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Microsoft is getting hungry for fuel cells

Microsoft Corp. is moving to use fuel cells at its power-hungry server farms, saying the technology may double the efficiency of energy used.

The software company is testing how it can use the devices to generate electricity and plans to install a 10-megawatt fuel cell within a few years at a cost of about $45 million.

"This technology is very, very disruptive, and we're investing a lot of time and money into it," said Sean James, principal research program manager at Microsoft's R&D program on energy strategy. "We could almost double the energy efficiency. We've been able to model and measure in the lab that with fuel cells."

Once so expensive that they were only used in laboratories and space projects, fuel cells have spread to more commercial applications seeking lower-pollution forms of energy. They generate electricity through a chemical reaction involving natural gas, hydrogen or a biofuel. Companies developing them including Ballard Power Systems Inc., Ceres Power Holdings Plc and FuelCell Energy Inc. are also seeking to put them into home heating and to extend the range of electric vehicles.

Investment in the fuel cell industry has dipped in recent years, shrinking 85 percent between 2015 and 2016, according to data from Bloomberg New Energy Finance.

"While fuel cells were seen as the answer to electric vehicles in the 2000s, they never managed to achieve the scales of economy that we have seen with batteries," said James Frith, energy storage analyst at Bloomberg New Energy Finance. "This has led to fuel cells largely being left at the wayside."

Data centers are a good market for fuel cells because of the amount of power they consume. Worldwide, they draw more than 1 percent of the world's electricity. This demand is expected to rise as the global population becomes increasingly technology-savvy and more objects become gadgets as everything from thermostats to kettles connect to the internet. By 2020, 1 million new devices are expected to come online every hour, according to Microsoft.

Microsoft is also attracted to fuel cells because they are responsible for less greenhouse gases than traditional sources. Fuel cells that use natural gas emit small amounts of CO_2, but no pollutants such as sulfur or nitrogen oxides that are typically produced by burning fossil fuels. Microsoft gets 50 percent of its energy from solar, wind and hydropower and is targeting to increase that proportion to 60 percent by 2020.

While it will be using natural gas in its fuel cells at first, it will seek to procure a clean fuel such as hydrogen made from renewable energy in a similar fashion that it signs power purchase agreements with solar and wind developers, James said.

While Microsoft would like to install fuel cells in its data centers as soon as possible, the industry is nascent and it's not possible to buy the devices at the scale that the company would need, according to James.

"Essentially what we want to do is get out of R&D as soon as possible and actually use them to power the data center, we hope to do that as soon as possible," he said. "Unfortunately we have a supply chain issue. I need hundreds of megawatts of these things."

Source: https://www.bloomberg.com/news/articles/2017-10-31/fuel-cells-backed-by-microsoft-for-power-hungry-data-centers

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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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Nobel Laureate Gives Thumbs up for Fuel Cells: Opens ECS Meeting in Fuel Cell Car

History was made in October at the 232nd Electrochemical Society (ECS) meeting when Nobel laureate and former U.S. Department of Energy (DOE) Secretary Steven Chu arrived for his keynote speech in one of the world's first commercially available fuel cell electric cars—which was particularly fitting since electrochemistry was at the heart of enabling this technology.

Steven Chu gives a thumbs up while riding to ECS in a fuel cell electric vehicle.

Forty years ago, government, national labs, and industry convened to brainstorm options for reducing dependence on foreign oil and the DOE fuel cell program was born. Since then, researchers have made great strides by reducing platinum loading and improving electrode performance; achieving dramatic cost reductions and durability improvements; and eventually enabling industries to commercialize fuel cell technology.

Given that the 40th anniversary of DOE as well as celebration of National Hydrogen and Fuel Cell Day (October 8, aptly chosen for the atomic weight of hydrogen: 1.008) occurred during October, Chu's entry to the ECS meeting via a fuel cell electric vehicle—the very first at any ECS conference—was quite a sensation.

At his keynote speech, Chu spoke of exciting advances in the carbon-free production of hydrogen and CO from electrochemical reduction of CO_2 to H_2 and CO being the first step to the production of liquid fuels.

There are three fuel cell car models now commercially available in limited regions with a driving range of up to 360 miles, offering quick refuel, fuel economies of up to 67 miles per gallon gasoline equivalent, and completely pollution free from the tailpipe.

One of those fuel cell car models, the Toyota Mirai, was on display at ECS for the Fuel Cell Car Ride-and-Learn hosted by DOE. ECS attendees had the unique opportunity to see electrochemistry in action and ride in the Mirai.

