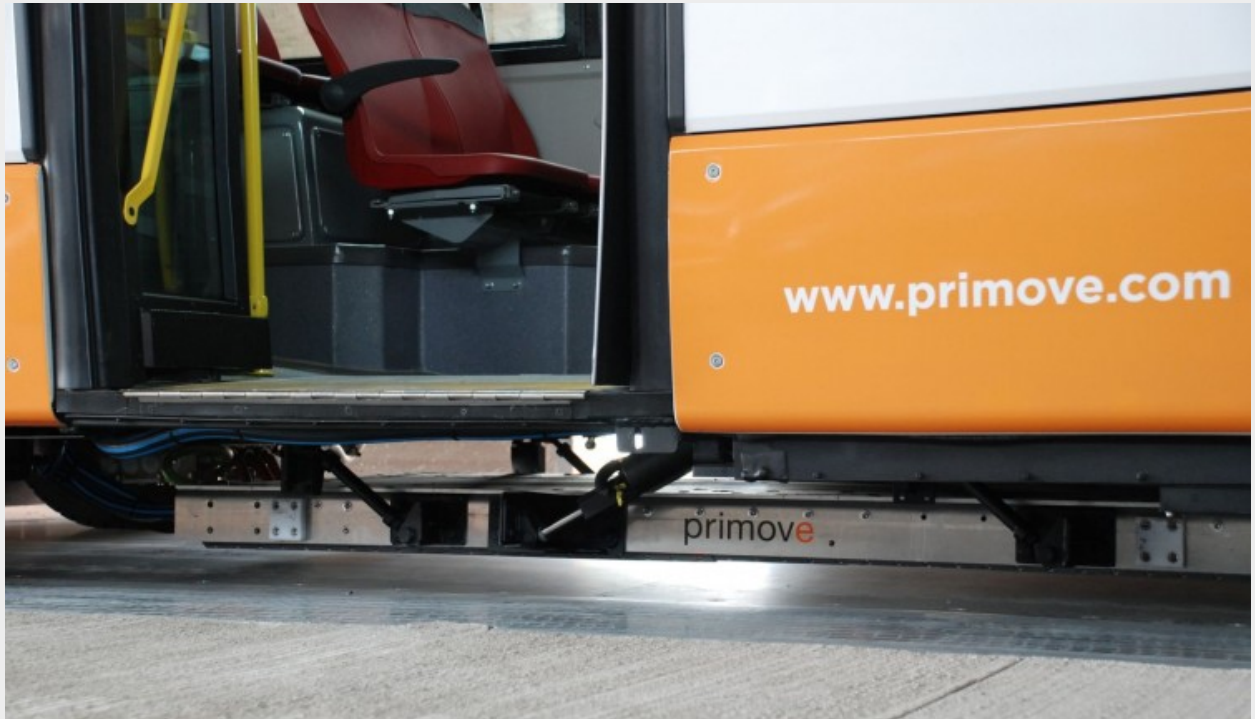
Recently, Braunschweiger Verkehrs from Brunswick, Germany got the first 12m Solaris electric bus, equipped with Bombardier PRIMOVE inductive charging.

All together, in the project "EMIL" (Elektromobilität mittels induktiver Ladung, electric mobility via inductive charging), five such buses (12m and 18m long) will operate on a 12 km line.

Very high is the power of this wireless charging system- up to 200 kW. Buses will not be fully charged at once at bus stops, but instead several times throughout the whole day at different locations (see video). Battery pack capacity is 60 kWh.

Interesting is the receiver, which has some kind of undercarriage pantograph-like mechanism to reduce the distance to the ground charging pad.

12m Solaris battery-electric bus with the PRIMOVE inductive charging system from Bombardier



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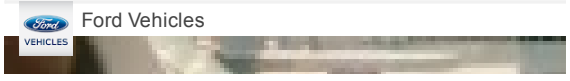
Undercarriage charging pad

The drivetrain of the bus comes from Vossloh Kiepe and puts out power of 180 kW (240 kW in 18m version).

> *"On March 27, 2014 a 12 m long battery bus from Solaris with electrical traction and on-board power supply equipment from Vossloh Kiepe went into passenger service with the Braunschweiger Verkehrs-AG as the first of altogether five buses. For the first time ever the modular system from Vossloh Kiepe has been combined with the inductive charging system Primove from Bombardier."*

Source: "EMIL" (Elektromobilität mittels induktiver Ladung, electric mobility via inductive charging) via Green Car Congress



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4 responses to "Brunswick Gets First Of Five Electric Buses With Wireless Charging"

Thomas
April 23, 2014 at 4:29 pm

To my understanding the 12m version comes with a 180 kW motor and a 60 kWh battery and the later to be delivered 18m version comes with a 240 kW motor and a 90 kWh battery.

There is no video to watch included in this news.

Mark Kane
April 23, 2014 at 5:05 pm

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OLEV Technologies' dynamic wireless inductive system charges vehicles while in motion

Posted May 1, 2014 by Markkus Rovito & filed under Features, Infrastructure Features.

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When one thinks of Nikola Tesla and electric vehicles, the obvious connection points to Elon Musk's favorite part-time project. However, we also have to give the Serbian inventor proper credit for pioneering technology that eventually may become even more important to EVs than battery breakthroughs. Tesla's obsession with wireless power transmission defined much of his life. When he first demonstrated wireless energy transfer in 1891, he may not have thought about using the breakthrough to power a motor carriage – an invention a mere five years old at the time – although we wouldn't put it past him.

We know that in many ways Tesla was far ahead of his time, and it was more than a century after his first wireless power demonstration that a form of wireless energy transmission known as inductive charging would be used to juice up the infamous General Motors EV1 and others such as the Toyota RAV4 EV. Those Magne Charge (also known as J1773) chargers used

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induction, but they still required the insertion of a paddle-type plug into the vehicle.

Hands-free inductive charging made a quiet debut in 2002, when the Italian cities of Turin and Genoa activated a couple dozen electric buses that were charged with induction coils installed in the bus chassis and at stopping points along the route. The German company Conductix-Wampfler produces the Inductive Power Transfer (ITP) system, which is still in use today. However, like hydrogen vehicles, inductive charging has largely remained one of those technologies that always seems a few years away.

