Alternative Fuels

MARCH | 2020

BULLETIN

FutureBridg

WHAT'S INSIDE!

- Nikola is becoming first public fuel cell truck company
- European Union new announcement on clean hydrogen alliance
- Aiways revealed first edition of methanol fuel cell supercar
- Toyota-Hino partnership for fuel cell heavy duty truck
- H24US filing patent for hydrogen purification membrane
- UK Government is panning to introduce E10 fuel

Read our Spotlights to understand how European Union is supporting the development of hydrogen fuel cell technology.

- European 'Clean Hydrogen Alliance' : Building a European green industry

Learn more about Alternate fuels : launches, startups, collaborations, competitor movement

01 **Nikola Motors** going public

02 **UK Government** is set to introduce E10 fuel

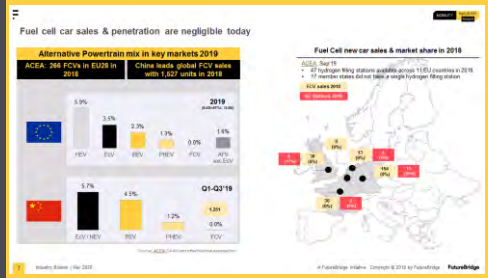
03 **H24US** patenting their hydrogen purification membrane technology

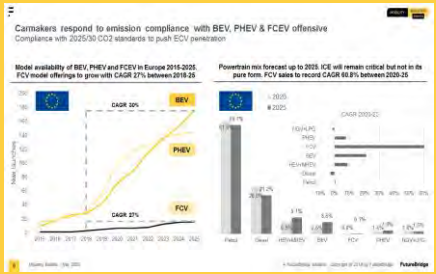
04 **European Union** Plans for Clean hydrogen alliance

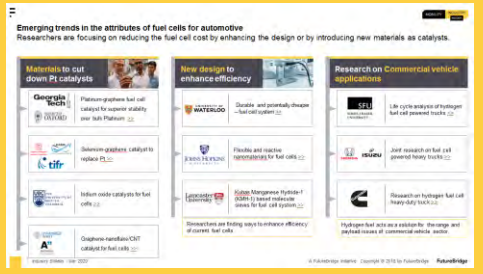
05 **Aiways** launched first edition of methanol fuel cell supercar

06 **Toyota-Hino** to develop heavy-duty fuel cell truck

Highlights







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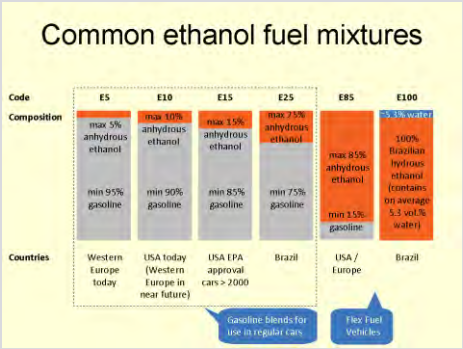

Image source: Wikipedia

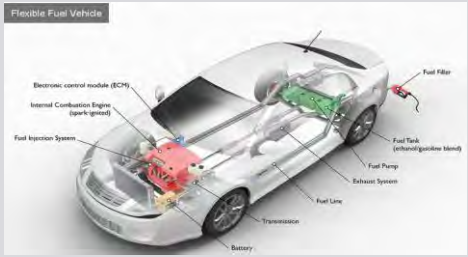

Image source: afdc_energy

-Expert Says-

"Before electric cars become the norm we want to take advantage of reduced CO2 emissions today."

- Grant Shapps, the transport secretary, UK

03 Mar 2020

Nikola is becoming first public fuel cell truck company

Nikola is merging with a publicly listed acquisition company called VectoIQ.

- The joint venture is mainly focus on the development of next-generation smart transportation.
- The company will receive $525 million in new investment as a result of this joint venture.

Analyst comment : Nikola lined several customers, such as Anheuser-Busch and Iveco. They have also signed a deal with energy company Nel to develop the hydrogen filling stations, and automotive supplier Bosch to help design parts of its trucks.

Read this story

04 Mar 2020

UK government introducing E10 fuel

UK government is set to introduce E10 ethanol as a new form of cleaner petrol.

- The fuel has a potential to reduce CO2 emissions by about 750,000 tonnes per year or the equivalent of 350,000 fewer cars on the road.
- The government was consulting on plans to make it the standard grade at British filling stations from 2021.