The Mirai offers a driving range of 312 miles with a full hydrogen tank (H_2 Tank Capacity: 5.0 kg). It also provides a very impressive fuel economy of 66 mpg_{-US} for city, highway and combination case driving experience. The hydrogen being used as the fuel in the Toyota Mirai is stored within two-high-pressure carbon fiber tanks. During the acceleration, a nickel-metal hydride battery assists the fuel cell stack and the extra energy liberated during decelerating is also stored within the nickel-metal hydride battery.

DOE plans to participate in the 233rd ECS meeting next May in Seattle.

IAHE newsletter team members Yasser Ashraf Gandomi (l) and Cyrus Daugherty (r) participated in the Ride-and-Learn Event. Also pictured is Dr. Eric Miller, program manager of production and delivery at DOE.


Ride-and-Learn participants pose in front of the Toyota Mirai with Dr. Miller and Dr. Sunita Satyapal, director of the Fuel Cell Technologies Office at DOE.

Renewable hydrogen in Fukushima and a bridge to the future

Economic implementation of a new technology requires a bridge of practical actions that stretch from the settled status quo to the desired future state. Creating such a bridge is often difficult, and is made the more so when the new technology suffers a cost disadvantage vs. the incumbent. Such a disadvantage must generally be overcome by government subsidies and/or regulations – which tend to be complex and uncertain by their very nature. Proponents of the new technology must therefore employ every available expedient to minimize the cost gap. This is the implicit argument of those who foresee an important role for ammonia in the hydrogen energy economy. It is critical to take advantage of ammonia's favorable economics as an energy carrier whenever possible, especially if government support is involved.

These reflections were brought to mind by an August 1, 2017 announcement from the Japan Government's New Energy and Industrial Technology Development Organization (NEDO) that it will proceed with funding for the construction of a hydrogen production plant in Namie Township, about ten kilometers from the site of the Fukushima nuclear disaster. The project's budget is not mentioned, but the installation is projected to be "the largest scale in the world" — in other words, a real bridge to the future and not a demonstration project.

The project no doubt has a variety of motivations, not least the symbolic value of a renewable hydrogen plant rising in the shadow of the Fukushima Daiichi nuclear station. In economic terms, though, it appears to be a dead end. This is unfortunate because a similarly conceived project based on ammonia could be a true bridge-building step that aligns with leading-edge developments elsewhere in the world.

Project Essentials

The project developers are Tohoku Electric, Toshiba, and the industrial gas company Iwatani. The hydrogen will be produced by electrolyzers powered by a 20 MW photovoltaic farm installed on the same site. Tohoku will feed some of the electricity into its distribution grid. The electrolyzers, with a cumulative power rating of 10 MW, will be used as an energy storage mechanism. Equipment selection is not mentioned but it is fair to assume that Toshiba will supply its recently introduced alkaline water electrolyzers that can produce nine kg of hydrogen per hour. The plant will produce 900 tons of hydrogen per year.

The scale of the plant contrasts with a 100 MW plant announced by Nel Hydrogen (an NH_3 Fuel Association sponsor) in June 2017 that will be built for the French company H_2V. Like the NEDO plant, it will come on line in 2020. Nel's agreement with H_2V calls for "seven to eight" additional plants of this scale to be constructed in quick sequence after the first one. Nel is also discussing a 400 MW plant, equipped with electrolyzers that can produce 44 kg of hydrogen per hour, with an "international industrial company."

Economic Evaluation

The difference in scale between the 10 MW Japanese plant and the 100 MW French plant is the first factor that will undermine the economics of the Namie project. Earlier in 2017, IEA analyst Cédric Philibert modeled the economics of electrolyzer plants to determine the cost of hydrogen produced under various scenarios. Under currently prevailing design parameters, the capital cost of electrolyzers is about $850 per kW of power capacity. Philibert estimates that that cost will fall to $450 per kW for Nel's 400 MW plant. The effect of this difference on the cost of hydrogen is $0.20-$0.30 per kilogram. This is for a commodity whose baseline production cost is $1.00 per kg (via large-scale steam-methane reforming with natural gas priced at approximately $4.00 per GJ and downstream logistics excluded).

