international association for hydrogen energy
Clean and Abundant Energy for Sustainability

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California amends rules to push vehicles toward hydrogen, electricity, biofuel

Utilities will earn credits for electric car charging stations and subsidize EV purchases.

Last week, California's Air Resources Board (CARB) announced that it would tighten restrictions on transportation fuels in the state in the hopes of spurring adoption of electric, hydrogen, and biofuel-based cars, trucks, buses, and even planes.

Fuel economy standards kill people, Trump administration claims

Since 2011, CARB has had a Low Carbon Fuel Standard (LCFS) on the books that requires a 10 percent reduction in "carbon intensity" for all fuels sold in California by 2020. Carbon intensity for fuels takes into account lifecycle carbon emissions, including any emissions created processing oil into gasoline, processing feedstock into ethanol, or transporting a fuel from a refinery to the point of sale.

With CARB's decision on Friday, the lifecycle emissions for transportation fuels needs to drop by 20 percent by 2030.

The LCFS also lets the state issue credits to utilities for installing electric vehicle charging stations. Utilities can then turn around and sell those credits to fuel producers who can't meet the 20 percent carbon intensity reduction. Part of the money that the utilities make from the credit program will go into a collective fund to help Californians buy electric vehicles. The more people who have electric vehicles, the more demand there will be for electricity, a good that utilities provide.

Not just a car thing

California's approach is an interesting one because transportation is a difficult sector of the economy to decarbonize. Unlike the electricity sector, where a relatively few companies are responsible for most of the carbon emissions, millions of Californians drive, and all of them have different reasons why they might or might not move to electric or hydrogen vehicles.

Personal preference, lack of a garage, concerns about resale value, and use patterns that don't allow for long recharging periods all play a part in the sluggishness of the transportation sector to decarbonize. But incentivizing fueling/charging infrastructure is one lever that state policy can pull to entice more people to move away from internal combustion vehicles. Reducing the price of electric vehicles through subsidies is also another lever that state policy can pull. The LCFS pulls both of those levers at the same time.

California Government says 100% clean electricity not enough, state must go carbon neutral

One area of transportation that doesn't quite fit into that model is aviation, but that sector is hard to decarbonize.

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IAHE Objective

The objective of the IAHE is to advance the day when hydrogen energy will become the principal means by which the world will achieve its long-sought goal of abundant clean energy for mankind. Toward this end, the IAHE stimulates the exchange of information in the hydrogen energy field through its publications and sponsorship of international workshops, short courses, symposia, and conferences. In addition, the IAHE endeavors to inform the general public of the important role of hydrogen energy in the planning of an inexhaustible and clean energy system.

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One reason for that is that we don't yet have batteries with sufficient energy density to power a commercial plane. Additionally, attempts to blend jet fuel with biofuel-based alternatives have been stymied by exorbitant cost and few real-world tests, although Qantas, United, and Alaska Airlines have done initial flights with biofuel. Still, CARB notes, "The international aviation market is responsible for about two percent of the world's GHG emissions."

But as of Friday, the new low carbon standards in California also include a provision for credits to be issued to producers of alternative aviation fuels.

The amended LCFS also now accounts for Carbon Capture and Storage (CCS), which would allow fuel producers to capture carbon from the refining process and store it. "This process should be particularly useful to ethanol producers, as it has the potential to reduce their carbon intensity by up to an additional 40 percent," CARB states in its press release.

California policy makers have been extremely aggressive in proposing policy to tackle climate change, especially in recent years. Earlier this month, the state voted to move to 100-percent zero-emission electricity generation by 2045, one of the most aggressive decarbonization programs in the nation. The state has also promised a fight with the Trump Administration, which is trying to roll back fuel economy standards in passenger vehicles. CARB benefits from a unique legacy exception under the Clean Air Act, which allows the state to set more aggressive fuel economy standards than the federal standard. The Trump Administration is attempting to remove CARB's power to do that.

Source: https://ww2.arb.ca.gov/news/carb-amends-low-carbon-fuel-standard-wider-impact

Renewable hydrogen could match gas, battery storage on cost by 2025: CSIRO

Clean hydrogen could be cost-competitive with existing industrial fuels like natural gas, and with emerging energy storage technologies like batteries, by 2025, a new CSIRO report has claimed.

The National Hydrogen Roadmap report, published by Australia's premier research agency, says Australia has an "urgent" opportunity to establish a "hydrogen economy," that would allow its rich renewable resources to be exported around the world.

The report is the latest—following reports from chief scientist Alan Finkel and ARENA—to focus on hydrogen gas—derived primarily by splitting water, using either fossil fuels or zero emissions sources—as a "versatile energy carrier and feedstock."

Using renewable energy, the report notes (and that is the CSIRO's stated focus), hydrogen can enable deep decarbonization across the energy and industrial sectors, replacing natural gas as a source of heat as well as a potentially cost competitive low emissions feedstock for a number of industrial processes.

CSIRO also points to its potential to be used to help manage the national electricity market's transition to renewables, by overcoming challenges associated with energy intermittency; offers an opportunity for optimization of renewables between the electricity, gas and transport sectors; and could play a key role in protecting Australia from fuel supply shocks.

"Australia has a unique and urgent opportunity to turn significant natural resources … into a low-emissions energy product and ship it around the world—in some cases literally exporting Aussie sunshine," said CSIRO chief Larry Marshall in comments accompanying the report.

The CSIRO blueprint for an Australian clean hydrogen industry follows the release of two separate reports, last month, from the Australian Renewable Energy Agency and a research group led by chief scientist Alan Finkel.

Those reports, too, highlighted the enormous opportunities for Australia in pursuing "green" hydrogen exports, based around the country's enormous potential for wind and solar power.

As Giles Parkinson reported here, several small-scale hydrogen facilities have been commissioned in Australia – in South Australia and the ACT – but these are mostly focused on transport solutions or smaller scale electricity

storage.

Hydrogen as a major renewables-based export industry, meanwhile, has faced some serious hurdles—both logistical and economical.

One of those hurdles, however, has been significantly lowered by the CSIRO, which began testing a breakthrough method to transport hydrogen safely in the form of ammonia.

In its report, CSIRO says an economically-sustainable hydrogen industry could soon be on the cards, with cost competitiveness said to be "firmly on the horizon."

The roadmap finds that hydrogen technologies are now reaching maturity, with the narrative shifting from R&D to market activation.

CSIRO says the fuel not only presents a new opportunity for export, but could also place downward pressure on the cost of renewables—already falling at a steady clip.

But as with Australia's emerging electric vehicle industry, the report notes that one of the main barriers preventing that market activation is the lack of supporting infrastructure and policy framework.

"Development of an appropriate policy framework could create a 'market pull' for hydrogen, with investment in infrastructure then likely to follow," the report says.

"This National Hydrogen Roadmap provides a blueprint for growing Australia's hydrogen industry through coordinated investment to be globally competitive," said Dr. Marshall.

"CSIRO is at the forefront of innovation with our partners in industry, government and the research sector, like our recently developed, world-first membrane to separate hydrogen from ammonia for fuel cell vehicles."

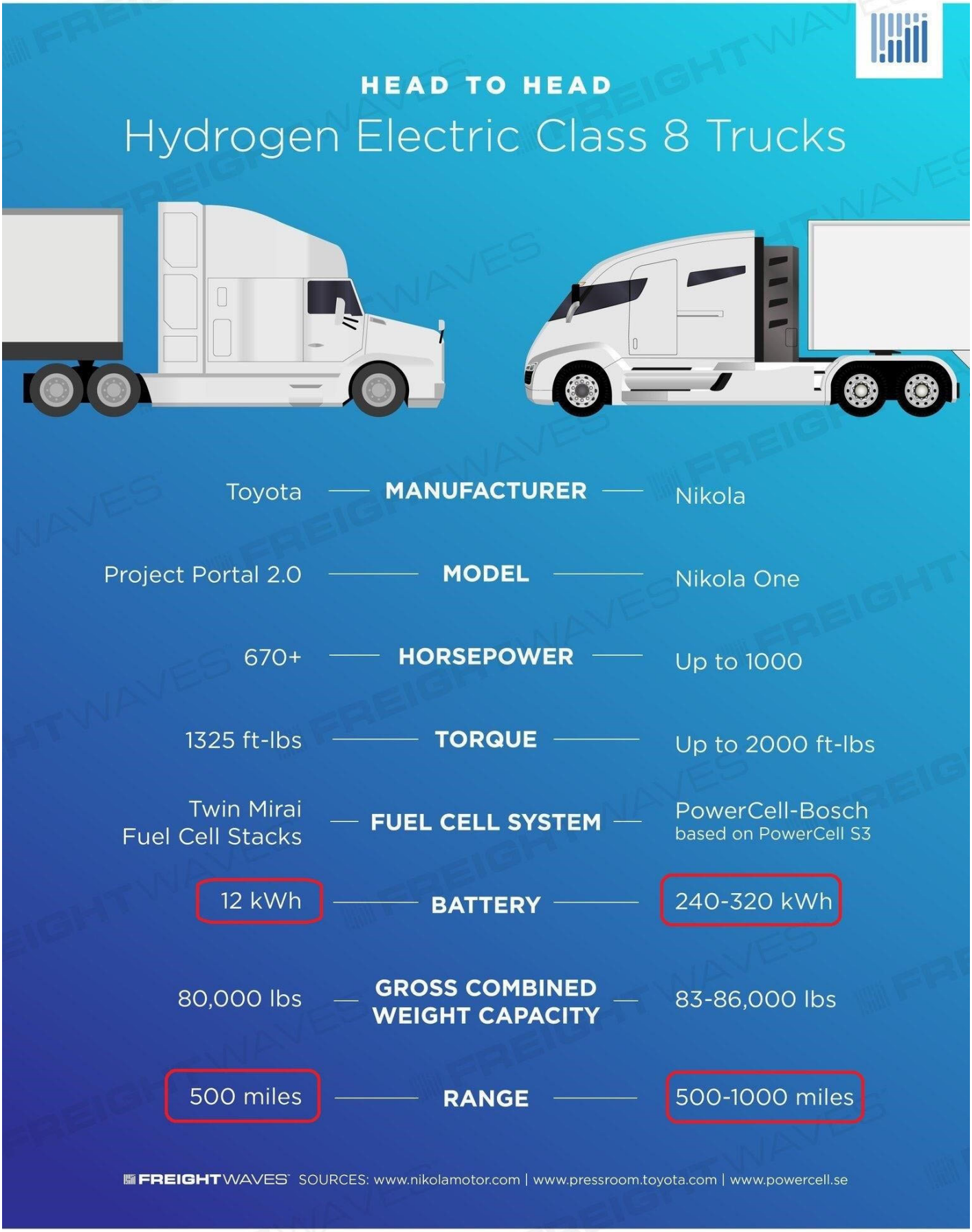
CSIRO Hydrogen Future Science Platform Director Dr. Patrick Hartley said industry interest is evident.

"We've established a strong network of partners and collaborators that support current, practical research and technology initiatives right across the hydrogen energy value chain."

"And while it's now underpinned by a series of mature technologies, there is considerable scope for further R&D," said Dr. Hartley.

The national science agency consulted broadly to develop the Roadmap, which was sponsored by 21 industry and government bodies.

Source: https://reneweconomy.com.au/renewable-hydrogen-could-match-gas-battery-storage-on-cost-by-2025-csiro-46302/


HEAD TO HEAD
Hydrogen Electric Class 8 Trucks
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MODEL
Nikola One
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HORSEPOWER
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1325 ft-lbs
TORQUE
Up to 2000 ft-lbs
Twin Mirai Fuel Cell Stacks
FUEL CELL SYSTEM
PowerCell-Bosch based on PowerCell S3
12 kWh
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240-320 kWh
80,000 lbs
GROSS COMBINED WEIGHT CAPACITY
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WWW.FREIGHTWAVES.COM

1,000 Hyundai fuel cell electric trucks headed to Switzerland

Hyundai Motor Co. will build 1,000 commercial fuel cell electric trucks to be operated in Switzerland beginning in 2019, the automaker said Wednesday at the 2018 IAA Commercial Vehicle show in Hanover, Germany.

Hyundai will work with Swiss hydrogen company H2 Energy to build an infrastructure that will support hydrogen refueling stations across the country.

The fuel cell truck is developed from the Hyundai XCient truck currently in use throughout Asia. It is equipped with up to eight hydrogen storage tanks providing energy to two parallel fuel cell stacks on board.

"Especially for heavy-duty trucks, we think that fuel cell is the perfect fit," said Mark Freymueller, head of commercial vehicle new business projects for Hyundai.

The system produces 190 kilowatts of power, and an electric motor makes the equivalent of 465 horsepower and 2,500 pound-feet of torque. The truck is capable of up to 400 kilometers of range, or about 250 miles. Its hydrogen tanks can be refilled in seven minutes.

Hyundai will deliver the first trucks by the end of 2019. The order of 1,000 trucks will be completed by 2023.

Hydrogen fuel cell trucks are gaining traction. In the U.S., Toyota Motor Corp. unveiled a new version of its Project Portal prototype in August to test at ports in Southern California. Startup Nikola Motor Co. has received 9,000 non-binding orders for its hydrogen fuel cell truck, including 800 for brewing giant Anheuser-Busch.

Hyundai intends to expand its hydrogen fuel cell project beyond Swiss borders.

"With a successful start in Switzerland we believe we can expand our market presence to other European countries as well," Freymueller said.

The truck will be available in 4×2 or 6×2 configurations. It also marks the introduction of Hyundai to the heavy-duty commercial market in Europe.

Switzerland was chosen for the program for several reasons. First, the small nation features challenging terrain with steep elevation. "If it works in the Alps it might also work in the Netherlands," said Rolf Huber, founder and chairman of H2 Energy.

Second, the country levies steep road taxes on commercial vehicles to reduce emissions and prevent trucks from crossing through the country as they traverse Europe. Depending on weight and distance driven the annual tax can cost up to $50,000 per vehicle, Huber said.

But electric trucks are exempt from the tax. The potential savings from the tax exemption alone contributes to a total cost of ownership that Huber expects will be equivalent to operating a conventionally powered truck.

Hyundai and H2 Energy will build hydrogen stations across Switzerland that will fuel both commercial vehicles and passenger cars. Huber estimates that about 50 stations will be built to support the 1,000 trucks.

Maintenance or repairs to the truck's hydrogen fuel cell components will be handled through a partnership with Swiss laboratories and research centers, Huber said.

Operators who take delivery of the Hyundai trucks are part of the H2 Mobility Switzerland Association, a consortium of private companies. Among them is Coop Cooperative, which operates the largest gas station chain in Switzerland. It opened the country's first hydrogen station in 2016.

Hyundai is not finished introducing fuel cell vehicles. The company said it was developing a hydrogen fuel cell truck for the medium-duty market as well.

Source: https://www.trucks.com/2018/09/21/hyundai-fuel-cell-electric-trucks-switzerland/

Nikola World to launch in Phoenix

Nikola Motor Company is welcoming everyone to Phoenix April 16-18, 2019 for a new blockbuster event, Nikola World.

The first two days, April 16 and 17, are devoted to invite-only Nikola reservation holders, suppliers, media and investors while April 18 will be reserved for the public.

On April 16, Nikola will unveil the pre-production hydrogen electric semi-truck, 2.3 megawatt hydrogen station and the Nikola NZT 4X4. April 17 will be dedicated to demonstration drives and hydrogen filling. On April 18, the public is invited to see the latest trucks and NZT in action.

"Not only will our team be unveiling the most advanced production semi-truck the world has ever seen, but we will also be revealing the Nikola NZT all-electric 4x4 vehicle and a massive 2.3 megawatt hydrogen station. This is why we named it Nikola World - we want to create a better place to live where emissions are eliminated," said Trevor Milton, CEO, Nikola Motor Company.

Nikola World registration will open on December 3, 2018 at www.nikolamotor.com. All the activities will be free.

Milton added: "The largest fleets and customers in the world will attend this event and they will see what no other OEM could deliver – a production-ready, zero emission semi-truck, with over 1,000-mile range, 20 percent less operating costs per mile, more horsepower, torque and safety features than any other diesel ever built, and a startup did it. Remember that!"

The highlight of the event will be the Nikola truck, hydrogen station and NZT unveilings, followed by a series of demonstration drives. While only a few lucky guests will be in the vehicles during the drives, the truck and NZT will be available for viewing by everyone while in action. Nikola will also show off their 2.3 megawatt hydrogen station in Phoenix during the event.

To date, the company has nearly eleven billion dollars in pre-order reservations. Ryder System and Thompson Caterpillar will be on site at the event to work with fleets and customers to finalize orders.

By 2028, Nikola is planning on having more than 700 hydrogen stations across the USA and Canada. Each station is capable of up to 8,000 kgs of daily hydrogen production.

Source: https://nikolamotor.com/press_releases/nikola-world-launches-in-phoenix-april-16-18-51

FPT Industrial showcases its Hydrogen Fuel Cell Powertrain Concept at the IAA Commercial Vehicles trade fair in Hannover, Germany

FPT Industrial, the powertrain brand of CNH Industrial N.V. , believes that this Hydrogen Fuel Cell technology could be used in commercial vehicles to deliver zero Tank-to-Wheel and Well-to-Wheel emissions. Furthermore, it could play a significant role in the development of a virtuous cycle, where hydrogen is produced locally through renewable energy sources such as biomethane, wind or solar energy. The aim of FPT Industrial's R&D project is to explore the possibilities of using hydrogen as a zero emissions fuel alternative for the long-haul transport market while delivering the level of performance, autonomy, efficiency and reliability that this sector demands.

This Concept has been designed with a carbon fiber, high-resistance fuel tank from which the hydrogen flows directly into the fuel cells to generate the electricity that powers a 400 kW engine. It is this combination of electricity and fuel cells that creates a zero emissions vehicle and demonstrates that hydrogen is the next phase in the development of the use of natural gas in long-haul commercial vehicles requiring zero nitrogen oxides, zero particulate matter and zero CO_2.