Finally, those years for inductive charging are creeping up on us. In addition to Conductix-Wampfler, companies like Qualcomm, Momentum Dynamics, WiTricity, Evatran and WAVE have systems on the path to wide commercial availability.

A key turning point may have been in 2009, when WiTricity demonstrated wireless inductive power at a TED conference, and Evatran, maker of the Plugless Power EVSE based on inductive charging, was founded.

That was also the year that researchers at the Korea Advanced Institute of Science and Technology (KAIST) first tested its On-line Electric Vehicle (OLEV) system. This inductive charging scheme uses a technology called Shaped Magnetic Field in Resonance (SMFIR), which places lengths of cable beneath the street surface and allows compatible vehicles to receive a charge automatically while still in motion. In 2009, KAIST installed a system on its own campus and was able to charge vehicles inductively with 60 percent efficiency over a gap of

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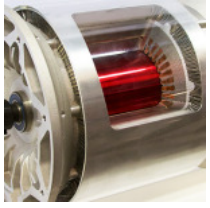

Tesla's motor guru says simulations are key to avoiding exotic materials and expensive manufacturing methods

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12 cm.

Since then, KAIST has steadily improved all aspects of OLEV, and spun off the technology into two companies: OLEV Korea and OLEV Technologies in Boston, launched in 2011. With a recently appointed CEO and a new round of angel funding, OLEV Technologies is poised to commercialize its wireless charging technology for commercial and industrial EVs in the US.

Power strips

Bryan S. Wilson, CEO and President of OLEV Technologies since December, arrived at the company 12 years after founding and successfully growing Northeast Wireless Services, which developed infrastructure for broadband wireless service providers. While his new post also deals with growing a wireless infrastructure business, it's a whole new world for the executive. Still, he thinks that OLEV's unique technology and cost-saving propositions practically speak for themselves.

For example, compared to OLEV's 2009 results, the system can now charge with 85 percent efficiency at 100 kW over a gap of 20 cm. And with OLEV, vehicles can charge while in motion.

OLEV's system can now charge with 85 percent efficiency at 100 kW over a gap of 20 cm. And vehicles can charge while in motion.

"Instead of having a coil that creates the inductive field – basically a dot like a manhole cover that the vehicle has to be stationary over, our inductive charging system is linear and charges in a strip," Wilson said. "The vehicle can be charged either moving or stationary. A bus might stop for three minutes and pick up a charge, but if that bus needs additional power to go up a steep hill, our system can send the power directly to the motor while in motion."

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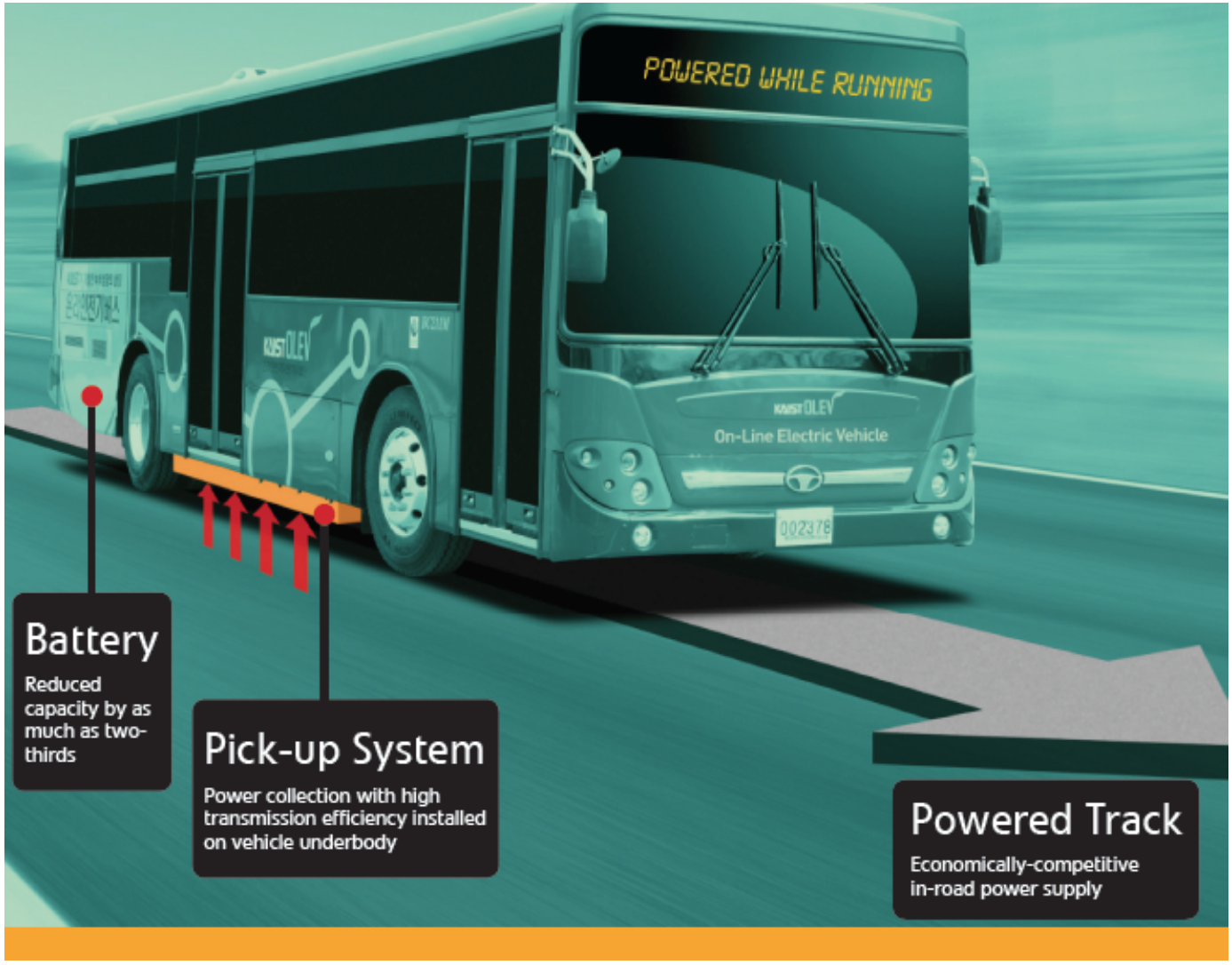

Last August, OLEV Korea set up its system for two buses in Gumi, South Korea, each running a continuous 24 km inner-city route. As an example of a typical application of the OLEV charging system, charging apparatuses are installed beneath the street in strips of concrete-encased wires 5 m at a time. The wires create the inductive charge, and when needed are placed in series, as in the case of "take-off segments" – 20 m strips that provide an extra lift for accelerating up hills.