Analyst comment : The E10 blend is already used in countries including Germany, France, Belgium and Finland.

Read this story

08 Mar 2020

H24US new patent for hydrogen purification membrane

H24US has filed a patent application with the USPTO for its advanced hydrogen separation membrane.

- The membrane can be used in a system with minimum capital expense, has a low or zero carbon footprint.
- The company is dedicated to reducing hydrogen cost and to provide an "accelerant" to realize the promise of clean hydrogen energy.

Analyst comment : The technology behind the patent for H24US will help solve the global energy transition challenge by bringing down the cost to produce hydrogen from low carbon energy sources.

Read this story

Future of fuel cell vehicles : Players are massively using fuel cells for CV applications

HYUNDAI H2 XCIENT Fuel Cell heavy duty truck

NIKOLA IVECO FPT Partnership for fuel cell truck

HYUNDAI HDC-6 NEPTUNE concept truck

Cummins Hydrogen fuel cell concept truck

PLUG POWER Class 6 trucks for logistics

BALLARD 8th generation fuel cell module for heavy duty sector

NIKOLA Fuel cell electric pick up

H2Rescue fuel cell truck

*image credits: OEMs , Supplier and Start-ups

-Expert Says-

"We welcome the proposal of a Clean Hydrogen Alliance, which can exploit all benefits that hydrogen can bring to the EU economy and jobs. This initiative is a clear evidence of the success of our public private partnership and we will actively support it."

— Bart Biebuyck, FCH JU Executive Director, European Union.

11 Mar 2020

European Commission is planning for 'clean hydrogen alliance'

European Union is all set for a new and wide partnership to develop clean hydrogen fuel technologies as a part of push towards carbon neutrality by 2050.

- The program is named as "Clean Hydrogen Alliance" which is expected to receive €3.2bn in public support.
- The new EU strategy points to the efforts of competitor markets, such as China and the US, here new technologies and trade policies have been developed.

Analyst comment : Germany, France, and the Netherlands are among those EU countries that have signaled their strong interest in hydrogen.

Read this story

19 Mar 2020

Gumpert Aiways has launched methanol fuel cell electric supercar

Gumpert Aiways unleashed the first edition of Nathalie powered by electric motors backed by a methanol fuel cell.

- It delivers a driving range of over 500 miles (805 km) refuel times of 3 min, and performance figures include a 2.5-second 0-62 mph (100 km/h).
- The chemical reaction in the fuel cells is charging the batteries and a negligible percentage of nitrogen oxide released as byproducts.

Analyst comment : Methanol fuel cell vehicle would produce 44% less CO2 than a diesel one, and it would produce 37% less CO2/kWh than a battery vehicle.

Read this story

24 Mar 2020

Toyota-Hino partnership to develop heavy-duty fuel cell truck

Toyota and Hino are going to develop a heavy-duty fuel cell truck jointly.

- The heavy-duty fuel cell truck in this joint development project is based on Hino Profia, and is being developed taking maximum advantage of the technologies both Toyota and Hino.
- The powertrain is equipped with two Toyota fuel cell stacks that have been newly developed for Toyota's next Mirai and includes vehicle driving control that applies heavy-duty hybrid vehicle technologies, developed by Hino..

Analyst comment : Toyota and Hino have positioned hydrogen as an important energy source for the future.

