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Factsheet: Hydrogen and Fuel Cell Technology in China

OVERVIEW

Driven by climate, energy and industrial policy objectives, hydrogen and fuel cell applications are being developed and promoted in China as key future technologies.

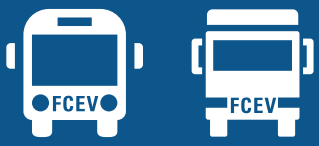
A particular focus of the developments, which are largely directed by the central government, lies in the mobility sector, where hydrogen fuel cell vehicles, just like battery vehicles, are considered New Energy Vehicles (NEV) and are receiving equivalent support. Additional infrastructure funding is developing the market landscape in China in an accordingly dynamic manner.

There are currently several suppliers who already produce fuel cell buses and light trucks in small series. A first mass-produced passenger car model from China's leading vehicle manufacturer SAIC has already been trialled in test operation, and its market launch has been announced for the end of 2020. In the long term, the required hydrogen is to be produced from electricity generated by means of renewable energies. The first power-to-gas demonstration plants using electricity from wind power and photovoltaics are already being planned or implemented.

Political framework

In order to achieve the climate, energy and industry policy goals, the Chinese central government has drawn up strategic guidelines that set out China's future economic and social development. From the most important of these guidelines – "Made in China 2025" – 10 roadmaps were derived, one of which is the "Energy Saving and New Energy Vehicle Technology Roadmap". It highlights the importance of Fuel Cell Electric Vehicles (FCEV) for China's future energy independence and global competitiveness. Furthermore, it also specifies concrete target dates for technical development of e.g. fuel cells and for the commissioning of FCEVs and hydrogen filling stations. Additional target definitions – and/or those adapted to the respective target region – are also published in some cases by Chinese city governments, e.g. by the mega-metropolis Shanghai. The 13th Five-Year Plan (2016–2020) does not contain any concrete measures, but emphasises the importance of FCEV and hydrogen and fuel cell applications for China's future development. This is also underscored in the overarching strategy to revolutionize energy supply and consumption (2016–2030), which aims to reduce the import dependency of innovative and renewable energy technologies. According to the forecast of the Chinese National Alliance of Hydrogen and Fuel Cells, around 35 million tons of hydrogen per year will be produced in 2030 (status at end of 2019: 25 million tH_2/a).

Current status of vehicle ramp-up in the PRC



STEPS TO COMMERCIALISATION

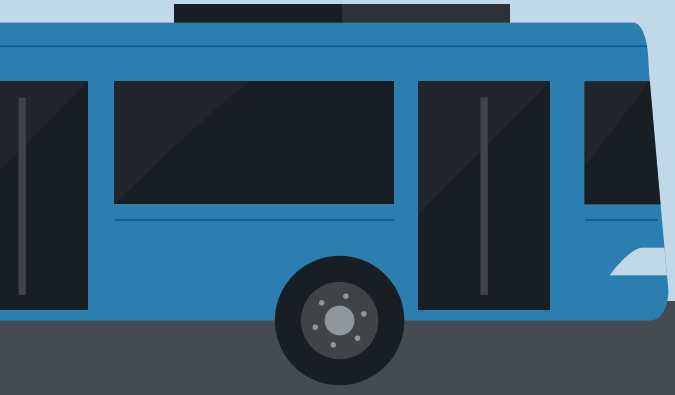
of fuel cell buses and trucks in the 7.5 t class

2022

Olympic Games in Zhangjiakou (Hebei Province): Increase from 174 fuel cell buses in operation today to 1,500 fuel cell vehicles

2025

Planned operation of 40,000 fuel cell passenger cars



These activities in the still young market of hydrogen and fuel cell applications should be viewed in particular against the background of China's striving for technological leadership and its efforts to establish international trade and infrastructure networks through the so-called "Silk Road Initiative".

2019

In 2019, 2,737 fuel cell vehicles were sold in China, mainly buses (approx. 44%) and vans (approx. 56%).

2020

China already has a wide variety of fuel cell vehicle manufacturers: 10+ for fuel cell buses, 4+ for light commercial vehicles, 10+ active fuel cell manufacturers and system integrators.