"If it's a 20 m strip, it's not all 20 m turned on at the same time," Wilson said. "It's only 5 m turned on at any given time. They all run off of the same inductive inverter, so if you have five

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segments of charging strip, you don't need five different electronic controllers – it's all controlled by the same unit."

The inductive charging begins almost instantaneously as soon as the vehicle is within reach of the charging electronics. Naturally, the idea is to install only as much charging infrastructure as needed – usually 10-15 percent of a total route, according to Wilson – but there is no limit to the length of the segmented charging strips.

"Obviously, if there's one 5 m strip, and the vehicle's running at 50 mph, it's not going to pick up much of a charge," Wilson said. "But the segments turn on and off as the vehicle goes over them. You theoretically could have an endless strip – the vehicle would charge the whole time it's going regardless of the speed – and you'd never run out of battery charge. You could put in one of our charging systems around the Indianapolis Speedway and run a bus around it at 100 mph forever."

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Benefits & applications

That life-size Hot Wheels racetrack scenario sounds like a blast, but OLEV rather has its sights set on economizing the performance of many types of heavy-duty industrial and commercial vehicles. By reducing the amount of batteries that such vehicles need by as much as two-thirds, OLEV's system can also reduce the weight and cost of vehicles, according to Wilson, while allowing them to stay in service longer with its high-power charging.

OLEV's system can also reduce the weight and cost of vehicles, while allowing them to stay in service longer with its high-power charging.

Each of the current OLEV pickups charges at 20 kW, so on a large vehicle installation, five pickups along the bottom of the chassis would combine for a 100 kW charge rate. The OLEV companies and KAIST are working on a system that would charge at 200 kW, to hit the marketplace soon.

"Because we can charge at 100kW, we are most suited for transit buses or off-road vehicle applications, like airport equipment, cargo ship terminal equipment or mining equipment,"

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Wilson said. “Anything where a vehicle needs to be in service for a long period of time and needs to have no emissions, or reduced emissions.”

The high power of the OLEV charging system currently makes it impractical for consumer vehicles because of the equipment needed on the vehicle. “The pickups themselves are designed for high-power transfer, and weigh about 400 lbs apiece,” Wilson said, “so it wouldn’t make sense to put something like that on a Nissan LEAF. But it sure makes sense to put it on a 40,000 lbs transit bus if you can save thousands of pounds in battery weight by doing that. So we’re probably not going to compete in the space with WiTricity or Plugless, which are trying to do an installation for somebody’s driveway or garage.”

OLEV’s specific market niche gives it the advantage of going after service vehicles that currently show a total cost of ownership savings when electrified, and then making their lifetime costs even lower. Wilson also mentioned that it doesn’t hurt that there are currently federal and other subsidy dollars available to municipalities to add electric buses to their rosters.

“It’s attractive for operators to pay the premium for electric busses right now,” Wilson said. “In terms of acquisition costs, electric buses aren’t really competitive with diesel busses, but for total cost of ownership, they’re much more attractive. Our infrastructure that goes in the road can charge all of the buses on that route. So if you have 10 buses that typically run a 10-mile route around the city, and you can reduce the batteries by two-thirds on all of them, then it’s more of a cost savings using our technology. These things are easy to install overnight at a low cost. There are no moving parts; there are not a lot of electronics. What goes on the bus is just an inductive pickup. There’s a small box that goes on the roadside that connects to the electrical grid. The system’s really low maintenance.”

With OLEV’s SMFIR system on the verge of going into production, the company is seeking capital that would enable it to produce the hardware in the United States, rather than ordering it from Korea. Concurrently, Wilson is courting as many potential customers as possible. “We are

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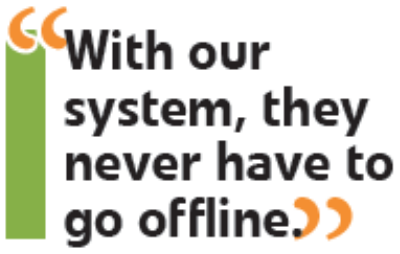
reaching out to electric bus companies, municipalities, marine terminal operators, mining companies, airlines and anybody who has an electric vehicle they need to keep in service and either reduce costs or weight," Wilson said.



OLEV's system can potentially save its customers additional money by avoiding standalone large-capacity recharging facilities, and save employee person-hours by eliminating the need for battery swaps and other tasks. Wilson gave the example of industrial warehouse forklifts, which are often subject to expensive battery swapping. "With our system, they never have to go offline," Wilson said. "They can recharge while in motion, or the operator can just park it in a certain place to recharge. Potential customers also have told us that in situations where they need to plug in a vehicle to recharge the batteries, a specific employee has to do that – they can't just let the operator plug it in. It has to do with union regulations and operational protocols."

Because the OLEV SMFIR system is not a pantograph-type system like the one commonly used on electrified streetcars, the vehicles can move off the specified route at any time. That makes it attractive in cases where a set route is usually followed but is not constant, like the aforementioned warehouse vehicles or airport baggage handling systems and aircraft tugs.

The possibilities for KAIST's system, which is now in pilot programs in the Seoul, Jejudo, Daejeon, and Sejong regions of South Korea, are legion. And now, four years after SMFIR was named to Time Magazine's 50 Best Inventions of 2010, this could be its time to make its mark on American transportation and industrial efficiency.