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Alternative Fuels

European 'Clean Hydrogen Alliance': Building a European green industry

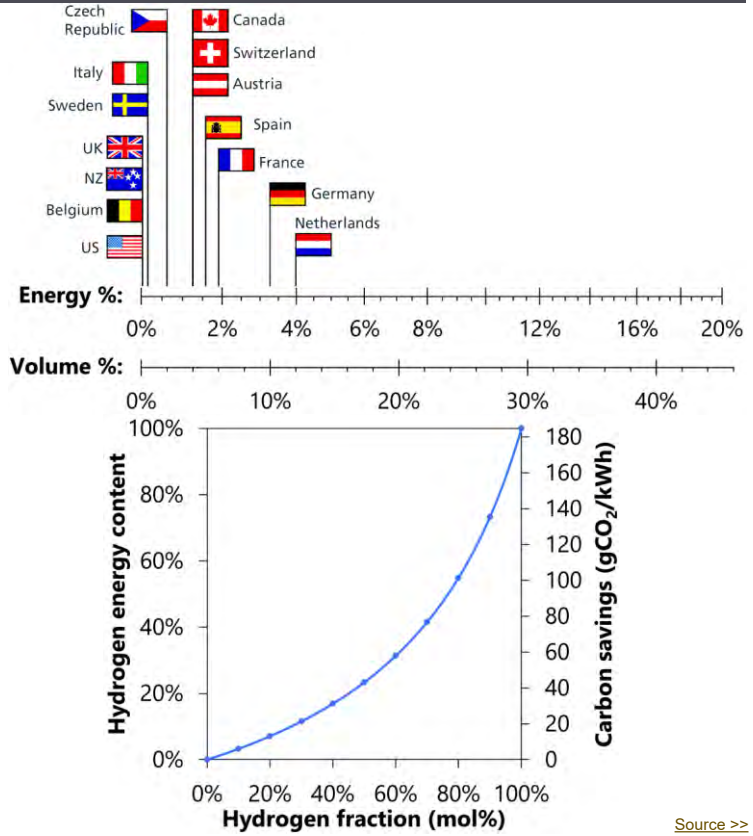
The European Commission has announced plans to set up an EU-wide "alliance" to promote the production of clean hydrogen in an effort to speed up the decarbonization of industry. The Clean Hydrogen Alliance, bringing investors together with governmental, institutional and industrial partners, will build on existing work to identify technology needs, investment opportunities, and regulatory barriers and enablers.

HYDROGEN TECHNOLOGIES AND SYSTEMS

- Potential to replace fossil-based energy with low-emission renewable hydrogen
- Could enable and optimize large-scale renewable electricity generation
- Could increase EU energy security and resilience

RECOMMENDATIONS:

- Develop a road map for a future European hydrogen economy.
- Build a supportive regulatory framework on renewable energy, develop common standards
- Support R&D investments and build an innovative industrial system through cross-border collaboration and partnerships in Horizon Europe
- Ensure safety and public acceptance through demonstrations and standardization