CNH IndustrialN.V. is a global leader in the capital goods sector with established industrial experience, a wide range of products and a worldwide presence. Each of the individual brands belonging to the Company is a major international force in its specific industrial sector: Case IH, New Holland Agriculture and Steyr for tractors and agricultural machinery; Case and New Holland Construction for earth moving equipment; Iveco for commercial vehicles; Iveco Bus and Heuliez Bus for buses and coaches; Iveco Astra for quarry and construction vehicles; Magirus for fire-fighting vehicles; Iveco Defense Vehicles for defense and civil protection; and FPT Industrial for engines and trans-

missions. More information can be found on the corporate website: www.cnhindustrial.com

Source: https://www.marketwatch.com/press-release/fpt-industrial-showcases-its-hydrogen-fuel-cell-powertrain-concept-at-the-iaa-commercial-vehicles-trade-fair-in-hannover-germany-2018-09-19-101844411

Hydrogen fuel cell vehicles could benefit from ammonia breakthrough

In what could be good news for the growth and adoption of hydrogen-fuel-cell-vehicles, an Australian agency says it has developed a way to create hydrogen from ammonia—and ammonia is far easier to store and transport than hydrogen. In fact, Ammonia stores almost twice as much energy as liquid hydrogen.

Australia's Commonwealth Scientific and Industrial Research Organization, an independent government agency responsible for scientific research, says it has created a metal membrane that filters out pure hydrogen gas from ammonia. It can then be dispensed into fuel cell cars, buses and even trucks. CSIRO says it recently powered Toyota's Mirai and Hyundai's Nexo fuel cell electric vehicles using locally produced, ultra-high-purity hydrogen.

This technology links hydrogen production, distribution, and delivery in the form of a modular unit that can be used at, or near, a refueling station. It could pave the way for bulk hydrogen to be transported in the form of ammonia, using existing infrastructure, and then reconverted back to hydrogen at the point of use. It has the potential to fill the gap in the technology chain to supply fuel cell vehicles around the world with low-emissions hydrogen.

This means that the transportation and storage of hydrogen – currently a complex and relatively expensive process – is simplified, allowing bulk hydrogen to be transported economically and efficiently in the form of liquid ammonia.

"This is a watershed moment for energy," said CSIRO chief executive Larry Marshall.

Source: https://www.truckinginfo.com/311576/tech-can-turn-ammonia-into-hydrogen-for-fuel-cell-vehicles-say-australian-resear

European Nations backing hydrogen as viable alternative

Hydrogen is seeing support grow in Europe as an alternative to oil and gas, and over renewable energy such as wind and solar.

On Tuesday, 25 European nations backed a measure to increase hydrogen use to power factories, drive vehicles, and heat homes. A non-binding agreement was signed in Linz, Austria, that delved into increasing research into the technology and using existing gas grids to distribute hydrogen.

The coalition sees it as an alternative to fossil fuels to cut the continent's carbon emissions, and to solve the problem for electricity generation caused by fluctuating supply of renewable energies.

Advocates of the "hydrogen economy" have been pushing the fuel for decades. Yet support has been slow and instead, lawmakers have backed other technologies like electric vehicles. Oil and gas continue to be dominant in power plants, vehicles, and heating systems. Natural gas continues to grow as a cleaner and safer fuel over coal and nuclear for electric power, and is seeing more support for liquefied and com-pressed natural gas technologies in commercial vessels and vehicles.

Hydrogen fuel cell vehicles and hydrogen as an alternative power source does have growing business and government support in Europe, the U.S., Japan, and China. While fuel cell passenger vehicles are much smaller than even electric vehicles in sales, hydrogen is gaining global support for energy production and storage, heating systems, and fuel cell vehicles in the transport and public transit sectors.

Miguel Arias Canete, the European Union's top climate and energy official, said hydrogen could help Europe

meet its obligations to cut carbon emissions under the 2015 Paris accord. Canete told reporters it could also contribute to energy security by reducing imports of natural gas, much of which is shipped from Russia and countries outside of Europe.

Hydrogen advocates say that using more of it can stabilize energy prices and supply that can be erratic from fluctuating supplies of wind, solar, hydro, and other renewable energies. Converting electricity generated by renewables into hydrogen means the energy can be stored in large tanks and released again when necessary.

They say hydrogen fuel cell vehicles become just as clean as EVs, which need large lithium-ion battery packs to store their energy. Fuel cell vehicles generate power on board, taking away the range restrictions EVs face; and the fueling can be done in less than five minutes versus a half hour or more for recharging an EV.

Trains and transit buses are seen as a growth area, but it is at an embryonic phase. The world's first commuter train service using a prototype hydrogen-powered train began in northern Germany on Monday.

Sources of hydrogen vary from fueling station to station, coming from techniques such as electrolysis and hydrolysis, and gases such as methane. Japan continues to lead the world in hydrogen fueling stations, and aims to have 160 of these stations opened by March 2021 to support a fleet of 40,000 fuel cell vehicles. That beats out California, which aims to have 50 of these stations in place by 2020. Japan expects to see the number of hydrogen stations grow to 900 by 2030, supporting a fleet of 800,000 FCVs.

Europe has about 80 hydrogen fueling stations in operation, and China is only just starting to deploy stations.

California (and eight other U.S. states backing California's policy) and China support hydrogen stations and fuel cell vehicles through their zero emission vehicle mandates.

Japan sees it as part of its economic growth, with two of its local companies, Toyota and Honda, leading the charge. Much of the appeal in Japan came forth out of the Fukushima disaster in 2011. The country has shut down almost all its nuclear reactors since that time, and has been importing hydrogen, oil, coal, and liquefied natural gas since then.

Toyota continues to lead the fuel cell passenger car market with its Mirai sedan. Along with Toyota, other global automakers have made commitments and vehicle launches in fuel cell vehicles — including Honda, Hyundai, Audi, BMW, General Motors, and Mercedes-Benz.

The Japanese automaker also sees commercial trucks as a viable channel for sales growth supporting city government efforts to bring in more low-emissions trucks capable of driving through crowded city streets and pulling into restricted cargo storage yards. Toyota has made a deal with Seven-Eleven Japan to bring small fuel cell trucks into the retail chain's distribution system.

During the summer, Toyota revealed a new prototype of its "Project Portal" fuel cell electric truck while hinting at future commercialization. The "Beta" test truck is built on a glider version of the Kenworth T680 tractor. It can go 300 miles on a tank of hydrogen, and is about 10 percent more powerful than the "Alpha" prototype that Toyota unveiled last year, according to the company.

Toyota has remained silent on the fuel cell truck's future production plans, but sees it as more commercially viable than its past efforts. The company continues to remain committed to its broad, across-the-board strategy in vehicle technology and fuel. That covers fuel cell vehicles, hybrids, electric vehicles, gasoline-powered light-duty vehicles, and gasoline- and diesel-powered medium duty trucks through its Hino Trucks subsidiary.

Source: https://oilprice.com/Alternative-Energy/Fuel-Cells/European-Nations-Backing-Hydrogen-As-Viable-Alternative.html

Plastic waste destroying oceans could be used to fuel cars

The world's use of plastic is costing us, and our oceans, a high price.

But thanks to scientists at the University of Swansea, there might be one solution to the waste that kills thousands of sea creatures every year.

The new research, led by Dr. Moritz Kuehnel, would see plastic waste turned into hydrogen. If we're lucky, that could one day be used to fuel hydrogen cars.

"There's a lot of plastic used every year -- billions of tonnes -- and only a fraction of it is being recycled," Dr. Kuehnel told the BBC. "We are trying to find a use for what is not being recycled."

The process works by cutting the plastic, roughening it up and adding a photo catalyst to it. This is a material that can absorb sunlight and transform it into chemical energy.

"Our process is based on a principle called 'photoreforming' that uses semiconductor nanoparticles (quantum dots) to transform solar energy into chemical energy," Dr. Kuehnel told CNET in an email.

The researchers then put the plastic into an alkaline solution and shine sunlight or a solar simulator lamp onto it, producing bubbles on the surface -- hydrogen gas.

"The quantum dots can use sunlight to drive two simultaneous chemical reactions: The production of hydrogen gas from water and the degradation of plastics," Dr. Kuehnel wrote. "From a more practical point of view, the process is simple: The quantum dots are dropped onto the plastic, and the plastic is then placed into alkaline water. As soon as light shines on the plastic, bubbles of hydrogen appear."

Gas that could be used to fuel a hydrogen car.

A setback for recycling plastic bottles is that they're commonly made from PET, polyethylene terephthalate, which needs to be washed to be recycled into new, clear bottles. But the university's process would not require oily or greasy plastic to be cleaned, because it can degrade many kinds of waste.

"Even if there is food or a bit of grease from a margarine tub, it doesn't stop the reaction, it makes it better," Kuehnel told the BBC.

The process is also cheaper than recycling the plastic, which is often burned or thrown in landfill because of expenses -- it costs approximately $4,000 to recycle a ton of plastic bags, according to The Balance Small Business.

As for progress on hydrogen cars, Toyota, for instance, aims to sell a combined 1 million electric and fuel cell cars worldwide by 2030. In Japan, Toyota will launch a fuel cell-powered bus called the Sora in 2020.

While the plastic fuel project may take a few years before reaching an industrial level, the researchers have received some handy funding from the Engineering and Physical Sciences Research Council out of Swindon and an Austrian petrochemical company.

Dr. Kuehnel said his team is currently looking into scaling up from tiny dimensions (milligrams of plastic) to more realistic sizes, and working to expand the scope of plastics photoreforming can be applied to.

"We have so far demonstrated it works with PET (polyethylene terephthalate), PLA (polylactic acid) and PU (polyurethane), but we would like to use it to generate hydrogen from other important plastics such as PE (polyethyelene), PP (polypropylene) and PVC (polyvinyl chloride)," Dr. Kuehnel wrote.

Source: https://www.cnet.com/news/plastic-waste-could-be-used-to-fuel-hydrogen-cars/

The fuel Musk called stupid seeks another shot at green-car race

Hydrogen-powered vehicles are gearing up to challenge electric vehicles again in the race for mass-market clean cars. This week, a much larger group of companies signed on to a global coalition aimed at drumming up government support for the technology that Tesla Inc. Chief Executive Officer Elon Musk has derided as "mind-bogglingly stupid" for cars. The firms also pledged to find a cleaner way to produce the gas.

"Hydrogen has been talked about as the ultimate solution for zero emissions in the auto industry for decades," Hyundai Motor Co. Vice Chairman Yang Woong-chul said on the sidelines of the Global Climate Action Summit in San Francisco. "There was reluctance because the technology of fuel-cell vehicles wasn't mature enough, but now it is."

What the hydrogen believers need next is scale. The South Korean carmaker, the first to mass-produce fuel-cell vehicles back in 2013, is doubling down on its efforts and this year announced plans to join forces with Volkswagen AG's Audi unit to "lead industry standards." The concept of hydrogen cars has failed to gain popularity after declining costs of lithium-ion batteries and more charging stations made EVs more affordable.

In the past five years, Hyundai has seen the cost of fuel-cell systems halve and it expects it to decline by at least another 50 percent in the next five years, said Yang. [Yang] is also a co-chair of the Hydrogen Council, whose size has quadrupled since it was formed 18 months ago to 53 energy and auto firms.

The Council is betting 2030 will be a tipping point when millions of transport vehicles, including 1.5 million autonomous taxis and 3.6 million delivery trucks, will grow the use of fuel cells to 6.4 million. The group expects hydrogen could be used to provide up to 18 percent of the world's energy by 2050, even outside of transportation, if the world is to meet the Paris Agreement's goal of containing global warming to 2 degrees Celsius.

Toyota Motor Corp. unveiled the Mirai, a four-door family sedan powered by hydrogen and fuel-cell technology about four years ago. However, sales of the $59,000 car available in Japan, California and some parts of Europe, reached only a little over 5,000 as of end-2017. Hyundai has moved about 1,000 of its Tucson Fuel Cell since 2013. Honda Motor Co. hasn't seen much success with its Clarity Fuel Cell model either since its debut in late 2016.

"With scale, the price goes down dramatically," Yang said, adding Hyundai sees opportunity for fuel cells powering long-distance trucks, refrigerated transport and autonomous vehicles.

Advocates say hydrogen has a long-term advantage over lithium-ion batteries in cars, not just because it weighs less and readily available, but it also offers longer driving ranges and shorter fill-up times, making the investment worthwhile.

Japan, Germany, Denmark, California, South Korea and Australia already have programs built to address the infrastructure needed to support hydrogen cars, and the group aims to have similar investments made around the world. California has spent roughly $100 million to build charging stations in the past several years, and the French government said in June that it would spend 100 million euros on vehicle subsidies and cleaner production of the fuel by 2023.

"We cannot be as competitive as the combustion engine today, but we have a road map that includes technologies, emissions reductions and regulations," said Benoit Potier, chairman and CEO of Air Liquide SA and a co-chair of the Hydrogen Council. "If we want to achieve the 2 degree scenario in 2050 we have to join forces to make it happen -- it's our job to make it competitive."

Although the market share of hydrogen cars will be stuck at less than 2 percent of automobile sales through 2030, fuel-cell car sales should reach 10 percent of that market by 2035 and 26 percent by 2050, according to forecasts by the European Climate Foundation.

As part of the plan to make hydrogen more competitive the group also aims to find a cleaner way to produce it. Most of the hydrogen produced for fuel cells today uses natural gas, but it could be rapidly decarbonized through use of renewable energy, biogas and carbon capture and storage technology, Potier said.

Source: https://www.bloomberg.com/news/articles/2018-09-14/the-fuel-musk-called-stupid-seeks-another-shot-at-green-car-race

Duke students engineer a record 14,573 miles per gallon from a fuel-cell powered vehicle

Powered by hydrogen, an innovative vehicle just broke a 13-year-old Guinness World Record for fuel efficiency

Duke University has set a record for fuel efficiency with a hydrogen fuel-cell powered vehicle. The team, from the university's Pratt School of Engineering, set a record with equivalent energy usage of 14,573 miles per gallon. It bested the previous mark of 12,600 miles per gallon, which was set by a team from ETH Zurich and stood for 13 years. Guinness World Records has confirmed the record by the Duke University team.

Student-Led

"Everything was done by the students," Nico Hotz, assistant professor in the Mechanical Engineering and Materials Science department, told *Design News.* "Five to seven years ago, some students in Duke Engineering decided to participate in the Shell Eco-marathon. Initially, they competed in the category that uses a battery powered vehicle. Because it worked so well, some students within the team decided that they wanted to try something different. This

Duke University Pratt School of Engineering team with their hydrogen fuel cell vehicle.

past year, the students decided to compete in two categories—continue with the battery vehicle, but also try to build a vehicle with a fuel cell powered by hydrogen," said Hotz, who acted as the student's advisor on the project. He added, "They worked for ten months—I was surprised that they could get it done so quickly!"

In April of this year in Sonoma, California, the Duke Engineering team won the Shell Eco-marathon competition in the battery vehicle category as well as the category for fuel cell vehicles. "The fuel cell version was so good that the students realized, when calculating the efficiency at miles per gallon equivalent, that it was very close to the world record," noted Hotz. "After the semester was over, some students stayed over the summer, worked on the fuel cell vehicle, and improved it. And in test runs, they realized that they were several percent better than the world record (as recognized by Guinness)," said Hotz.

Record Attempt

A record attempt was set up with the necessary observers and run under the required conditions, measuring total hydrogen consumption, total distance traveled, and total time of the run while ensuring the car traveled at a minimum average speed of 15 mph. The efficiency was computed based on the total distance traveled, divided by the total hydrogen consumed. To set the world record, the vehicle traveled eight-and-a-half miles on a racetrack and used a total of less than one gram of hydrogen. "To put that in perspective," said team member and 2018 electrical engineering graduate, Patrick Grady, in a Duke University news release, "our vehicle is capable of driving to any point on the globe using the energy in one gallon of gas."

The design of the vehicle, named "Maxwell" in honor of James Clerk Maxwell's electromagnetism equations from the 1860s, supplemented the hydrogen fuel cell with a bank of supercapacitors that could provide the driver with a short burst of acceleration when needed. This allowed the fuel cell to be much smaller, reducing overall energy consumption.

Bigger Picture

"In engineering, we always have a challenge when we teach students because it takes quite a while until they can actually apply their knowledge to real projects, to real systems, and to machines and devices. You need a lot of physics and chemistry and math, and it takes a couple years to get there," noted Hotz. "This whole Duke electric vehicle team is an amazing opportunity, where students of any year can work on a real system—hands-on and applied—and make something work. And in this case, they made it work really, really well!"

Source: https://www.designnews.com/electronics-test/duke-students-engineer-record-14573-miles-gallon-fuel-cell-powered-vehicle/181628006859315

Toyota enters $82 million partnership to roll out hydrogen trucks in Los Angeles port

After showing its second-generation fuel-cell semi-truck at the Port of Los Angeles in July, Toyota announced last week it will build 10 more fuel-cell trucks for the project.

In addition to the trucks, the project will add two new heavy-duty hydrogen filling stations, two new hydrogen forklifts at Toyota's warehouse at the next-door Port of Long Beach, and two new zero-emissions yard tractors at the nearby Port of Hueneme.

The California Air Resources Board will provided $41 million of funding for the project. Toyota, Shell, and Kenworth, which builds the trucks, will provide the balance of the project costs, which totals $82 million.

The Port of Los Angeles is the largest in the country, and has been targeted by the state for investments in zero emissions technology.

Toyota Project Portal 2.0 fuel cell-powered semi-trailer truck

In July, Toyota revealed its second-generation fuel-cell semi truck after operating a proof-of-concept prototype for the previous year. The updated model can go 300 miles between hydrogen refills, rather than 200 for the initial truck, and has a small sleeper in the back of the cab, which the first truck lacked.

The trucks use two fuel-cell stacks from the Toyota Mirai fuel-cell car to deliver 670 horsepower and 1,325 pound-feet of torque, and include a 12-kwh battery pack to store power.