This article originally appeared in Charged Issue 12 – FEB 2014

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First large electric public-service bus with wireless inductive charging technology tested in the Netherlands

Wireless Charging of Electric Vehicles

01.10.2012

The first ever public-service field trials of a 12-meter electric bus charged wirelessly by induction are currently underway in s'Hertogenbosch (Den Bosch) in the Netherlands. Green power makes the electric bus, a converted Volvo diesel bus, completely climate-neutral. In addition to overnight plug-in charging, opportunity charging will allow the electric bus to run reliably for 18 hours, covering some 288 kilometers a day, without the need to stop for prolonged periods. Opportunity charging means that the electric bus invisibly receives a top-up charge by a 120 kW wireless inductive charging system within the space of a few minutes while at a bus stop.

Inductive Power Transfer – or IPT® – is an energy transfer system for electric vehicles that works by magnetic resonance coupling. The system consists of a primary coil in the road, which is connected to the power grid, and a pickup coil fitted beneath the vehicle. The key features of the system are its convenience and safety: the bus driver can monitor the charging process on a monitor in the vehicle cockpit.

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Press Release

Tripping hazards and electrical accidents are ruled out from the start, as are vandalism and metal theft. Economic benefits are above all the higher availability of the vehicles and the possibility of using smaller and therefore less expensive batteries.

The trial 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. Electric vehicles are particularly attractive, 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. In Milton Keynes in the UK, eight electric buses will go into regular service in summer 2013 with the clear target not only to prove ecologic but also economic advantages of electric buses with wireless inductive charging.

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UK motorway to charge electric cars on the move

14 April 2014 David Crawford

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An electric bus in Germany uses an inductive fast charging system

The Highways Agency intends to equip an English motorway to test wireless charging of moving electric cars.

A spokesperson has confirmed an off-the-cuff reference, by an official at an ITS(UK) EV working group meeting, to plan for the UK's first on-road trial of dynamic as opposed to static car charging.

This will mark a step change in EV charging activity that has focused mainly on electric buses until now. A newcomer in this sector is Transport Scotland, which, working with Scottish Enterprise and bus manufacturer Alexander Dennis, plans to trial a 'semi-dynamic' system using a hybrid-electric vehicle in Glasgow this summer.

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Claimed benefits of on-the-road charging – using electromagnetic fields generated by subsurface modules – include extended range and smaller batteries. US research at North Carolina State University (NCSU) suggests that car ranges could increase from around 100km to nearly 500km.

The HA says its initiative is supporting the government's low-carbon policy by "promoting the advantages of ultra-low-emission vehicles". At the same time, UK transport consultancy TRL has won a tranche of the €9m European Commission (EC) co-funded FABRIC programme set up to assess technological aspects of dynamic charging.

The Highways Agency (HA) has yet to give details of the trial site or dates. But it has issued criteria for system adoption, including a lifecycle comparable to that of asphalt (typically around 16 years), cost-effective maintenance, resistance to vibration and weather, and efficient charge collection at high speeds.

effect of massive switch' to electric cars

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UK static inductive charging experience to date involves test cars parking at existing plug-in stations in London and an electric bus service launched in January 2014 in Milton Keynes, where vehicles top up their overnight charge during drivers' rest breaks. Managing this five-year demonstration is the eFleet Integrated Service joint venture between Mitsui Europe and consulting engineers Arup.

Arup helped create a wireless power transfer system branded HALO in Auckland, New Zealand in 2010. US wireless technology developer Qualcomm, which bought HALO in 2011, is running the London static car trial and planning a dynamic test track in Auckland.

For operational experience, the HA can look to Asia, where the Korea Advanced Institute of Science and Technology (KAIST) is running two online electric vehicle (OLEV) buses on a 12km continuous charging route in the city of Gumi. It claims 85 per cent maximum efficiency in power transfer.

The HA will also be monitoring the semi-dynamic charging trial highlighted by Transport Scotland chief executive David Middleton at a Chartered Institute of Highways & Transportation conference in March 2014. A halfway house between static and dynamic technologies, it will enable a hybrid bus to pick up charge from a series of modules installed under the road surface at strategic points along the route so it can run for long periods in fully electric mode.

A Transport Scotland spokesman explains that the approach "is likely to cause less disruption than, for example, installing dynamic charging along the length of a road".

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More recently, TRL announced that it is taking part in another European project, ZeEUS, to investigate zero emission urban bus systems using different technologies as part of regular services in eight cities, including London and Glasgow. The electric buses deployed at both these UK demonstrator sites will use wireless ‘opportunistic’ charging, which will allow them to complete routes that would otherwise be too demanding for regular electric buses.

A similar technique is being used in Braunschweig, Germany, where a bus fitted with Bombardier Primove fast-charge technology went into passenger service on 27 March.

Transport authorities can also learn from the 2010-2013 Continuous Electric Drive (CED) project, run by the Flanders DRIVE automotive research centre. This segregated a 500m stretch of the Belgian N769 highway as a temporary test track with both asphalt and concrete surfaces. It concludes that dynamic charging is “very feasible” in terms of both road construction and system design – the latter performing comparably with static charging. It also declares the system electrically safe.

A central issue for road operators is the extent of the road surface impacted by dynamic on-road charging – 10 per cent according to NCSU’s modelling, 5-15 per cent in KAIST’s experience. An alternative concept triallled by UK start-up Ampium envisages replacing trenching by less intrusive saw cutting to accommodate charging units powered from off-road sources.

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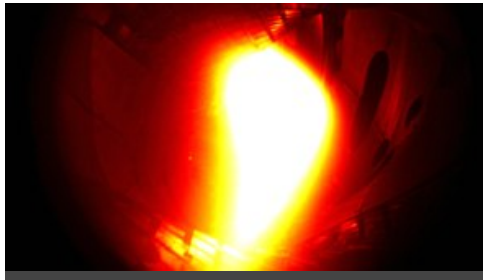

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BEN COXWORTH AUGUST 5, 2013 3 PICTURES

One of Gumi's two new buses that will draw power from the road using the Online Electric Vehicle (OLEV) system
Image Gallery (3 images)

As of this Tuesday (August 6th) the South Korean city of Gumi's transit system will see the addition of two electric buses that draw their power from the road. It's the latest step in the development of the Korea Advanced Institute of Science and Technology's (KAIST's) Online Electric Vehicle (OLEV) system, in which electric cables embedded in the asphalt provide power to vehicles traveling on its surface.

