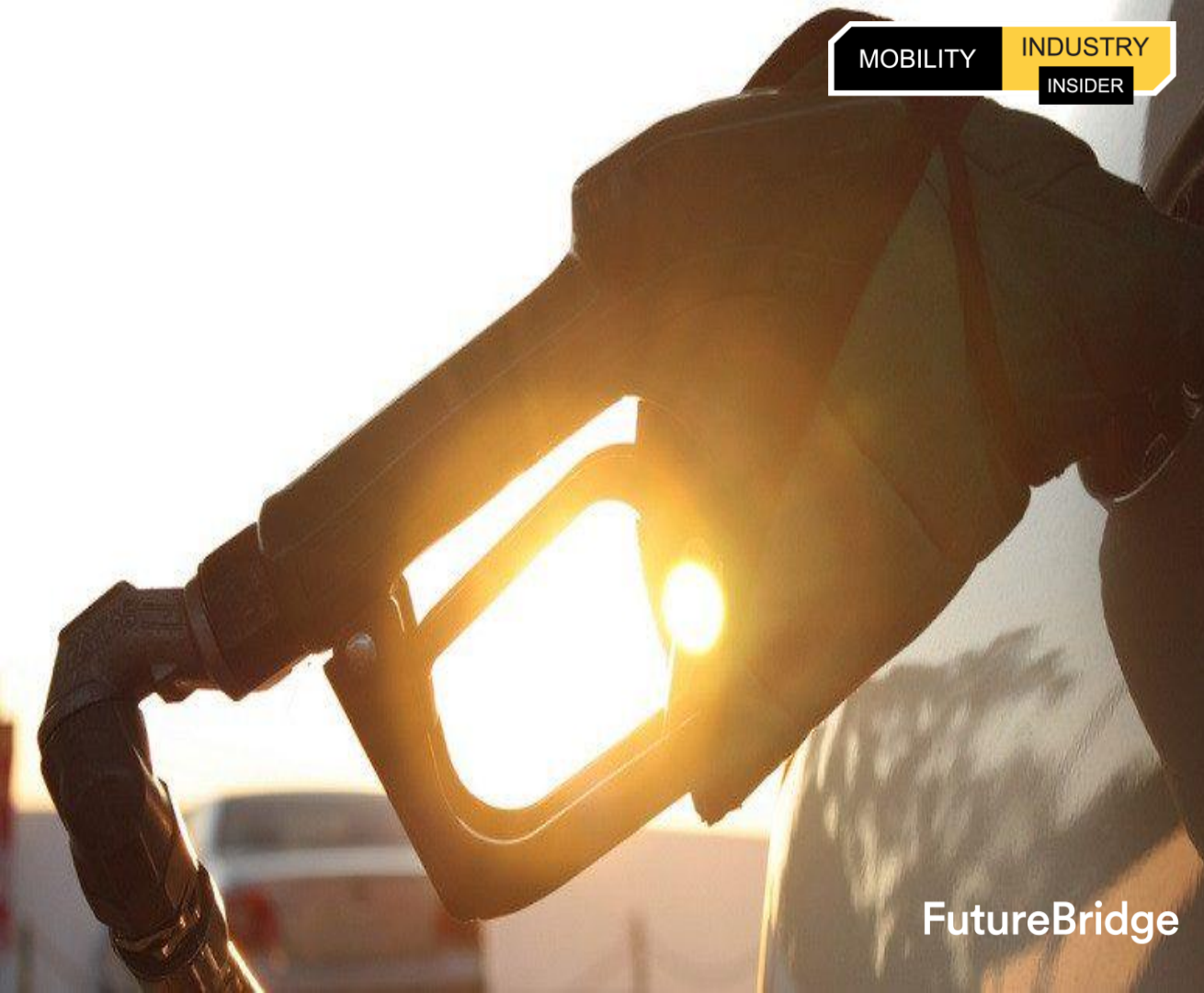




Alternative Fuels

JANUARY | 2020
BULLETIN



WHAT'S INSIDE!










