Key milestone for electric buses

40 partners have launched ZeEUS, a UITP-coordinated project to support electric bus development

Stefan Baguette

The European Union is making available substantial support to get electric bus technology out of the research lab and onto the road. There, the real test will be to run full-size buses in demanding, all-day operation. A coalition of 40 partners has come together in the ZeEUS project to face this challenge.

The message from suppliers is that the bus manufacturing industry is ready. Electric buses have moved beyond prototype stage, but the proof of the pudding is in the eating - or rather, in the operating.

Today's operational practices have been shaped by the capabilities and range of diesel buses. Hybrid buses work well within the existing framework, but only reduce fuel consumption and carbon footprint by around 30%. Even cleaner buses, running emission free 70-100% of the time, are more difficult to integrate.

Perhaps we will see ground-breaking change in how we run buses at a future point in time, when diesel engines are a thing of the past - but right now that is a utopia for transport planners and adventurous politicians to dream about.

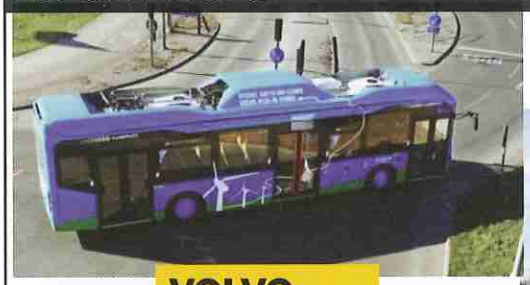
For now, electric buses need to fit into existing operational practices. Buses run all day, for up to 18 hours and more, but batteries for electric buses are nowhere near good enough yet to offer this range. Despite steady advances, they are unlikely to become so for at least another 20 years.

Currently, a ton in battery weight roughly corresponds to a good 100kWh in energy storage. On a fine day for electric bus operation (when the weather is neither too hot nor too cold, traffic is predictable and there are no unexpected peaks in passenger numbers), an all-electric full-size single decker will need something like 2kWh to cover a mile. In the vagaries of the real world, this rises to up to 4kWh if heating is electric to ensure zero emissions at all times. With an effective constructive limit of around 3 tons to the batteries that can be carried on a full-size single decker (and significantly less on a double decker), no more than 300-350kWh of energy storage are possible - just about enough to reliably cover between 75 and 90 miles all year round, and in many cases nowhere near enough to cover a full day's work. And that's before considering the drastic reduction in passenger capacity brought about by the added weight.

It makes more sense, therefore, to use smaller batteries and to top these up during the day. This requires the installation of infrastructure. Plug-in hybrids also make use of recharging infrastructure, but keep a diesel engine on board to cover for shortfalls when there is not enough layover time - as a result of scheduling constraints or of congestion - to supply enough energy to reach the next charging point with battery power alone.

But which combination of energy supply, operational strategy and vehicle specification will work in which environment? What is

ZeEUS BUSES



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"The proof of the pudding is in the eating - or rather, in the operating"

the right balance between the number of recharging points, layover time for charging and the size and weight of batteries? The only way of knowing is by trying out different solutions in different conditions, analysing their performance and deriving practical guidance. This is where demonstration programmes such as ZeEUS come in.

Agile, independent European bus builders such as Poland-based Solaris Bus & Coach, one of the industry partners in ZeEUS, have responded by developing fully modular electric drivetrains that allow specifications to be tailored to meet local requirements. Similar work is now being undertaken by some of the major commercial vehicle groups. At the heart of these systems are electric motors that power the bus and the traction electrics that control them. Energy is stored in batteries (or in supercapacitors), the size of which can be scaled to requirements. All the system then needs is one or several means of energy supply or generation, which can be picked and mixed without changing the underlying concept. Electricity can be fed to the bus by plug and cable, automatic pantographs and contacts, wireless induction or from trolleybus-style overhead lines. On board, diesel or gas-fuelled generators may produce energy. If the aim is to remain emission free at all times, hydrogen fuel cells may take on the role.

It is just semantics and marketing whether the resulting bus is called an electric bus, battery bus or, where there is a combustion engine on board, a plug-in hybrid. All are variations on the same modular theme and all will play a crucial part in finding out which technologies are the right ones to make electric buses a sustainable and permanent feature of European cities. The answer to that question may well not be the same in every country and city or even for every route within one operator's reach.