The trucks will ferry cargo from the Port of LA to Ontario, California, where Shell is installing the two new hydrogen filling stations to complement facilities already in the Port of LA.

The projects are part of Toyota's efforts to eliminate CO_2 emissions from its logistics facility in the next-door Port of Long Beach, where it is building a combined power facility to produce electricity, water, and hydrogen to power the trucks from agricultural wastes.

The ports of Los Angeles and Long Beach are a primary focus of California's efforts to clean up its air. About 40 percent of all imports and exports traveling to and from the U.S. come through the ports, creating a concentration of diesel trucks that has been linked to poor health in the area.

California is expanding efforts to replace those trucks with zero-emissions battery-electric and fuel-cell replacements. Toyota's agreement is the largest part of the hydrogen initiative in the area. The state is also expanding infrastructure to charge a growing number of electric drayage trucks and other equipment at the facility.

Source:
https://www.greencarreports.com/news/1118877_toyota-enters-82-million-partnership-to-roll-out-hydrogen-trucks-in-los-angeles-port

VW reimagines the microbus as an all-electric cargo hauler

The slow roll towards electrified vehicles isn't isolated to passenger cars and SUVs. Manufacturers are investing in commercial vehicles as well — everything from school buses and delivery vans to big commercial trucks.

VW Group's vision for an electrified commercial vehicle future also includes a microbus. The automaker's commercial vehicles unit unveiled five zero-emission vehicles at the 69th IAA Commercial Vehicles show in Hannover, Germany. Among them is an all-electric cargo van that's meant to be the commercial equivalent of the I.D. Buzz microbus revealed in 2017.

The others include a commercial-grade cargo e-bike, an electric concept van called the Crafter HyMotion that's powered by hydrogen fuel cell system, a Transporter concept van with a 48-volt mild hybrid drive system that combines a turbodiesel engine with an electric drive and finally, the ABT e-Caddy, a small van that will to arrive on market in mid-2019.

Some of these concepts such as the hydrogen fuel cell Crafter HyMotion are far from hitting the streets. The Crafter HyMotion concept 3.5tank that enable a total range of about 217 miles.

"This is still a concept vehicle, but the technical concept is already near-production," Heinz-Jürgen Löw, head of sales

and a board member of Volkswagen Commercial Vehicles -ton van is equipped with a hydrogen said in a statement. "We are conducting an intensive cost and benefit analysis to determine its market potential. The Crafter HyMotion with a fuel cell drive is absolutely a beneficial addition to our drive portfolio of petrol, diesel, natural gas and electric motors."

The microbus with its 1970s hippie-turned Jetson-vibe is of course the show stopper, which VW describes at the "ideal vehicle for the urban traffic of tomorrow." And unlike many other concepts, a version of this one might actually make it into production. The company said it could be launched into the market as early as 2021, a year ahead of the passenger version unveiled last year.

The I.D. Buzz cargo microbus concept is equipped with 20-inch wheels (smaller than the I.D. Buzz passenger van) and a solar roof that can extends the battery's range another 9 miles a day.

It also wide-opening rear wing doors, a new rear bumper and is equipped with a "connected" system that allows all items on its interior shelves to be tracked. Users can unlock the vehicle from the outside via a sensor that recognizes authorized persons via a digital key which is sent to the van from a smartphone.

The cockpit has all the futuristic leanings you might expect with information like navigation projected in #D via an augmented reality head-up display and a portable tablet where the infotainment and climate control functions are housed. The main controls for driving are located on the steering wheel.

The concept also has autonomous driving capabilities, although it's unclear if this technology will make it into a production version.

This isn't the first microbus concept VW has shown off in recent years. There was the BUDD.e, which was introduced in January 2016 at CES. BUDD.e was intended to show the world that VW was serious about electric vehicles in the wake of the diesel emissions scandal that has led to arrests, jail sentences and fines.

The following year, VW unveiled an electric all-wheel drive microbus called I.D. Buzz, a futuristic take on the family camper van. The I.D. Buzz will go into production starting in 2022.

While the diesel emissions saga drags on, VW is pushing slowly ahead with its electric vehicle plans. VW Group's board agreed in June 2016 to transform its core automotive business to focus more on electric vehicles, autonomous driving technology and launch mobility services such as shuttle on demand and ride hailing. Up to 25% of new vehicles under VW Group —a portfolio that includes Audi and Volkswagen Passenger Cars—will be all-electric under the board's Strategy 2025 plan.

Those electric ambitions (and investments) don't translate into an exodus of diesel—at least on the commercial vehicle front.

Thomas Sedran, board chairman of Volkswagen Commercial Vehicles, said that despite progress made in the electrification of its products, the business unit would continue to rely on highly advanced diesels as the backbone for logistics, particularly vehicles that make long distance runs, in rough terrains and for heavy loads.

Source: https://techcrunch.com/2018/09/19/vw-reimagines-the-microbus-as-an-all-electric-cargo-hauler/

Hydrogen-powered trains are now running in Germany

Hydrogen fuel cells are a greener way to power vehicles. But they have also been cost-prohibitive. Today, though, that's starting to change — on Monday, German passengers boarded the world's first hydrogen-powered trains.

"Sure, buying a hydrogen train is somewhat more expensive than a diesel train," said Stefan Schrank, a project manager at locomotive company Alstom, which built the

trains, in an interview with Agence France-Presse, "but it is cheaper to run."

The new trains transport passengers along 100 kilometers (62 miles) of track and can travel up to 1,000 kilometers (621 miles) on a single tank of hydrogen, reaching top speeds of 140 kmh (87 mph).

New research is helping cut the cost of hydrogen, and the fuel source is already in use elsewhere in the world to power buses and cars. Trains are much heavier, though, so

powering them with hydrogen instead of diesel could do much more to cut carbon emissions.

If all goes well with these first two trains, Alstom hopes to add another 12 to its Lower Saxony fleet.

Source;
https://www.weforum.org/agenda/2018/09/germany-just-rolled-out-the-world-s-first-hydrogen-powered-trains/

HYPE expands hydrogen fuel cell taxi fleet to 100

In July, France-based HYPE, the world's first taxi company operating exclusively with hydrogen vehicles, took delivery of 25 Toyota Mirai Hydrogen Fuel Cell Electric Vehicles. After almost 3 years of operation this delivery takes

HYPE's fleet to 100 vehicles.

More than 6000 Mirai are currently on the road globally, but the ambition is to sell 30,000 FC vehicles in the 2020s.

In France, hydrogen is gaining momentum. As part of the National Hydrogen Plan announced by the French Government, hydrogen mobility has been identified as a key element of this initiative.

This initiative is part of project ZEFER (Zero Emission Fleet vehicles for European Roll-out) that has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH JU) under grant agreement N° 779538. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation program and Hydrogen Europe and Hydrogen Europe Research.

Zefer will deploy 180 hydrogen fuel cell electric vehicles as taxis, private-hire vehicles and police cars in Paris, Brussels and London.

HYPE is accelerating its deployment in Paris with the intention of launching an equivalent service in Brussels at the end of 2018.

Source:
http://www.greencarcongress.com/2018/09/20180906-hype.html

Hydrogen LMP2 car unveiled at Spa

The Spa round of the European Le Mans Series saw the unveiling of the hydrogen-powered GreenGT prototype, with the developmental car completing a number of laps at the Belgian circuit. The prototype racer also completed a pitstop to demonstrate the safety of the hydrogen technology.

The experimental LMP2HG is part of the Automobile Club de l'Ouest's plans to have hydrogen-powered zero-emission cars on the grid in a special class at Le Mans in 2024. This, says ACO president Pierre Fillon, demonstrates the club's belief in hydrogen technology.

"Things are now starting to happen. We believe in hydrogen, just like we believed in hybrid technology and the introduction of a limited energy allocation," he said. "Today, hybrid cars are driven on public roads across the world.

"At the ACO we have always worked alongside manufacturers and other stakeholders in the automotive sector and we see Mission H24 as a genuine commitment to future mobility. With assistance from GreenGT we will rise to this new challenge."

The hydrogen racer is based on the ADESS 03 LMP3, and features two electric motors on each rear wheel, which are powered by electricity from the car's hydrogen fuel cell. This system serves up around 650 bhp, which can be boosted for 20 seconds by as much as 335 bhp courtesy of its energy-retrieval systems. The car shown off at Spa is a development of the car which was due to take the Garage 56 slot on the Le Mans grid in 2013.

"We have been convinced about the potential of hydrogen for several years now and have developed sound experience and recognized expertise in the field, added

GreenGT Technologies chief executive Jean-Michel Bouresche. "Speeding up the research process via motorsport is a challenge that we are enthusiastically—but realistically—ready to accept."

Source: https://www.racetechmag.com/2018/09/hydrogen-lmp2-car-unveiled-at-spa/

Hyundai-Kia pushing for autonomous technology

Hyundai-Kia has built a dedicated proving ground to develop autonomous vehicles and is targeting global leadership in the technology it admits it has been slow to develop to this point.

The vast 276-acre site, close to Hyundai-Kia's existing Namyang proving ground in Seosan, South Korea, is run by the Hyundai-owned Mobis supplier firm, which has been contracted to develop autonomous vehicles.

The current fleet of autonomous vehicles, based on domestic market Kia K5 (Optima) saloons, are called M.Billy, which stands for Mobis Intelligent Learning Library. The fleet is a small one – just three vehicles across Korea, the US and Europe – but it will expand to 20 in 2019.

The autonomous development is being overseen by ex-Daimler-Chyrsler, Siemens and Conitental engineer Gregory Baratoff, who said Hyundai Mobis was a long way behind German firms in developing its own radars, cameras and sensors that are key to ensuring autonomous vehicles can operate, as well as the software that runs them.

Hyundai-Kia and VW Group join forces on hydrogen fuel cell development

[Baratoff] expects it'll be 2021 before Hyundai Mobis's Level 2 autonomous technology is a match for the German technology firms. "We're behind the curve at the moment," he said. "It'll take four years to internalize the key technology and catch up with the likes of Bosch and Continental."

From 2021-2025 it will then develop the most advanced Level 3-5 systems that will are needed to allow fully autonomous driving – should legislation ever allow it. Mobis than plans to commercialize the technology to sell to other companies, as well as use on Hyundai-Kia's own vehicles.

Source: https://www.autocar.co.uk/car-news/industry/hyundai-kia-pushing-autonomous-technology

Cool Down the Planet Holding "How to Boost Trucks on Hydrogen" online challenge

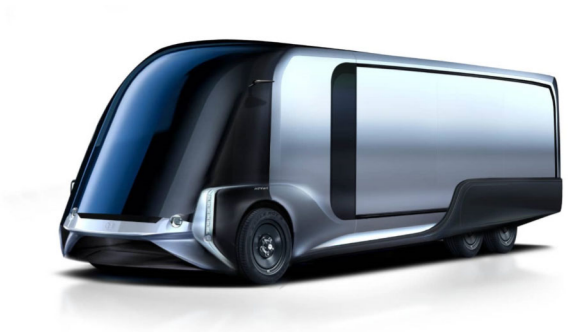
October 16 is the deadline for round two of Cool Down the Planet's "How to Boost Trucks on Hydrogen" online challenge.

Team Ulm (Germany) and team UTEC (Peru) are finalists and need your feedback.

For more information please visit https://www.cooldowntheplanet.com/challenges/boost-the-hydrogen-car-market/

Scotland's answer to Elon Musk plans historic hydrogen-powered road trip from Glasgow to London

Emil Rangelov could be described as Scotland's answer to Elon Musk.



The H2Van is set to complete its maiden trip next summer, driving from Glasgow to London

From his base in Glasgow, the half-Russian, half-Bulgarian entrepreneur is on a mission to revolutionize transport with hydrogen-powered vehicles – and save the environment in the process.

Next summer, [*i* news] can reveal, the businessman's company HV Systems will grab attention by driving its first prototype van 388 miles from Glasgow to London, with-

out stopping to refuel.

Rangelov, 31, hopes that the trip will generate a wave of excitement in hydrogen fuel technology, as no other green vehicle of such a size is currently capable of travelling such a distance without having to recharge. "

While a handful of car manufacturers in the UK have produced hydrogen-powered cars, the technology comes into its own over long distances, making it perfect for transporting freight.

Some delivery firms are already taking notice. In London, a six-month trial of a Renault hydrogen van with a range of 200 miles was recently undertaken by courier business CitySprint. But the H2Van, which will have a storage capacity of around 20 cubic meters, can travel up to 500 miles on a single tank of hydrogen and has a refueling time of just six minutes.

Rangelov first became interested in the technology around 10 years ago and now believes hydrogen vehicles will eventually leapfrog battery-powered ones due to their numerous advantages.

"It is truly a revolution," he says. "It can store a lot more energy in a smaller amount of space, which gives the vehicle a longer range and better durability, and refueling is as fast as diesel."

The entrepreneur believes that hydrogen-powered vehicles will be an occasional novelty on UK roads in five to 10 years, but predicts it will be more like 20 before they are a regular sight. The Hydrogen Council, a group of companies working to promote the technology, claims that by 2030 there will be 50,000 hydrogen buses and 350,000 trucks on the world's roads.

Elon Musk

Much like Musk, Rangelov insists that the technology his company is pursuing is superior to others and dismisses Tesla's plans for the Semi, the electric truck unveiled by the company last year.

Although it has a similar range to the H2Van, at the launch event Musk said the Semi would take half an hour to achieve 80 per cent power – if one of Tesla's special superchargers was used. "

"They will most likely not manufacture it because they cannot really supply that many batteries," Rangelov says, claiming it would take "about a week" to charge the Semi in a conventional way.

Musk, for his part, has criticized hydrogen technology in typically robust terms, claiming it will be a "generation" before it can be deemed workable.

Asked about hydrogen fuel cells in 2014 he replied: "They're mind-bogglingly stupid – you can't even have a sensible debate."

Consider the whole fuel cell system against a [Tesla] Model S. It's far worse in volume and mass terms, and far, far, worse in cost.

"And I haven't even talked about hydrogen being so hard to handle. Success is simply not possible."

Safety concerns are also a barrier to using hydrogen as a fuel. Last year, a taxi driver who was testing a hydrogen-powered vehicle in London said it was all his customers spoke about.

He said to many people the word "hydrogen" brought to mind the Hindenburg airship disaster of 1937 or the H-bomb, a successor to what the US dropped on Japan to end the Second World War.

Misplaced fears

But proponents of the technology say such fears are misplaced, arguing that hydrogen tanks in vehicles would have numerous safety features such as automatic shutdowns in the event of a leak.

Companies such as Shell say that, in a crash, hydrogen is most likely to evaporate, posing less of a risk than a leaking tank of petrol, which can easily ignite.

There is another issue: each hydrogen-powered van would cost two or three times more than a diesel equivalent, meaning that only big freight firms are likely to be able to afford the technology in its initial phases.

Most hydrogen is also currently generated using fossil fuels, so in order to be truly green, vehicles would have to rely on hydrogen generated using renewable electricity

through electrolysis.

Although he accepts that cost would be a "huge barrier" for smaller haulage operators, Rangelov points out that running and maintenance costs will be significantly lower for hydrogen vehicles, meaning that over the long term, savings could be made.

His company has already attracted some high-profile supporters, notably Professor Keith Ridgway, the internationally recognized manufacturing expert who leads the University of Strathclyde's Advanced Forming Research Centre.

In a letter to Scottish Enterprise, which has also said it is "highly enthusiastic" about the project, he described the potential of hydrogen technology as "genuinely transformational".

"While several UK-based organizations have active programs related to passenger vehicles, the area of freight transportation is receiving relatively little UK attention," he wrote.

"The HV Systems proposition is therefore of considerable interest, especially given the fact that it could see the basis for a game-changing product range from within Scotland."

Government support

In March, the UK Government also signaled its support for the technology by putting £8.8m into trials of 200 hydrogen-powered vehicles, which will be used by Scotland Yard and car rental firms.

The money is also being spent on four new hydrogen refueling stations in London, Birmingham and Derby, as current infrastructure is sorely lacking for customers who use the vehicles.

"Hydrogen has huge potential, especially for those making longer journeys and clocking up high mileage," roads minister Jesse Norman said at the time.

Rangelov is also concerned about the "massive impact" that diesel trucks and vans have on human health through air pollution, a cost ultimately borne by the NHS.

He cites an academic study published in June by researchers at the universities of Oxford and Bath, which claimed that such pollution results in an extra health spending of £6bn a year UK-wide.

The health cost of the average car in inner London over the vehicle's lifetime was nearly £8,000, while for diesel cars it was almost twice that.

Source: https://inews.co.uk/news/scotland/scotlands-answer-to-elon-musk-plans-historic-hydrogen-powered-road-trip-from-glasgow-to-london/

60 seconds with Kawasaki Heavy Industries

We spend 60 seconds with Yoshinori Kanehana, President and CEO at Kawasaki Heavy Industries

Why is your company a part of the Hydrogen Council? Why do you believe this initiative is so important?

In Japan, clean hydrogen energy has been gaining momentum since the endorsement of the Japanese Government's Strategic Energy Plan in 2014, which identified hydrogen as an important energy solution of the future. Kawasaki is developing world-leading technologies that will play an important role in realizing the hydrogen economy and global supply chains. These include liquefied hydrogen storage and supply systems for H-II space rocket base, hydrogen gas turbines, liquefied hydrogen carrier ships as well as electrolyzers. Our aim is to contribute to the realization of a decarbonized society relying on sustainable, affordable and stable energy. We will do this by promoting international hydrogen supply chains through our patented hydrogen-related technologies.

We believe the Hydrogen Council, bringing together global leaders from major industry sectors, has the potential to drive the global hydrogen revolution, promote collaboration, develop the social license and diversify its applications demonstrating its advantages to policymakers, investors and community stakeholders.

Are there any recent or upcoming hydrogen related milestones in your company that you are especially proud of?