Hydrogen fuel cells technology penetrating into commercial vehicle applications:

- [DOE](#) setting targets for hydrogen fuel cell heavy duty trucks
 - [E-Trucks & Proton Motors](#) partnership for hydrogen fuel cell trucks
 - [Honda-Isuzu](#) collaboration for hydrogen fuel cell trucks
- OEMs and Suppliers are researching and investing into SOFCs.
- [Hyundai](#) to invest \$87B for electric and hydrogen mobility

Read our Spotlight to understand how solid oxide fuel cell technology is developing with the help of OEMs and suppliers.

- [Ceres Power](#) collaborating with OEMs and suppliers for Solid Oxide Fuel Cell technology

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

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-Expert Says-

“At the moment, a fuel cell drive train costs about ten times more than a BEV system. We plan to offset these costs by 2025 with the third generation of our scalable fuel cell system, which could lead to hundreds of thousands of units”

- Klaus Fröhlich, Head of Development, BMW

02 Jan 2020

Hyundai to invest \$87B for electric and hydrogen mobility



Hyundai Motor Group (HMG) planning to invest more than KRW100 trillion (US\$87 billion) over next 5 years in electric and hydrogen mobility

- The plan mainly focusing to enhance Hyundai's leadership in the vehicle electrification, expansion of hydrogen industry ecosystem.
- The Group planning to supply 200,000 fuel-cell systems per year around the world by 2030.

Last year Toyota has announced that they are going to invest more in hydrogen fuel cell as the company expects to sell 30,000 FCEVs (which is 3000 now) in near future.

Read this story 

07 Jan 2020

BMW will reveal its second generation fuel cell technology



BMW intends to introduce the second-generation fuel cell technology developed together with Toyota in the BMW X6 and X7.

- Company is planning to offset the costs of the third generation FC system scalable fuel cell system.
- According to BMW, i Hydrogen Next only had to be slightly modified for fuel cell technology.

BMW is planning to deploy [i Hydrogen Next](#) on road by 2025, depending on market requirements and framework conditions.

Read this story 

13 Jan 2020

Daimler to commercialize fuel cell bus production



Daimler is planning to commercialize hydrogen fuel cell bus in next two to three years.

- The company have already begun delivering Mercedes-Benz GLC F-Cell in Europe in 2018 by combining hydrogen fuel cell and battery technologies.
- By 2021 a German public-transportation company will begin field-testing a new Mercedes-Benz electric bus, equipped with a fuel cell range extender.

Daimler is enhancing the [hydrogen infrastructure](#) in Germany. They have made a JV with Linde, Shell and Total to develop a network of hydrogen fueling stations

Read this story 



-Expert Says-

“Bosch strongly believes that the highly efficient solid oxide fuel cell (SOFC) has an important role to play in energy systems’ security of supply and flexibility. Bosch, together with our development partner Ceres Power, has made good progress in the development of fuel-cell stacks for stationary power applications.”

—Dr. Christian Fischer, member of the Bosch management board,

17 Jan 2020
Honda and Isuzu to test fuel cell-powered heavy-duty trucks



Isuzu Motors and Honda R&D signed an agreement to undertake joint research on heavy-duty trucks, utilizing fuel cells (FC) as the powertrain.

- Isuzu has been researching and developing various powertrains including clean diesel engine, engines for natural gas vehicles (NGVs) and electric vehicle (EV) powertrains.
- In parallel, Honda has been working on fuel cell vehicles (FCVs), in addition to hybrid and battery electric vehicles.

Fuel cells are finding more demand in heavy duty application since it can operate over longer range and on more demanding routes.

Read this story

23 Jan 2020
Bosch boosts stake in SOFC expert Ceres Power to around 18%



Bosch GmbH has agreed to become a significant strategic investor in Ceres Power Holdings Plc. by increasing its current stake in Ceres to around 18% from 3.9%.