2025

In 2025 the number of fuel cell passenger cars will significantly exceed that of buses and trucks. The first Chinese fuel cell passenger car model will be announced by the leading vehicle manufacturer SAIC in the form of an SUV at the end of 2020.

Ten years after the start of its intensive market ramp-up programme for battery vehicles, China now seems to be focusing its current support on the development of fuel cell vehicles. The main challenges in the market ramp-up for fuel cell passenger cars are the lack of domestic vehicle models and the expansion of filling stations throughout the country. Therefore, the government launched a national support programme for FCEV demonstration clusters in September 2020. The development of the value-added chain and the ramp-up of FCEVs and the corresponding hydrogen refuelling in joint networks will be implemented through a points system and translated into monetary funding. Joint ventures involving public authorities, industry and commerce can apply for the four-year programme under the leadership of the city administration, which provides funding support up to a maximum of 210 million euros each.

Goals and status of hydrogen fuel cell mobility in the PRC

		Year			
		2019 (Status year-end)	2020 (Goal)	2025 (Goal)	2030 (Goal)
FCEV	Quantity	2,300 vehicles in operation (1,200 buses & 1,100 light trucks)	5,000 (60% buses/trucks, 40% cars)	50.000 (20% busses/trucks, 80% cars)	> 1 million (commercial use)
H2 filling stations	Quantity	51	> 100	> 300	> 1,000

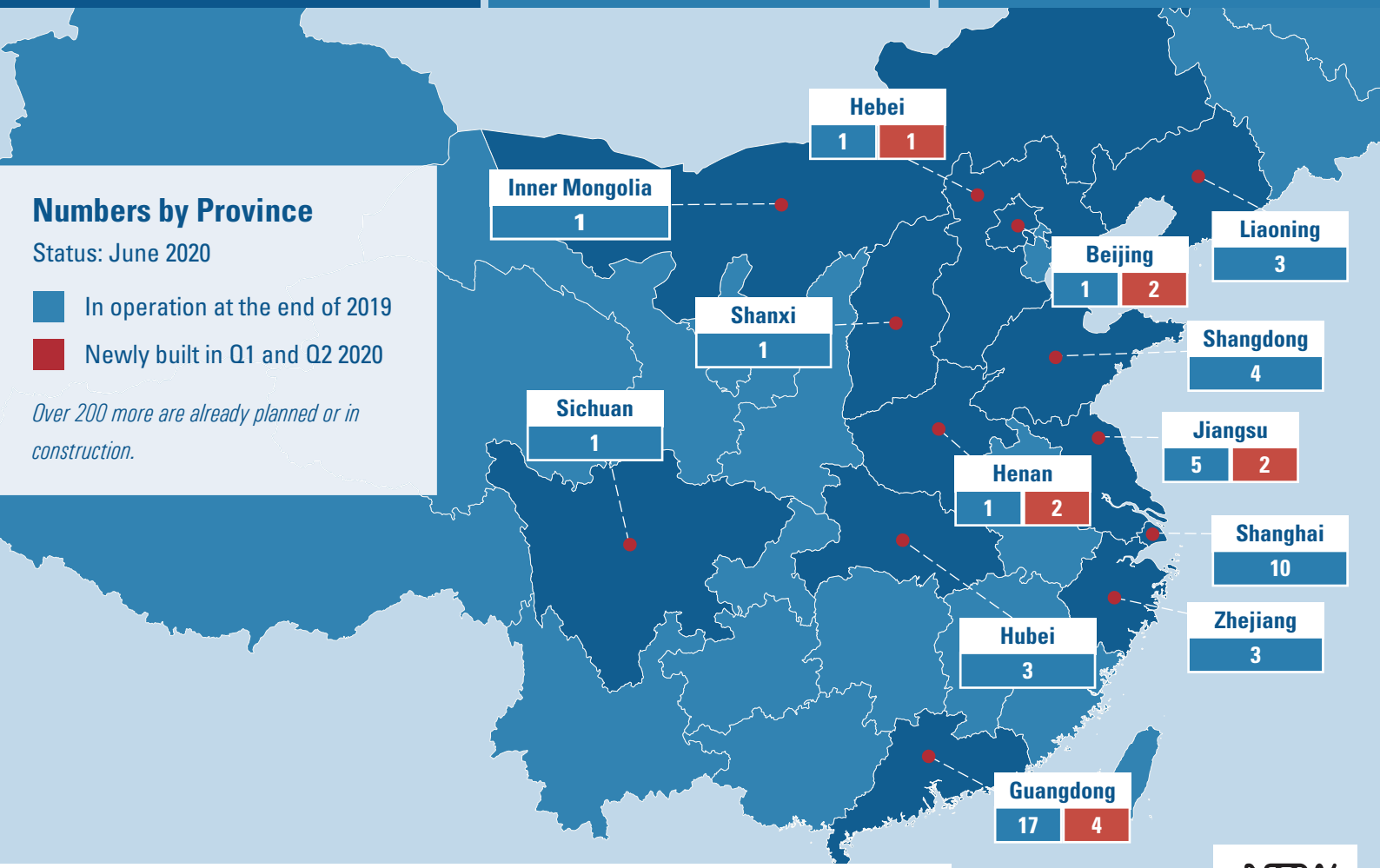
Current status of hydrogen filling stations in the PRC

