INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update October 2019: China

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1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

1.1 National Level

On April 8th, the National Development and Reform Commission (NDRC) released "Industrial Structure Adjustment Guidance Catalogue (2019, Draft for Comment)". High-efficiency hydrogen production and transportation, high-density hydrogen storage technology development and application and equipment manufacturing, hydrogen refuelling station are included in the fifth category (new energy) of the first class (encouraging). Fuel cell engine, stack and their key components are included in the sixteenth (automobile) category of the first class (encouraging).
http://www.ndrc.gov.cn/gzdt/201905/t20190514_936073.html (in Chinese)

On June 26th, the National Alliance of Hydrogen and Fuel Cell released "China's hydrogen energy and fuel cell industry white paper". The white paper systematically studies the position of hydrogen energy in the construction of China's modern energy system, comprehensively demonstrates the development status and trends of hydrogen energy and fuel cell industry chain, and proposes the development goals and action initiative of hydrogen energy and fuel cells in China in the near and medium term.

On September 19th, the Central Committee of the Communist Party of China and the State Council issued “Outline of the Construction of a Strong Transportation Country”. The outline proposes scientifically layout and construct urban parking facilities, and strengthen the construction of facilities such as charging, hydrogen refuelling, gas filling and bus stations.
http://www.gov.cn/zhengce/2019-09/19/content_5431432.htm (in Chinese)

On October 9th, the Ministry of Industry and Information Technology (MIIT) released "New Energy Vehicle Industry Development Plan (2021-2035)" (Draft for Comment). The plan proposes that after 15 years of continuous efforts, the core and key technologies of new energy vehicles will obtain major breakthroughs, convergence development will be coordinated and efficiency, industrial ecology will be sound and perfect. Pure electric passenger vehicles will become mainstream, and fuel cell commercial vehicles will become large-scale.

On October 11th, Premier LI Keqiang presided over the meeting of the National Energy Commission. On the meeting, he said that it is necessary to develop renewable energy such as hydropower, wind power and photovoltaics, improve the level of clean energy consumption, and actively explore commercialization paths such as advanced energy storage and hydrogen energy.
http://www.gov.cn/guowuyuan/2019-10/11/content_5438589.htm (in Chinese)

On October 15th, for the continued cooperation in the field of electric vehicles, the Ministry of Science and Technology (MoST) of China and Federal Ministry of Transport and Digital Infrastructure (BMVI) of Germany signed “Joint Statement of Intent on Continued

Cooperation in Innovation Driven Technology and Related Infrastructure" in Berlin. China and Germany will continue to actively promote the sustainable development of pure electric vehicles and fuel cell vehicles (including infrastructure construction).

1.2 Local Level

On May 24th, the "Hydrogen Corridor Construction and Development Plan of Yangtze River Delta", written by China Society of Automotive Engineers (SAE-China), was released. The construction of the hydrogen corridor will use industry leading cities like Shanghai as cores and first start 4 hydrogen highway demonstration lines.

From April to October, provinces including Shanxi, Hebei, Jiangsu, Zhejiang, and cities including Baicheng, Zhangjiakou, Zhangjiagang, Zhuzhou, Jiaxing, Chengdu, Liupanshui, Jinan released their development programs on hydrogen and fuel cell vehicles.

From April to October, provinces including Henan, and cities including Lu'an, Suzhou, Weifang, Jiading (district of Shanghai), Chongqing, Chengdu, Zhangjiakou, Laohekou, Huangpu (district of Guangzhou), Luoyang, Qingdao, Ningbo released their policies on encouraging the development of hydrogen refuelling stations and fuel cell vehicles.

2. Hydrogen and Fuel Cell R&D Update

2.1 Fundamental Research

In April, Wuhan University reported a new Mn-Co spinel cathode catalyst for alkaline polymer electrolyte fuel cell (APEFC). It can deliver greater power at high current densities than Pt catalyst. Moreover, it outperforms Pt at low humidity. In-depth characterization reveals that the remarkable performance originates from synergistic effects where the Mn sites bind O_2 and the Co sites activate H_2O, so as to facilitate the proton-coupled electron transfer processes. The result was published by the article "Synergistic Mn-Co catalyst outperforms Pt on high-rate oxygen reduction for alkaline polymer electrolyte fuel cells" on "Nature Communications" (DOI: 10.1038/s41467-019-09503-4).

2.2 Engineering Research

On September 29th, The Clean Energy Automotive Engineering Centre of Tongji University announced a single 125 kW fuel cell stack constructed by metal bi-polar plate. The stack was assembled by 370 single cells.

Fig. 1 Image of fuel cell stack

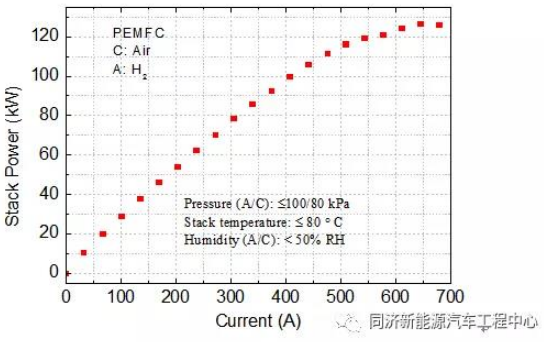

Fig. 2 Power curve of fuel cell stack

3. Demonstration, Deployments, and Workforce Developments Update

3.1 Demonstration

From September 23rd to 25th, "2019 Hydrogen Fuel Cell Vehicle Itinerant Exhibition & Roadshow in the Yangtze River Delta" was held in Jiaxing, Shanghai, Changshu, Nantong, and Rugao. During the activities, 15 fuel cell vehicles, including 4 passenger cars, 4 buses, 2 public buses, and 5 vans from Chinese and international automobile manufacturers were driven from Shanghai to Rugao (c.a. 210 km). Popular scientific lectures and parade demonstrations were held to let the public experience the safety and reliability of hydrogen fuel cell vehicles and help the development of hydrogen energy and fuel cell vehicles.