- Bosch is looking for the large opportunity of highly efficient solid oxide fuel cells in future energy sector.
- The total investment by Bosch will be approximately €90 million (US\$100 million).

Ceres Power is having partnerships with Honda and Weichai Power to supply Solid oxide fuel cells .

Read this story

24 Jan 2020
E-Trucks Europe to implement hydrogen fuel cell systems from Proton Motors



E-Trucks Europe has ordered five HyRange fuel cell systems from Proton Motor.

- The five hydrogen fuel cell systems will be used to outfit electric refuse trucks as part of the EU project REVIVE.
- The tender, which runs from 2018 to 2021, aims to build and put into operation 15 electric vehicles for the collection of waste in Europe.

Hydrogen is one of very few zero emission options that can provide the equivalent flexibility of diesel fuelled vehicles for heavy duty applications, as battery vehicles struggle to meet the range requirements.

Read this story

28 Jan 2020

Ballard-powered fuel-cell electric vehicles rack up 30M km



Ballard Power Systems announced that its proton exchange membrane (PEM) fuel-cell technology and products have now powering FCEV's, total of more than 30 million kilometers.

- Currently the company deployed 570 Fuel-Cell Electric Buses (FCEBs) and 2,000 commercial trucks in Asia, Europe and North America.
- In 2019, Ballard launched the FCgen-LCS next-generation PEM fuel-cell stack along with FCmove, the company's 8th-generation fuel-cell power module.

Ballard and Weichai together providing fuel cell solutions in China.

[Read this story](#)

28 Jan 2020

DOE sets technical targets for hydrogen and fuel cell in class 8 truck application



US Department of Energy has established technical targets for hydrogen and fuel cell technologies in long-haul tractor-trailer Class 8 truck applications.

- These targets will help guide early stage R&D and serve as benchmarks for tracking technology.
- Targets for battery electric tractor-trailer trucks will also be added to the Electrified Powertrain Roadmap.

The high energy storage density offered by these [hydrogen fuel cell](#) - powered vehicles provides sufficient vehicle range.

[Read this story](#)

27 Jan 2020

LBLN, Nissan researchers developing ethanol reforming SOFCs for vehicle applications

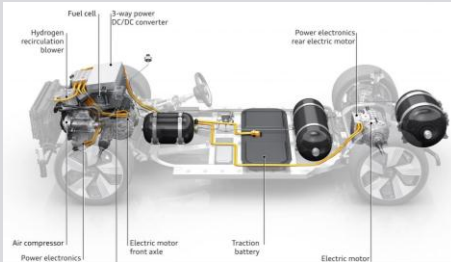


Researchers from Lawrence Berkeley National Laboratory (LBLN) and Nissan Research Center developing internal reforming of ethanol SOFCs for transportation application .

- Currently reforming of hydrocarbon fuels for use with SOFCs is mainly performed external to the SOFC stack.
- The researchers evaluated hydrogen concentration and internal reforming effects in a symmetric-architecture metal-supported solid-oxide fuel cell (MS-SOFC) with different fuels.

SOFCs are finding uses in larger vehicles and as range extenders for battery electric vehicles.

[Read this story](#)

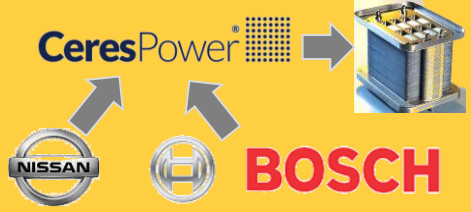


-Expert Says-

“Our products have powered FCEBs and commercial trucks in 14 countries around the world, and delivered 97.3% availability in 2019. Ballard’s unmatched field experience – through eight generations of fuel cell power module and a wide range of duty cycles, climate and road conditions – has enabled an effective feedback loop for our product design and development efforts, resulting in the fuel-cell industry’s highest performance products designed for Heavy- and Medium-Duty Motive applications, including bus, commercial truck, train and marine.”