Source >>

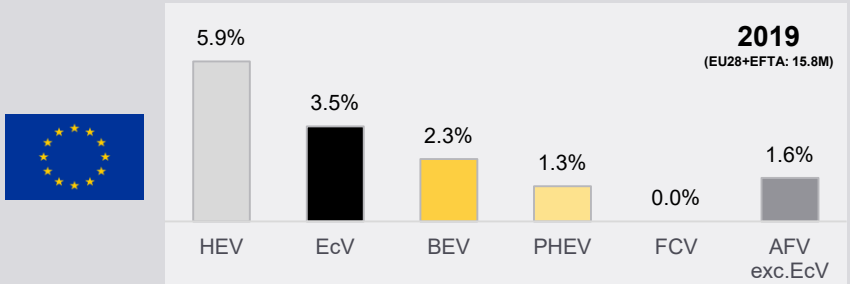
FutureBridge

Fuel cell car sales & penetration are negligible today

Alternative Powertrain mix in key markets 2019

ACEA: 266 FCVs in EU28 in 2018

China leads global FCV sales with 1,527 units in 2018

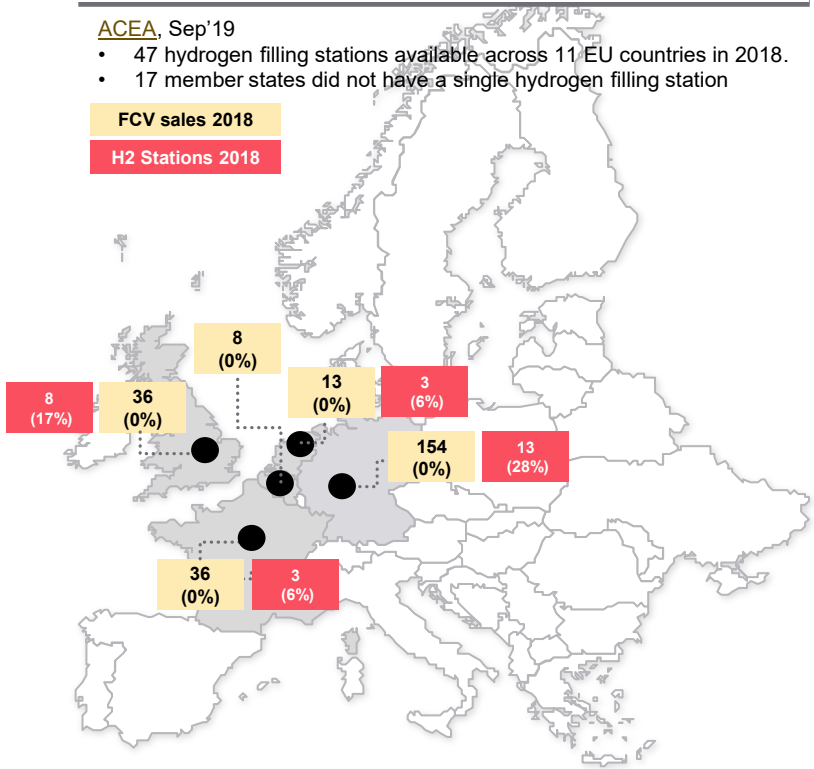


Source: ACEA, CAAM and other National associations

Fuel Cell new car sales & market share in 2018

ACEA, Sep'19

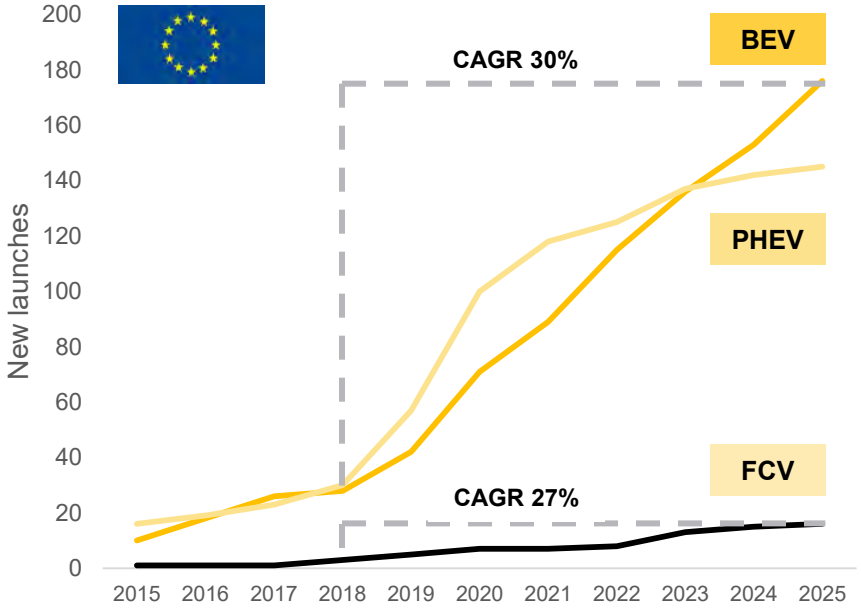
- 47 hydrogen filling stations available across 11 EU countries in 2018.
- 17 member states did not have a single hydrogen filling station



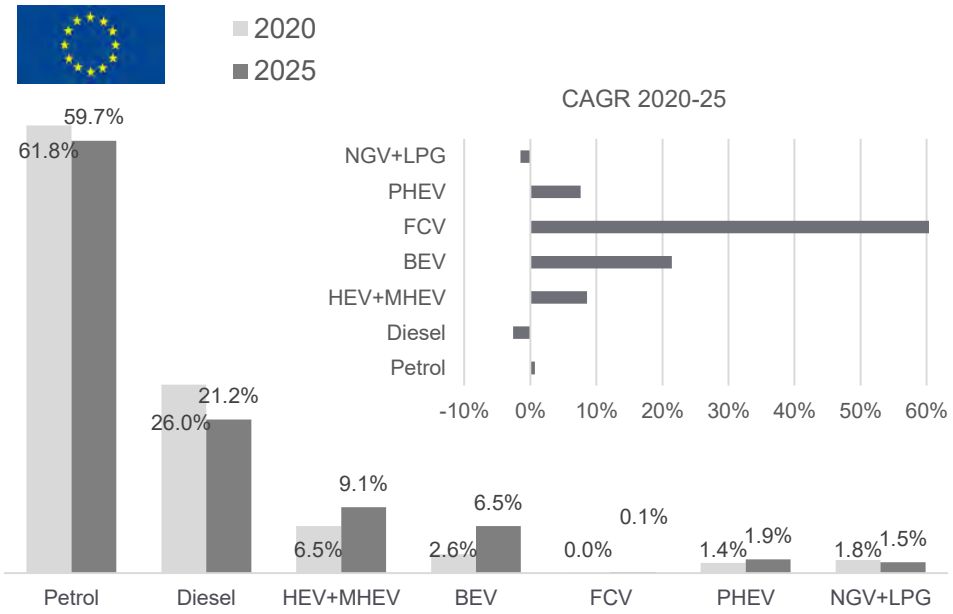
Carmakers respond to emission compliance with BEV, PHEV & FCEV offensive