Together with our private and public sector partners, we have launched the world's first hydrogen energy supply chain pilot project between Australia and Japan. Under this flagship initiative, we will establish an integrated supply chain for hydrogen exports from Australia to Japan. The Japanese, Australian and Victorian State Governments have invested in the project alongside a consortium of reputable private sector companies. In April 2018, the project was officially announced by industry and government leaders in the Latrobe Valley, Victoria. I am particularly proud of the unprecedented levels of collaboration we achieved with all stakeholders to get to this stage.

In addition, we have successfully demonstrated hydrogen-fueled gas turbine co-generation system in Kobe city, supported by Japan's New Energy and Industrial Technology Development Organization (NEDO). In April 2018, we achieved the world's first delivery of heat and power, generated exclusively by hydrogen.

What in your opinion is the biggest challenge for hydrogen in the near future, and how would you like to see it being tackled?

The biggest challenge for global hydrogen uptake is the initial cost needed in the introduction phase. However, at Kawasaki, we are convinced that we can deliver cost-competitive hydrogen in the future if we focus on large-scale, affordable hydrogen production from competitive sources such as excess renewable energy. Hydrogen take-up will increase exponentially as soon as scale and mass deployment start to drive costs down and infrastructure is available. Then the choice will become obvious as hydrogen is cleaner whilst being able to contribute to energy security and decarburization.

In addition, it is necessary for policy makers and societies at large to support forward-looking companies taking the risk to make the first investment into this fuel of the future. This should be done through policy incentives and by establishing effective frameworks to regulate emissions. It is also important for the Hydrogen Council to keep playing a leading role in demonstrating and socializing the benefits of the hydrogen economy in terms of industry development, employment generation and environment preservation to key stakeholders.

Finally, it is critical that we are able to standardize rules and regulations relating to hydrogen infrastructure, globally. Different rules and regulations applied in each country become a hurdle for the effective deployment of hydrogen energy and hydrogen-related technologies. We need to work together on the harmonization of standards under an organized framework for international cooperation. Safety is paramount.

If you could communicate one hydrogen-related message to the general public, what would it be?

Our Kawasaki Mission Statement, to which we fully abide, states that "We create new value for a better environment and a brighter future for generations to come." We believe that hydrogen is key to the fulfilment of our mission. Hydrogen has the potential to empower societies to be-

come sustainable while, at the same time, expanding the economy and creating new employment opportunities. At Kawasaki, we are fully committed to the global hydrogen transition. We will foster the technological and infrastructural solutions necessary to supply the world with sustainable, safe, stable and affordable hydrogen energy. The hydrogen society is just around the corner.

What is the one key message that you would like to pass on to all Hydrogen Council CEOs & teams?

We are honored to be working with many leading companies towards our common hydrogen goal. We know this will not happen overnight – it requires vision, leadership and tenacity. We need to work together towards the full realization of a global hydrogen economy. Along the journey, we need to remind ourselves and the whole society that hydrogen can indeed bring a brighter future and a better environment for generations to come.

Source: http://hydrogencouncil.com/60-seconds-with-kawasaki-heavy-industries/

Hydrogen Mobility Australia moves closer to its vision for a hydrogen society for Australia

Source: Hydrogen Mobility Australia

Hydrogen Mobility Australia (HMA) celebrated a significant milestone in its growth as a leading hydrogen (H_2) industry advocate by holding its first Annual General Meeting (AGM) of its members, government observers and industry supporters – and welcomed three new companies.

BOC, ITM Power and Siemens will join existing directors Hyundai Australia and Toyota Australia in supporting HMA to achieve its mission of a H_2 society for Australia.

HMA is delighted to welcome these organizations to the board who will bring new expertise, insights and experience to HMA and extend the association's leadership beyond the automotive sector to new industries in recognition of the growing Australian H_2 sector.

The AGM saw two major initiatives announced to support HMA meet its objective of accelerating the introduction of H_2 and fuel cell technologies to Australia, which included the expansion of its board of directors and the launch of its new membership program.

The program supports the association's objective to be representative of the H_2 sector as a whole. Previously by invitation only, membership of HMA will be offered to all organizations with interests in H_2 and who wish to support HMA's work in policy advocacy and education. This new membership offering will commence on the 1st of October.

AGM proceedings also saw presentations from leading authorities in the H_2 space, including the Chief Scientist of Australia, Dr. Alan Finkel who recently made a series of recommendations to COAG on the significant potential for the creation of a domestic and export H_2 industry.

Dr. Finkel's H_2 strategy aligns with the initiatives of CSIRO and ARENA, who both presented at the AGM, and will shortly release two H_2 related studies - a blueprint for the development of an Australian H_2 sector and a H_2 export market study respectively. The H_2 export opportunity in particular could be facilitated by the development of an ammonia to H_2 membrane technology launched by CSIRO last week, the outcomes of which were similarly shared at the AGM.

Together, the work of the Chief Scientist, CSIRO and ARENA have had many commentators label August 'H_2 Month' in recognition of the significant activity that is occurring on the role that H_2 could play in Australia.

HMA and its members are highly motivated by the level of government commitment to exploring this exciting op-

portunity to create a new energy sector and urge all stakeholders to leverage the significant momentum being built and translate this into hydrogen projects across Australia, including hydrogen refueling infrastructure.

Hydrogen Mobility Australia CEO, Claire Johnson said H_2 could play a significant role in a sustainable energy system for Australia, and collaboration between the public and private sectors is essential to jump start the industry.

"H_2 applications, including mobility, are being supported by governments globally to meet their climate, energy and economic goals. With Australia a potential supplier of H_2 to the world, it is imperative of governments at all levels to work with industry to realize the full benefits of this opportunity, including the development of a H_2 refueling network across Australia," Johnson said.

Source: https://www.gasworld.com/hydrogen-mobility-australia-moves-closer-to-its-vision-/2015307.article#/close

Global renewable energy market set to grow as traditional energy sources dwindle

Data compiled by Allied Market Research suggests that the global renewable energy market is projected to reach USD 2,152 Billion by 2025 while growing at a compound annual growth rate (CAGR) of 4.9%. Traditional energy sources such as coal, oil and natural gas required millions of years for formation and will eventually run out of fossil fuel power, while renewable energy is generated from natural processes such as sunlight, wind, rain, tides, waves and geothermal heat. Unlike traditional energy sources, renewable energy can renew constantly throughout time. Additionally, an increase in awareness about environmental issues, such as climatic change, have driven the renewable energy market. Clear Blue Technologies International Inc. (CBLU), First Solar, Inc. FSLR, +0.70% SolarEdge Technologies, Inc. SEDG, +0.00% Sunrun
Inc. RUN, +0.24% Canadian Solar Inc. CSIQ, +0.70%

Based on energy type, the global market is divided into hydro & ocean power, wind energy, solar energy, bioenergy, and geothermal energy. The report indicated that the solar energy segment is projected to grow at the highest CAGR of 13.4%, in terms of revenue, during the forecast period. Based on geography, the Asia- Pacific region accounted for about 41.1% of the market share in 2016, followed by Europe. These two regions accounted for more than two-thirds of the global market share in 2016. The South African market is projected to grow at 27.6%, in terms of value, during the forecast years.

Clear Blue Technologies International Inc. (CBLU) earlier this month announced that it has, "fulfilled an initial contract worth approximately $850,000 for a new street light project in Nigeria, as part of a collaboration with Raeanna Nigeria Ltd., a Nigerian infrastructure company focused on rural connectivity and energy solutions.

Clear Blue delivered its Smart Off-Grid power solution for the installation and maintenance of 280 street lights along two separate roads, covering a combined 20 kilometers, which has been the initiative of Senator Dr. Ifeanyi Okowa, the Governor of Delta State. The project, which is to be completed later this month, is an early phase of a state-wide initiative in conjunction with other state governments to bring power, lighting, security and telecommunications to all regions of Nigeria.

More than 80 million people in Nigeria do not have access to electricity, while about 600 million people in sub-Saharan Africa also do not have access to power. The World Bank recently provided a $350-million loan for rural electrification of Nigeria to begin to address the dire need there.

'We are thrilled to be engaged with Clear Blue for the start of Delta State's state-wide lighting project,' said Jay Ogor, Chief Executive Officer of Raeanna Nigeria. 'Many previous projects in Nigeria have struggled to deliver reliable, high-quality power solutions for ongoing services. We have partnered with Clear Blue because they have proven to us that their technology and ongoing service management ensure that these investments will deliver value for many years. The success of Clear Blue's Smart Off-Grid power technology on our previous collaboration made it an easy decision to utilize it for our rollout of street lighting in Delta State. Our plans and focus are to expand our rollout across Delta State and other regions of Nigeria, as it is key to the long-term betterment of Nigeria by bringing back a vibrant street life.'

Utilizing the predictive analysis of Illumience, Clear Blue's

service team will manage, control and maintain all street lights remotely, ensuring that the lights stay on when they are needed and that continuing system life is maximized.

'Off-grid power, lighting, security and telecommunications provide immense benefits to people around the world and to the environment,' said Miriam Tuerk, Chief Executive Officer and co-founder of Clear Blue. 'Nigeria is a fantastic country with great people, and we are very pleased to continue to grow our partnership with Raeanna and expand our presence there.'

Clear Blue previously delivered its Smart Off-Grid platform to Raeanna for a series of telecommunications systems installations across eight Nigerian sites earlier this year, in collaboration with Nuran Wireless. The project provided reliable communications services for tens of thousands of Nigerians.

About Clear Blue Technologies International Inc: Clear Blue Technologies International, the Smart Off-Grid company, was founded on a vision of delivering clean, managed, wireless power to meet the global need for reliable, low-cost, solar and hybrid power for lighting, telecom, security, Internet of things devices, and other mission-critical systems. Today, Clear Blue has thousands of systems under management across 34 countries, including the United States and Canada."

First Solar, Inc. FSLR, +0.74% is a leading global provider of comprehensive photovoltaic (PV) solar systems which use its advanced module and system technology. First Solar, Inc. recently announced plans to build a new solar module manufacturing facility near its existing Perrysburg, Ohio flagship plant. The 1.2 gigawatt factory is expected to create 500 new jobs in northwestern Ohio, and will produce the company's advanced technology Series 6 thin film photovoltaic (PV) module. With production facilities in the U.S., Malaysia and Vietnam, First Solar has sold more than 17GW of solar modules providing clean, renewable energy worldwide. "Strong demand in the U.S. for advanced solar technology, along with recent changes in U.S. corporate tax policies, have encouraged our decision to grow First Solar's U.S. production operations," said Mike Koralewski, First Solar's Senior Vice President of Global Manufacturing. "State and local officials and JobsOhio have also worked with us to create a business-friendly environment that supported our objectives. These factors, combined with our own economies of scale in high tech manufacturing, make expanding U.S. operations an attractive, win-win opportunity."

SolarEdge Technologies, Inc. SEDG, +0.00% is a global leader in smart energy technology. By leveraging world-class engineering capabilities and with a relentless focus on innovation, SolarEdge creates smart energy solutions that powers people's lives and drive future progress. The Company recently announced that it is unveiling its expanded StorEdge solution that now offers immediate energy backup of the entire house at Solar Power International. SolarEdge's expanded StorEdge solution with a backup interface provides backup power to the entire house, eliminating the need to pre-select backed-up loads. This solution offers easier and faster installation with integration of the meter and auto transformer into the backup interface, and eliminates the need for an additional back-up panel. Higher power and higher capacity backup systems are also supported with multiple batteries connected. "This expanded solution ensures that homeowners are better prepared, safer, and no longer have to be left without power during blackout events," stated Lior Handelsman, VP of Marketing and Product Strategy, and Founder of SolarEdge. "By further enhancing our StorEdge solution with backup for all house loads, we are providing customers with more flexibility and control over the energy they produce, store, and consume. This advancement is another demonstration of how SolarEdge is leading the industry in expanding the PV inverter's role within the energy ecosystem, from a simple DC/AC converter to a holistic energy management system."

Sunrun Inc. RUN, +0.32% is the nation's leading residential solar, storage and energy services company. Earlier this month, the Company announced that it launched an expansion of its low and moderate income solar offering. The Company plans to develop a minimum of 100 megawatts of solar on affordable multi-family housing, where 80% of tenants fall below 60% of the area median income, over the next decade in California. Sunrun's commitment, when fully deployed, will directly benefit at least 50,000 moderate and low-income households. The installations will be done through building owners at no cost to the tenants, creating significant economic benefits and reducing cost for renters. This initiative will also improve local air quality, decrease reliance on fossil fuels and offer freedom from climbing electric utility bills. In addition to its

commitment in California, Sunrun is also introducing a discounted electricity rate to low-income residents in Nevada, supported by the state's RenewableGenerations program, which comes shortly after Sunrun joined the Connecticut Green Bank Program. Canadian Solar Inc. CSIQ, +0.70% is one of the world's largest and foremost solar power companies. As a leading manufacturer of solar photovoltaic modules and provider of solar energy solutions, Canadian Solar has a geographically diversified pipeline of utility-scale power projects in various stages of development. Recently, the Company announced that it has been awarded a contract to supply 164 MW of photovoltaic (PV) modules to the 350 MWp Escatrón Solar power project owned by COBRA Group, a subsidiary of ACS Groupin Spain. ACS Group will serve as the EPC provider of the project that was awarded in the recent round of Spain's renewables auction in July 2018. Over 481,900 Canadian Solar's high-efficiency MaxPower modules (CS6U-P 345/350 W) will be installed. This 72-cell polycrystalline module is the best solution for this large-scale project, as it offers industry-leading cell technology and low power loss in cell connections, which are the key factors for the success of the project. Module shipments will commence in September 2018 and the project is expected to reach commercial operation in 2019.

Source: https://www.marketwatch.com/press-release/global-renewable-energy-market-set-to-grow-as-traditional-energy-sources-dwindle-2018-09-24

European nations plan to use more hydrogen for energy needs

Dozens of European countries are backing a plan to increase the use of hydrogen as an alternative to fossil fuels to cut the continent's carbon emissions.

Energy officials from 25 countries pledged Tuesday to increase research into hydrogen technology and accelerate its everyday use to power factories, drive cars and heat homes.

The proposal, which was included in a non-binding agreement signed in Linz, Austria, includes the idea of using existing gas grids to distribute hydrogen produced with renewable energy.

The idea of a "hydrogen economy," where fuels that release greenhouse gases are replaced with hydrogen, has been around for decades. Yet uptake on the concept has been slow so far, compared with some other technologies.

Advocates of hydrogen say it can solve the problem caused by fluctuating supplies of wind, solar, hydro and other renewable energies. By converting electricity generated from those sources into hydrogen, the energy can be stored in large tanks and released again when needed.

Electric vehicles can also use hydrogen to generate power on board, allowing manufacturers to overcome the range restrictions of existing batteries. Hydrogen vehicles can be refueled in a fraction of the time it takes to recharge a battery-powered vehicle.

On September 17, the world's first commuter train service using a prototype hydrogen-powered train began in northern Germany.

The European Union's top climate and energy official said hydrogen could help the bloc meet its obligations to cut carbon emissions under the 2015 Paris accord. Miguel Arias Canete told reporters it could also contribute to the continent's energy security by reducing imports of natural gas, much of which currently comes from Russia and countries outside of Europe.

Kirsten Westphal, an energy expert at the German Institute for International and Security Affairs, said encouraging the use of hydrogen as a means of storing and transporting energy makes sense, but added the overall goal for should be reducing fossil fuels rather than pushing a particular energy alternative.

Source:
https://abcnews.go.com/Technology/wireStory/european-nations-plan-hydrogen-energy-57913763

Hydrogen—the “missing link” in energy transition

A recent study performed by the International Renewable Energy Agency (IRENA), says that hydrogen produced from renewable energy could enable large amounts of power to be channeled into sectors otherwise difficult to decarbonize through electrification.

“Hydrogen could, therefore, be the missing link in the en-

ergy transition," the agency said.

The target sectors have been highlighted by the agency as follows:

Industry, where it could replace fossil-based feedstocks, including natural gas, in high-emission applications.

Buildings and power, where it could be mixed with natural gas or combined with industrial carbon dioxide (CO_2) emissions to produce syngas.

Transport, where it can provide low-carbon mobility through fuel-cell electric vehicles.

Launched during IRENA's Innovation Week, the latest technology outlook 'Hydrogen from Renewable Power' outlines the potentially pivotal role hydrogen may play in the energy revolution.

The agency explained that while hydrogen is already widely used in facilities such as chemical plants and refineries, by switching the fuel used to produce it from hydrocarbons to renewable electricity, it can become a carrier of renewable energy, complementing the role solar and wind play in power production.

"[Currently], over 95% of current hydrogen production is fossil-fuel based. Steam-methane reforming (SMR) is the most common way of producing hydrogen," the report highlighted.

The renewable energy agency highlights why hydrogen could be critical to the renewable energy transition:

No economically viable option exists to reduce the carbon emissions produced by around one-third of the energy sector. Combustible fuels remain critical to transport and industrial practices from aviation to refining, where electrification is currently not suitable. This could make hydrogen from renewables the missing link in the transformation of the global energy system.

Hydrogen from renewable energy can support higher shares of wind and solar energy in power sectors all over the world. Excess variable power (which is energy produced by intermittent wind and solar projects) can now be directed to hydrogen production and used in transport, industry or gas grid injection. Used in this way, hydrogen becomes a source of storage for renewable electricity, keeps power systems flexible and helps to balance the grid.

Hydrogen offers possibilities to tap high-quality renewable energy resources. Often, the best solar and wind resources are located far from end-users in cities and major urban centers. Hydrogen, once produced, can be transported on land (like liquefied natural gas) as a global commodity unconstrained by grid connections.

Hydrogen can take advantage of existing energy infrastructure. Up to a certain share, hydrogen can be injected into natural gas grids reducing the emissions of existing gas infrastructure, such as gas turbines for the power sector.

Fueled by hydrogen, fuel cell electric vehicles (FCEVs) offer consumers a low emission driving performance similar to a conventional vehicle when the hydrogen is produced from renewable energy sources. Fuel cells vehicles can complement electric vehicles, overcoming the weight, range and charging limitations associated with EVs.

