The Hydrogen & Fuel Cell Connection is a bi-monthly newsletter published by the IHFCA that highlights the latest industry news and business opportunities for global hydrogen fuel cell research, demonstration and commercialization.

IN THIS ISSUE

I. THE ASSOCIATION NEWS

As of April 30, 2018, the IHFCA has 55 member organizations from 14 countries. Our latest member is Centro Nacional del Hidrógeno (CNH2) – Spain's H2 and Fuel Cell Technology Experimentation National Center.

For the 2nd half of 2018, the IHFCA is getting ready to launch two events and publish two documents in October as below.

1. The 3rd International Hydrogen Fuel Cell Vehicle Congress (FCVC 2018);
2. FCV Itinerant Exhibition and Tours in the Yangtze River Delta region with expected participation of 30 organizations;
3. The 2018 Blue Book: Global FCVs and H2 Infrastructure (Chinese & English versions);
4. The "Hydrogen Corridor Development Plan" in the Yangtze River Delta region, which welcomes the participation of *all* enterprises, nationally and internationally.

II. FCVC 2018 UPDATE

The FCVC 2018 will take place on Oct. 23-25 in Rugao. For exhibition and sponsorship opportunities and media partnership, please visit www.ihfca.org.cn, then click FCVC.

Anglo American Platinum, which has fostered the connections of some of the worlds' foremost fuel cell enterprises within the ever-growing Asian market, will continue to sponsor the event this year.

The FCVC Congress Committee is pleased to announce the preliminary confirmation that the Presidents/Senior Executives of the World Bank, GEF, UNDP, FISITA, and U.S. DOE FCTO will be presenting at the FCVC 2018.

III. GLOBAL HFC NEWS

The Canadian Government awarded Vancouver-based Cellula Robotics a contract for developing a fuel cell that could improve the ability of autonomous underwater vehicles to store sufficient energy for long range sub-surface missions in the Arctic region.

The British Columbia (BC) Government announced a project to evaluate the potential of large scale production and use of renewable hydrogen in BC as well as its export to Japan and California. A techno-economic feasibility study will be conducted for commercial-scale, centralized production of renewable hydrogen in BC - the west coastal province that has one of the world's cleanest grids, with 92% of its power generated by hydro at competitive electricity rates.

Xebec Adsorption, a Montréal-based gas purification technology developer, formed a strategic partnership with Furui HP, a Chinese company engaged in hydrogen generation and distribution, to expand their business in renewable hydrogen supply chain.

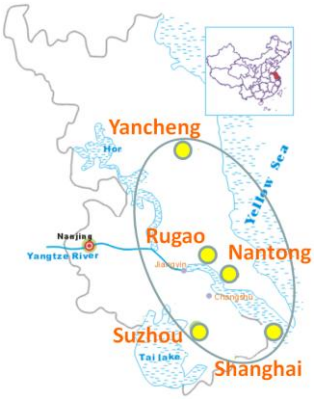
Effective April 1, 2018, China introduces a new sales quota system for passenger vehicles - *Corporate Average Fuel Consumption (CAFC) & New Energy Vehicle (NEV) Credits*.

The so-called Dual Credits ("双积分" in Chinese, pronounced "Shuang-ji·fen") refer to the "CAFC+NEV" credits to be calculated in parallel.

The NEV credit is a mandate policy for all passenger vehicle producers in China with annual production of 30,000+ units to have a minimum 10% of NEV production in 2019, and 12% in 2020. If such ratio cannot be met, the vehicle producers shall cut its non-NEV production or buy NEV credit from other vehicle producers. Surplus NEV credits can be used to offset negative CAFC credits, but cannot be carried over to the following year.

In February the Central Government renewed its FCV subsidy, to be unchanged through 2020. In addition, local governments offer various incentive programs and subsidies. For example in Shanghai, each qualified FC bus (> 8 meters) and heavy duty truck is eligible for a total RMB 1.1 million (approx. US$ 172,000) in subsidy, of which the Central Government and Shanghai local government, respectively, provides RMB 0.5 million and RMB 0.6 million.