Together with other demonstrations already taking place or planned, ZeEUS brings together transport authorities, operators, bus builders and energy providers to work hand in hand on an unprecedented scale. The trials are sure to throw up the odd unforeseen complication that the partners will need to address, but they will deliver a wealth of expertise that can be compared and contrasted thanks to scientifically defined performance indicators that will be applied to all demonstrations in the programme.

The results will help the entire industry to better know how to face its electric future. ■

ABOUT THE AUTHOR

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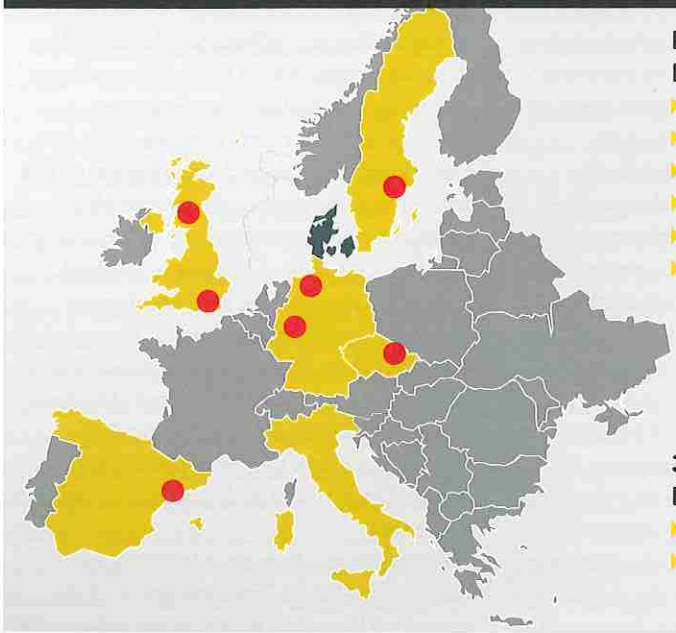
ZeEUS CORE DEMONSTRATIONS



EIGHT DEMONSTATIONS IN SIX COUNTRIES

- Barcelona (Spain)
- Bonn and Munster (Germany)
- Glasgow and London (UK)
- Plzen (Czech Republic)
- Italy (to be decided)
- Stockholm (Sweden)

35 HIGH CAPACITY ELECTRIC BUSES

- Full Electric
- Plug-in Hybrid

ABOUT ZeEUS

On January 23, UITP, the International Association of Public Transport, launched ZeEUS, the largest demonstration programme for electric buses to date. Running until April 2017, ZeEUS - the acronym stands for Zero Emission Urban Bus System - will see 35 electric and plug-in hybrid buses put into service in eight cities in six European countries, including the UK. The focus will be on high-capacity full-size single or double deckers.

Speaking at the launch event in his role as president of UITP, Sir Peter Hendy said that electricity has been 'identified as one of the most promising alternative fuels for transport' and was gaining ground in urban buses. The relevance of the project to European policy was stressed by Fotis Karamitsos, deputy director general for mobility and transport of the European Commission, who highlighted the opportunity to reduce Europe's oil dependence.

Demonstrations will take place in London, Glasgow, Barcelona, the German cities of Bonn and Münster, Stockholm, Plzen in the Czech Republic as well as a yet-to-be-confirmed Italian city. Charging solutions to be utilised include slow charging in depots as well as fast charging at termini by means of wireless induction, pantographs and contacts.

ZeEUS has a total budget of €22.5m. The EU provides €13.5m as part of the implementation of its Seventh Framework Programme by the Directorate General Mobility and Transport, with the rest covered by the coalition of 40 partners involved in the project, drawn from a wide field that includes universities, energy providers, transport authorities, operators, manufacturers and consultants. UK-based coalition members are Alexander Dennis, Scottish and Southern Electricity, Strathclyde Partnership for Transport, Transport for London, Transport and Travel Research and the Transport Research Laboratory.

In addition to the core demonstrations, ZeEUS will observe and monitor other demonstrations and pilots across the UK, Europe and beyond. This combined expertise will be used to draw up proposals for the standardisation of key interfaces such as charging connections and to draw up tools to help cities and transport authorities in the procurement of future electric buses. ■