3.2 Deployments

From April to October, several cities started demonstration operations of fuel cell public transportation buses. Key points of information are as follows:

Date	City	Province	Number
April 15th	Datong	Shanxi	50
May 29th	Wuhan	Hubei	21
June 12th	Foshan	Guangdong	11
July 10th	Wuxi	Jiangsu	4
August 23rd	Liaocheng & Weifang	Shandong	60
October 16th	Jiashan	Zhejiang	10

4. Events and Solicitations

From April 18th to 25th, the 18th Shanghai International Automobile and Manufacturing Technology Exhibition (Automobile Shanghai) was held in Shanghai. 10 fuel cell vehicles from 8 domestic and international automobile manufacturers were exhibited, including Toyota Mirai, Hyundai Nexo, and SAIC Maxus G20FC.

From July 1st to 3rd, 2019 World New Energy Vehicle Congress was held in Boao City, Hainan Province. International speakers from Austria, France, Germany, Japan, Korea, UK, USA and Clean Energy Ministerial (CEM) were invited to give presentations.

From September 26th to 28th, the 4th International Hydrogen Fuel Cell Vehicle Congress was held in Rugao City, Jiangsu Province. International speakers from Canada, European Union, Germany, Japan and Korea were invited to give presentations.

From October 26th to 28th, the United Nations Development Programme (UNDP) China Hydrogen Energy Industry Conference and the 3rd China (Foshan) International Hydrogen and Fuel Cell Technology and Products Exhibition will be held in Foshan City, Guangdong Province.

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

On October 11th, the MIIT publicized "2017 New Energy Vehicle Promotion Application Subsidy Fund Clearing Review". CNY67M (≈ US$9.45M) will be granted to 114 fuel cell vans

and 20 fuel cell light buses (CNY500,000 per vehicle). To get subsidy, the vehicle is required to drive at least 20,000 km.

Fig.3 Granted Fuel cell van

Fig. 4 Granted Fuel cell light bus

6. Regulations, Codes & Standards, and Safety Update

Nothing new to report.

Summary Country Update October 2019: China

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles[1]	10,000 by 2020	Approx. 4050	• FCV Technology Roadmap is released	
FC Car		Approx. 50		Subsidy for purchase 0.2M CNY (28K USD)
FC Bus[2]		Approx. 2800		Subsidy for purchase 0.3M or 0.5M CNY (42K USD or-70K USD)
FC Trucks[2]		Approx. 1200		Subsidy for purchase 0.3M or 0.5M CNY (42K USD or-70K USD)
Forklifts	No national target	2		No support policy
H_2 Refueling Stations	**Target Number**	**Current Status**	**Partnerships, Strategic Approach**	**Support Mechanism**
70 MPa On-Site Production	No national target	1		Subsidy for installation of a new hydrogen refueling station with 200kg H_2 capacity, 4M CNY (0.56M USD)
70 MPa Delivered	No national target	1		Same to above

[1] Includes Fuel Cell Electric Vehicles with Range Extenders

[2] Estimated number from data released by China Association of Automobile Manufacturers

35 MPa On-Site Production	No national target	1		Same to above
35 MPa Delivered[3]	No national target	Approx. 32	Many cities proposed plans for building HRS (mainly 35 MPa HRSs), such as Beijing, Shanghai, Wuhan, Foshan, Suzhou, Rugao, Yancheng, etc.	Same to above
Stationary	**Target Number[4]**	**Current Status**	**Partnerships, Strategic Approach**	**Support Mechanism**
Small[5]	No target			
Medium[6]	No target			
Large[7]	No target	1		
District Grid[8]	No target			
Regional Grid[9]	No target			
Telecom backup	No target	Approx. 50 units		
H_2 Production	**Target[10]**	**Current Status**	**Partnerships, Strategic Approach**	**Support Mechanism**

[3] Including skid-mounted stations
[4] Targets can be units installed and/or total installed capacity in the size range indicated
[5] <5 kW (e.g., Residential Use)
[6] 5kW – 400 kW (e.g., Distributed Residential Use)
[7] 0.3MW – 10 MW (e.g., Industrial Use)
[8] 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)
[9] 30MW plus (e.g., Grid Storage and Systems Management)
[10] Target can be by quantity (Nm^3, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target

Fossil Fuels[11]	No target			
Water Electrolysis [12] (PEM, Alkaline, SOEC)	No target			
By-product H_2	No target			
Energy Storage from Renewables	**Target[13]**	**Current Status**	**Partnership, Strategic Approach**	**Support Mechanism**
Power to Power[14] Capacity	No target			
Power to Gas[15] Capacity	No target	1 (100kW)		

[11] Hydrogen produced by reforming processes
[12] Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)
[13] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity
[14] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity
[15] Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)