The next problem for the Namie plant is the nature of its electricity source. Philibert's analysis indicates that the price of electricity needs to be $30 per MWh or less if hydrogen is to be produced at a competitive cost. At 20 MW, the Namie solar farm barely qualifies as utility scale, and as such is unlikely to produce a levelized cost of electricity that is even close to the $30 benchmark. More significantly, Philibert argues that electrolyzer plants must have high capacity utilization to be competitive. For green hydrogen production, this is likeliest if two or more sources of renewably generated electricity are used. A plant whose electricity is priced at $60 per MW and whose capacity utilization is 50% (an optimistic assumption with a single source of renewable electricity) will produce hydrogen at a cost of approximately $3.40 per kg,

240% higher than the benchmark. By contrast, the H_2V plant, which is being deployed as a profit-making venture (albeit with help from the French tax code), will be powered with electricity from both solar and wind installations.

Yet another negative economic factor is downstream logistics. Iwatani plans to liquefy the hydrogen before transporting it. Iwatani holds about two thirds of Japan's industrial hydrogen market, delivering about a third of its volume in liquid form. In 2014, the *Nikkei Asian Review* reported that Iwatani was selling hydrogen – unprofitably — for ¥1,100 per kg ($10.00 at current exchange rates). Assuming refinery production of the hydrogen, transportation is clearly adding a significant increment of cost. By contrast, the H_2V hydrogen plants will be sited in such a way that they can inject their hydrogen directly into France's natural gas distribution system.

An Ammonia-Based Alternative

An alternative, ammonia-based scenario could involve a plant of similar scale to the Namie installation that is supplied by renewable electricity derived from multiple sources with complementary diurnal generation profiles. This scenario is close to one that was modeled earlier this year by the Dutch research agency Institute for Sustainable Process Technology (ISPT) as part of a groundbreaking feasibility study. As described in the study's final report, "In this option, electricity produced by means of a base load source of CO_2-free electricity (e.g. geothermal or hydro) is converted into H_2 by means of electrolysis and subsequently converted into NH_3. Then the NH3 is transported to Eemshaven by means of seagoing vessels. In the base case an electricity price of 25 EUR/MWh(e) [$30] is taken . . . [and a] 500 MWe (input) electrolyser case has been used."

The study concluded that the cost of the ammonia produced would be "between 365 and 500 EUR/ton, and with a combination of optimistic assumptions on CAPEX and power price, a NH_3 cost of 260-370 EUR/ton can be achieved." It should be noted that stakeholders from a number of countries are working on the concept of "distributed ammonia production" at relatively small plants that are powered with local generation resources, similar to the Namie concept. The Dutch engineering firm Proton Ventures, for example, has studied ammonia plants with an annual capacities ranging from 1,000 to 20,000 tons of ammonia (equivalent to 180-3,600 tons of pure hydrogen, the same order of magnitude as the 900 ton/year Namie plant). (Proton Ventures Managing Director Hans Vrijenhoef is a member of the NH_3 Fuel Association's Board of Advisors.)

Enabling Fuel Cell Vehicles

The intended use of the Namie plant's hydrogen is to power fuel cell vehicles (FCVs). FCVs today are a textbook example of a virtuous technology that lacks a bridge to the sustainable future. As discussed in a previous Ammonia Energy post, in Japan the vehicles cost more than comparable offerings even with government subsidies. The fuel costs so much more that the gap can scarcely be closed even with the superior energy efficiency of fuel cells. And fueling stations, currently very few and far between, are being rolled out at a slow pace.

The likeliest bridge to a FCV-friendly future might be a fueling station price of green hydrogen that is comparable on a per-MJ basis to incumbent light-duty vehicle fuels. This would allow the superior fuel efficiency to create operating economies for the vehicle owner that could offset the up-front price premium of the vehicle itself. Such a circumstance could stimulate market uptake which in turn could stimulate more rapid roll-out of fueling stations.

Petrol in Japan is currently priced at ¥131 per liter which translates to ¥4.1 per MJ. Hydrogen at ¥1,100 per kg translates to ¥7.8 per MJ, 90% higher than the figure for petrol. The cost of green ammonia in the basic ISPT scenario is ¥3.1 per MJ, and ¥2.3 per MJ in the optimistic scenario, 24% and 44% less than the petrol figure, respectively. Such savings might be enough to start a virtuous cycle of FCV uptake.

It should be emphasized that the ISPT study was based on estimates for costs as they could evolve by the early 2020s. But this is the point. Projecting technical capabilities and costs is one of the essential skills needed to build a bridge to the future. This is the only way that likely dead ends can be distinguished from building blocks that could carry us toward a sustainable outcome.