Compliance with 2025/30 CO2 standards to push ECV penetration

Model availability of BEV, PHEV and FCEV in Europe 2015-2025. FCV model offerings to grow with CAGR 27% between 2018-25



Powertrain mix forecast up to 2025. ICE will remain critical but not in its pure form. FCV sales to record CAGR 60.8% between 2020-25



Emerging trends in the attributes of fuel cells for automotive

Researchers are focusing on reducing the fuel cell cost by enhancing the design or by introducing new materials as catalysts.

Materials to cut down Pt catalysts

- Georgia Tech / University of Oxford — Platinum-graphene fuel cell catalyst for superior stability over bulk Platinum >>
- University of Hyderabad / IISER Thiruvananthapuram / tifr — Selenium-graphene catalyst to replace Pt >>
- UBC The University of British Columbia — Iridium oxide catalysts for fuel cells >>
- universität wien / Aalto University — Graphene-nanoflake/CNT catalyst for fuel cells >>

New design to enhance efficiency

- University of Waterloo — Durable and potentially cheaper – fuel cell system >>
- Johns Hopkins University — Flexible and reactive nanomaterials for fuel cells >>
- Lancaster University — Kubas Manganese Hydride-1 (KMH-1) based molecular sieves for fuel cell system >>

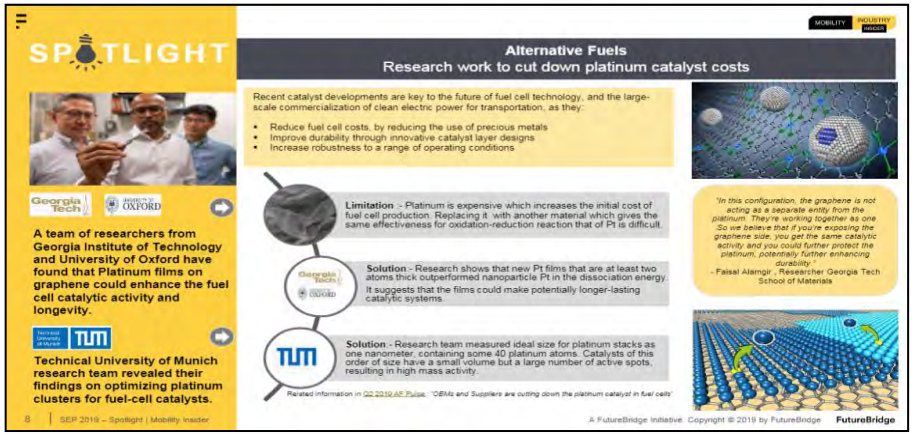
Researchers are finding ways to enhance efficiency of current fuel cells

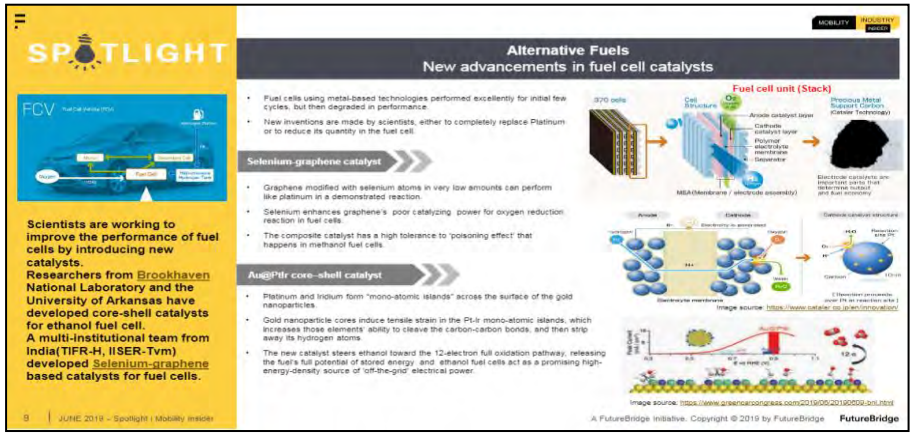
Research on Commercial vehicle applications