Hydrogen may become a key contributor to a potential 100 per cent renewable energy future. To get there, however, cost reductions are necessary and only possible through economies of scale. With enabling policies and regulatory frameworks in place, more private investment will be stimulated allowing technologies to mature resulting in cost reductions.

Dolf Gielen, Director of the IRENA Innovation and Technology Centre commented: "Hydrogen may have a very important role to play in the energy transition particularly if it can improve its cost-competitiveness. We believe that is possible if the production process utilizes low-cost renewable electricity such as from wind and solar facilities.

"Large, off-grid hydrogen projects that are directly connected to solar and wind farms developed in the most suitable locations can potentially supply low-cost, 100% renewable, hydrogen. That will be a critical development for our low-carbon future."

Source: https://www.esi-africa.com/hydrogen-the-missing-link-in-energy-transition/

Toyota Mobility Foundation calls for second round of research proposals to support innovative hydrogen energy solutions

The Toyota Mobility Foundation (TMF) is calling for research proposals from Japan for 2018 under the Hydrogen Research Initiative established in 2017.

This initiative is part of TMF's goal to promote sustainable mobility. It recognizes that pairing carbon-free hydrogen systems with renewable energies contributes to energy sustainability. It also underscores the foundation's commitment to tackle energy-related issues such as environmental degradation and resource depletion.

Shifting the world to hydrogen-based systems for energy supply and consumption is a heavily discussed topic, however cost remains a daunting obstacle for execution. For this reason, the Toyota Mobility Foundation seeks projects that demonstrate progress in reducing carbon dioxide emissions and lowering the cost of hydrogen. When screening the submitted proposals, TMF will emphasize innovations in the generation, storage, transportation, and use of hydrogen.

In 2017, TMF launched a five-year program to provide grants for fundamental and innovative research that helps develop a "hydrogen society." It also assembled a screening panel of hydrogen and energy experts from universities and public-sector institutes in Japan to assess the research programs and select the grant recipients. The 10 grantees (earlier post) from the first year of the program continue to discuss their research with panel members.

In this second year of the initiative, an additional research field has been included for consideration. Applicants from both universities and public-sector institutions in Japan are invited to submit proposals in the following research fields:

- Hydrogen generation
- Hydrogen carriers
- Hydrogen applications
- Energy systems
- Social systems utilizing hydrogen

TMF is targeting young researchers who represent the next generation to participate in the program. They also encourage repurposing knowledge and technology from other fields to the research of hydrogen.

Total budget is approximately ¥100 million (US$890,000); TMF envisions 10-20 projects, with up to ¥10 million (US$89,000) per project.

Source: http://www.greencarcongress.com/2018/09/20180923-tmf.html

HES Energy Systems to launch autonomous hydrogen aviation program in France

Singapore-based HES Energy Systems is expanding to France to begin work on the first decentralized hydrogen (H_2) infrastructure for autonomous fuel cell powered aerial vehicles.

The developer of high performance H_2 fuel cell propulsion systems for aerial platforms said the move is part of the company's broader goals to introduce long-range zero-emission aviation powered by renewable H_2.

HES Energy Systems first introduced its range-extending propulsion technology to small drones several years ago, and the company is now evolving towards manned aerial platforms, such as flying cars and inter-urban electric aircrafts.

From its lab in Singapore, HES has spent the last ten years developing advanced ultra-light H_2 propulsion systems that are up to ten times lighter than batteries. Following a number of international experiments powering small unmanned aircraft for record durations, HES' systems are now being scaled up to power larger manned electric aircraft, potentially revolutionizing aerial logistics and mobility—increasing their flight range while eliminating carbon emissions.

A subsidiary of H3 Dynamics, HES is part of the France-Singapore innovation link that continues to intensify between both countries. Last year H3 Dynamics set the tone by opening its European headquarters in Paris with the

warm welcome of President Macron. HES is now following suit and joining forces with France's world-class aerospace and H_2 eco-system.

As part of its set up in France, HES is announced its partnership with France's leading professional unmanned aircraft builder Delair and ERGOSUP, a French start-up developing energy-efficient H_2 production systems.

Derived from a broader 2016 French National Call for Projects looking to deploy H_2 technologies into airport applications in Toulouse, HES' partnership will focus on creating infrastructure around smaller-scale H_2 unmanned aircraft.

"Starting with smaller scale aerial vehicles help turn bigger visions to reality faster, and reduces the challenges related to commercializing complex technology" said Taras Wankewycz, CEO of HES and parent company H3 Dynamics.

HES envisions a continental network of H_2 air bases for a fleet of autonomous, long-range and electric aircraft. The joint initiative will create economic and social benefits, while starting the path to reducing carbon emissions in aviation.

"We are proud to start our initiatives in France and we look forward to bright outcomes together with our partners. This is a major step toward an exciting prospect: zero-emission aerial mobility," Wankewycz added.

Aligning well with HES' roadmap, 50+ global leaders in the energy, transport, and industrial sectors, led by the CEO and Chairman of Air Liquide and the Chairman of Hyundai came together on 14thSeptember to announce their landmark commitment to 100% decarbonized H2 for all mobility applications by 2030. France's government has also launched a national H_2 plan to utilize H_2 across all sectors.

Source: https://www.gasworld.com/hes-energy-h2-aviation-programme-/2015488.article

Romania has signed the Hydrogen Initiative

Romania in September joined Austria's initiative on the collaboration of EU Member States in common projects for the development of technologies based on renewable hydrogen.

The document was signed by Energy Minister Anton Anton at the Informal Energy Council and the high-level Conference 'Charge for Change: Innovative Technologies for Energy-Intensive Industries', carried out during September 2018 in Linz, Austria.

Romania's Energy Minister Anton Anton was the first Minister to sign the Declaration on the Hydrogen Initiative.

"Europe needs new technologies and methods to store electricity, an important condition for the energy security of the continent. The development of the European energy market is harder to achieve without a market for its storage. Hydrogen is one of the promising solutions, while it is also a non-polluting energy storage method. I wish this initiative to become much clearer as regards the opportunities it opens up for academia and research institutes for the development of hydrogen-based technologies," Minister Anton has stated.

By signing this proposal, Romania commits to continue its involvement in the research and innovation sector relating to hydrogen use as a future energy source.

Renewable hydrogen use technologies can be used in the fields of electricity storage, transport fuels, industrial applications, hydrogen injection into natural gas networks etc.

Hydrogen does not emit CO_2 at all when it is used as a clean energy source or clean fuel, and it can play an important role in the transition to a clean, low-carbon energy system. With these characteristics, it fits perfectly into the European desideratum of decarburization of the energy industry and beyond.

Moreover, large corporations in the world have shown their preoccupation for hydrogen technologies for many years. For example, car manufacturer Hyundai has already opened hydrogen stations in countries like Germany.

Hydrogen is seen as a perfect replacement for gasoline or diesel at least for cars in major cities, thereby reducing metropolitan pollution. However, the use of hydrogen as an alternative to conventional fuels is still in its infancy and its imposition on international markets could be done

with the support of governments, given the high costs of manufacturing and fueling motor vehicles with this new type of fuel.

Source:
https://energyindustryreview.com/renewables/romania-has-signed-the-hydrogen-initiative/

Project to develop hydrogen fuel cells launched in Eastern China

A project to develop hydrogen fuel cells in Eastern China has been launched.

China's Ministry of Science and Technology aims to build a 'hydrogen city' Shandong Province's Jinan.

It plans to advance research and development of core technology related to hydrogen, promote the application of hydrogen fuel cells in vehicles and push forward the development of a hydrogen-powered vehicle industry.

Shandong Heavy Industry signed agreements with Ballard Power Systems and Westport Fuel Systems from Canada to develop engines fueled by hydrogen and natural gas.

Subsidiary Weichai Power will use a ¥1.98 billion (£222m) to work with 12 other companies, as well as universities and research institutes, to improve the sustainability and adaptability of fuel cells.

The country plans to achieve mass production of fuel cell vehicles by 2020.

Shandong Heavy Industry has recently announced it plans to develop and deploy 2,000 hydrogen fuel cell buses in China.

Source:
https://www.energylivenews.com/2018/08/31/project-to-develop-hydrogen-fuel-cells-launched-in-eastern-china/

Hydrogen could play bigger role in Middle East energy transition

The Middle East could potentially endorse more industrial and commercial use of hydrogen, a transition fuel being optimized in de-nuclearizing economies globally, according to German industrial engineering company Siemens.

"In terms of interests from the region, it is changing. We started from western Europe and we realized there was a big demand in Australia and then there was a big interest from the Middle East," said Klaus Scheffer, Siemens project lead for Energiepark Mainz, the world's largest hydrogen electrolysis facility based in Germany.

"The Middle East has certain advantages as the region can produce very cheap electricity from the Sun, which is not the case for western Europe."

There is already interest in hydrogen in the UAE. Last year, the first hydrogen car refilling station in the country opened in Dubai, at a cost of $2 million.

Japan, which began its transition away from nuclear power stations after the Fukushima disaster in 2011, is rethinking its energy systems as well, Mr. Scheffer said.

Siemens is one of the global companies developing turbine technology to use stored hydrogen fuel.

The German industrial firm, which has plans to develop a hydrogen economy in the Middle East, is seeking opportunities in the region for this technology.

The Middle East, which accounts for nearly 35 per cent of the global oil production, is undergoing a transition to a greener economy to free up more crude for export. Saudi Arabia, the world's largest sovereign producer of oil, has plans to invest as much as $7 billion in solar and wind projects this year alone. The UAE, which relies on gas to power 98 per cent of its utility requirements, aims to generate 75 per cent of its energy from clean sources by 2050 and plans to invest around Dh50bn in such projects.

Siemens is already promoting more hybrid sources of clean fuel. In February, the company signed an agreement with Dubai Electricity and Water Authority for a pilot solar-driven hydrogen electrolysis facility at Mohammed bin Rashid Solar Park.

The project aims to produce hydrogen using solar photovoltaic technology. The gas will then be stored and used for transport or other industrial needs. Hydrogen has the potential to help accelerate adoption of renewables in the region, Dewa said earlier this year.

Dubai plans to take hydrogen-fueled transport more

mainstream by using fuel-cell vehicles that run on the "green" hydrogen generated by the pilot scheme during the Expo 2020.

The hydogen-powered Toyota Mirai last year made its debut in the UAE in collaboration with its UAE dealership Al-Futtaim, Abu Dhabi's Masdar City and French fuel multinational Air Liquide.

The use of hydrogen in cars will be a game changer. Ninety percent of the fuel is used in the industrial sector, more prominently in the oil and gas, and refining sectors. Metal smelting and fertilizer productions are also finding more applications for hydrogen fuel.

Source:
https://www.thenational.ae/business/technology/hydrogen-could-play-bigger-role-in-middle-east-energy-transition-1.769602

New technology improves hydrogen manufacturing

Industrial hydrogen is closer to being produced more efficiently, thanks to findings outlined in a new paper published by Idaho National Laboratory researchers. In the paper, Dr. Dong Ding and his colleagues detailed advances in the production of hydrogen, which is used in oil refining, petrochemical manufacturing and as an eco-friendly fuel for transportation.

The researchers demonstrated high-performance electrochemical hydrogen production at a lower temperature than had been possible before. This was due to a key advance: a ceramic steam electrode that self-assembles from a woven mat.

"We invented a 3D self-assembled steam electrode which can be scalable," said Ding. "The ultrahigh porosity and the 3D structure can make the mass/charge transfer much better, so the performance was better."

In a paper published by the journal Advanced Science, the researchers reported on the design, fabrication and characterization of highly efficient proton-conducting solid oxide electrolysis cells (P-SOECs) with a novel 3D self-assembled steam electrode. The cells operated below 600°C. They produced hydrogen at a high sustained rate continuously for days during testing.

Hydrogen is an eco-friendly fuel in part because when it burns, the result is water. However, there are no convenient suitable natural sources for pure hydrogen. Today, hydrogen is obtained by steam reforming (or "cracking") hydrocarbons, such as natural gas. This process, though, requires fossil fuels and creates carbon byproducts, which makes it less suited for sustainable production.

Steam electrolysis, by contrast, needs only water and electricity to split water molecules, thereby generating hydrogen and oxygen. The electricity can come from any source, including wind, solar, nuclear and other emission-free sources. Being able to do electrolysis efficiently at as low a temperature as possible minimizes the energy needed.

A P-SOEC has a porous steam electrode, a hydrogen electrode and a proton-conducting electrolyte. When voltage is applied, steam travels through the porous steam electrode and turns into oxygen and hydrogen at the electrolyte boundary. Due to differing charges, the two gases separate and are collected at their respective electrodes.

So, the construction of the porous steam electrode is critical, which is why the researchers used an innovative way to make it. They started with a woven textile template, put it into a precursor solution containing elements they wanted to use, and then fired it to remove the fabric and leave behind the ceramic. The result was a ceramic version of the original textile.

They put the ceramic textile in the electrode and noticed that in operation, bridging occurred between strands. This should improve both mass and charge transfer and the stability of the electrode, according to Dr. Wei Wu, the primary contributor to this work.

The electrode and the use of proton conduction enabled high hydrogen production below 600°C. That is cooler by hundreds of degrees than is the case with conventional high-temperature steam electrolysis methods. The lower temperature makes the hydrogen production process more durable, and also requires fewer costly, heat-resistant materials in the electrolysis cell.

Although hydrogen is already used to power vehicles, for energy storage and as portable energy, this approach could offer a more efficient alternative for high-volume

production.

Source:
https://www.sciencedaily.com/releases/2018/09/180904140548.htm

ITM Power Opens Seventh Hydrogen Refueling Station at Johnson Matthey's Swindon site on M4 corridor

ITM Power (AIM: ITM), the energy storage and clean fuel company, and Johnson Matthey (LSE: JMAT), a global leader in science that enables a cleaner and healthier world, are pleased to announce the opening of ITM Power's seventh public access hydrogen refueling station (HRS) located at Johnson Matthey, Swindon on the M4 corridor. The opening is being supported by Toyota, Hyundai and Honda who will also present and participate in a Q&A session. Attendees will also be able to experience a zero emission journey in a Fuel Cell Electric Vehicle (FCEV) Ride and Drive which will be available at the opening.

About the new M4 Swindon Hydrogen Refueling Station:

The new Swindon HRS is ITM Power's seventh public access HRS and joins Cobham on the M25, Beaconsfield on the M40, Rainham in Kent on the A14, Teddington in London, Rotherham on the M1 and Kirkwall in Orkney. Located at Johnson Matthey in Swindon, which is home to the company's fuel cell component manufacturing facility, the new HRS lies just off the M4 linking South Wales with London. It is now open for public and private fleets operating fuel cell electric vehicles. The station uses electricity via a renewable energy contract and water to generate hydrogen on-site with no need for deliveries.

The Pan European H2ME2 project:

The new HRS is the first of two stations in the UK to be deployed as part of the pan European H2ME2 project, which was funded by the European Fuel Cell and Hydrogen Joint Undertaking (FCHJU) and the Office of Low Emission Vehicles (OLEV). A further station to be deployed by ITM Power under H2ME1 will be located at Gatwick Airport and will be opened before the end of this year.

UK Government's Commitment to Hydrogen Vehicle Roll Out

On 11 September at the 'Zero Emission Vehicle Summit' in Birmingham, Prime Minister Theresa May outlined the UK Government's "Road to Zero Strategy" which includes funding of £1.5 billion for ultra-low-emission vehicles by 2020. At the event, the Prime Minister also announced more than £100 million of funding for innovators in ultra-low-emission vehicles and hydrogen technology. The Road to Zero Strategy is the most comprehensive plan globally – mapping out in detail how the UK will reach its target for all new cars and vans to be, effectively, zero emission by 2040 – and for every car and van to be zero emission by 2050.

Commenting on the award of grant funding, Bart Biebuyck, Executive Director of the FCH JU said: "I would like to congratulate the consortium for the opening of the first HRS station in the UK, deployed as part of the H2ME2 project. The importance of the H2ME projects comes in part from their aim to bring together national hydrogen transport initiatives, which vary in aim and scope. By supporting them, the FCH JU demonstrates the potential of hydrogen-fueled road transport as a pan-European solution to the need for viable and competitive alternatives to fossil fuels."

Dr. Graham Cooley, CEO, ITM Power, commented: "We are extremely pleased to have launched our seventh hydrogen refueling station. ITM Power is grateful for the co-operation of our H2ME2 partners and for the funding support of FCHJU and OLEV. We are again collaborating with local stakeholders to develop a significant FCEV fleet around the new station."

Matthew Harwood, Group Strategy Director, Johnson Matthey, commented: "There's no doubt that hydrogen

will be part of our energy mix going forward and we are delighted that ITM's seventh refueling station is located at our site in Swindon. JM has a great heritage in the development of fuel cell technologies, as well as in the catalysts and technologies for the large scale production of hydrogen. At JM we apply our science to making a cleaner, healthier world; our fuel cell technology, where hydrogen is converted electrochemically to clean power, is an important enabler in the journey to zero emission transport and pollution free roads."

Paul Van der Burgh, Toyota (GB) PLC President and Managing Director, said: "The opening of this new ITM Power facility establishes a valuable, strategic link in the development of the UK's hydrogen fuel infrastructure. We welcome it not only as a benefit for drivers of the Toyota Mirai hydrogen fuel cell electric saloon, but also as another step towards realizing the wider benefits of hydrogen as a clean and sustainable energy source in the future – a key mission for Toyota globally."

Tony Whitehorn, President and CEO Hyundai Motor UK said "As the demand for zero emission vehicles of all types is increasing at a rapid rate, it's imperative that the necessary infrastructure is deployed at a pace that matches. For Hyundai, the opening of the 7th station from ITM shows a clear and timely commitment to hydrogen deployment from both the public and private sector as we prepare for the imminent UK launch of NEXO, our next generation fuel cell electric vehicle"

Thomas Brachmann, Chief Project Engineer, Automobile Powertrain & Material Research Honda R&D Europe (Deutschland) commented: "The opening of the new hydrogen refueling station in Swindon is an important step for the UK's infrastructure, as it now enables travel along the M4 corridor to the M25. This will further enhance the uptake of hydrogen vehicles and will help our Clarity Fuel Cell drivers in the UK with the knowledge that there is increased hydrogen refueling capacity available."