Source: http://www.ammoniaenergy.org/renewable-hydrogen-in-fukushima-and-a-bridge-to-the-future/

'Project Hesla' is the world's first hydrogen-powered Tesla

Elon Musk has made it pretty clear that he believes using hydrogen fuel cells as an alternative for vehicles isn't the right option when it comes to moving forward with green energy. However, this hasn't stopped many automakers from still pursuing the technology on their own. It's also led to one of Musk's very own Teslas getting the hydrogen treatment by a Netherlands gas supplier. The result? A vehicle with double the original range.

Using alternative hydrogen fuel cells has been a controversial topic for years. Musk doesn't even consider it debatable, calling the solution "an incredibly dumb one to pick." He argues that it's difficult to store hydrogen inside of a car and claims that it runs at half the efficiency of batteries. Of course, multiple automakers, like Toyota and GM, have still pursued hydrogen fuel cell vehicles.

Despite inefficiencies and expense concerns, General Motors plans to release 20 electric vehicles that run on both battery and fuel cells by 2023. There's some potential to create cheaper fuel cells with a new method to release hydrogen from seawater. Ultimately, battery-powered electric vehicles are expected to have a bigger share of the market than the hydrogen alternative.

These projections didn't stop one company from tinkering with Tesla's vehicles. The Holthausen Group was able to supplement a Tesla Model S with hydrogen power, calling it "Project Hesla." While the electrical part of the vehicle was not altered, they added lightweight hydrogen tanks and the infrastructure needed to make it work.

Through two power sources that were fully charged, the modded vehicle was able to reach approximately 620 miles in range. This would easily solve the problem with limited mileage in EVs today. However, engineers not only admitted that it was a difficult project to achieve, but it would likely add $58,000 US to the Model S. The vehicle already has a retail price of around $80,000 US.

In order for hydrogen fuel cells to be worth it, the infrastructure has to improve. Battery recharging stations are becoming more accessible and easier to find, but hydrogen fueling stations are still very limited across the United States. In fact, only a handful are found outside of California. However, just like we've found some cheaper ways to create hydrogen, companies like Toyota believe that hydrogen fuel cell vehicles will be on par with hybrids by 2025.

Tesla, expectedly, was not involved in the making of "Project Hesla." Knowing Musk's stance on hydrogen fuel cells, there will likely never be an official vehicle under the Tesla umbrella with the technology. Perhaps it'll be better served in public transportation and automation than with personal use.

"Where hydrogen would make sense is where high-capacity electric cars are already making the most sense, which is in super-controlled, standardized environments," Karl Brauer, executive publisher for Autotrader and Kelley Blue Book, told *CNBC*. "Hydrogen may never make sense for consumer vehicles...but it does make sense for B2B and B2C vehicles that do community standardized shuttling and personal transportation services."

Source:
http://www.greenmatters.com/renewables/2017/11/08/1jX12T/tesla-vehicle-range-hydrogen-modifications

General Motors, with an eye on China, promises at least 20 all-electric vehicles by 2023

Auto buyers have yet to show much love for electric cars.

Sales of the Tesla Model S and Model X have stalled at around 25,000 per quarter. The company has yet to prove it can make and sell the lower-priced Model 3 in large numbers, saying Monday that it had produced only 260 of the cars through Sept. 30. Chevrolet sells only a few thousand Bolt EVs a month, despite rave reviews. Electric cars total only about 1% of total passenger vehicles sold in the

U.S.

Yet last month, auto giant General Motors announced it will begin selling two new all-electric vehicles in the next 18 months, and will have at least 20 new zero-emission electric vehicles in its lineup by 2023.

The announcement follows similar plans revealed by major automakers around the world.

Volkswagen Group, which last year was the world's top automaker, has said it will offer 80 new electric vehicles by 2025, and will electrify its entire fleet by 2030.

Mercedes-Benz similarly promised to make all its cars available with electric drive trains by 2020, while Volvo and Jaguar have stated they will eventually stop building cars that run only on gasoline or diesel fuel.

"This latest event by GM regarding 'all electric' is further proof of a rapidly changing industry, whether the consumer wants it or not," said Rebecca Lindland, analyst at Kelley Blue Book.

If the consumer doesn't want it, at least not to date, who does?

China, India, France, the United Kingdom and California. All are reviewing plans to severely limit or ban regular gas and diesel engines between 2030 and 2040. Although details are scarce, automakers need to get ready.

This is especially true in China, which is both the world's largest auto market and its fastest growing. General Motors now sells more of its cars in China than in the U.S.