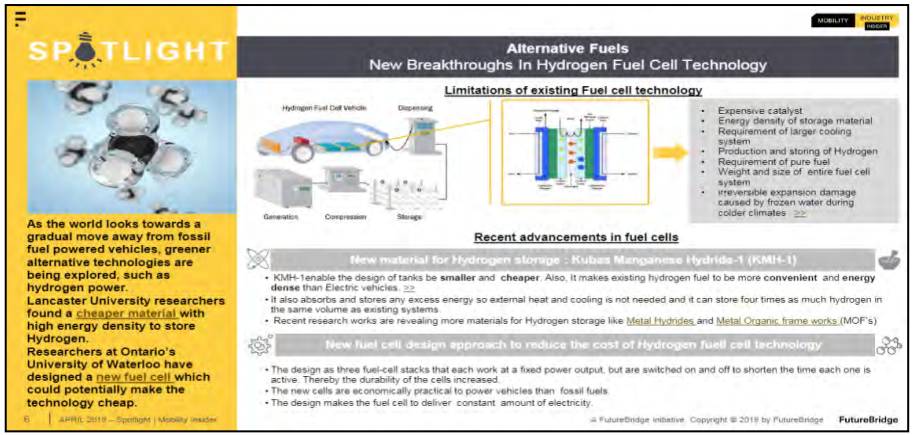
- SFU Simon Fraser University — Life cycle analysis of hydrogen fuel cell powered trucks >>
- Honda / Isuzu — Joint research on fuel cell powered heavy trucks >>
- Cummins — Research on hydrogen fuel cell heavy-duty truck >>

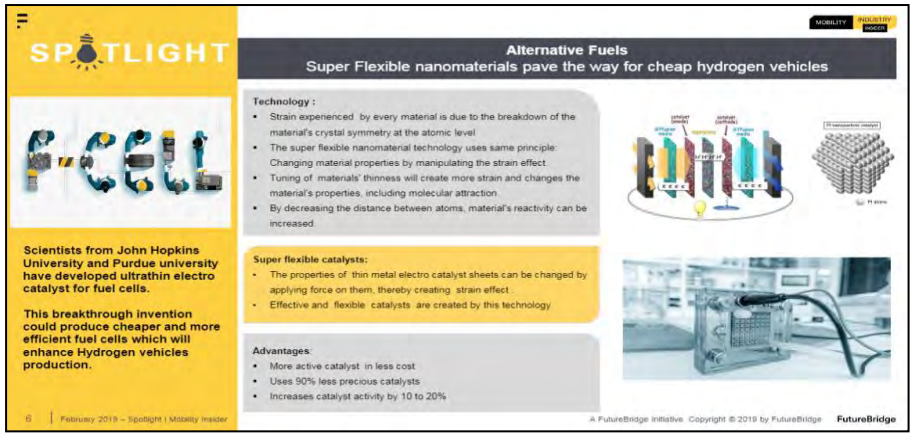
Hydrogen fuel acts as a solution for the range and payload issues of commercial vehicle sector.

