Technology Strategy Board
Driving Innovation

Innovation **results**

AN R&D CASE STUDY #007

Ultra-low emission vans of the future

This international collaboration developed a new fuel-cell engine that fits into a standard delivery van

The need

The Government aims to cut UK carbon emissions by 80% by 2050. Greater use of electric cars and vans could reduce UK carbon emissions from road vehicles (currently around 24%). Conventional battery vehicles have several disadvantages, including low vehicle operating range, and the battery size and weight. Fuel-cell vehicles have zero emissions from the exhaust and are highly efficient in urban driving conditions (especially in congested or slower moving traffic). However, particular issues with fuel-cell vehicles are their cost, lifetime, ability to start in cold weather and durability.

The results

The project consortium used proton exchange membrane fuel-cell technology to develop a 10 kWe engine for a new all-electric delivery van. This engine is compact enough to fit under the bonnet and can start and operate from temperatures as low as -20°C.

Intelligent Energy and PSA Peugeot Citroën successfully integrated the new engine into the Peugeot Partner van to give a hybrid electric vehicle, the H_2Origin. The vehicle is powered by a battery and the fuel-cell system (which extends the vehicle's range and can be refuelled in a similar time to that of a petrol or diesel vehicle). The engine is mounted on a custom-designed chassis that mimics the layout of a conventional vehicle.

Automotive technology specialist, Prodrive, developed the electronic control unit for the fuel-cell engine. Compressed hydrogen is stored securely in a novel, exchangeable, swap rack in the rear of the van. This offers a practical and convenient alternative to refuelling at a hydrogen 'fuel station'.

As with the existing battery-electric Partner van, the H_2Origin has no tail-pipe exhaust emissions, but its range is three times greater (300 km). To date, it has covered over 800 km with no reported problems.

Making it happen

Intelligent Energy and PSA Peugeot Citroën (one of the world's biggest producers of electric vehicles) worked closely together to integrate the fuel-cell technology in a standard Peugeot Partner electric van. They used only the space already available under the bonnet and made no changes to the layout of the existing powertrain.

What is a fuel cell?

Fuel cells are electrochemical devices that convert the energy of a chemical reaction directly into electricity and heat. They are similar in principle to batteries in a torch or radio, except that the fuel and oxidant are stored externally, enabling them to continue operating as long as reactants are supplied. In this case, the fuel is hydrogen, which is stored in pressure vessels and the oxidant is air, which is drawn from around the vehicle. They are silent, modular and contain no moving parts.

Future activities

Intelligent Energy is working with LTI Vehicles, Lotus and TRW Conekt to develop a London black taxi that will be powered by a fuel-cell system that is based on the technology demonstrated with the H_2Origin. The first prototype 'green zero emissions' vehicles will be ready in early 2010. Up to 100 fleet demonstrators will be available for the 2012 Olympics.

Removable hydrogen storage rack

HOW THE TECHNOLOGY STRATEGY BOARD MADE A DIFFERENCE:

'The project accelerated the development of a reduced- or zero-emission fuel-cell vehicle.'

Henri Winand, Chief Executive, Intelligent Energy

Potential markets

The project team believes the fleet of fuel-cell vehicles worldwide will grow from a few hundred now (worth about $45 million) to around 2 million by 2020 and around 25 million by 2030 (with market values of around $85 billion and $630 billion respectively in new vehicle sales). The H_2Origin is a multi-purpose vehicle aimed at the urban light-duty cargo and passenger sector, which represents between 8% and 10% of the total market.

Project #210008

Project partners
Intelligent Energy Ltd, Prodrive, PSA Peugeot Citroën and Robert Bosch GmbH

Technology Strategy Board investment
£1,717,600

Total project investment
£4,090,500

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Technology Strategy Board
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Collaborative research and development projects are one of the tools that the Technology Strategy Board uses to drive innovation in the UK. The Technology Strategy Board is a business-led executive non-departmental public body, established by the Government. Its role is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve the quality of life. It is sponsored by the Department for Business, Innovation and Skills (BIS).

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