"China is their biggest market," said Michelle Krebs, analyst at Autotrader. "If China decides to go electric, they have to do it."

China's government last week announced that roughly 10% of passenger vehicles sold in 2019 will be zero-emission "new energy vehicles," moving up to 12% by 2020 and growing year by year. One highly placed Chinese official said the country may ban traditional engines altogether at some point in the future.

The stakes for automakers were made clear, Krebs said, by a Detroit auto executive who recently told her: "If the Chinese can regulate procreation, they can regulate electrification."

No one is expecting internal combustion engines to disappear anytime soon. In fact, many executives see hybrid cars and plug-in hybrids as a bridge that will move consumers toward all-electric cars.

"General Motors has drawn a line in the sand: Its future will be all electric," Krebs said. But she said GM was a little coy about what the new vehicles will be and when they'll start getting here.

"The automaker wisely gave no time frame for when its full line of product would be electric because, frankly, no one knows how the EV future will evolve," Krebs said.

GM Chairman and CEO Mary Barra made the announcement near Detroit at the company’s design center. The new cars, she said, are part of a sweeping plan to move toward an automotive world that includes “zero emissions, zero congestion and zero crashes.”

The two new cars will be based on technology derived from the company's Bolt EV, the 238-mile-range electric sedan that Chevrolet introduced late last year.

They will be plug-in electric vehicles or hydrogen fuel-cell vehicles that have no internal combustion engines and do not burn gasoline or emit harmful vapors from their tailpipes.

"GM is committed to a zero-emission future," said the company's advanced-technology spokesperson, Kevin Kelly. "We said the Bolt EV would be a platform for electric vehicles going forward. Today we are showing the next chapter of that."

The new vehicles could be more like SUVs or crossovers than standard passenger cars, Kelly said.

The company also said it is developing a new fuel-cell architecture that will allow twin electric motors, powered by compressed hydrogen, that could drive a heavy-duty truck, delivery vehicle or ambulance.

GM is basing the two new electric vehicles on Chevrolet Bolt underpinnings.

The company also pledged to start producing hydrogen fuel-cell vehicles for commercial or military use in 2020, and to convert its entire model lineup to zero emissions in the future.

The two new electric vehicles probably will be SUVs or maybe a sportier car designed to compete with Tesla's Model 3.

GM says most of the new vehicles will be based on a new electric architecture with a longer range than the Bolt's 238 miles.

The automaker made the announcements Monday at its technical center in the Detroit suburb of Warren. Executives offered few specifics on the new vehicles.

GM, with its Bolt and Volt plug-in hybrid, is pushing into an increasingly competitive space while facing an uncertain sales future.

Though Tesla says more than 350,000 people have put down $1,000 refundable deposits to get in line for the upcoming Model 3 sedan, sales of the Bolt EV have not met analysts' expectations.

On Monday, the company said it had produced only 260 Model 3s from the start of production in late July through Sept. 30, far short of the 1,500 vehicles it had forecast. Tesla had planned to be churning out 20,000 Model 3s a month by December, and 500,000 a year by the end of 2018.

In a note to investors, Tesla blamed "production bottlenecks" but offered no details. "It is important to emphasize that there are no fundamental issues with the Model 3 production or supply chain," the company said. "We understand what needs to be fixed and we are confident of addressing the manufacturing bottleneck issues in the near-term."

Analysts were more concerned with slow sales of the Model S and Model X, which have remained in the low to mid-20,000s for the last four quarters.

Source: http://beta.latimes.com/business/autos/la-fi-hy-general-motors-electric-20171002-story.html

Electric and fuel-cell carmakers dream of an airless tire

Toyota debuted a new hydrogen fuel-cell concept car, the Fine-Comfort Ride, at the 45th Tokyo Motor Showthat wrapped up on November 5. The Fine-Comfort Ride signals Toyota's ongoing commitment to fuel-cell vehicles—the company still believes that fuel cells will eventually beat electric batteries on cost. Even though Toyota insists on going its own way on emission-less cars, they showcased one piece of technology that should also appeal to electric car makers trying to save weight: Sumitomo's prototype airless tires. Sumitomo's prototype is essentially a band of rubber wrapped around a plastic-aluminum hub and has already been tested on golf carts and small Japanese kei cars.

