Further hope for HYDROGEN

Once a lot of the fears surrounding fuel cell buses had been dispelled, they entered into a period of quiet acceptance with small-scale trials. Now, however, there is a new EU project that could propel them back into the limelight. John Challen reports

Fuel cell buses currently operate in London (run by Transport for London) and Aberdeen (looked after by Stagecoach and First Group), having entered service as part of the EU's High V.Lo-City and HyTransit projects.

At their peak, there were ten buses running in both locations, and the reactions from operators and passengers was positive, with no major issues being reported. In addition, the CHIC (Clean Hydrogen in European Cities) programme was hailed a success when it concluded back in 2016.

"In 2008 we had the first projects undertaken by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)," explains Sabrine Skiker, EU policy manager and a key figure in the European fuel cell programmes. "At that time, the cost of the buses was in the region of €1.2 million – a big investment, but it was the first time that fuel cell buses had been put on the road. We wanted to see if it would work on a larger scale and find out how they would operate alongside traditionally powered vehicles."

The latest initiatives – JIVE and JIVE 2 – are the final two projects in the FCH JU programme. Started at different times, the two actually have a lot in common, and the only reason they are not combined is due to the funding allocations. "There was one amount of money allocated for a project for 2017 and another funding stream set aside for the following year," recalls Skiker. "There are different cities involved in the two projects: there are a lot of German cities in both JIVE and JIVE 2, simply because there were a lot of regions there that wanted a large number of fuel cell buses. It was impossible to have them from just one country in JIVE, so we had to spread it out."

There has to be a minimum of five different cities in different countries, she explains, adding that there are ten countries involved across the two schemes: UK; Germany; France; Denmark; Iceland; Norway; Sweden; Netherlands, Latvia and Italy.

COST DIFFERENTIAL

The biggest difference between the two programmes is the purchase price of the buses. Having seen prices fall from the €1.2 million back in 2008, JIVE introduced a cap of €650,000 for each bus, with JIVE 2 taking it one step further to €625,000 for 12m-long buses.

Participating OEMs include ADL, CaetanoBus, EvoBus/Daimler, Safra, Van Hool, VDL and Wrightbus. Sub-suppliers include Ballard, ElringKlinger, Hydrogenics, Luxfer, Proton Motor and Siemens.

In total, there will be 300 buses across the two projects – roughly equal numbers between both, says Skiker. "In past projects, we talked about very small fleets – typically three to five buses for each city. The largest deployment was in Aberdeen, which had ten buses," she explains.

"But for these projects we are going much larger – so in Cologne there will be 30 buses and most of the others will

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Sabrine Skiker

have at least ten hydrogen vehicles.

"In countries with no experience of shuttle buses, such as many cities in France, a smaller number of buses were ordered, simply because it was more of a risk for them," she adds. "Originally the call was for ten-plus or 20-plus buses, but then we subsequently decided that newcomers could have a mix of both."

In the UK, JIVE will place 20 buses in Birmingham and 26 in London; JIVE 2 will place 12 in Dundee and 20 in Brighton. In addition, three extra buses will be placed in Belfast and 25 in Bootle, Merseyside with UK funding. A related €5.5m project, Mehrlin, will install seven hydrogen bus refuelling stations around Europe, including in both Birmingham and London to supply the JIVE buses.

As the vehicles involved in JIVE and JIVE 2 have yet to enter service, there remain decisions to be made about the specifications of the vehicle, although some cities are further down the line than others. "Cologne has ordered Van Hool 12m-long buses, while Pau in France has chosen the same manufacturer, but 18m-long versions," explains Skiker. "It is the first time they have been used for a Bus Rapid Transit system, which is another interesting element of the project."

The fuel cell module order from Van Hool was for 40 FCveloCity-HD 85kW units and was, according to Ballard, the largest order ever for fuel cell buses in Europe. The system will also feature a 210kW Siemens PEM electric traction motor. "Transit buses are an excellent example of a strong fit for fuel cell technology, which is able to meet the key requirements of long range, rapid refuelling, heavy payload and full route flexibility," says Rob Campbell, Ballard's chief commercial officer.

The Cologne and Pau operations will begin in September/October 2019, the same time as ebe Europa-supplied fuel cell buses take to the streets outside Frankfurt. While deliveries will be made over the summer, there will be a 'settling-in' period. "What we found out from previous projects – which I was also involved in – was that the buses needed time to adapt to the route and the telemetry," says Skiker.

"The technology was there, and the buses were operating, but they only reached 85-90% of their performance potential, and we want to improve that."

The Van Hool buses are designed for 29 seated passengers and up to 49 standing. Thanks to the hybrid power source, they will be able to carry out a full day's schedule of 350km (217mi). The tank capacity is 38.2kg of hydrogen, with typical consumption (helped by the re-use of braking energy) at around 8kg of hydrogen over 100km.

Skiker believes the technology will complement battery buses in fleets of the future. "If you need up to 200km [124mi] of range, then a battery bus would make sense, but if you need a longer range for inter-urban traffic, travelling hilly routes or when running in winter, then the fuel cell is the better option," says Skiker.

"Also, there is no diesel generator required for heating in hydrogen-powered buses, because they can use the heat recuperated from the fuel cell.

"A lot of the decision will also be down to cost, but we have seen indications of fuel cell bus prices falling to €450,000 [£385,000], which is comparable with battery buses, so that will be a game-changer," she says. "Cologne is investing in battery buses as well as being a part of JIVE," she adds. Another example is Norway, which had a battery-only policy for many years, "but now they are part of our project because they realise that EVs do not solve all of the problems". TE

HOW FUEL CELLS WORK

Together with the lithium batteries and electric motors, the fuel cells form the basis of an all-electric power source. Hydrogen is converted into electricity in the fuel cell – with water vapour as its only emission – while batteries provide additional power as needed. ***Image: Ballard***