The appeal of OLEV lies in the fact that electric vehicles using the system don't have to be equipped with large, heavy batteries, they don't have to stop to recharge, and messy overhead trolley lines aren't required. Instead, the cables in the road produce magnetic fields, which receiving devices in the vehicles' undersides pick up and convert into electricity. It can be a continuous process, or


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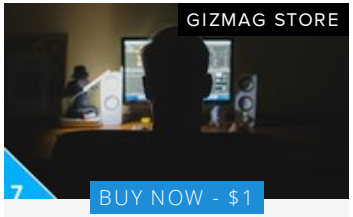
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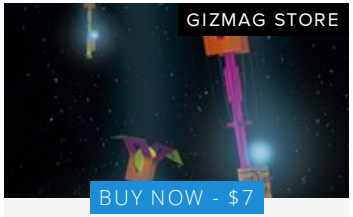
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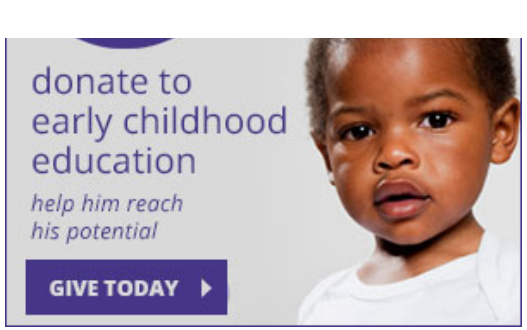

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undersides pick up and convert into electricity. It can be a continuous process, or cables can be placed in separate locations along the road, providing ongoing top-ups to a relatively small battery within the vehicle. Typically, only about 5 to 15 percent of the road surface needs to be excavated for the embedding of the cables.

The buses will run a 24-km (15-mile) round trip route in Gumi's inner city between the train station and the In-dong district. They will maintain a 17-cm (6.7-in) gap between their underbodies and the asphalt the whole time, receiving 20 kHz and 100 kW (136 horsepower) of electricity at a maximum power transmission efficiency of 85 percent.

EMF (electromagnetic field) levels within the buses are reportedly well within safe limits, plus the cables in the road only switch on when they detect the presence of one of the buses overhead – this should minimize pedestrians' and other vehicles' exposure to the magnetic fields, and will also save power.

Although this will mark the first time that OLEV is used in a public transit system, the technology has previously been tested in a tram at an amusement park in Seoul. Assuming all goes well with the two buses in Gumi, the city plans to add an

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additional 10 such vehicles to its fleet by 2015.

Source: KAIST

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About the Author

An experienced freelance writer, videographer and television producer, Ben's interest in all forms of innovation is particularly fanatical when it comes to human-powered transportation, film-making gear, environmentally-friendly technologies and anything that's designed to go underwater. He lives in Edmonton, Alberta, where he spends a lot of time going over the handlebars of his mountain bike, hanging out in off-leash parks, and wishing the Pacific Ocean wasn't so far away.

All articles by Ben Coxworth

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10 Comments

It's nice to get overhead powerlines out of view, but what happens to cables buried in the street when that street gets potholes?

Ashley Zinyk 6th August, 2013 @ 2:27 a.m. (California Time)

Well, this is merely a new twist on a very old idea. I know that in London there were trams that used rails rather than overhead wires for electricity well before WW2. If you don't object to the overhead wires then there was the "trolley bus" which had rubber tyres just like a bus.

professore 6th August, 2013 @ 4:25 a.m. (California Time)

It would be interesting to see the cost for this kind of installation and a comparison to track less trolley lines and buses with fast charged batteries.

Alexander Engman 6th August, 2013 @ 5:09 a.m. (California Time)

I like the part where they only need 15% of the road dug up. As it says, much smaller batteries can be used, or even super capacitors ! Chuck in flywheel energy storage and your on your way. I just wonder how they'd prevent energy theft.

esar 6th August, 2013 @ 8:36 a.m. (California Time)

Was there a reason the word, 'induction' wasn't used?? We've been powering things with induction for quite a while now. This is the first example I've seen of it used on a vehicle. Is the word 'Induction' taboo in South Korea?

Dan Lewis 6th August, 2013 @ 1:09 p.m. (California Time)

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Very promising initial development. They have a system for charging people for the electricity.

Paul Bedichek 6th August, 2013 @ 9:03 p.m. (California Time)

Despite being notably opposed to the stupidity of stored energy EVs, I like this and even think having the bus have enough batteries for going a couple clicks off the "wire" is a good idea for detours and getting around the maintenance yard. I would prefer an electrical connection allowing power to be pushed back into the grid but this does avoid the risk of electrocution and the inconveniences of having over head wires.

Slowburn 7th August, 2013 @ 12:44 p.m. (California Time)

South Korea has ice and snow in the winter, how much electricity goes through ice and snow. Do they first plow the snow with one truck before they let the bus use the road? I like the idea though, it needs to be tried in major cities in the US to cut down on massive engine exhaust.

Yellow River 8th August, 2013 @ 7:16 a.m. (California Time)

re; Yellow River

Magnetic fields go right through water frozen or not.