Toyota and Sumitomo still have to solve some problems before the tires will be commercially viable: right now the airless tire prototypes weigh about the same as their air-filled cousins and still have 10-20% more rolling resistance than air-filled tires. Rolling resistance refers to the force resisting motion when a body rolls on a surface. One major factor contributing is the deformation of the wheels—imagine a typical pneumatic tire with too low pressure flattening as it meets the road, increasing the size of the contact surface and thus increasing the rolling resistance of the tire.

Rolling resistance is why properly inflated tires help save fuel costs, and it explains why airless tires, which exhibit much more deformation, have not been introduced to the market yet. Until airless tires weigh less than traditional pneumatic tires and have comparable rolling resistance, makers of fuel-cell and electric cars

will not see any performance gains by switching to them. At the Tokyo Motor Show, Toyota's chief engineer Takao Sato said he expects to shave enough weight off the airless tires to make them comparable to pneumatic tires by 2025.

Sumitomo's airless concept joins a select group of tire-makers developing airless car technology—Michelin introduced its Tweel airless tires in 2005, and started selling them in North America for steer-skid loaders in 2012. In 2015, Hankook introduced their 5th airless tire prototype, the iFlex. In 2013, Bridgestone unveiled their second generation 'Air Free Concept (Non-Pneumatic) Tire'. Polaris has sold its TerrainArmor airless tire with its ATVs since 2013, boasting that it can take a .50 caliber round and drive another 350 miles.

So far, airless tires have seen use in specific industrial and commercial applications where the vehicle lacks suspension such as a lawnmower or skid-steer loader, where the vehicle is exceptionally light, like a golf cart, and is able to avoid serious tire deformation, or where the vehicle is extremely heavy and needs to avoid punctures while traversing a job site.

The most farsighted concept in the airless tire space is Michelin's new 3D-printed prototype that combines wheel and tire in one, nicknamed 'The Vision'. The tire features a psychedelic, blue-webbed structure and is composed of organic, recyclable materials, with orange zest instead of petroleum being used for the resin. The reloadable tread band can be easily retreaded with custom patterns—for snow or sand, for instance—with a 3D printer and has embedded sensors that collect diagnostic information for the driver.

Source: https://www.freightwaves.com/news/2017/11/6/electric-and-fuel-cell-carmakers-dream-of-an-airless-tire

China develops world's first hydrogen-powered tram

As the world's biggest polluter, China may have earned its reputation as the big bad wolf of greenhouse gas emissions. That being said, officials left many with their mouths open recently after their rare admission that they are aware of the negative impacts emissions have on

global climate, which could threaten the country's infrastructure projects, crop yields and environment.

Although still reluctant to set a target for slashing emissions, China is investing a substantial amount into green energy and was even a world leader in renewable energy production back in 2013. They generate more wind power than any other country in the world and their contributions accounted for almost 30% of all global investment in clean energy. Now, continuing with their push for clean energy developments, China has just announced the production of the world's first hydrogen-powered tram.

The vehicle was developed by Sifang, a subsidiary of China South Rail Corporation, and was rolled off the assembly line in Qiangdao, Shandong Province, last week. Although hydrogen fuel cells have been around for a while and are currently being used and tested in various vehicles, including buses, nobody had managed to master the technology for trams before.

"It took two years for Sifang to solve key technological problems, with the help of research institutions," said chief engineer Liang Jianying, according to Xinhua news agency. But Liang did not give any indication as to when the tram would be in operation.

As pointed out by RT, hydrogen-powered trams are an attractive mode of transport for numerous reasons. Hydrogen is extremely abundant and can be extracted from a variety of sources, both renewable and non-renewable. Furthermore, hydrogen fuel cell vehicles are zero emission, producing only water. The newly designed vehicle will also help slash energy running costs as one tank will last for around 100 kilometers (62 miles), and it only takes three minutes to refuel.

"The average distance of tramcar lines in China is about fifteen kilometers [nine miles], which means one refill for our tram is enough for three round trips," said Liang.

Source: http://www.iflscience.com/technology/china-develops-worlds-first-hydrogen-powered-tram/

Secretary Perry test drives hydrogen fuel cell car to commemorate National Hydrogen and Fuel Cell Day

To commemorate National Hydrogen and Fuel Cell Day, the U.S. Department of Energy Secretary Rick Perry drove one of the world's first commercial fuel cell electric vehicles at Department of Energy headquarters in Washington, D.C. Now commercially available, fuel cell vehicles are a part of America's transportation portfolio, bringing the country a wider range of clean transportation options.