62
Hydrogen filling stations in operation in China
(Status: June 2020)

above all
350 bar
(European standard for bus refuelling)

Many established industrial players can be found among the manufacturers and operators of hydrogen filling stations, including the state-owned Sinopec group, which is the largest operator in China with over 30,000 conventional filling stations. Sinopec built the first hydrogen filling station in China in 2019, which is integrated in a conventional filling station.

In terms of the rolling out fuel cell vehicles, China is initially focusing on buses and trucks, which are operated mainly in commercial fleets and are refuelled at a pressure of 350 bar. Accordingly, 350 bar filling stations are currently predominantly being built and operated*.



* In contrast, the majority of filling stations in Germany are 700 bar filling stations for cars.

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Support for hydrogen fuel cell vehicles in China

The procurement of fuel cell vehicles was initially supported under the government "Financial Support Policy for New Energy Vehicles 2016–2020" programme, jointly launched by the Ministries of Finance, Science, Industry and Information and the National Reform Commission (MoF, MoST, MIIT, NDRC). A simplified overview is presented in the table below. Central government support could be combined with support from individual provinces (most recently in at least 17 out of 34) and cities, which could be up to 100% of central government support, e.g. in Shanghai, Guangzhou, Foshan, Shenzhen, Wuhan. With the new funding scheme for FCEV demonstration clusters, financial support will in future be targeted at regions and stakeholders that will implement the industrial value chain and deployment on location.

Sample calculation for the purchase of a small city bus from the manufacturer Foton:

The investment costs of approx. €207,000 were supported with almost €65,000 each from both the central and local governments.

The combined funding support meant that the final purchase price for the buyer was around €77,000.

Government funding support for New Energy Vehicles (NEV)

Vehicle type	Until end 2019	From 2020
BEV (Battery Electric Vehicle)	–	In 2020: 90% of funding in 2019
	18,000 RMB/Veh.** (approx. €2,280)	In 2021: 80% of funding in 2020
	25,000 RMB/Veh. (approx. €3,160)	In 2022: 70% of funding in 2021
PHEV (Plug-in Hybrid Electric Vehicle)	10,000 RMB/Veh. (approx. €1,270)	In 2020: 8,500 RMB/Veh. (approx. €1,075)
		In 2021: 80% of funding in 2020
		In 2022: 70% of funding in 2021
FCEV: Passenger cars	6,000 RMB/kWel (approx. €760) max. 200,000 RMB/Veh. (max. approx. €25,300)	From September 2020: Support programme for FCEV demonstration clusters Distribution according to a points system that takes vehicle ramp-up and value chain development into account (duration 4 years from approval)
FCEV: small buses or trucks	300,000 RMB/Veh. (approx. €38,000)	
FCEV: large buses or trucks	500,000 RMB/Veh. (approx. €63,300)	

Table 2: Financial Support Policy for New Energy Vehicles 2016 – 2020*

** approx. 7.9 RMB = 1 Euro

Regional activities in the field of hydrogen and fuel cells

China's provinces and individual cities are important players competing with each other for the successful implementation of national guidelines.

