Newsletter No.1, September 2020

Sweden-China Bridge – Collaborative Acedemic Platform for the Electrification of Transportation Systems project is funded by Trafikverket-TRV (Swedish Transport Administration), and formally started on 1 September 2020. The first research and management team meetings were held on 4 September 2020 at VTI in Linköping, Sweden.

The research team intends to publish regular newsletters to update readers on developments in the Chinese context in the area of the electrification of transportation systems (ETS).

The author of Newsletter No 1 is Dr. Jasmine Lihua Liu.

I. The "New Infrastructure" campaign in China

In March 2020, China launched the "New Infrastructure" campaign to offset the economic influence of the coronavirus disease and boost sustainable growth. The "*New Infrastructure*" projects are focused on seven areas: 5G networks, industrial internet, data centers, artificial intelligence, ultra-high voltage, new energy vehicle charging stations, and inter-city transportation and inner-city rail systems (Junfeng, 2020).

The projects aim to construct digital infrastructure (to build 550,000 5G base stations in 2020 and 5 to 5.5 million 5G base stations by 2025), assist in the upgrading of digitalization and intelligence, and upgrading power systems and transport systems (build 4.8 million decentralized charging poles and 12,000 centralized charging and battery exchange stations by 2020, and build 36,000 centralized charging and battery exchange stations by 2025) (Government, 2015) to be more sustainable and smarter.

The government and enterprises, probably together with private capital, will pay for the construction of digital infrastructure in the future, and public-private partnership (PPP) could be a very important model.

It is evident that the electrification of transportation in China is being carried out in the context of the rapid development of digitalization and intelligence in the infrastructure and power systems in an integrated way.

II. Renewable Energy Vehicle Industry Development plan (2021-2035) of China (Government, 2019)

Renewable energy vehicle definition: pure EVs, plug-in hybrid energy vehicles, and fuel cell vehicles, among others.

This is the file that specifies China's strategic plan for renewable energy vehicle development for the coming 15 years. It has been developed by China's Ministry of Industry and Information Technology. The following content is an abstract from the file.

1. Development trend.

- "China's renewable energy vehicles have entered a new stage of accelerated development."
- "The "linear" ecosystem of the renewable vehicle industry consists of components, whole vehicle R&D and manufacturing, and marketing & service companies are evolving into "network" ecosystems consisting of automobile, energy, transportation and IT, etc.; multi-actors across multi-domains."

2. Guiding Principles

- **Market orientation**

"Enterprises should be the main force in selecting the technical route, product selection and the distribution of manufacturing capacity. Government agencies should play an active role in regulation and standards development, monitoring quality and security issues, market regulation, and encouraging green consumption behavior in order to create a favorable industrial development environment."

- **Coordinated action**

"To strengthen cross-sectoral coordination in order to promote the deep integration and synchronized progress of renewable energy vehicles, transportation and IT sectors in technology R&D, standard-setting, application promotion and infrastructure construction activities."

- **Open development**

"To develop a timetable and roadmap for the renewable energy vehicle field to be open for international collaboration."

3. Mission statement

"By 2035, China will be in a leading position in key renewable energy vehicle technologies; Chinese brands in the field have strong international competitiveness; China will become one of the strongest global countries in the automobile industry."

"By 2025, pure electric vehicles should become the major preference (renewable energy vehicles account for 25% of the market share for new vehicle sales); fuel cell vehicles should achieve commercialization; and public vehicles should achieve total electrification; highly autonomous vehicles (intelligent connected vehicles account for 30% of the market share for new vehicle sales) are on the way to becoming popularized; and energy saving, decarbonization and societal operating efficiency are moving forward effectively."

4. R&D strategy

"To strengthen integrated technology innovation at whole vehicle level. To select pure EVs, plug-in hybrid vehicles, and fuel cell vehicles as the "three pillars" of renewable energy vehicles to be developed.

"To make breakthroughs in key component technologies. To select battery power and its management systems, drive motors, power and electronics technologies, and networking and intelligent technologies as key component technologies to be the focus of development."

From the file we can see an obvious orientation that emphasizes the cross-sectoral coordination of actors from the automobile, energy, transportation, and IT sectors when developing renewable energy vehicles.

We can also see that pure EVs and hydrogen fuel cell vehicles are perceived as strategic renewable energy vehicles supporting China to achieve the zero emissions target in the long term. Plug-in hybrid vehicles are perceived as a temporary solution in order to facilitate the green transformation during the process.