Secretary Perry's timing for driving the fuel cell vehicle coincides with the release of a new report showing DOE-funded research resulted in over 650 U.S. patents and citing roughly 75 innovations that could potentially be commercialized by American industry in the next several years. These emerging hydrogen and fuel cell technologies have economic growth potential and can provide Americans with cleaner and more resilient energy options across a wide range of applications.

DOE has funded early-stage hydrogen and fuel cells research and development enabling a 60% reduction in fuel cell cost, a fourfold increase in durability, and an 80% cut in the cost of electrolyzers (for hydrogen production) over the past decade.

There are now nearly 3,000 commercial fuel cell cars on the road, with industry projections for roughly 40,000 by 2023. These cars can refuel in minutes, offer fuel economies of over 60 miles per gallon gasoline equivalent, and have a driving range of over 300 miles. The U.S. currently has about 30 public hydrogen fueling stations, located primarily in California, with plans for 100. At least an additional 12 are planned for deployment in the Northeast with private funding.

National Hydrogen and Fuel Cell Day, aptly chosen for the atomic weight of hydrogen (1.008), recently occurred on October 8. DOE's Fuel Cell Technologies Office and the national labs are celebrating with activities and announcements across the country throughout the month of October.

DOE's Office of Energy Efficiency and Renewable Energy supports early-stage research and development of energy efficiency, sustainable transportation, and renewable energy technologies that make energy more affordable and strengthen the reliability, resilience, and security of the U.S. electric grid. The Fuel Cell Technologies Office contributes to EERE's mission by working with industry, academia, and national laboratory partners on a balanced portfolio of research in hydrogen and fuel cell technologies.

Source: https://energy.gov/eere/articles/secretary-perry-test-drives-hydrogen-fuel-cell-car-commemorate-national-hydrogen-and

Toyota targets 620-mile range with concept fuel-cell vehicle

Toyota Motor Corp. is set to unveil a fuel-cell concept car that aims to offer 50 percent more driving range than its current hydrogen-powered sedan in a technology push that defies a rising wave of battery-driven vehicles.

Japan's biggest auto manufacturer is targeting a 1,000-kilometer (620-mile) range for the Fine-Comfort Ride concept under local standards, compared with about 650 kilometers for the current Mirai fuel-cell vehicle, according

to a statement Wednesday. The concept car, to be introduced at the Tokyo Motor Show next week, will include artificial intelligence and automated driving features.

Toyota is continuing to champion fuel-cell vehicles as the ultimate zero-emission cars, even as the falling cost of lithium-ion batteries has lured a majority of automakers to plug-in technology in the face of ever more stringent environmental standards worldwide. China, the world's largest market, said last month that it was working on a timeline to end the sale of internal-combustion vehicles, joining countries including France, India and the U.K.

While Japan has created a Hydrogen Society Roadmap to increase the number of fuel-cell vehicles on its roads to 40,000 by 2020, there are currently just 2,200 or so. Bloomberg New Energy Finance estimates the government will only achieve 60 percent of its target.

Honda, Lexus

Other than the Mirai, which Toyota launched in late 2014, only Honda Motor Co. has a hydrogen-powered car for sale in the country, the Clarity Fuel Cell. Toyota's luxury arm, Lexus, has also committed to bringing a hydrogen-powered model to the market, introducing a concept sedan in 2015. Toyota aims to boost annual global sales of fuel-cell vehicles 10-fold to 30,000 units by about 2020 or after with a broader lineup.

The Fine Comfort-Ride sedan can accommodate six people and seats can be rearranged so that they all face inward. A Toyota spokeswoman declined to provide additional details of the powertrain or self-driving technology.

Although hydrogen vehicles can be refueled in about three minutes and have a substantially longer range than electric cars, they suffer from a lack of infrastructure. There are only 91 hydrogen stations in Japan, with the government targeting 160 by 2020, according to BNEF.

By comparison, Japan has about 7,200 public quick chargers for EVs, according to a Nissan Motor Co. estimate. Nissan's Leaf takes about 30 minutes to charge and offers about 400 kilometers of driving range.

To encourage the establishment of more refueling stations, Toyota is developing hydrogen-powered commercial vehicles, including a delivery truck it will use in a project with convenience store 7-Eleven Japan. A pair of Toyota fuel-cell buses began operation in Tokyo this year. The company has also joined with Honda and Royal Dutch Shell Plc to build seven hydrogen refueling stations in California.