—Randy MacEwen, Ballard President and CEO

SPOTLIGHT



Nissan Motor in collaboration with Ceres Power, researching and developing a Solid Oxide Fuel-Cell (SOFC)-powered system using bio-ethanol as the on-board hydrogen source. Ceres Power's patented SteelCell® stack SOFC technology will be utilized by the OEM to extend the range of electric vehicles and allow a shorter refuelling time.

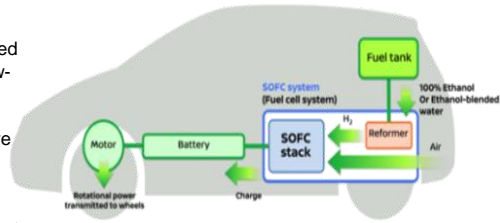
Bosch to become a significant strategic investor in Ceres Power by increasing its current stake to 18% from 3.9%. A total investment of \$100M will be done by Bosch aiming the large opportunity of SOFC in future energy sector

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Ceres Power collaborating with OEMs and suppliers for Solid Oxide Fuel Cell technology

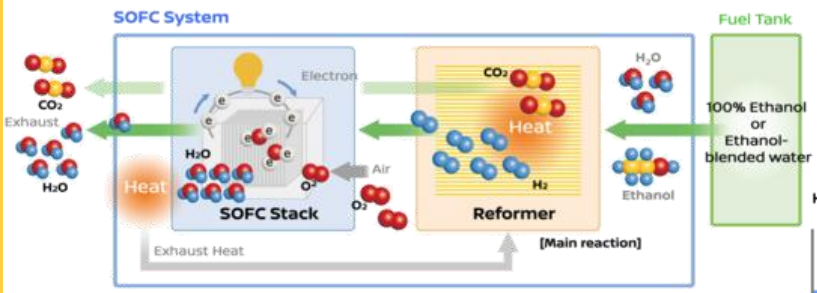
SOFC Technology developments

- University of Maryland researchers have partnered with Redox Power Systems to commercialize low-temperature SOFC for transportation >>
- Researchers at Washington State University have been developing liquid hydrocarbon/oxygenated hydrocarbon-fueled for aviation >>
- Honda R&D signed a joint development agreement with Ceres Power to develop SOFC stacks >>



SOFC TECHNOLOGY

- The solid oxide fuel then generates electricity via the reaction of hydrogen with oxygen from the air.
- e-Bio Fuel Cell system produces hydrogen from ethanol or ethanol-water blends through the on-board reformer.
- Reaction:
 $C_2H_5OH + 3H_2O \rightarrow 6H_2 + 2CO_2$
- Highly active catalyst is not necessary due to high operating temperature.
- The system reuses the heat generated by that reaction for the reformer.

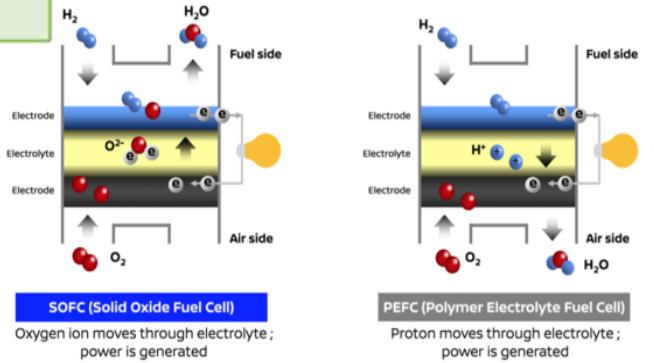


ADVANTAGES

- Well suited for larger vehicles and longer ranges (~600 km, 373 miles) than BEVs.
- Features a quiet drive and short refueling time

DISADVANTAGES

- Operating at higher temperatures than the PEM fuel cells that are currently used in FCEVs to meet the need for high performance and low cost insulation



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