Dawn Brooks, Market Specialist, Anglo American commented: "As one of the world's leading suppliers of platinum group metals (PGMs), we see platinum-containing hydrogen powered Fuel Cell Electric Vehicles (FCEVs), as an important innovation. We believe hydrogen and FCEVs will play an important role in a low-carbon transport future and we continue to support the development of the technology and the expansion of supporting infrastructure."

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Source: http://www.itm-power.com/news-item/itm-power-opens-seventh-hydrogen-refuelling-station-at-johnson-mattheys-swindon-site-on-m4-corridor

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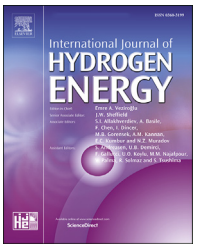


Editorial

Most cited papers of 2016 & 2017

Dear IJHE Authors and Readers:

As announced earlier this year[1], the IJHE created ten Awards to be presented to the authors of the most cited papers in five different categories to be selected for the previous odd and even years. These categories are Hydrogen Energy/Hydrogen Economy, Hydrogen Production, Hydrogen Storage & Distribution, Fuel Cells and Hydrogen Applications. The first Award Winners were selected out of the papers published in the years 2016 and 2017, and the Award Certificates were presented during the Gala Festival of the 22 World Hydrogen Energy Conference (22 WHEC 2018), 17–22 June 2018, Rio de Janeiro, Brazil. It is my honor to introduce to you the recipients of these awards.

The winners for the year 2016 awards are:

1. **IJHE T. Nejat Veziroğlu Award** presented to Ahmed, A., Al-Amin, A.Q., Ambrose, A.F., Saidur, R. for authoring the paper "Hydrogen fuel and transport system: A sustainable and environmental future," the Most Cited Paper of the Year 2016 in the Hydrogen Energy/Hydrogen Economy Category
2. **IJHE John O'M. Bockris Award** presented to Sivagurunathan, P., Kumar, G., Bakonyi, P., Kim, S.-H., Kobayashi, T., Xu, K.Q., Lakner, G., Tóth, G., Nemestóthy, N., Bélafi-Bakó, K. for authoring the paper "A critical review on issues and overcoming strategies for the enhancement of dark fermentative hydrogen production in continuous systems," the Most Cited Paper of the Year 2016 in the Hydrogen Production Category.
3. **IJHE Juan Carlos Bolcich Award** presented to Rusman, N.A.A., Dahari, M. for authoring the paper "A review on the current progress of metal hydrides material for solid-state hydrogen storage applications," the Most Cited Paper of the Year 2016 in the Hydrogen Storage & Distribution Category.
4. **IJHE Valery A. Legasov Award** presented to Akhairia, M.A.F., Kamarudin, S.K. for authoring the paper "Catalysts in direct ethanol fuel cell (DEFC): An overview," the Most Cited Paper of the Year 2016 in the Fuel Cells Category.
5. **IJHE Zong Qiang Mao Award** presented to Wilberforce, T., Alaswad, A., Palumbo, A., Dassisti, M., Olabi, A.G. for authoring the paper "Advances in stationary and portable fuel cell applications," the Most Cited Paper of the Year 2016 in the Hydrogen Applications Category.

The winners for the year 2017 awards are:

1. **IJHE Cesare Marchetti Award** presented to da Silva Veras, T., Mozer, T.S., da Costa Rubim Messeder dos Santos, D., da Silva César, A. for authoring the paper "Hydrogen: Trends, production and characterization of the main process worldwide," the Most Cited Paper of the Year 2016 in the Hydrogen Energy/Hydrogen Economy Category.
2. **IJHE Tokio Ohta Award** presented to Han, G.-Q., Shang, X., Lu, S.-S., Dong, B., Li, X., Liu, Y.-R., Hu, W.-H., Zeng, J.-B., Chai, Y.-M., Liu, C.-G. for authoring the paper "Electrodeposited MoSx films assisted by liquid crystal template with ultrahigh electrocatalytic activity for hydrogen evolution reaction," the Most Cited Paper of the Year 2016 in the Hydrogen Production Category.
3. **IJHE David Sanborn Scott Award** presented to Ren, J., Musyoka, N.M., Langmi, H.W., Mathe, M., Liao, S.for authoring the paper "Current research trends and perspectives on materials-based hydrogen storage solutions: A critical review," the Most Cited Paper of the Year 2016 in the Hydrogen Storage & Distribution Category.
4. **IJHE Onkar N. Srivastava Award** presented to Xu, H., Yan, B., Zhang, K., Wang, C., Zhong, J., Li, S., Yang, P., Du, Y. for authoring the paper "Facile synthesis of Pd-Ru-P ternary nanoparticle networks with enhanced electrocatalytic performance for methanol oxidation," the Most Cited Paper of the Year 2016 in the Fuel Cells Category.
5. **IJHE Carl-Jochen Winter Award** presented to Su, T., Ji, C., Wang, S., Shi, L., Yang, J., Cong, X. for authoring the paper "Improving idle performance of a hydrogen-gasoline rotary engine at stoichiometric condition," the Most Cited Paper of the Year 2016 in the Hydrogen Applications Category.

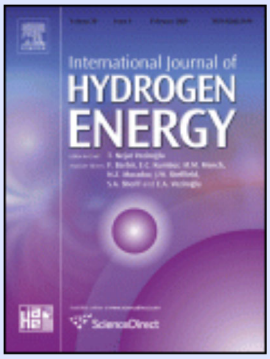
Please join me in congratulating all of these Award-Winning Authors.

[1] https://doi.org/10.1016/j.ijhydene.2018.04.130.

Emre A. Veziroglu
Editor-in-Chief, International Journal of Hydrogen Energy, USA

https://doi.org/10.1016/j.ijhydene.2018.07.160

International Journal of Hydrogen Energy Highlights



The *International Journal of Hydrogen Energy* aims to provide a central vehicle for the exchange and dissemination of new ideas, technology developments and research results in the field of Hydrogen Energy between scientists and engineers throughout the world. The emphasis is placed on original research, both analytical and experimental, covering all aspects of Hydrogen Energy, including production, storage, transmission, utilization, enabling technologies, environmental impact, economic and international aspects of hydrogen and hydrogen carriers such as NH_3, CH_4, alcohols, etc.

The utilization includes thermochemical (combustion), photochemical, electrochemical (fuel cells) and nuclear conversion of hydrogen, hydrogen isotopes and/or hydrogen carriers to thermal, mechanical and electrical energies, and their applications in transportation (including aerospace), industrial, commercial and residential sectors. When outstanding new advances are made, or when new areas have been developed to a definitive stage, special review articles will be considered. Shorter communications are also welcome.

Most Cited IJHE Articles (in 2018)

1. **The investment costs of electrolysis - A comparison of cost studies from the past 30 years**
   Saba S, Müller M, Robinius M, Stolten D. Int J Hydrogen Energy 2018;43(3):1209-1223
2. **Nanomaterials for photoelectrochemical water splitting - review**
   Joy J, Mathew J, George S. Int J Hydrogen Energy 2018;43(10):4804-4817
3. **Numerical and experimental investigation of hydrogen-rich syngas production via biomass gasification**
   Aydin E, Yucel O, Sadikoglu H. Int J Hydrogen Energy 2018;43(2):1105-1115
4. **Investigation of layered Ni0.8Co0.15Al0.05LiO2in electrode for low-temperature solid oxide fuel cells**
   Chen G, Sun W, Luo Y, Liu H, Geng S, Yu K, Liu G. Int J Hydrogen Energy 2018;43(1):417-425
5. **Hydrogen-iodide decomposition over Pd-CeO2 nanocatalyst for hydrogen production in sulfur-iodine thermochemical cycle**
   Singhania A, Krishnan V, Bhaskarwar A, Bhargava B, Parvatalu D. Int J Hydrogen Energy 2018;43(8):3886-3891
6. **Calibration of low-pressure MEMS gas sensor for detection of hydrogen gas**
   Gerdroodbary M, Anazadehsayed A, Hassanvand A, Moradi R. Int J Hydrogen Energy 2018;43(11):5770-5782

Most Downloaded IJHE Articles (August-October 2018)

1. **Future cost and performance of water electrolysis: An expert elicitation study**
   Schmidt O, Gambhir A, Staffell I, Hawkes A, Nelson J, Few S. Int J Hydrogen Energy 2017;42(52):30470-30492
2. **A comprehensive review on PEM water electrolysis**
   Carmo M, Fritz D, Mergel J, Stolten D. Int J Hydrogen Energy 2013;38(12):4901-4934
3. **Kinetics study and modelling of steam methane reforming process over a NiO/Al_2O_3 catalyst in an adiabatic packed bed reactor**
   Abbas S, Dupont V, Mahmud T. Int J Hydrogen Energy 2017;42(5):2889-2903
4. **Hydrogen and fuel cell technologies for heating: A review**
   Dodds P, Staffell I, Hawkes A, Li F, Grunewald P, McDowall W, Ekins P. Int J Hydrogen Energy 2015;40(5):2065-2083
5. **Developments of electric cars and fuel cell hydrogen electric cars**
   Wilberforce T, El-Hassan Z, Khatib F, Makky A, Baroutaji A, Carton J, Olabi A. Int J Hydrogen Energy 2017;42(40):25695-25734
6. **Electrocatalysts for hydrogen evolution reaction**
   Eftekhari A. Int J Hydrogen Energy 2017;42(16):11053-11077
7. **Formic acid synthesis using CO_2 as raw material: Techno-economic and environmental evaluation and market potential**
   Pérez-Fortes M, Schöneberger J, Boulamanti A, Harrison G, Tzimas E. Int J Hydrogen Energy 2016;41(37):16444-16462

Who are the early adopters of fuel cell vehicles?

S. Hardman, G. Tal. Int J Hydrogen Energy 2018: 43(37):17857-17866

The market entry of any new technology is dependent on that technology being adopted by consumers. Early technology adopters are people that are poised to help guide policy makers by giving feedback and serving as statistical survey pools. As fuel cell vehicles (FCVs) and battery electric vehicles (BEVs) expand their market shares, it is of interest of both the manufacturers of these types of vehicles as well as policy makers to understand the market.

The current work is based on surveys conducted in California, USA, which leads the global market in FCV sales (67.9% of all sales globally in 2017). Statistical tests were performed to understand the similarities and differences between adopters of FCVs and BEVs. The surveyed parameters were gender, highest level of formal education, household income, age, number of people in the household, number of household vehicles, travel patterns, ownership of previous AFVs (alternative fuel vehicles) and attitude towards sustainability.

Many of the findings of the study confirm findings of previous studies, such as early adopters being highly educated, and having high incomes, etc. Perhaps the two most interesting findings from the study were (1) the similarity in commute distances and frequency of trips longer than 200 miles and (2) the difference in homeowners vs. renters. From the standpoint of vehicle manufacturers as well as policy makers, understanding the early adopters' views regarding range anxiety is critical. It is commonly understood that the need to travel large distances (in reasonable refueling time) is one of the greatest advantages of FCVs (~3 minutes to refuel) over BEVs (~30 minutes to recharge). However, the survey found that both groups had, on average, similar commute distances, yearly trips over 200 miles and longest trip distance. These findings do not support the hypothesis that range anxiety would be a determining factor in AFV purchasing decisions. The difference that elucidates the thinking behind AFV selection more strictly is being a homeowner vs. a renter. FCV owners are more likely to be renters and those living in apartment buildings that may have no ability to charge a BEV. In highly urbanized settings there are few options for charging BEVs.

For either of these technologies to achieve mass use, adoption by low income households will be imperative. However, in terms of infrastructure, hydrogen is still lacking or nonexistent in most of the world. From a policy perspective these are some of the more pressing obstacles to AFVs' future.

https://www.sciencedirect.com/science/article/pii/S036031991832490X *-By Michael Daugherty*

Hydrogen in low-carbon energy systems in Japan by 2050: The uncertainties of technology development and implementation

A. Ozawa, Y. Kudoh, A. Murata, T. Honda, I. Saita, H. Takagi. Int J Hydrogen Energy 2018: 43(39): 18083-18094

The migration to low-carbon energy systems is a global issue. According to the fifth report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), the low-carbon energy share of the global primary energy supply must be increased from 15% (ca. 2010) to 50-70% by 2050, and account for as much as 90% by 2100 to stabilize long-term greenhouse gas (GHG) concentrations at manageable levels (430-480 ppm CO_2eq). Such changes are also necessary to contain global temperature increases below 2^{o}C for the 21st century relative to pre-industrial levels. In 2015, Japan set a near-future GHG emission reduction target of -26% total GHG emissions by fiscal year (FY) 2030 relative to those in FY 2013. However, uncertainties remain as to the feasibility of the development of low-carbon technologies and implementation. Therefore, possible scenarios for the potential of these technologies should be considered to allow for flexible decision-making with respect to long-term energy strategies in Japan.

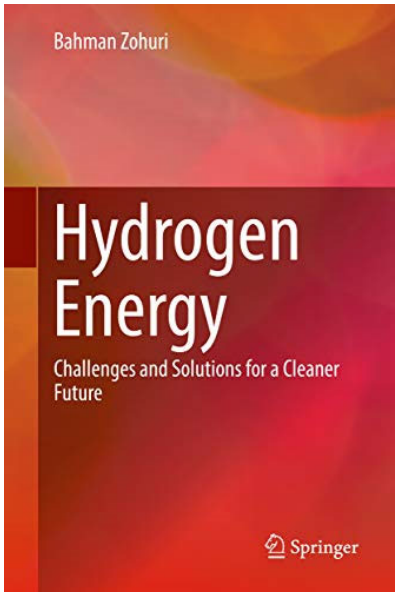
This study evaluates the role of hydrogen in future energy systems in Japan using a MARKet ALlocation (MARKAL) model. A range of uncertainties are considered for nuclear power generation and carbon capture and storage (CCS) from fossil power generation. This work suggests that an 80% reduction of CO_2 emissions from the 2013 level by 2050 requires emissions from the electricity sector to decrease to nearly zero. Hydrogen power must play a functional role in future energy systems in Japan, but its contribution should depend on nuclear power and CCS.

https://www.sciencedirect.com/science/article/pii/S0360319918319293 *-By Yasser Ashraf Gandomi*

From the Bookshelf

Hydrogen Energy
Challenges and solutions for a cleaner future

Author: Bahman Zohuri



This book describes the challenges and solutions the energy sector faces by shifting towards a hydrogen-based fuel economy. The most current and up-to-date efforts of countries and leaders in the automotive sector are reviewed as they strive to develop technology and find solutions to production, storage, and distribution challenges. Hydrogen fuel is a zero-emission fuel when burned with oxygen and is often used with electrochemical cells, or combustion in internal engines, to power vehicles and electric devices. This book offers unique solutions to integrating renewable sources of energy like wind or solar power into the production of hydrogen fuel, making it a cost effective, efficient and truly renewable alternative fuel.

- Presents cutting-edge research in hydrogen energy development;
- Contains case studies and examples to enhance practical application of the technologies presented;
- Presents innovative and unique solutions to integrating hydrogen into renewable sources.

https://www.springer.com/gp/book/9783319934600

Have suggestions for a future book feature? If so, send the book title to Kathy Williams at williamk@utk.edu.

Become a Member of IAHE

The International Association for Hydrogen Energy (IAHE) has four categories of membership:

- **H-Members:** Scientists, engineers, and laypersons who are interested in fields relating to Hydrogen Energy. They receive IAHE e-newsletter, hard copies of the International Journal of Hydrogen Energy (IJHE), and reduced registration for IAHE conferences.
- **E-Members:** Scientists, engineers and laypersons who are interested in fields relating to Hydrogen Energy. They receive IAHE e-newsletter, access to electronic copies of the International Journal of Hydrogen Energy (IJHE), and reduced registration for IAHE conferences.
- **Student Members:** They are students who are interested in hydrogen energy. They receive the IAHE e-newsletter. The student membership is free and led by Dr. John Sheffield. Please email him at john.sheffield@dnvkema.com for more information.
- **IAHE Fellows:** Long-time IAHE members who have significantly impacted society by promotion of Hydrogen Economy through research, education and/or service.

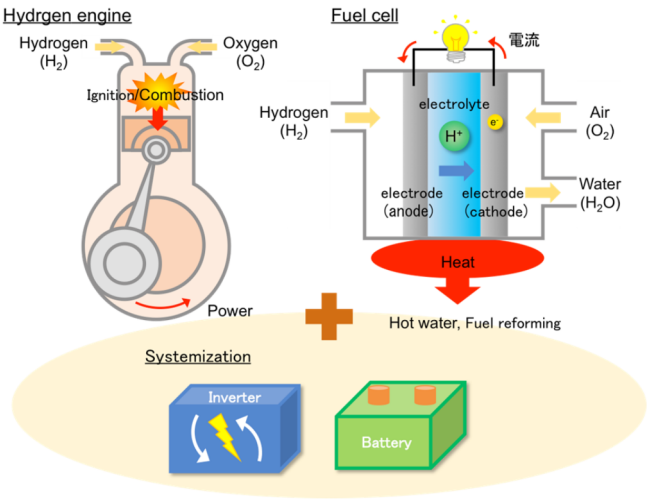
If you are interested in becoming a member of IAHE, please visit the membership page at www.iahe.org. You can sign up for membership directly on the membership page.