Spotlights on focus: Research work for fuel cell development

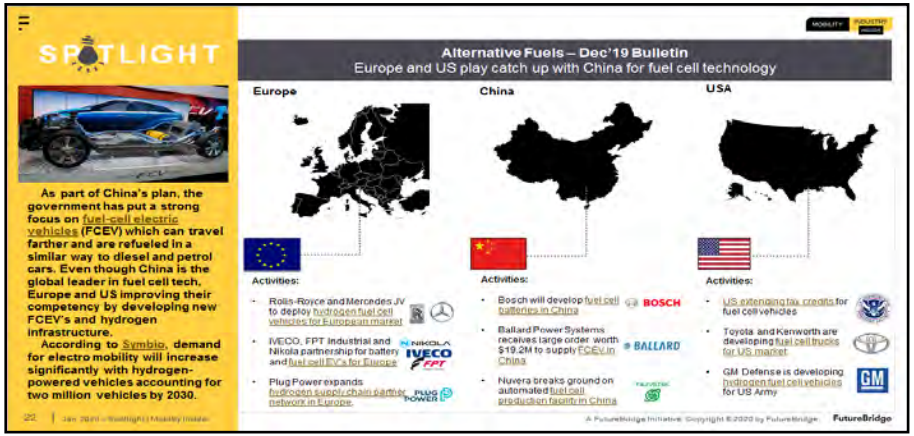


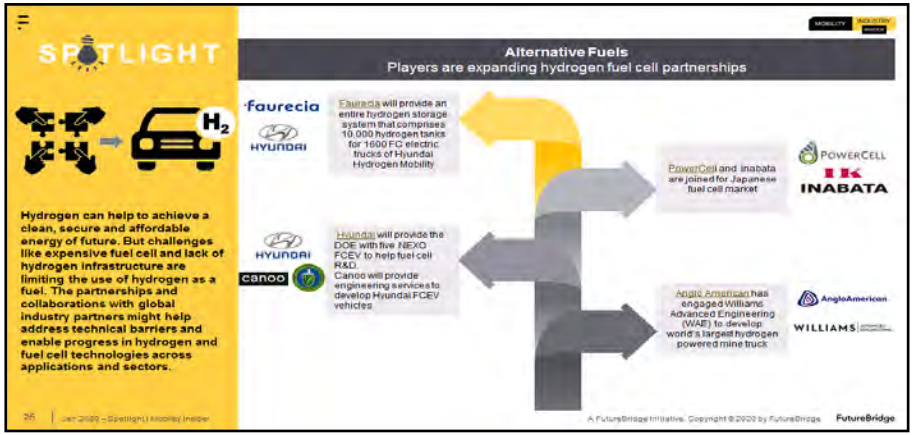


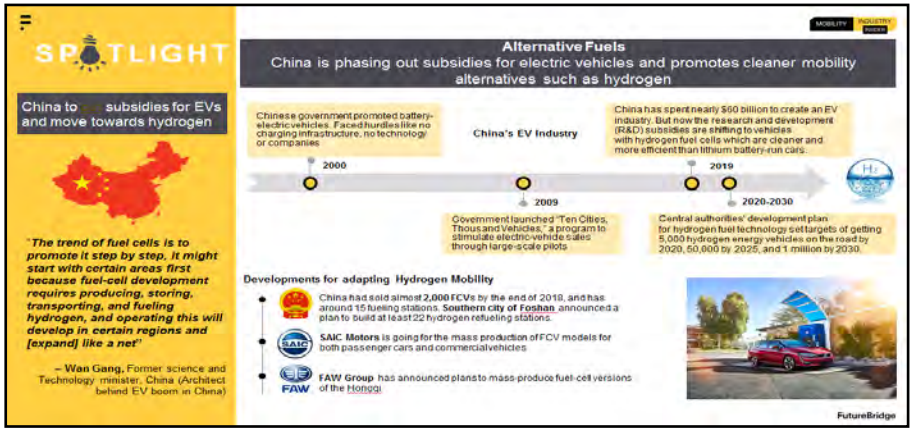


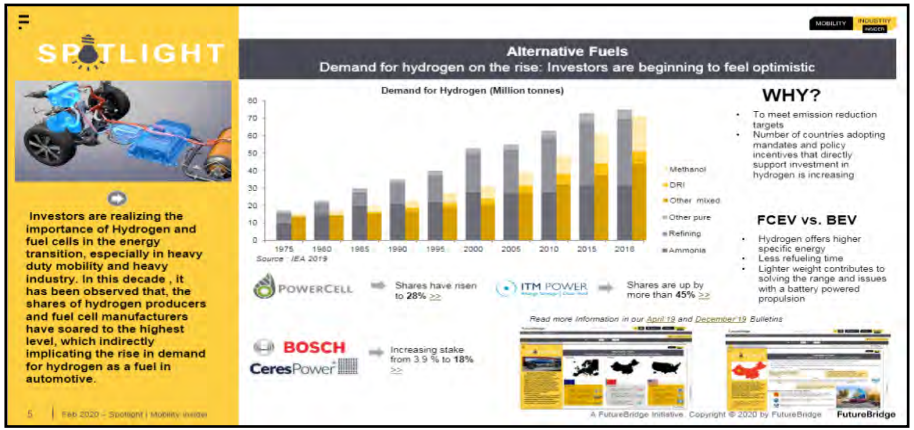


Spotlights on focus: Demand of hydrogen mobility



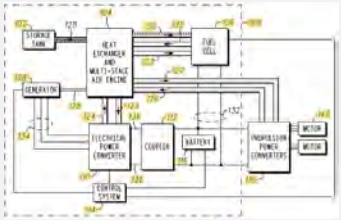






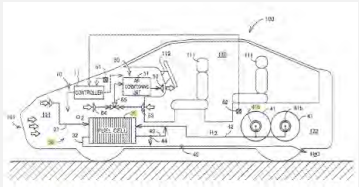
IP excerpts

Apparatus and method using hydrogen pressure in fuel cell electric vehicle



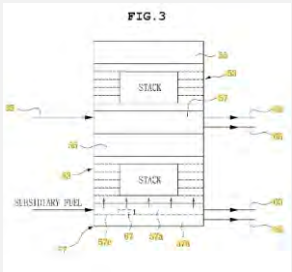
- Patent explains a hydrogen fuel cell based EV which includes one tank for storing hydrogen under pressure.
- A combined heat exchanger and air engine expands the pressurized hydrogen and converts the expanding hydrogen into mechanical energy. Fuel cells receive the expanded hydrogen and charges battery. System also consists of a generator and an electrical power converter.

Method of preventing fuel gas from entering cabin of mobile object including fuel cell and mobile object including fuel cell



- Patent includes a car comprised of a fuel cell, an air-condition cabin and a gas concentration detection unit .
- The controller switches an operation mode of the air conditioning device to an internal air circulation mode from another mode when the concentration of the gas is equal to or higher than a predetermined upper-limit threshold.

Device and method for heating fuel cell stack and fuel cell system having the device



- Patent relates to a device and method for heating fuel cell stack and fuel cell system.
- The fuel cell system includes a power generating unit having fuel cell stacks arranged with an interval defined between the stacks. The subsidiary fuel is burnt in the outlet manifold unit so as to heat both the outlet manifold unit and the stack coming into contact with the outlet manifold unit.

Energy control method, device and the fuel cell car of fuel cell car

- Patent explains a kind of energy control method of fuel cell car.
- The energy control method includes finding SOC value of a power cell which controls the working mode of fuel cell car in turn a fuel cell which generates power according to the working mode.

Questions raised during fuel cell webinar and our Answers

What about the Hydrogen storage? Actors, disruptors and new technologies?

We capture hydrogen storage solutions for mobility applications in our Mobility Insider program while FutureBridge's Energy Insider captures Industrial applications. Regarding new technologies,

- 1. Carbonaceous materials, such as CNTs and metal hydrides
- 2) Nanomaterials
- 3) porous manganese hydride
- 4) Nafion membranes enhanced with TiO2/SnO2

How do you see the position of suppliers like powercell, elringklinger, borit in automotive sector?