Numerous large cities and provinces in China are striving to establish themselves as hydrogen regions. Currently, the development of production capacities and/or demonstration projects is being pushed forward in many provinces, which are illustrated on the following map.

The majority of the provinces presented define their own ramp-up targets and provide additional incentives through local support programmes and concessions. The development of production capacities for hydrogen and fuel cell applications often takes place at established business locations and is frequently accompanied by the initiation of local demonstration projects, such as the commissioning of fuel cell bus fleets.

The provinces and cities act largely independently of each other. For example, there is currently no centrally coordinated planning for a national network of filling stations. At the provincial level, coordinated, cross-city planning is only known to exist in the Yangtze delta around Jiangsu province and the Jing-Jin-Ji region.

Guangdong Province is currently leading the way in the construction of hydrogen filling stations and the operation of fuel cell vehicles.

Strategic cooperation and alliances

Chinese companies and associations are entering into a large number of national and international cooperative ventures, particularly in the field of fuel cell development. For example, Weichai Power, China's largest engine manufacturer, will invest more than €5 billion in fuel cell development until 2030 and is cooperating with Ballard and Bosch for this purpose.

At the political level, the National Alliance of Hydrogen and Fuel Cell (NAHFC) was founded in February 2018, a consortium of companies from the energy and automotive industries, supported by the Chinese government. The NAHFC serves as a platform for key stakeholders and as a think tank for the further development of a Chinese hydrogen strategy.

NAHFC members

Research & Development	Energy & Industry
Beijing Institute of Technology	CHN Energy (Chair)
CASC	Baosteel
CISRI	Chery
Harbin Institute of Technology	China Shipbuilding Industry Corporation
North China Electric Power University	CRRC
Tsinghua University	Dongfeng Motor Group
Tongji University	FAW
Zhejiang University	SAIC Motor
	Shanghai Electric
	State Grid Corporation

In the international "Hydrogen Council" industrial initiative, the People's Republic of China is represented at CEO level by the following members: Weichai Power, Great Wall Motor, CHN Energy, Sinohytec, Sinocat and Re-Fire Technology.

International norms and standardisation

Foreign countries, and the People's Republic of China in particular, are an immensely important market for German vehicle and component manufacturers. Standards and safety issues also play an important role for the future market of fuel cell vehicles. Currently, for example, the existing national safety regulations in the People's Republic of China are still an obstacle to the expansion of hydrogen filling stations. However, work is ongoing on this issue. In recent years alone, the development and successive completion of various national standards for hydrogen electric mobility has taken place in the PRC.

In contrast to battery electric mobility, an internationally coordinated approach to the standardisation of hydrogen technologies has so far largely been achieved. For passenger cars, the 700-bar storage tank in the vehicle and the correspondingly designed high-pressure refuelling infrastructure is a consensus in Japan, Europe and the USA. As new mobility applications based on hydrogen fuel cells and their corresponding requirements are currently being developed worldwide, this area now requires close attention and intensive communication in order to avoid the creation of possible barriers to trade.

Activities of the Federal Ministry of Transport and Digital Infrastructure (BMVI)

German-Chinese cooperation on electric mobility with battery and hydrogen fuel cell technology between the BMVI and the Chinese Ministry of Science and Technology MoST

Since 2014, NOW and the China Automotive Technology and Research Center (CATARC) have been active as lead organisations to support the ministries. The activities and German-Chinese research and development projects within this framework have been bundled in the virtual "Sino German Electro Mobility Innovation and Support Center" (SGEC) since 2018. From a German perspective, it is intended to drive forward the market ramp-up of electric vehicles (battery and fuel cell) in China for German companies, building on China's experience in the field of electric mobility in research and development. National partners from both countries (universities, research institutions, industrial partners) are to be involved. The SGEC will be run by Germany and China together with parallel coordination structures for each country, with both countries financing their national activities in the respective thematic fields.

This factsheet is based on the findings arising from monitoring in the field of electric mobility with hydrogen fuel cells, currently being conducted by hySOLUTIONS.

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