Slowburn 8th August, 2013 @ 5:52 p.m. (California Time)

I saw this idea in a video game

Gargamoth 22nd August, 2013 @ 8:47 p.m. (California Time)

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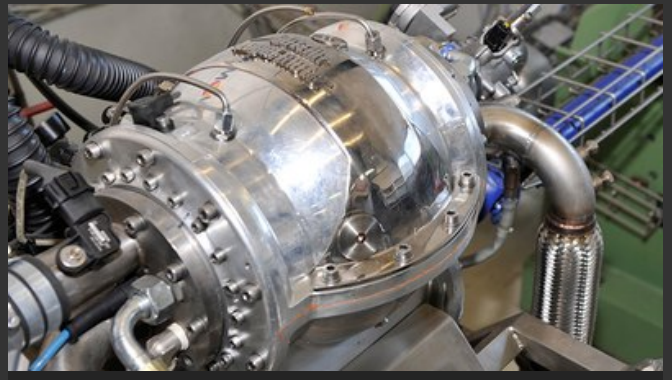

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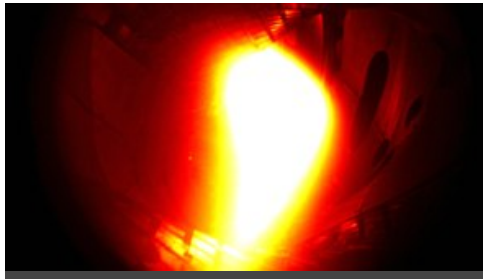

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UK to trial in-road wireless charging tech for electric vehicles

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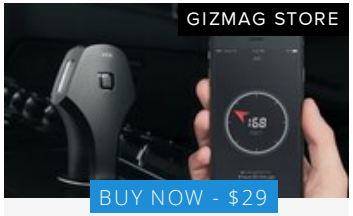

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The technology could allow EVs to be driven for longer distances, without the need to stop and charge their batteries (Credit: Highways England)
Image Gallery (2 images)

Technology to power electric vehicles wirelessly from under the road surface is about to be trialed in the UK. Highways England has announced that it plans to carry out off-road (test track) trials with a view to carrying out subsequent on-road trials of the technology, which is designed to increase the range of EVs.

The concept of embedding electric vehicle charging technology under the road has been explored by Stanford University and used to power buses in Korea. These trials, however, are said to be the first of their kind.

UK Transport Minister Andrew Jones says the trials will help to keep Britain at the forefront of the development of this technology. "The potential to recharge low-emission vehicles on the move offers exciting possibilities," he says. "We continue to explore options on how to improve journeys and make low-emission vehicles accessible to families and businesses."

The trials follow the completion of a study by Highways England into the feasibility

his potential
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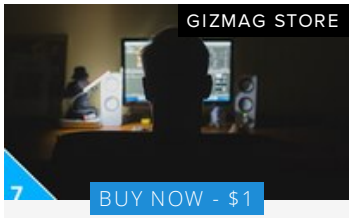
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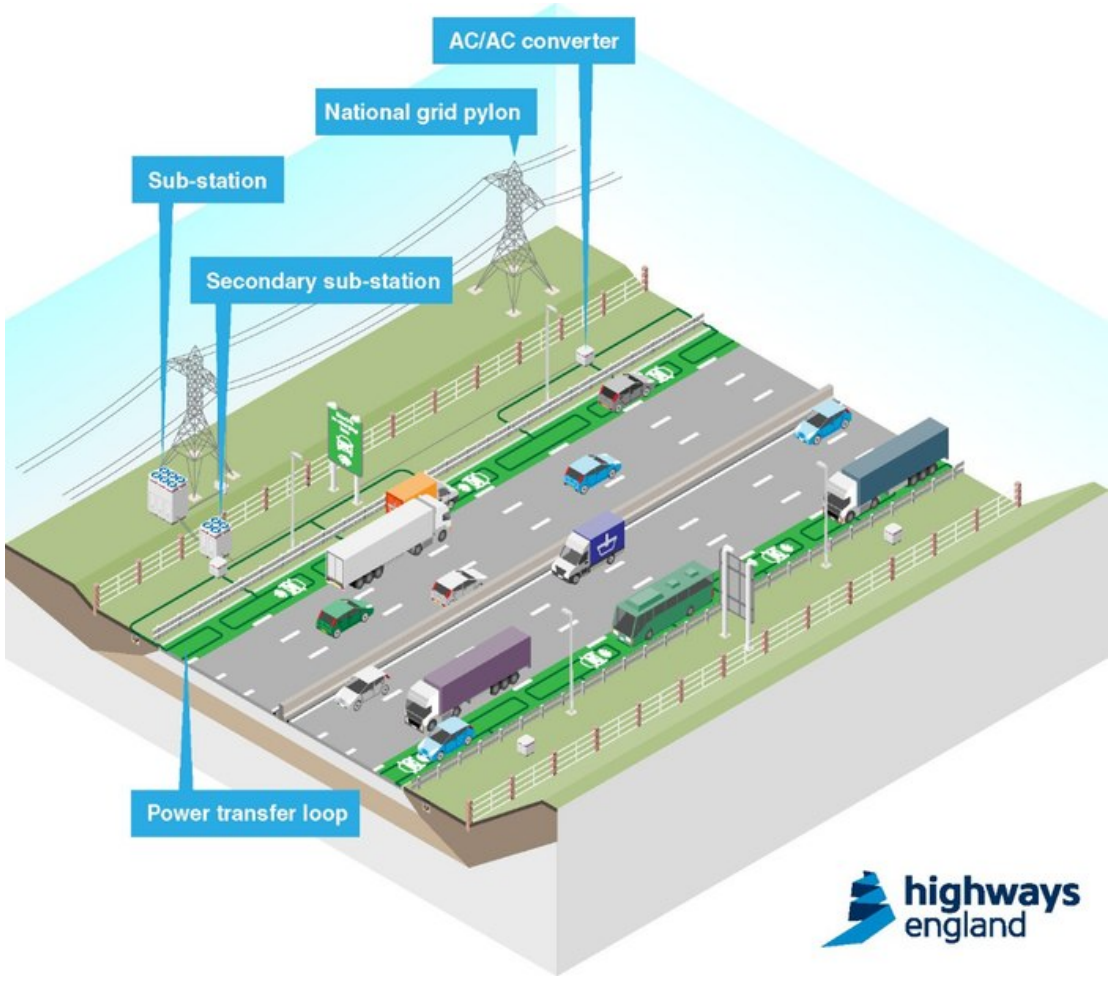
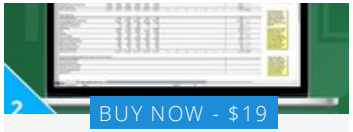
of wireless in-road charging and potential solutions. Highways England is the government organization responsible for maintaining and operating England's motorways and major A roads. It says the trials will test if the technology could work safely and effectively on motorways and A roads.