In March JD.COM, one of the two largest B2C online retailers in China, received its first two *Dongfeng* fuel cell delivery trucks. Powered by fuel cell engines built by Shanghai Re-Fire Technology, these trucks will serve JD.COM's distribution center in Shanghai – the city that has three H2 fueling stations in trial operation and one on schedule to open this June. The combined capacity of these four stations is 2,500 kg/day, designed to supply 500 FCVs. Current H2 retailing prices at these locations are roughly RBM 40 (US$ 6.4) per kilogram.



On April 28, the initiation meeting to develop a world class "Hydrogen Corridor" in the Yangtze River Delta Region was held in Shanghai. This marks the official launch of China's first Hydrogen Corridor Development Plan, which welcomes the participation of *all* enterprises worldwide.

The IHFCA and the China-SAE, in conjunction with Shanghai and four other cities (Suzhou, Nantong, Rugao and Yancheng) in Jiangsu Province, will conduct an open comprehensive techno-economic study to develop a hydrogen infrastructure plan to link these five cities in creating the largest HFC industry belt in China.

SHANGHAI, at the southeast end of the corridor, has a solid plan of 20,000 FC passenger cars and 10,000 FC commercial vehicles by 2025, along with 50 hydrogen fueling stations.

SUZHOU, at the southwest end of the corridor, just released its preliminary plan for fuel cell commercial vehicles, including 800 FC buses and logistics vehicles along with 10 hydrogen stations by 2020, anticipating a scaling up to 10,000 fuel cell commercial vehicles and 40 stations by 2025.

NANTONG and RUGAO, in the center of the corridor, are along the lower reaches of the Yangtze River. The former is an important auto hub in China for NEVs; the latter is UNDP's first Hydrogen Economy Demonstration City.

YANCHENG, at the north end of the corridor, has a big plan for hydrogen development, especially for renewable hydrogen generation, as it did eight years ago for solar and wind energies, which now supply 20% of the city's electricity.

Fuel Cells and Hydrogen Joint Undertaking (FCH JU), in conjunction with Shift2Rail, launched a joint call for tender in conducting a study on fuel cell applications in the railway environment. The study will address the needed market analysis and assess potential HFC technologies that could be deployed in large scale for passenger and freight railways.

Air Liquide and 12 French partners published a prospective study, predicting that by 2050, hydrogen could account for 20% of France's energy demand and the H2 industry could generate €40bn of annual revenue and create over 150,000 jobs. To achieve this, France needs an estimated €8bn initial investment in R&D, equipment and infrastructure by 2028, to quickly reduce hydrogen fuel cell costs.

NOW GmbH and GIZ GmbH, under the framework of Germany's Federal Ministry for Environment to encourage export initiatives, will collaborate to build up a network in emerging countries to promote climate friendly projects such as the use of fuel cell technologies.

In the UK, a consortium managed by Element Energy, comprising ITM Power, Shell, Toyota, Honda and Hyundai, won £8.8m of funding from the Department for Transport to expand the UK's hydrogen refueling network - among which ITM Power will receive £4.3m, along with further funding support from the FCH JU, to build four new hydrogen stations, complete three ones in construction, and upgrade five existing ones.

The combined on-site hydrogen production (electrolyser) capacity of these 12 stations will reach 3,000 kg/day, allowing for stable H2 supply during rush hours in metro areas such as in London, which has a fleet of 11 Toyota *Mirai* police cars and a fleet of 52 *Mirai* taxi cars.

In March Toyota launched the production of its fuel cell bus *SORA*, the name representing the water cycle of "sky, ocean, river and air" on earth.

Before the 2020 Tokyo Olympics, Toyota is expected to introduce 100 *SORA* FCBs, of which light-weight roof panels and high-pressure hydrogen tanks will be supplied by Toyoda Gosei, a Japanese composites product producer for global auto industry.

