

Road/Railways - Environmental friendly vehicles:

The European Commission's hydrogen alliance and hydrogen fuel cell bus projects

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【概要 : Summary】

In the past years, there have been several trials with hydrogen-powered buses in cities around the world, which have demonstrated that fuel cell passenger buses can cut emissions and noise pollution while providing good quality public transport. Hydrogen is considered to have also future potential for replacing fossil fuel powered buses with integrated combustion engines (ICE) with clean, efficient hydrogen fuel cell powered propulsion systems.

The EU legislation, in particular the European Commission's "Clean Power for Transport: A European alternative fuels strategy" of 2013 identifies hydrogen and several other sources as alternative fuels. The production of hydrogen (H₂) itself does release CO₂, but if the utilised hydrogen is produced from renewable energies, the hydrogen fuel cell-powered vehicles can run completely carbon neutral. Several cities are increasingly investing in low- or zero emission vehicles for their public transport and hydrogen powered fuel cell buses are seen as one possible solution to improve the environmental friendliness of public transport.

The 2019 European Green Deal sets the main goal for Europe to become the first climate-neutral continent by 2050. The European Commission's industrial Strategy, which is based on the objectives of the

European Green Deal, will include specific measures to accompany industry's green transition, including a Clean Hydrogen Alliance. This new Clean Hydrogen Alliance follows the precedent set by the European Battery Alliance. The new EU Hydrogen Alliance has the purpose to develop clean H₂ technologies as the EU intends to move toward its Green Deal goal of carbon neutrality by 2050.

The Clean Hydrogen Alliance brings together investors with governmental, institutional and industrial partners for the promotion of the production of clean hydrogen in an effort to speed up the decarbonisation of the European industry. The European Commission's Clean Hydrogen Alliance represents a proactive initiative to deploy a range of trade, procurement and competition policies and it is important to tackle environmental problems, while also meeting energy resource security concerns. Not only passenger vehicles are expected to gain from a growing appreciation for hydrogen energy, it is in fact buses and trucks that could soon be powered entirely by hydrogen fuel cells.

Several German cities have tested hydrogen fuel cells powered buses and they are expanding their fleets of these buses as a way to reduce emissions in their public transportation systems.

【記事 : Article】

1. Hydrogen and fuels cells in transport vehicles

The EU legislation on ambient air quality and cleaner air for Europe (Directive 2008/50/EC) sets air quality standards that obliges the Member States to limit harmful air pollutants including NO₂ and PM₁₀. Furthermore, the European Commission's "Clean Power for Transport: A European alternative fuels strategy" of 2013 identifies electricity, hydrogen, biofuels, natural gas, and liquefied petroleum gas (LPG) as alternative fuels. The idea is to decarbonise the transport sector by using alternative fuels and to reduce also other pollutants' emissions. Most recently, the European Green Deal, presented in December 2019, sets the main goal for Europe to become the first climate-neutral continent by 2050. The objectives of the European Green Deal and the Industrial Strategy will include specific measures to accompany industry's green transition. It will support breakthrough technologies, and proposes a dedicated Strategy for a sustainable built environment. One initiative to support the green transition is the launch of a Clean Hydrogen Alliance. Currently, hydrogen is considered being one of the alternatives to replace fossil fuels also in road transport. This is expected to contribute to improving air quality and reducing noise. Fuel cells and hydrogen (FCH) are seen as an efficient conversion technology with a great potential to help reducing CO₂ emissions in the transport sector. Although the production of hydrogen (H₂) itself does release CO₂, a hydrogen fuel cell (FC)-powered engine will still emit less CO₂ globally than a conventional internal combustion engines (ICE). Furthermore, if hydrogen were produced from renewable energies it would make hydrogen fuel cell power units totally carbon neutral. A hydrogen-powered fuel-cell vehicle emits no local pollutants or CO₂, and has an operating range of between 500 and 700 kilometres. Therefore, the utilisation of hydrogen for powering fuel cells in passenger road transport is supported in several ways. Mainly, fuel cell buses are a convincing solution for

public transport as they can travel long, cost-effective shifts before being refuelled quickly at bus depots. Also a fuel cell bus can drive for 300-450 kilometres before it needs to be refuelled, giving this technology a significant advantage over most battery buses. At the same time, and in contrast to ICE in conventional diesel powered busses, the fuel cell busses are quieter and produce no extra CO₂ emissions or particulate emissions during their operation time. Thereby, the Fuel Cell buses minimise their environmental and health impacts. There have been several trials with hydrogen-powered buses in cities around the world, which have demonstrated that fuel cell passenger buses can cut emissions and noise pollution while providing good quality public transport.

2. Fuel Cell and Hydrogen bus research projects supported by the European Commission

There are several projects on the way to introduce hydrogen-powered buses in public transport. Several EU Member States are already using or are setting up Hydrogen refuelling networks and are testing public transport buses with fuel cell propulsion. The potential for fuel cells and hydrogen to enhance energy security and mitigate climate change was recognised in 2003 with the creation of the Hydrogen and Fuel Cell Technology Platform, which led to the formation of a Public Private Partnership, the "Fuel Cells and Hydrogen Joint Undertaking" (JU), between the European Commission, industry and the research community.

The European Commission has supported the development of hydrogen fuel cells since the early 1990s, leading to a number of demonstration projects and the formation of an informal 'European Hydrogen for Transport Partnership'. The recently completed Coordination Action "HyLights" supported technology assessment and validation and analysed policy options for promoting hydrogen and fuel cells. HyLights aimed at coordinating action to accelerate the commercialisation of hydrogen fuel cells in the field of transport in Europe.