III. Fuel cell vehicle (FCV) development status quo and future direction in China

1. Development status quo

In recent years, China has seen a boom in the development of the hydrogen energy economy. Relevant planning and support policies have been introduced in many locations. Hydrogen FCVs have also entered into an important window period of industrial development. The domestic hydrogen energy industry has formed six major industrial clusters, Beijing, Shanghai, Guangdong, Jiangsu, Shandong, and Hebei. By 2019, there were 6000 FCVs and 64 hydrogen refueling stations put into use in China (Zhao, 2020).

China is already the world's largest producer of hydrogen energy, with an existing industrial hydrogen production capacity of about 25 million tons per year. At present, companies focus on hydrogen energy manufacturing and storage. Hydrogenation infrastructure, fuel cells and applications accounted for 48.5%, 9.7%, and 41.8% of the hydrogen industry respectively. Hydrogen storage and transportation and hydrogen refueling stations are comparatively less well developed.

2. Development target

- **General targets**

China has developed a roadmap for hydrogen FCVs. The objective is to produce and sell one million FCVs by 2030. In addition, zero emissions from

transportation will be achieved by 2050 through the combined solution of hydrogen FCVs and pure EVs.

- **Deployed targets**

FCVs put into operation will have reached 5,000 to 10,000 by 2020, and a representative FCV model here is the city bus. FCVs put into operation will have reached 50,000 (10,000 commercial vehicles and 40,000 passenger vehicles) by 2025, and a representative FCV model here is the large SUV. FCVs put into operation will have reached one million by 2030, and a representative FCV model here is the long-distance heavy-duty truck.

By 2030, 50% of hydrogen is estimated to be produced via renewable energy, with hydrogen refueling station numbers reaching 1000 (Wang, 2020).

By 2050, more than 50% of China's heavy-duty trucks will be powered by hydrogen fuel cells.

According to an estimate by China Hydrogen Alliance, China's hydrogen demand will reach 35 million tons by 2030, accounting for 5% of the end-energy systems in China. Hydrogen could account for 10% to 15% of the end-use energy systems by 2050. By 2050, the annual manufacturing capacity for FCVs is estimated to reach 5.2 million, and hydrogen refueling station numbers to reach at least 10,000.

By 2050, 19% of energy consumed by the transportation field is estimated to come from hydrogen (Mi et al., 2019).

3. Development direction in near future

According to leading Chinese expert in the field, China should develop hydrogen power through replacing diesel vehicles and enter the 'era of hydrogen energy driven heavy duty trucks'. Port areas with intensive logistics activities are suitable locations for establishing demonstration projects of hydrogen replacements for diesel vehicles.

In 2020, the Chinese government issued an incentive policy to reward regional governments supporting the construction of hydrogen refueling stations.

The 2022 Winter Olympics will be held in Beijing and Zhangjiakou city, and there will be thousands of fuel cell buses put into operation to provide services for the Winter Olympics. Twenty to thirty hydrogen refueling stations will be built in 2021. Beijing and Zhangjiakou will be demonstration cities for hydrogen FCV operations.

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Research Team

- Mike Danilovic, Project Leader, Professor, Halmstad University, Sweden.
- Tomas Mülllern, Professor, Jönköping University, Jönköping International Business School, Sweden.
- Jasmine Lihua Liu, PhD, Affiliated Researcher at MMTC, Jönköping University, International Business School, Sweden.
- Arne Nåbo, Tech. Lic., Research Director, Swedish National Road and Transport Research Institute, Sweden.
- Jeanette Andersson, Researcher, Swedish National Road and Transport Research Institute, Sweden.
- Philip Almestrand Linné, PhD, Researcher, Swedish National Road and Transport Research Institute, Sweden.
- Wang Junhua, Professor, Tongji University, Shanghai, China.
- Liu Shuo, Assistant Professor, Tongji University, Shanghai, China.
- Qiu Xiaoping, Professor, Southwest Jiatong University, Chengdu, China.
- Susan Lijiang Sun, Professor, Shanghai Dianji University, Shanghai, China.
- Ma Hongwei, Associate Professor, Shanghai Dianji University, China.

Industry

- Scania China Innovation Center, Beijing, China.
- Shanghai Powerkeeper, Shanghai, China.
- Shanghai Jiulong Power, Shanghai, China.
- Guoxun Yang, CEO, Zhejiang VIE-Evatran Electronic Technologies Co., Ltd., Shanghai, China.
- Liu Zhen, Senior Engineer, Shanghai, Urban and Rural Construction and Transportation Development Research Institute, China.

Contact:

Mike Danilovic, Ph.D.
Professor of Industrial Management Innovation and Technology Management Halmstad University
P O Box 823
SE 183 01 HALMSTAD, SWEDEN

Phone:
+46708157588 (Sweden)

+8613761129945 (China)

mike.danilovic@hh.se

Visiting professor:
Distinguished Overseas Professor at Shanghai Dianji University Shanghai, China