For PGMs, Japanese trading company Hanwa recently secured the right of stable platinum supply from South Africa, ensuring 20% of Japanese demand for fuel cell industry and FCVs.

The U.S. extends its fuel cell credit and incentive programs, highlighted by the restoration of 30 percent investment tax credit for fuel cell power generation and forklifts – to be extended through 2022 with a reduction in the final two years (i.e., 26% tax credit in 2021 and 22% in 2022).

In April the U.S. DOE announced its funded research has reduced transportation fuel-cell costs by 60% from $120/kW in 2006 to current $45-50/kW, and improved fuel cell durability by a factor of four, from 30,000 miles in 2006 to current 120,000 miles.

For fuel-cell stationary applications, the U.S. DOE announced a federal funding up to $32.5 million for cost shared R&D to advance SOFC technologies, including:

- Applied R&D and test projects to upgrade fuel cell components, stack architectures and balance-of-plant technologies;
- Long term reliability improvement and prototype tests of the second-generation SOFC power systems in an operational environment that could directly contribute to lowering the system degradation to less than 0.5 percent/1,000 hours.

IV. IHFCA MEMBER INTRODUCTION

"We are just an advanced breed of monkeys on a minor planet of a very average star. But we can understand the Universe [and make use of hydrogen]. That makes us something very special." - Stephen Hawking (1942-2018)

Hydrogen, the most abundant element in the universe, was discovered in 1766 by British Scientist Henry Cavendish. The fuel cell was first demonstrated by Sir William Grove in 1839 however it was not applied until its use on NASA's Apollo spacecraft in the 1960s.

In 1983 Ballard Research Inc., with a small research fund from the Canadian government, pioneered PEM fuel cell development, bringing this neglected technology to the world and ushering in the subsequent fuel cell "renaissance".

In 1992 Ballard, after an initial PEM research success, reached a partnership agreement with Daimler AG for joint development of a compact, high power density fuel-cell stack. The result was Daimler's first generation FCV *NECAR 1*, which proved the basic suitability of fuel cell technology as an electric vehicle propulsion system had already been met.

In 1994 Ballard asked for Vancouver-based Powertech Labs to determine the safety feasibility of using CNG cylinders for hydrogen, an initiative leading to the release of CSA B51, the first published hydrogen fuel tank standard in the world.

In 2010 a fleet of 20 Ballard-powered fuel cell buses were deployed to serve the Vancouver Winter Olympics. In 2011 the fleet surpassed one million kilometers in operation, and its fast fueling station (70MPa, 1,000 kg/day) was built and operated by Air Liquide – the world's largest industrial gas producer that has been introduced in the JAN/FEB issue.

BALLARD

Ballard Power Systems provides clean energy products reducing costs and minimizing risks. It helps customers solve difficult technical and business challenges in their fuel cell programs through customized technology solutions.

After 40 years in business, Ballard is one of most recognized fuel cell brands in the world. It pioneers PEM fuel cell applications in mass transit and commercial vehicles in China, North American and EU. The London-based Anglo American Platinum has been its long-term strategic shareholder since 2013.

The success of Ballard is the story of PEM fuel cell technology development. To learn more about this, please visit www.ballard.com.

DAIMLER

Daimler AG, headquartered in Stuttgart, is one of the largest producers of premium cars and the world's largest manufacturer of commercial vehicles with a global reach.

As a global leader in FCV development since the 1990s, Daimler has introduced a number of research, concept and demonstration vehicles, the first being *NECAR 1* - Daimler's first generation FCV in 1994.

In Sept. 2017 at the 67th International Motor Show in Frankfurt, Daimler unveiled its pre-production models of the new *Mercedes-Benz GLC F-Cell* as the next milestone on the road to emission-free driving. Its fuel cell system, produced by Vancouver-based AFCC, can, for the first time, be installed entirely in the engine compartment using the mounting points for a conventional engine.

Daimler's quarter century on the frontiers of FCV technology advancement is one small step in *A Brief History of Time*, and one giant leap for mankind.