The hydrogen bus demonstration projects CUTE and its successor HyFleet;CUTE (2006-2009) have made major advances in proving hydrogen fuel cell propulsion technologies. Under these demonstration projects, 33 fuel cell buses and 14 internal combustion engine buses have operated in daily public service. The project demonstrated that the new fuel cell technology was very reliable and that the next generation fuel cell / battery hybrid bus also reduced hydrogen consumption by half. The 2011 HyChain Mini-Trans project demonstrated around 50 innovative fuel cell vehicles of different types, including scooters, wheelchairs, cargo-bikes, small trucks and minibuses in four European regions.

One more recent example for an initiative in public transport is the JIVE (Joint Initiative for hydrogen Vehicles across Europe) project I and II. These projects use hydrogen fuel cell powered buses for testing a large-scale deployment of vehicles and infrastructure in cities' and regions' public transport systems. On 25 January 2017, the Joint initiative for hydrogen vehicles across Europe (JIVE) project was launched, aiming at deploying 139 new zero emission fuel cell buses and associated refuelling infrastructure across five countries. JIVE project will run for six years and is co-financed by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) under the EU' s Horizon 2020 framework. On 25 January 2018, the JIVE 2 project (Second Joint Initiative for hydrogen Vehicles across Europe) started. Also this second project will run for six years and is also funded by the FCH JU (Fuel Cell and Hydrogen Joint Undertaking) - with a grant of EUR 25 million for the deployment of 152 zero emission fuel cell electric buses across 14 European cities throughout France, Germany, Iceland, Norway, Sweden, the Netherlands and the UK. Combined, the JIVE and JIVE 2 projects will deploy nearly 300 fuel cell buses in 22 cities across Europe by the early 2020s.

3. European Commission presents the “Clean Hydrogen Alliance” initiative

The hydrogen fuel cell technology to produce the

alternative fuel cleanly through electrolysis of water still remains a very expensive alternative energy. The aviation and automotive sectors have called for government support to bring the technology into the mainstream. As part of its new Industrial Strategy, which is expected to help deliver on three key priorities, including making Europe climate-neutral by 2050 and shaping Europe' s digital future, the European Commission presented the new initiative to support the utilization of hydrogen on 10 March 2020. The Clean Hydrogen Alliance brings investors together with governmental, institutional and industrial partners, to build on existing work and to identify technology needs, investment opportunities, and regulatory barriers and enablers. Following the precedent of establishing the European Battery Alliance, which will receive EUR 3.2 billion in public support, the European Commission follows with this new Clean Hydrogen Alliance. This Clean Hydrogen Alliance initiative is expected to help Europe' s industry lead the transition towards climate neutrality and digital leadership. The Clean Hydrogen Alliance can help decarbonize process industries and heavy-duty transportation such as aviation, maritime and long-haul trucking. Germany has already revealed its intentions for the promotion of H₂ for powering transportation and to invest into the technology' s research and development.

4. Hydrogen fuel cell bus projects in Germany

A hydrogen fuel cell bus can drive for 300-450 kilometres before it needs to be refuelled, giving this technology a significant advantage over most battery buses, which have more limited ranges and longer recharging times. At the same time, and in contrast to conventional diesel engine powered busses, the fuel cell busses are quieter and produce no extra CO₂ emissions or particulate emissions during their operation time. Thereby, the hydrogen fuel cell buses minimise their environmental and health impacts. So far, bus fleet operators were reluctant to invest in new fuel cell vehicles without concrete evidence of the risks and benefits involved. Moreover, low demand

made the hydrogen fuel cell buses expensive. Therefore, the overall objective of projects like the JIVE and JIVE 2 is to advance the commercialisation of fuel cell buses through large-scale deployment of vehicles and infrastructures. These projects will also allow the bus manufacturers to test and further improve their products and improve the economies of scale.

In 2018, the German city of Cologne's public transport company Regionalverkehr Köln GmbH (RVK) (Cologne) and Wuppertal's WSW mobil GmbH (Wuppertal) joined forces to order hydrogen buses for their public transport network. They merged for a joint procurement to tender 25 fuel cell buses with 2 lots for articulated buses and 2 further optional lots for 12m buses. In the evaluation of the offers, three of the total of five offers fulfilled the tender criteria and one manufacturer got the contract for both cities, with an individual commissioning of the buses. The joint procurement was less time-consuming on the basis of experiences of JIVE and the fact that only two cities built a merger.

Meanwhile, on 12 March 2020 Regionalverkehr Köln GmbH (RVK) in Cologne, Germany, announced the placement of the order for 15 hydrogen buses from Solaris Bus & Coach S.A. and Wuppertaler Stadtwerke ordered 10 hydrogen buses. The buses will be purchased as part of the EU project JIVE 2 and will be funded by the "Fuel Cells and Hydrogen Joint Undertaking" (FCH JU), the German Federal Ministry of Transport and Digital Infrastructure (BMVI) and the Ministry of Transport of the State of North Rhine-Westphalia. Furthermore, four other German cities including Frankfurt am Main, Mainz, Muenster and Wiesbaden also plan to operate 15 fuel cell buses, which are expected to be delivered within the next 12 months.

If the delivery of hydrogen fuel cell buses goes according to plan, by 2022, the city of Cologne alone is expected to operate a total of 52 fuel cell buses, which could become the largest fleet of hydrogen-powered fuel cell hybrid buses in a European city.

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