- Shares in some producers of hydrogen and manufacturers of fuel cells have increased to a higher level. According to the share prices, Powercell, is on the top of the list, followed by Ballard Power systems and ITM Power. Shares of Powercell have risen 28 per cent over the same period and 342 per cent over the past 12 months.
- ElringKlinger is not just a fuel cell manufacturer, it is an worldwide development partner and original equipment supplier to all of the world's vehicle and engine manufacturers.

What is the position of Nikola Hydrogen trucks?

- We would welcome the opportunity to showcase our profile for Nikola and our assessment of their strategy, portfolio and market position. We could schedule a demo so that you can experience what forms part of our offerings available exclusively to the subscribers of FutureBridge's Mobility Insider platform.
- Nikola is one of the leaders of hydrogen fuel cell trucks. They have secured $480Mn funding from CNH Industrials, Bosch&Hanwa. They also become the first public hydrogen fuel cell truck company.

Following discussion I understand that there is no EU common policy about fuel cell. Is it correct?

- There are common policies and Programs within the EU. EU initiatives and funding opportunities have greatly contributed to the growing market for hydrogen across multiple sectors in the region. Here are the most important initiatives in the past 5 years.
- The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) was established in 2008
- Linz Hydrogen Initiative , Sep 2019
- European Strategic Energy Technology (SET) climate policy with a time horizon of 2020 and beyond

with a lower energy density compared to batteries, why is FCV expected to be cleaner mobility as well as more efficient?

- Hydrogen offers much higher specific energy than batteries. The lighter weight could contribute to solving the range and payload issues inherent to a 100% battery-powered propulsion. They could be zero-emission electric vehicles since they emit only water vapor.

What are trends in biofuels policy Worldwide? This can influence push on ethanol/methanol fuel based fuel cell.

- Sixty-four countries around the world have targets and mandates for biofuels so far. Under our membership program you can gain access to all the latest activities from the front of policies and regulations in Biofuels.
- We are seeing an increase in blending of Biofuels such as Biodiesel, ethanol and methanol to conventional fuels. There are more incentives, subsidies and programs which promote biofuel production. This obviously will have an influence on ethanol/methanol fuel based fuel cell.

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