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Germany Fuel Cell Industry Developments

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By Jackson Carr, FCHEA Intern

In 2006, the German government began a strategic partnership with national industry and science leaders to advance the role of hydrogen and fuel cell technology in Germany's energy system. The original objectives of the National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP) were to secure Germany's position as a leader in fuel cell and hydrogen technology, accelerate market development in a wide range of applications, and strengthening the country's hydrogen and fuel cell value chain.

Initially a 10-year program, the NIP was renewed in 2016 with new goals for the 2016-2026 period. With generous research and development funding from both the Federal Ministry of Transport and Digital Infrastructure and the Federal Ministry for Economic Affairs and Energy, Germany has been positioning itself as an international leader in hydrogen and fuel cell technology for more than a decade. Here are some recent developments in the German fuel cell industry, for both the transportation and stationary power sectors.

By the end of 2018, there were 60 hydrogen refueling stations open to German customers, 54 of which are owned and operated by H2 Mobility, a joint venture formed by FCHEA members Air Liquide and Linde along with other industry partners. H2 Mobility's goal is to operate 100 stations in Germany by the end of 2019, with another 300 stations planned to follow as fuel cell vehicle (FCV) commercialization increases. On September 7, 2018, H2 Mobility held a grand opening for Germany's 50th retail hydrogen refueling station, in the northeast city

of Potsdam, Brandenburg. The Potsdam station, funded in part by the Fuel Cells and Hydrogen Joint Undertaking (FCH2JU), includes a facility for an optional 350-bar hydrogen pump to refuel fuel cell-powered buses.

In July, Germany's National Organization for Hydrogen and Fuel Cell Technology (NOW) announced that Linde will construct a hydrogen refueling station in Wermelskirchen, North Rhine-Westphalia in 2019. Once completed, the facility will supply up to 20 hydrogen fuel cell buses with 500 kilograms (kg) of hydrogen per day for German bus company Regional Transport Cologne (RVK). According to NOW, the Wermelskirchen station will feature the first deployment of Linde's new hydrogen storage technology, which uses steady pressure accumulators to supply more hydrogen to vehicles in a shorter amount of time.

Linde also opened a hydrogen refueling station at its 'Gas and More' retail outlet in Hannover, Germany in December. Receiving approximately €450,000 (~$508,400) in funding from the NIP, the station was built as part of Germany's Clean Energy Partnership, an industrial project dedicated to further deployment of hydrogen transportation. According to Linde, the station uses a new generation of its proprietary cryogenic pump, which converts the liquid hydrogen stored into a gaseous compressed to 900 bar and allows the facility to refuel up to 200 cars per day.

Newly opened hydrogen refueling station in Hannover. Source: Linde.

On November 13, Daimler officially launched its first FCV to select customers in Germany. The Mercedes-Benz GLC F-Cell is an SUV with a hybrid fuel cell and lithium-ion battery powertrain, the first of its kind on the market. Hoping to gain real-world performance data from the public, the GLC F-CELL has been made available to various regional and national ministries, as well as industry partners and H2 Mobility.

The integration of hydrogen fuel cells into Germany's transportation sector has not been limited to light-duty passenger vehicles. On September 16, the world's first hydrogen fuel cell-powered train began commercial passenger service in the German state of Lower Saxony. Using fuel cells from FCHEA member Hydrogenics, French multinational train manufacturer Alstom built two models of the Coradia iLint for German railway company EVB, replacing diesel trains along the 62 mile Elbe-Weser network. The trains are fueled by a mobile hydrogen station provided by FCHEA member Air Products, which will be replaced with a stationary fueling station in 2021 to accompany an additional 14 Coradia iLint trains. From late January to mid-February 2019, Alstom held roadshows across

Germany to demonstrate the capabilities of its Coradia iLint model to other states.

In 2019, Ballard Power Systems will begin to deliver 40 fuel cell buses to German cities Cologne and Wuppertal, as a part of the European Union's Joint Initiative for hydrogen Vehicles across Europe (JIVE) program. Cologne, which will receive 30 of the vehicles, has already introduced fuel cell buses into its transit system. The existing fleet is fueled at an Air Products hydrogen station which will be upgraded to accommodate the increase in buses. The JIVE and JIVE 2 projects had been granted €57 million (~$64.4 million) in EU funding as of the February 2018 announcement, and plan to supply close to 300 fuel cell buses and accompanying infrastructure to 22 European cities by 2023.

With NIP objectives of developing the market for hydrogen fuel cells across multiple applications, German industrial leaders are taking steps to bring hydrogen fuel cell power to stationary sources. In January 2018, Shell announced that they will construct a 10 MW hydrogen electrolysis plant in Germany, after securing €10 million (~$12.3 million) from the European Union's Fuel Cell Hydrogen Joint Undertaking. The "Refhyne" plant will help power Shell's crude oil refinery in Wesseling, North Rhine-Westphalia, and includes design options for scaling up over 100 MW. According to Shell, when the plant goes into operation in 2020, it will be the world's largest hydrogen electrolysis system and the first large-scale industrial application of polymer electrolyte membrane (PEM) technology.

Shell and ITM Power announce plans for the world's largest electrolysis plant. Source: ITM Power.

On October 30, Linde announced a cooperation agreement with German steel producer Salzgitter Flachstahl GmbH and German energy company Avacon Natur GmbH on a project to generate hydrogen in the Germany city of Salzgitter through electrolysis and electricity from wind power. According to Salzgitter, the €50 million (~$56.5 million) project will begin to produce hydrogen at its electrolysis plant in 2020, and will lay the foundation for the future deployment of larger hydrogen volumes to reduce direct carbon dioxide emissions in the production of steel.

In the 12 years since the establishment of the NIP, Germany has certainly fulfilled its first objective of positioning themselves as international leaders in fuel cell and hydrogen energy. As of the program's 2016 Phase 1 evaluation, Germany had the third-largest funding program for hydrogen and fuel cell technologies, behind only Japan and the United States. The public-private structure of the NIP puts Germany in an opportune position to further commercialize fuel cell and hydrogen technology in 2019 and beyond.

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Fuel Cell & Hydrogen Energy Association
1211 Connecticut Avenue Northwest, Suite 650
Washington D.C. 20036
(202) 261-1331 info@fchea.org