Research Lab Highlight

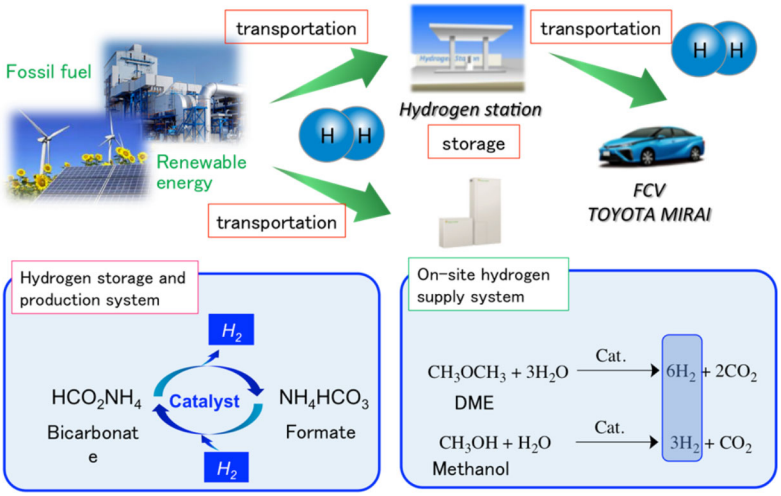
Tokyo Metropolitan Research Center for Hydrogen-based Society (ReHES)

Overview: Tokyo Metropolitan Research Center for Hydrogen-based Society (ReHES) directed by Prof. Kiyoshi Kanamura has been established to promote the application of hydrogen energy. Tokyo Metropolitan Research Center for Hydrogen-based Society (ReHES) has the following sub-divisions:

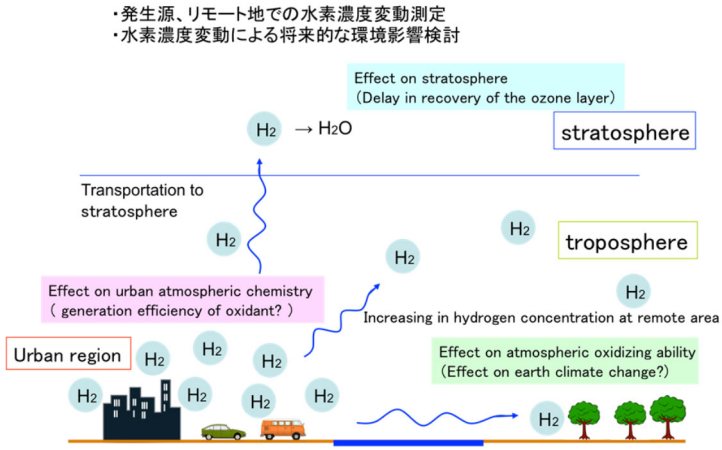
1. Division of high performance fuel cell systems



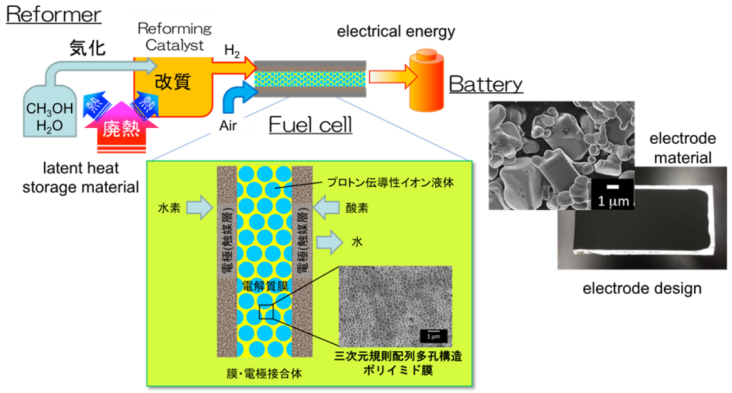
2. Division of hydrogen supply systems and carriers



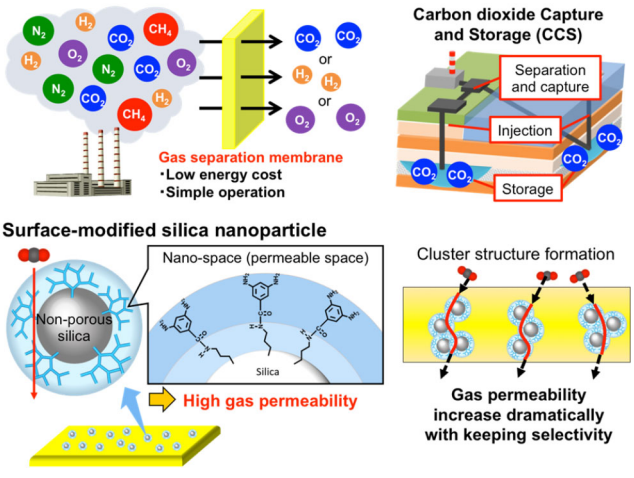
3. Division of hydrogen carriers



4. Division of high efficiency energy conversion systems



5. Division of carbon dioxide capture and storage



6. Division of infrastructure and buildings with energy-saving systems

For more info visit: http://www.comp.tmu.ac.jp/hydrogen/en/index.html

Ulster University

Part-time Postgraduate Short Courses and CPD

- **Principles of Hydrogen Safety**
- **Hydrogen Safety Technologies**

These short courses are designed to provide you with the knowledge and understanding of hydrogen safety engineering and technologies, developing your ability to deal with complex safety problems. The programmes are ideal for anyone involved in the safety of hydrogen systems and infrastructure, including its production, storage, transportation and use, and the safety training of personnel. Upon completion, opportunities for further doctoral study exist.

Course information

- **Principles of Hydrogen Safety**
  This course focuses on the fundamentals of hydrogen safety to existing and foreseeable hydrogen and fuel cell systems and infastructure.
- **Hydrogen Safety Technologies**
  This course focuses on advances in hydrogen safety technologies, including but not limited to prevention and mitigation strategies.

Duration & mode of delivery

These part-time courses run for 12 weeks each and are delivered fully online (face-to-face block-release may be possible for a group of more than 12, subject to demand). Principles of Hydrogen Safety runs in semester one and Hydrogen Safety Technology runs in semester two.

Assessment

100% coursework – two pieces of coursework per course focusing on problem-based solutions and qualitative questions *(50% each).*

Entry requirements

Any undergraduate degree.

Credit points

30 points per course, 60 credits for both leading to the award of a Postgraduate Certificate of Professional Development (Hydrogen Safety).

Frequently asked questions

How much will each course cost?

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- England, Scotland and Wales: £916.50*
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Find out more

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W: ulster.ac.uk/principles-hydrogen-safety
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Get in touch

Prof Vladimir Molkov, E: v.molkov@ulster.ac.uk
Dr Volodymyr Shentsov, E: v.shentsov@ulster.ac.uk
Dr Dmitriy Makarov, E: dv.makarov@ulster.ac.uk

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*Terms and conditions apply.
Correct at the time of publishing. Fees illustrated are based on 2018/2019 entry and are subject to an annual increase. Please visit ulster.ac.uk/finance/student/tuition-fees-rates/tuition-fees-201819 for full details of fees.
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24-26 October 2018

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The purpose of the conference is to provide an excellent platform for researchers and practitioners, to exchange emerging ideas and investigate key issues such as; recycling and reuse concerns, advanced wastewater treatment, membrane technologies for recycling and reuse, advanced oxidation technologies, waste reduction, water and wastewater management, solid waste treatment and management, hazardous waste management, resource use, renewable energy technologies, current and future recycling markets, public health issues, laws and policies of recycling and reuse.

Topics

- Renewable energy technologies,
- Hydrogen Recycling Systems
- Utilizing modified fuel cell technology for hydrogen recovery and recycling.
- Hydrogen production and energy technologies,
- Solid waste management for recycling, reuse and energy recovery,
- Green technologies for energy production and wastewater reuse,
- Wastewater treatment, recycling and reuse technologies,
- Membrane technologies and wastewater separation technologies,
- Hazardous waste management,
- Public health issues,
- Laws and policies of recycling and reuse

Important Dates

Date	Event
15 May 2018	Abstract submission
1 June 2018	Notification of acceptance
1 July 2018	Early bird registration
24-26 October 2018	Conference dates

Information

For registration and more information please visit the conference website: http://rr.istanbul.edu.tr or send an e-mail to rr@istanbul.edu.tr

Keynote Speakers

Giorgio Bertanza

Ibrahim Dincer

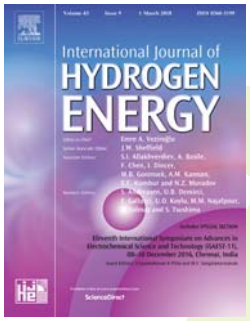
Mustafa Ersoz

Bilsen Beler Baykal

Gianluca Li Puma

Marek Bryjak

Publications



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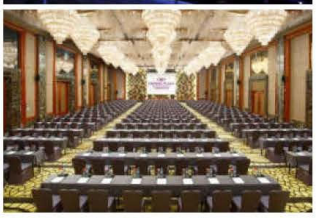

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Tuesday May. 1, 2018
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Deadline for abstract submission

Friday Aug. 31, 2018
Deadline for early bird registration

Sunday Oct. 28. 2018
Registration and conference opening

CONTACT
Dr. Liuzhang OUYANG
Email: meouyang@scut.edu.cn
Tel:+86 20 8711 4253

South China University of Technology

Key Laboratory of Advanced Energy Storage Materials of Guangdong Province

Call for papers

The 3rd International conference on Alternative Fuels, Energy and Environment: Future and Challenges (ICAFEE20018)

28th-31st October 2018 (Nanjing, China)

On behalf of ICAFEE2018 organizing committee, we are delighted to announce our upcoming event; **The 3rd International Conference on Alternative Fuels, Energy and Environment: Future and Challenges (ICAFEE2018)** to be held in Nanjing, China during 28th-31st October 2018 (http://icaf-e.com/). This event has been initiated to set a platform to join researchers around the world in one place. Conference program includes Plenary/invited speaker, Invited speakers, Scientific workshops and Seminars. Moreover, some of the renewed researchers were invited to join the conference scientific committee.

Notes for Prospective Authors:

1- Submission to ICAFEE:

Abstracts Submission can be made at: http://icaf-e.com/submit-abstract.php. Authors are requested to use the online submission system, however, if there are some technical issues then we welcome the submissions via email: icafe.series@gmail.com, icafee_icwrs2018@163.com.

2- Important dates (Special Issue):

Open for Manuscripts Submission: **15th November 2018**

Manuscripts Submission Deadline: **15th January 2019**

Close of Special issue: **October 2019**

Submitted papers should not have been previously published nor be currently under consideration for publication elsewhere. Papers will be refereed through a peer-review process.

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International Conference on Electronics, Energy and Measurement

November 27-29, 2018, Algiers, Algeria

The Laboratory of Instrumentation at USTHB organizes the *International Conference on Electronics, Energy and Measurement, IC2EM'2018* on November 27-29, 2018. The conference provides opportunity to bring scientists and engineers from academia, research institutes and industrial establishments to present and discuss the latest results in the field of electronics, instrumentation and measurement, sensors and energy. This event follows previous workshops of the Laboratory of Instrumentation series (JLINS) that held in 2007, 2010 and 2012 respectively.

Conference themes

Papers are invited in the following themes, including, but not restricted to:

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- Power Electronics
- Embedded systems

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- Energy efficiency
- Hydrogen energy

Measurement

- Metrology and standards
- Laboratory accreditation
- Data acquisition systems
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Instrumentation

- Sensors technology and modeling
- Advanced in sensing materials
- Smart sensors and interfaces
- MEMS, MOEMS and RFID technology
- Optical fiber instrumentation
- Microwaves instrumentation

Applications

- Solar and wind energy
- Petroleum and gas industries
- Health sciences
- Sport technology
- Agriculture and Environment
- Smart cities and IoT devices
- Disaster mitigation
- Automotive industry
- Avionics.

Important dates

Full paper submission **July 10, 2018**
Acceptance notification **September 15, 2018**
Final version paper **September 30, 2018**
Registration **October 15, 2018**
IC2EM-2018 Conference **November 27-29, 2018**
Conference website: https://ic2em-2018.sciencesconf.org/

INTERNATIONAL CONFERENCE ON MATERIALS FOR ENERGY APPLICATIONS

6-8 DECEMBER, 2018

Organized by

S S JAIN SUBODH P.G. (AUTONOMOUS) COLLEGE, JAIPUR

Affiliated to University of Rajasthan, Jaipur-302004, India

In Association with NANO & MOLECULAR SOCIETY

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Agra University, Agra, India
Dr. Pratibha Sharma
IIT Bombay, India

Dear Colleagues,

It gives us immense pleasure to inform you that S S Jain Subodh P.G. (Autonomous) College, Jaipur, India is going to organize an International Conference on Materials for Energy Applications (ICME-2018) during December 6-8, 2018.

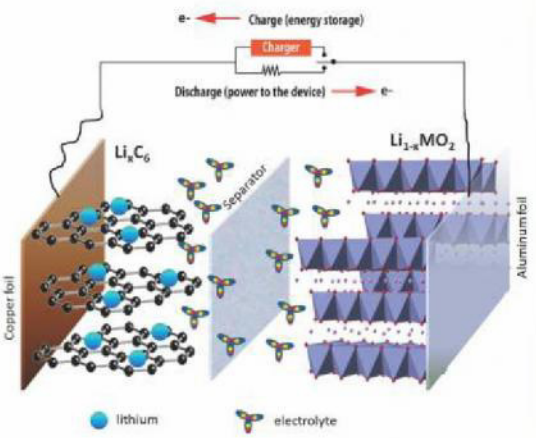
On behalf of organizing committee, We invite you along with your esteemed colleagues/students for the contribution of papers and active participation in the conference. ICME-2018 is an interdisplinary conference to promote and enhance excellence of materials for energy applications. Last date for abstract / paper submission is 10th August, 2018. The accepted papers will be published in a reputed International Journal.

Looking forward to welcome you all in Pink City, Jaipur (Rajasthan) India.

For more information visit conference website : **www.icme2018.subodhpgcollege.com**

TOPICS

- Hydrogen energy
- Solar energy
- Thermoelectric energy
- Ferroelectric photovoltaics
- Fuel cells
- Sensors, Bio-sensors
- Membranes
- Nanocomposites
- Smart materials
- Functional materials
- Photo catalysts
- Thermo and Piezoelectric materials
- Dielectrics
- Supercapacitors
- Batteries (Li-ion, Li-S, Na, Mg, Solid state)
- Alternate Energy
- Wind Energy
- Fossil Energy
- Bio Energy



CHAIRMAN

Prof. K. B. Sharma
Principal

ORGANIZING SECRETARY

Dr. Balram Tripathi
Associate Professor

CONFERENCE SECRETARIAT (ICME-18)

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icmessj18@gmail.com, balramtripathi1181@gmail.com

Website :
www.icme2018.subodhpgcollege.com, www.subodhpgcollege.com

IMPORTANT DATES

Start Date for Abstract Submission	11th April, 2018
Last Date for Abstract Submission	10th August, 2018
Acceptance Notification of Abstracts	30th September, 2018
Last Date for Full Paper Submission	30th October, 2018

7th INTERNATIONAL HYDROGEN & FUEL CELL CONFERENCE

Hydrogen Association of India

WITH SUPPORT FROM INTERNATIONAL JOURNAL OF HYDROGEN ENERGY (IJHE), OFFICIAL JOURNAL OF THE IAHE, USA

Theme: To build partnerships for a Sustainable Hydrogen Energy Economy at Jodhpur – The Blue City

Call for Papers

Abstracts invited & last date of submission **Sep. 30th, 2018**

Abstracts Selection by **Oct. 31st, 2018**

Submission of Full Manuscript by **Nov. 30th, 2018**

Date : 9th-11th December 2018

Registration & Fee : Rs.15,000/- Inclusive GST (US$250)

From 1st September 2018 onwards

*Early Bird Rates : Rs. 10,000/- (US $ 200)
Upto 30 September 2018

Note: Limited Seats - Allotment on "First Come First Serve" basis

Note: Pre-registration information is available at contact point.Program details and highlight will issued soon.

Please pay by crossed Cheque/DD drawn in favor of "Hydrogen Association of India- A/c 31132125420" Payable at Faridabad
For Electronic Transfer :
State Bank of India, IOC Complex,Faridabad,
Branch Code-10449 & IFSC Code-SBIN0010449

CONTACT POINT :

Alok Sharma, Organizing Secretary
Hydrogen Association of India
C/o Indian Oil Corporation Limited, Sector-13, Faridabad (HR)
121007, Ph.No. +91-129-2294443
Mobile : + 91 9818601855
E-mail: sharmaa@indianoil.in

HYDROGEN ASSOCIATION OF INDIA

The much awaited seventh (7th) in the series, International Hydrogen & Fuel Cell Conference (IHFC-2018) is being held during 9th–11th December 2018 at FairfieldSM Marriott®, Jodhpur (India) by Hydrogen Association of India. The conference is once again patronized by the most prestigious International Association of Hydrogen Energy (IAHE), USA and with continuous support from many Indian Business Houses, Government Organizations and Academic Institutes working in the area of hydrogen energy.

In past six years, event has evolved starting from hydrogen related research & novel topics in the area of hydrogen production through novel routes, storage & transportation through innovative approaches, hydrogen applications and safety aspects involved with hydrogen handling. With constructive feedback from the participants and our patrons, the conference has now started incorporating the commercialization techniques, market penetration ideas, roadblock in implementation of hydrogen economy etc. with extensive deliberation by conducting a full day panel discussions on various facets of hydrogen. The Speakers / Experts / Senior Govt. Officials / Overseas Partners from the hydrogen and related area will likely to deliberate on the issues which are highly flagged during past two conferences.

Like in past this year also we are expecting a huge participation from the hydrogen related Industry and Government organizations for the extended deliberation on the promotion of hydrogen related economy in the country.

The aims and objectives of the Hydrogen Association of India are to conduct scientific activities which shall include the following:

- To promote, encourage and develop the growth of Hydrogen Energy and its applications in the country.
- To establish an active association of all those persons, bodies, institutions (private or public) and industries interested in promotion of Hydrogen Production, Storage, Transportation, Distribution and Dispensing related technologies in India.
- To disseminate information concerning the developments in Hydrogen Energy and its applications through publications, such as bulletins, reports, newsletters, journals, workshop and conference etc.
- To render advice (technical or otherwise) to government and commercial bodies on matters pertaining to Hydrogen Energy and its applications, when needed or requested.