For the trials, vehicles will be fitted with the requisite wireless technology, and equipment will also be installed underneath a test-road surface. Full technical details will be released once a contractor has been appointed to build the system.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The testing will replicate motorway conditions and, if successful, may ultimately mean that EVs could be driven for long distances without the need to stop and charge their batteries. Highways England says it is also committed to installing plug-in charging points every 20 miles (32 km) on the motorway network.

The trials are scheduled to begin later this year and are expected to last for approximately 18 months.

Source: Highways England

'Bobine' Flexible iPhone Charging Dock

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About the Author

Stu is a tech writer based in Liverpool, UK. He has previously worked on global digital estate management at Amaze and headed up digital strategy for FACT (Foundation for Art and Creative Technology). He likes cups of tea, bacon sandwiches and RSS feeds.

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Not only a good and obvious idea, it might even work in the US to get government off its thumbs and start repairing the highway/infrastructure. Let's get a gas tax that fits a scale based on the price of gasoline at the pump. Oil is going to stay cheaper in the US, and probably the world until our new Iranian allies invade Saudi Arabia.

Robert Walther 12th August, 2015 @ 2:20 p.m. (California Time)

The heck is an AC to AC converter....

JweenyPwee 12th August, 2015 @ 6:37 p.m. (California Time)

Given the weight of batteries and the added power required to move them, if enough of this infrastructure was installed then electric cars without batteries might be possible.

byrneheart 12th August, 2015 @ 7:18 p.m. (California Time)

The simplest and least expensive solution would be to imbed neodymium magnets, which don't need a current going through them like an electromagnet does, in the road, put pick-up coils under the cars, and when you drive over the magnets current is produced...like the magnet on an air cooled engine's flywheel turning past the coil to produce the spark that runs the engine.

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Lightwave 13th August, 2015 @ 8:53 p.m. (California Time)

@Lightwave - And where does the energy to keep you moving come from? I think you should do some research on the expression 'over unity'. MW

Martin Winlow 14th August, 2015 @ 12:34 a.m. (California Time)

@Light Wave: completely wrong, if you don't provide energy, then there will be no energy for the car. In your example, the coil in the car will create a force that will slow down the car, it is a closed system without additional energy, it will consume energy instead of creating it.

LeMinhDuc 14th August, 2015 @ 8:17 a.m. (California Time)

It will never fly in the US unless you can bill the car's owner for the juice. That's just the way the money grubbing, greedy corporations work here. Thanks, Ronald Reagan. F-ing jerk.

Wolf0579 14th August, 2015 @ 10:31 a.m. (California Time)

Very simple, very obvious...and the obvious way to let the corporations benefit would be toll roads. Car would carry a battery good for 100 miles, toll road would supply power to run the car and keep the battery topped off. 100 miles can be driven between toll roads (eg off the toll road, over the river and through the woods to Grandmother's house). Long as you're less than 50 miles from the toll road at your destination, you don't even have to beg a recharge, just get back to the toll road and recharge as you go.

Bryan Paschke 14th August, 2015 @ 4:18 p.m. (California Time)

Battery technology will advance far more quickly than building out billions of dollars of infrastructure for this kinda system. I can see it taking place of light rail and buses that use electric overhead wires though.

Rann Xeroxx 17th August, 2015 @ 7:31 a.m. (California Time)

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I drive an EV so I know what a problem charging the batteries can be on a long trip. At home and at work charging is simple and there is enough time. On the road, charging takes more time than driving if you can find places to plug in at all. Faster charging requires the right equipment, of which there is very little due to the expense. So, if all you had to do to charge up and go were to get on the highway and drive, we would have little trouble getting around in our electric vehicles. We would rely less on heavy batteries to go the distance.

CraigMoore 3rd October, 2015 @ 7:46 p.m. (California Time)

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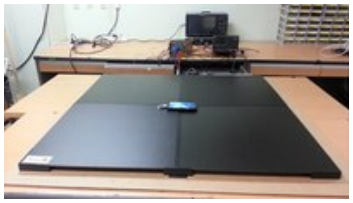

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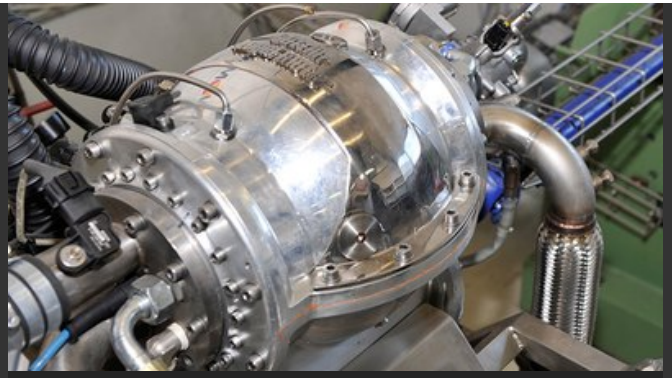

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AP Environmental Science

Utah State University Develops an E-Bus That Charges at Each Stop

Utah State University has tested a first-of-its-kind electric bus that is capable of charging itself through wireless induction technology. Dubbed 'the Aggie Bus', the e-bus uses a high-power, high-efficiency wireless

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power transfer system capable of transferring enough energy to quickly charge an EV over an air gap of 10 inches.


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KAIST Launches First Road-Charged OLEV Electric Buses in South Korea

Several years ago the Korean Advanced Institute of Technology (KAIST) unveiled their On Line Electric Vehicle (OLEV) charging system, which promised to charge cars and even city buses wirelessly through induction systems contained within roads. After tests on campus vehicles and at amusement parts, the first OLEV buses just hit inner city streets in Daejoen, South Korea.

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7 AUGUST 2013 COMMENT

Bosch And Evatran Team Up to Launch Wireless Electric Vehicle Charging System

Bosch Automotive Service Solutions and the Evatran Group are developing a wireless electric vehicle charging system that could become the first commercially available system of its kind in the US. Unlike other EV charging systems, the Plugless Level 2 Electric Vehicle Charging System offers hands-free, automatic EV charging. All EV drivers have to do is park their vehicles on the system's floor-mounted Parking Pad and

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their vehicle begins charging.


