



Graphic credit: Akzonobel

1. Introduction

Climate change is one of the greatest challenges we face. To combat climate change and to meet the targets set by the Paris Agreement, we need to have disruptive technologies to tackle pollution and greenhouse gas (GHG) emissions. Two of the largest contributors to pollution and GHG emissions are the transportation and energy sectors. Hydrogen fuel cell (FC) technology, which generates electricity through an electrochemical reaction of hydrogen with oxygen while emitting just water vapor, could be a potential solution.

2. What is the hydrogen economy?

The hydrogen economy entails hydrogen becoming a key part of the energy mix of a country or city, reducing dependency on fossil fuels. Applying hydrogen can reduce pollution and GHG emissions and the economic dependence on fossil fuels.

The hydrogen economy is not just a futuristic idea but a future reality; McKinsey has predicted that by 2050 fuel

cell vehicles will constitute 20% to 25% of the world's total vehicles and create 30 million job opportunities¹.

3. UNDP's contributions

UNDP supports China's transformation to a low-carbon economy through policy engagement and pilots that lead to scale, which in turn will impact global efforts to combat climate change and environmental degradation. UNDP has been a pioneer and catalyst in introducing and scaling Fuel Cell Vehicle (FCV) technology in China, which are key steps in moving towards a hydrogen economy.

With every innovation there are challenges of acceptance and buy-in from governments and the public. The same has been true with the promotion of hydrogen fuel cell technology. Pilot cities under UNDP projects have been the first to address regulatory barriers to the demonstration and commercialization of FCVs in China. UNDP is continuing to work on scaling the hydrogen economy in China through the implementation of several phases of hydrogen related projects, which began with the UNDP-GEF Fuel Cell

¹ McKinsey & Company, Hydrogen: The next wave for electric vehicles? <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/hydrogen-the-next-wave-for-electric-vehicles>, accessed 12 Mar 2019

Vehicles project more than a decade ago. Tangible contributions include: Policy and Regulatory Frameworks Recommendations for the Application and Commercialization of FCVs; Enhancement of Information Dissemination and Awareness about FCV Transport Systems; Improvement of Hydrogen Production and Refueling Systems; Improvement of Local FCV Quality and Performance; and FCV Technology Capacity Development Programs.

UNDP China has become “a partner of choice” piloting hydrogen economy projects with cities such as Rugao in Jiangsu Province which is already underway, and Zibo in Shandong Province, which is in the pipeline.

4. Current status in China

Hydrogen economy policy was a vacuum in China. UNDP’s 15 years of experience in the sector and its catalytic support has helped the country shift from fuel cell bus demonstrations to the commercialization era of the fuel cell technology.

Achievements include policy incentives and development plans in place in 11 provinces and cities, 33 publicly listed companies along the value chain, and over 41 automakers having set up FCV assembly lines and over 4 industrial clusters. Three of the clusters are centred around the project pilot cities - the North China Cluster around Beijing and Zhengzhou, the Yangtze River Delta Cluster around Rugao, Shanghai and Yancheng, and the Greater Bay Area Cluster around Foshan. Combined production/sales volume of FCVs in 2017 and 2018 reached 2,800. What began as a US\$ 19 million GEF funded project in 2003, has now expanded to US\$12 billion worth of research and development of the hydrogen fuel cell industry in China.

The rapid growth of the hydrogen economy in China is based on the policy outcomes and results of UNDP interventions, which have contributed to the following national initiatives²:

- Hydrogen and fuel cell technology was listed in *Made in China 2025* launched in May 2015 as one of the major technological breakthroughs;
- The research and development and industrialization of fuel cell vehicles was included in the *13th Five-Year National Strategic Emerging Industries Development Plan*, which was launched in December 2016;
- Hydrogen and fuel cell technology were listed in the *Outline of The National Strategy for Innovation-Driven Development* launched by the Central Committee of the Communist Party of China and the State Council in 2016 as the new-generation of energy technologies, indicating that hydrogen has been considered as a major strategic direction of national energy development;

- The National Development and Reform Commission (NDRC) and National Energy Administration (NEA) published *China Energy Technology Innovation Action Plan 2016-2030*, including fuel cell and hydrogen related technology.
- Hydrogen and fuel cells have been listed as one of the 20th strategic directions and priorities for energy science and technology innovation under *China’s Strategic Action Plan for Energy Development (2014-2020)*;
- As a direct output of the project, an *FCV Roadmap* was published in 2017, serving as a reference guide for China to accelerate its hydrogen and FCV industrial development to achieve FCV deployment of **5,000 by 2020**, **50,000 by 2025** and **1 million by 2030**.

5. Next steps:

Hydrogen vocational education

To meet the demand for human resources development to cater to the rapid growth of the industry, UNDP is in the process of establishing China’s first-ever hydrogen/fuel cell vocational school aimed at training front-line technicians and skilled workers. With the full support of the local government, the proposed vocational school will be based in Foshan City in Guangdong Province, which is one of the 5 pilot cities under the GEF FCV Project. The proposed vocational school will also be open for other countries in the long run.

South-South Cooperation and exchange

UNDP China is sharing lessons with other UNDP COs on promoting the hydrogen economy in China. There is an increased interest in hydrogen FCVs from countries such as Sri Lanka, Malaysia, Indonesia and Zimbabwe. Some of these countries are importing FCVs from the companies that UNDP China has been working with in the past years, which provides an opportunity for UNDP to support the development of the enabling policy, infrastructural, operational and management environment.

Promotion of thermal chemical application of hydrogen

The thermal chemical application of hydrogen is also applicable to light or heavy transport vehicles; agricultural equipment, mining equipment, power generators, locomotive transportation, marine transportation and in future, even aviation. into the future aviation. The target customer market is any existing/in-use engines using gasoline, diesel, LNG or methane as fuel.

Ensuring a sustainable green-sourced hydrogen supply

To ensure the sustainability of a green-sourced hydrogen supply, UNDP China has completed a feasibility study on

² Some of the contributions listed below are under the direct influence of UNDP’s project while others are indirect, for instance, the project fulfils the advisory role through engaging and working with agencies and experts playing formative roles in the policy making processes i.e. those sit in

the relevant national committees, work for key research institutions, or are members of industrial associations

“bio-ethanol for Hydrogen and FCV”, in which hydrogen could be generated from sugar-rich farming crops, such as sugarcane, sweet sorghum or cassava.

Contact Information

Energy and Environment

Sustainable Development Team

United Nations Development Programme in China

No. 2 Liangmahe Nanlu, Beijing China 100600

weidong.zhang@undp.org

wanyi.wang@undp.org