Sponsorship:

Platinum	: Rs.10 lakhs / USD 16000	10 Delegates and One Stall Free
Diamond	: Rs.5 lakhs / USD 8000	5 Delegates and One Stall Free
Gold	: Rs.3 lakhs / USD 5000	3 Delegates and One Stall Free
Silver	: Rs.2 lakhs / USD 4000	2 Delegates Free
Session Sponsor	: Rs.1.5 lakh / USD 2400	1 Delegate Free

THE KEY PERSONS ASSOCIATED WITH HYDROGEN ASSOCIATION OF INDIA (HAI)

President	: Dr.R.K.Malhotra, Director General Federation of India Petroleum Industry (FIPI)
Vice President	: Arun Nemani, Expert in the area of Fuel Cell
Secretary	: K. K. Gandhi, Executive Director Society of Indian Automobile Manufacturers (SIAM)
Joint Secretary	: Puneet Kishore, General Manager ONGC Energy Centre
Treasurer	: Alok Sharma, Chief General Manager Indian Oil Corporation Limited (IOCL)

Participants in this conference would automatically become member of HAI for 2018-19

Accommodation At

Fairfield by Marriott Jodhpur,
Opposite New High Court,
Near Shatabdi Circle, Vijay Raje Nagar,
Jodhpur – 342013, Rajasthan, India.
Website - www.fairfieldjodhpur.com
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Hydrogen Association of India
Indian Oil Corporation R&D Centre,
Faridabad-121007, India
www.hai.org.in

International Association for Hydrogen Energy (IAHE)

With support from International Journal of Hydrogen Energy (IJHE) Official Journal of the IAHE, USA

Twelfth International Symposium on Advances in Electrochemical Science and Technology (iSAEST-12)

The Society for Advancement of Electrochemical Science and Technology (SAEST) is a vibrant professional body of electrochemists and electrochemical engineers engaged in the pursuit of electrochemistry research and teaching in India. The objective of the Society is to promote research & development, and education in electrochemistry and contiguous disciplines. In order to take stock of the recent developments in the area of Electrochemical Science and Technology, SAEST and CSIR-Central Electrochemical Research Institute jointly organizes the Twelfth International Symposium on Advances in Electrochemical Science and Technology (iSAEST-12) at Hotel Trident, Chennai, India during 8-10 January 2019 along with a Preconference Workshop on 7th January 2019.

The Symposium will provide a forum for researchers from industries, institutions and academia from across the world to meet and exchange ideas and research experience. The symposium themes include Electrochemical Power Systems, Electroplating and Surface Engineering, Bioelectrochemistry and Biotechnology, Electrochemical Sensors, Devices and Instrumentation, Corrosion Science and Materials Protection, Electro-synthesis, Electrometallurgy and Industrial Electrochemical Processes.

The Symposium is open to students, research scholars, scientists, academicians and industrialists working in the above and related areas. Prior registration is mandatory for participation in the symposium. Please e-mail your contact details and an abstract of your presentation to The Secretary, SAEST at **saestkkd@yahoo.com.**

Salient features of iSAEST-12 include:

- A pre-conference workshop on *Fundamentals and Application on Electrochemical Impedance* by Prof. Frank Marken, University of Bath, UK has been arranged exclusively for the benefit of young scientists and research scholars
- Best oral/poster awards will be geiven to encourage young researchersfor presentations made at the symposium by young researchers
- Selected, peer-reviewed high-quality symposium papers in the area of hydrogen energy and fuel cells in the *International Journal of Hydrogen Energy* (Impact Factor : 4.229)

Supporters & Sponsors

Important Dates

Deadline for abstracts with Pre-registration	: November 01, 2018
Acceptance notification to author(s)	: December 15, 2018
Deadline for submission of full text of papers	: December 25, 2018

Call for Papers

1st International Conference on Smart Innovation, Ergonomics and Applied Human Factors

SEAHF 2019

22nd-24th January 2019, Madrid, Spain

URL http://www.seahf.eu

Scope

The 1st edition of SEAHF conference targets different scientific fields and invites academics, researchers and educators to share innovative ideas and expose their works in the presence of experts from all over the world.

SEAHF focuses on original research and practice-driven applications. It provides a common linkage between a vibrant scientific and research community and industry professionals by offering a clear view on modern problems and challenges in information technology. SEAHF offers a balance between innovative industrial approaches and original research work while keeping the readers informed of the security techniques, approaches, applications and new technologies. The conference is an opportunity for students, doctors, academics and researchers to open up to the outside world, make connections and collaborate with various domain experts. SEAHF particularly welcomes papers on the following topics:

- Smart technologies and Artificial Intelligence (SAI)
- Green Energy Production and Transfer Systems (GETS)
- Aerospace Engineering/ Robotics and IT (AERIT)
- Information Security and Mobile Engineering (ISME)
- IT in Bio-Medical Engineering and smart agronomy (BESA)
- IT, Smart Marketing, Management & Tourism Policy (SMTP)
- Technology and Education (TE)
- Hydrogen & Fuel cell energy technologies (HFCET)

Important Dates:

Paper submission due: October 31st, 2018
Decision notification: November 30th, 2018
Camera-ready copy due: December 15th, 2018

Submission Types:

Accepted types of submissions are including:

- Full papers,
- Short papers,
- Posters.

Also parallel activities and special session proposals are accepted:

- Tutorial
- Workshop
- Demonstration

IEEE PES Power & Energy Society®

IEEE Advancing Technology for Humanity

IREC 2019

International Renewable Energy Congress

The 10th International Renewable Energy Congress

March 26 - 28, 2019 Sousse- Tunisia

CALL FOR PAPERS

The **I**nternational **R**enewable **E**nergy **C**ongress **(IREC)** provides a forum for researchers, academicians, scientists and industrial professionals around the world on recent developments in the fields of renewable energy. The congress consists of keynotes, oral sessions and poster presentations. Considered as a catalyst for research works, the IREC publishes the best presented papers in partner journals.

Sousse - Tunisia

Authors from academia as well as industry working within the scope of the congress subjects are invited to submit their papers. Submissions will be peer reviewed by our International Program Committee on the basis of full manuscripts. Acceptance will be based on quality, originality and relevance. Contributions should be original and not published elsewhere or submitted for publication during the review period.

SESSIONS

Authors are invited to select one of the following sessions while submitting papers:

- **ESMAT: Energy Storage, Management and Transmission**
- **HYBIO: Hydrogen, Biomass and Other Sources**
- **SGMSD: Smart Grid, Micro-grid and Sustainable Development**
- **SLOEN: Solar Energy : Thermal, Photovoltaic and PV/T**
- **WEOFS: Wind Energy and Offshore systems**

SCOPES

Submissions may treat various scopes such as:

- **Materials and technologies**
- **Modeling and simulation**
- **Resource assessment and forecasts**
- **Optimization**
- **System sizing**
- **Instrumentation and Control**
- **Smart metering**
- **Energy efficiency**
- **Economics**
- **Sustainability, policies and regulations**

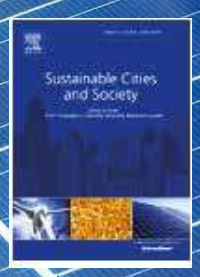
Special Sessions

Special issues of selected papers will be published in top journals

PSVHE
«Production, Storage and Valorisation of Hhydrogen Energy»

SCI Thomson (IF=3.41)

SSGC
«Smart Sustainable Green Cities»



SCI Thomson (IF=3.16)

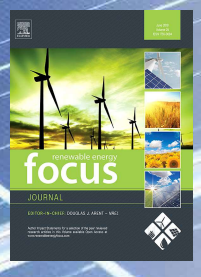
IREP
«Integration of Renewable Energy with Power Grid»

SCI Thomson (IF=1.78)

WSE
«Wind as a Source of Energy»

ESCI Thomson (IF=2.68)

ORER
«Optimization of Renewable Energy Resources»



Scopus (Hindex=17)

Contact : info@irec-conference.com Website : irec-conference.com

Université de Sfax

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Important Dates

Full paper submission
November 25th, 2018
Acceptance notification
February 6th, 2019
Camera ready
February 20th, 2019
Registration
February 25th, 2019

ALL PRESENTED PAPERS THAT FULFILL IEEE CONDITIONS WILL APPEAR IN IEEE Xplore

9th International Seminar on Fire and Explosion Hazards

St. Petersburg, Russia, 21-26 April 2019

The 9th International Seminar on Fire and Explosion Hazards ISFEH9 (www.isfeh9.org) will be held in St.-Petersburg, Russia, on 21-26 April 2019. This conference continues past successful events organized in Moscow, Russia (1995, 1997), Lake Windermere, UK (2000), Londonderry, UK (2003), Edinburgh, UK (2007), Leeds, UK (2010), Providence, USA (2013), and Hefei, China (2016).

During its more than 20-year history, the Seminar has become one of the important international events in fire and explosion science and engineering. The Seminar program will include broad areas of fire and explosion studies, mitigation, and prevention. The following conference tracks (with the variety of topics therein) are available for paper submission:

- Combustion fundamentals of fires
- Deflagration, DDT, detonation
- Fire dynamics
- Material behavior in fires
- Fire safety engineering
- Fire suppression
- Hydrogen safety
- Wildland fires
- Toxicity
- Evacuation and human behavior

Papers will be peer-reviewed and, if accepted, will be included in the book of the Seminar Proceedings. Authors of selected papers will be invited to submit extended versions for publication in special issues of *Fire Safety Journal*, *Combustion Explosion and Shock Waves*, and *International Journal of Hydrogen Energy*. These journals are indexed by Scopus and Web of Science.

Abstract submission deadline is July 1st, 2018. Please do your best to submit the one- or two-page abstract via the conference website http://www.isfeh9.org/submission by this date, and do not hesitate to contact ISFEH9 Organizing Committee at info@isfeh9.org if you have any inquiries. Notification with the decision on the abstract will be sent off as indicated in the Key Dates section of the conference website www.isfeh9.org.

The city of St.Petersburg is an exciting place to visit and has much to offer for participants and accompanying persons, for whom an extensive social program is being developed.

Welcome to submit your research to ISFEH9 and to visit St.Petersburg!

ICENES 2019

19th International Conference on Emerging Nuclear Energy Systems
6 - 9 October 2019, Bali, Indonesia

The 19th International Conference on Emerging Nuclear Energy Systems (ICENES 2019) is recognized as one of the major international conference on scientific, engineering, and other technical aspects of innovative nuclear reactor design, advanced nuclear technology, etc. In the conference, we are looking at "bold" and "unthinkable" ideas on a sound scientific-technical basis. Papers on strategy, concept, technique and method related to innovative nuclear system are welcome.

ICENES has been held in 14 countries as a venue for sharing ideas and research results on emerging nuclear energy technologies and applications. The ICENES 2019 will be held by The Technical University of Bandung in Holiday Inn, Bali, Indonesia (6-9 October 2019). The conference will cover keynote, invited and contributed oral talks and poster presentations.

Host organizations
Technical University Bandung
Bahçeşehir University

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Technical Topics

1. **Innovative Nuclear Energy Development Strategy**
1. **Advanced Fission Systems**
   - **Space Nuclear Reactors**
   - **Generation IV Reactors**
   - **Small Modular Reactor**
2. **Fusion Energy Systems**
   - **Magnetic Confinement Fusion System**
   - **Inertial Confinement Fusion System**
4. **Hybrid Nuclear Energy Systems**
   - **Fusion Driven Subcritical System**
   - **Accelerator Driven Subcritical System**
5. **Advanced Technology and Other Issues**
   - **Modeling, Database and Simulations**
   - **Advanced Fuels & Materials**
   - **Facility and Component Development**
   - **Radiation Protection & Shielding**
   - **Safety and Environment**
   - **Operation and Maintenance**
   - **Reprocessing**
6. **Nuclear Energy Expanded Applications**
   - **Solar and Wind Power**
   - **Hydrogen Energy**
   - **Nuclear Hydrogen Production**
   - **Others**
7. **Knowledge, Management**
8. **Human Resources and Social Issues**

Key Dates

- **April 30, 2019**
  Abstract Submission Deadline
- **May 30, 2019**
  Abstract Acceptance Notification
- **June 15, 2019**
  Early Registration Deadline
- **October 6-9, 2019**
  Conference Convened
- **September 30, 2019**
  Manuscripts Submission Deadline

Contact Information

Tel: +62 813 22 19 66 44
E-mail: awaris@fi.itb.ac.id
Website:
http://portal.fmipa.itb.ac.id/icenes2019

Upcoming Meetings & Activities

October 2018

4th International Conference on Recycling an Reuse
October 24-26, 2018
Istanbul, Turkey
http://rr.istanbul.edu.tr/

16th International Symposium on Metal-Hydrogen Systems
October 28-November 2, 2018
Guangzhou, China
http://www.mh2018.cn/dct/page/1

Batteries and Electric Vehicles Conference 2018
October 29-30, 2018
Port Elizabeth, South America
http://uyilo.org.za/Events/Batteries-and-Electric-Vehicles-Conference-2018

November 2018

16th Ulm ElectroChemical Talks (UECT)
November 13-14, 2018
Ulm, Germany
https://uect.de/home-2018

International Conference on Electronics, Energy and Measurement
November 27-29, 2018
Algiers, Algeria
https://ic2em-2018.sciencesconf.org/

December 2018

International Conference on Materials for Energy Applications
December 6-8, 2018
Jaipur, India
http://www.icme2018.subodhpgcollege.com/

7th International Hydrogen & Fuel Cell Conference
December 9-11, 2018
Jodhpur, India

Do you have a hydrogen-related meeting, workshop, or activity you would like us to include in the next issue of the IAHE Newsletter? If so, please email a description and web link to Kathy Williams at williamk@utk.edu.

January 2019

Twelfth International Symposium on Advances in Electrochemical Science and Technology (iSAEST-12)
January 8-10, 2019
Chennai, India
http://krc.cecri.res.in/isaest/Home.html

1st International Conference on Smart Innovation, Ergonomics and Applied Human Factors
January 22-24, 2019
Madrid, Spain
http://www.seahf.eu/

February 2019

Energy, Utility & Environment Conference (EUEC2019)
February 25-27, 2019
San Diego, California
http://www.euec.com/

March 2019

International School Progress in Hydrogen Safety
March 11-15, 2019
Belfast, Ireland
https://www.ulster.ac.uk/conference/progress-in-hydrogen-safety

April 2019

9th International Seminar on Fire and Explosion Hazards
April 21-26, 2019
St. Petersburg, Russia
http://www.isfeh9.org/

July 2019

Energy Security and Chemical Engineering Congress 2019
July 17-19, 2019
Penang, Malaysia
http://esche.ump.edu.my/index.php/en/

October 2019

19th International Conference on Emerging Nuclear Energy Systems
October 6-9, 2019
Bali, Indonesia
http://portal.fmipa.itb.ac.id/icenes2019

Get Connected—Internet Groups of Interest

LinkedIn Connections

Hydrogen Group

Hydrogen Group is a global specialist recruitment business, placing exceptional, hard to find candidates in over 70 countries.

Global Hydrogen Ambassadors Network

Their goal is to exchange opinions on a topic, which may look easy at first glance, but is rather complex. All questions are allowed. A wealth of answers can be expected.

World EcoEnergy Forum: Driving Innovation in the Energy Storage and Smart Grid Industry

The aim of this group is to bring together executives responsible for R&D to discuss about new product development and sustainable development in the energy storage and smart-grid industry.

Hydrogen Pathway

This is a very active group-page within LinkedIn that includes discussions and latest news regarding hydrogen energy.

Renewable Energy Solutions

I.R.E.S. platform to create bridges between international based investors, manufactures and wholesale companies in the Renewable Business Industry. Solar power, wind energy, tidal power, geothermal power, air power, hydrogen, waste management.

Global Renewable Energy Network

Global Renewable Energy Network (GReEN) is the premier business network for professionals and companies involved in the development, commercialization, and utilization of renewable energies (e.g. bioenergy, geothermal, hydro, hydrogen, ocean, solar, and wind), worldwide.

Fuel Cell & Hydrogen Network

Bringing together professionals and enthusiasts alike, the Fuel Cell & Hydrogen Network serves to connect those advocating fuel cell and hydrogen technologies. The group welcomes people who are interested in all types of fuel cell technologies as well as the wide variety of hydrogen technologies, and is not exclusive of hydrogen fuel cells.

Fuel Cells

Welcomes those who are interested in clean energy fuel cell applications and technologies. Encourages members to start discussions that are relevant to fuel cells, to post promotions and jobs, and to use this group to develop their professional network.

Fuel Cell Energy

The Fuel Cell Energy Group advocates the use of Fuel Cell Energy & the promotion of its Technology and for those interested in learning more about Fuel Cell Technology. Fuel Cell Professionals, Renewable Energy, Clean Technology, and Environmental Advocates are welcome. Solar, Wind, Biomass, Biofuel, Tidal Power & Wave Professionals also welcome to learn about this emerging technology.

Facebook Connections

Horizon Fuel Cell Technologies

Horizon Fuel Cell Technologies was founded in Singapore in 2003 and currently owns 5 international subsidiaries, including a new subsidiary in the United States. Having started commercialization with small and simple products while preparing for larger and more complex applications, Horizon already emerged as the world's largest volume producer of commercial micro-fuel cell products, serving customers in over 65 countries.

International Association for Hydrogen Energy

Facebook community for sharing the information regarding advances in hydrogen energy.

Blogs

Fuel Cell Nation

Fact-Based Analysis and Discussion of Clean Energy
http://blog.fuelcellnation.com/

H2-International

Offers a blog and newsletter that contains articles which are published in the German magazine HZwei. Offers detailed information on hydrogen and fuel cells, and is a respectful attempt at continuing the work of Peter Hoffman, the author of *Hydrogen & Fuel Cell Letter*.
http://www.h2-international.com/

Contacts and Information

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International Journal of Hydrogen Energy (IJHE)
The Official Journal of the IAHE
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