Read the rest of Bosch And Evatran Team Up to Launch Wireless Electric Vehicle Charging System

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Post tags: bosch, electric vehicles, ev, ev wireless charging, Evatran Group, infrastructure, Plugless Level 2 Electric Vehicle Charging System, wireless charging

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BOSCH, ELECTRIC VEHICLES, EV, EV WIRELESS CHARGING, EVATRAN GROUP, INFRASTRUCTURE, PLUGLESS LEVEL 2 ELECTRIC VEHICLE CHARGING SYSTEM, WIRELESS CHARGING
19 JUNE 2013 COMMENT

Navia Driverless Electric Shuttle Reduces Traffic (and Pollution) in Pedestrian-Heavy Urban Areas

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Google may have captured all the headlines with its driverless cars, but it's not the only one experimenting with autonomous vehicles. Induct, a mobility solutions firm based in France, has developed a driverless electric shuttle designed for use in pedestrian-heavy areas such as airport parking lots, shopping malls, business parks and universities. Called "Navia", the shuttle can provide an on-demand, planet-friendly transportation in areas that existing vehicles cannot reach.




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In place of a driver, Navia boasts laser range finders, cameras and GPS technology as well as accelerometers and gyroscopes that allow it to instantly calculate its position, route and distance traveled. This arsenal of high-tech equipment ensures that the vehicle will move safely, even though areas crowded by pedestrians. Capable of carrying up to eight passengers at a maximum speed of 12.5 mph, Navia's propulsion system uses Lithium-Polymer batteries and a 15" instant wireless recharging system that gives the shuttle a boost of juice at each stop.

The first Navias have already been scooped up for early testing at Switzerland's Ecole Polytechnique Fédérale de Lausanne (EPFL), with partnerships already planned with the University of West Florida and Singapore's Nanyang Technological University, Induct says.

via Springwise

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DRIVERLESS VEHICLE, ELECTRIC CARS, ELECTRIC VEHICLE, GREEN TRANSPORTATION, INDUCT, MOBILITY, NAVIA, NEWS, URBAN AREAS, WIRELESS CHARGING

31 DECEMBER 2012 COMMENT

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Massive Beijing charging station can charge 30 e-buses at up to 360 kW

Posted December 11, 2015 by Charles Morris & filed under Newswire, The Infrastructure.

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China is now the capital of big things, especially when it comes to EVs. China State Grid has opened the world's largest ultra-fast EV charging station in Beijing. The 26,500-square-meter charging complex at Xiaoying Terminal has 25 360 kW chargers and five 90 kW chargers, and can charge 30 electric transit buses at a time.

Xiaoying Terminal originally supported a natural gas hybrid bus fleet. At least 10 city bus routes have now converted to battery-electric buses. For example, route 13 is using Foton buses with battery technology from Microvast (featured in *Charged* Issue 4). Recharging takes 10-15 minutes, and takes place 2-3 times per day, during driver breaks, with several route loops between each charge.

There are already plans for the facility to be expanded as more bus routes convert to EVs.

SEE ALSO: 10 Minute Fast Charging with Microvast's LpTO Lithium-Titanate Battery Technology

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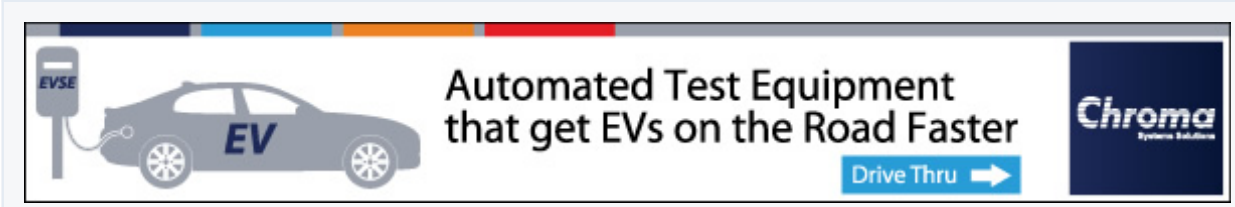

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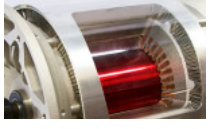

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First 12 meter electric bus with wireless inductive charging

First 12 meter (39-foot) electric public-service bus with wireless inductive charging technology tested in the Netherlands

15.10.2012 – The Netherlands

The first ever public-service field trials of a 12-meter electric bus charged wirelessly by induction are currently underway in s'Hertogenbosch (Den Bosch) in the Netherlands. Green power makes the electric bus, a converted Volvo diesel bus, completely climate-neutral.

Hybrid and Electric powertrain supplier EMOSS provided the electric powertrain and integrated the wireless charging system IPT (Conductix Wampfler) to the vehicle system. Besides the fact the original passenger capacity was maintained on a low floor concept, the efficient powertrain propels the GVW 18t vehicle without

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transmission box.

Benefits of this full electric ‘charging on route’ concept is a downsized battery pack, resulting in lower weight- and cost balance and able to operate on regular bus routes.

In addition to overnight plug-in charging, opportunity charging will allow the electric bus to run reliably for 18 hours, covering some 288 kilometers a day, without the need to stop for prolonged periods. Opportunity charging means that the electric bus invisibly receives a top-up charge by a 120 kW wireless inductive charging system within the space of a few minutes while at a bus stop.

Inductive Power Transfer – or IPT® – is an energy transfer system for electric vehicles that works by magnetic resonance coupling. The system consists of a primary coil in the road, which is connected to the power grid, and a pickup coil fitted beneath the vehicle. The trial 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, not only by the Dutch authorities who announced to aim for zero emission Public Transport in 2025. Electric vehicles are particularly attractive, 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.



About EMOSS

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EMOSS advanced electric powertrain enable our customers to develop and commercialize next-generation applications. With breakthrough technology, robust systems integration capabilities and demonstrated products in the field, we can help transform innovative concepts into market-ready solutions.

EMOSS supplies electric powertrains & auxiliary systems for electric bus, truck and taxi. The company has an unique basis of expertise: ten years of innovative products for automotive OEMs and tier 1 suppliers. We provide total powertrain, components and battery system solutions for vehicles up to 27t.

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