Source: https://www.bloomberg.com/news/articles/2017-10-18/toyota-targets-620-mile-driving-range-with-fuel-cell-concept-car

Hydrogen is (still) the fuel of the future, says Kia

The hydrogen fuel cell sector has been in and out of the automotive limelight over the past decade. Toyota's announcement in 2015 of making thousands of hydrogen fuel cell patents available on a royalty-free basis brought the technology back into focus. Does this mean affordable fuel cell vehicles (FCEVs) could be on our driveways any time soon? Although there is still some work to go, Kia believes it has the solution.

As the name suggests, a FCEV uses a fuel cell instead of a battery or super capacitor to power its on-board electric motor. Fuel cells in vehicles generate electricity to power the motor, typically using oxygen and compressed hydrogen. Like battery electric vehicles (EVs), they are silent to drive and emit no harmful emissions. The only waste is water vapor.

Cast your mind back a decade or so ago and you'll recall how hydrogen was among a number of promising alternative fuel candidates to replace petrol, compressed natural gas, bio-diesel and battery-electric power.

For a variety of reasons, however, demand for battery EVs has gradually increased to the point where every carmaker offers at least one battery-powered car.

Yet FCEVs have a few advantages over battery EVs. Unlike battery EVs that take several hours to recharge, hydrogen fuel cell cars can be refueled in minutes.

The driving range of hydrogen FCEVs is also favorable compared to battery EVs. While FCEV can roam over 300 miles (Toyota Mirai claims 342 miles), most EVs range well below that.

A few carmakers have offered hydrogen-powered FCEVs,

albeit leasing them in modest numbers. They include Toyota (Mirai sales to government and corporate customers began in Japan in late 2014) and Hyundai ix35 (also known as Tucson Fuel Cell in some markets) FCEV has been available for lease since 2014. And despite some press reports stating otherwise, Daimler says it still sees a future in the fuel cell.

Although hydrogen FCEVs perform a clever chemical trick, they have some downsides. They are far more expensive than most cars with an internal combustion engine or, for that matter, battery-electric powered one. For example, a Toyota Mirai FCEV will set you back £66,000 in the UK whereas a Nissan Leaf will cost less than half that.

There are also very few hydrogen refueling stations dotted around the globe. In the US there are currently just 39 such stations. 35 of which are in California (up from nine in 2014). So you are free to roam around the state but must stay within reach of a station. Japan got its first commercial hydrogen fueling station in 2014. By March 2016, the country had 80 stations, and the government aims to double this number by the 2020 Olympics.

1,000 Kia FCEVs to be produced annually-

Toyota, Hyundai, Honda and Daimler are not the only carmakers pushing back the technical boundaries of FCEVs. In November 2015, Kia Motors stated it will launch a fuel cell vehicle. The carmaker is targeting a 2020 launch for mass production of an all-new hydrogen FCEV, featuring its next-gen hydrogen fuel stack technology. Kia says it is working alongside 300 partner companies to develop this technology for global markets. Production of the new Kia FCEV is aimed to be around 1,000 units per year, a figure expected to rise as demand for fuel cell vehicles increases.

-with a 500 mile range

Kia's FCEV will feature a fuel stack similar in size to a 2.0-litre internal combustion engine, which development teams believe will offer drivers a high level of durability and power density from the advanced powertrain. Kia engineers are planning to develop the brand's next-generation fuel cell stack to be 5% more efficient and offer 10% greater stack performance, despite being around 15% lighter and 15% lower in volume, compared to current generation fuel cell stacks. The result is a targeted range of more than 500 miles from a single fill-up and a top speed of around 170 kph (106 mph).

Kia's research into fuel cells date back to 1998, which resulted in the creation of the limited production Kia Mohave FCEV, able to travel up to 428 miles on a single fill-up.

These plans, says Kia, will contribute towards its aim to raise its average corporate fuel efficiency by 25% over 2014 levels by 2020. As well as investment in advanced propulsion technologies, Kia will also replace seven out of its 10 current engine ranges with next-generation gasoline and diesel units, while increasing the number of turbocharged engines. Higher-efficiency, multi-speed transmissions are also planned, while Kia engineers are targeting a 5% reduction in the average weight of new car bodies through greater application of ultra-high strength steel.

Meanwhile, Kia's sister brand, Hyundai, has set its sights on launching its next-generation fuel systems on a production car next year. Last summer, at a preview event in Seoul, the carmaker displayed a near-production-ready hydrogen fuel cell vehicle.

While critics doubt whether hydrogen will be efficient or cost-effective for cars compared to other zero-emission, technologies, Dr. Sae-Hoon Kim, who is in charge of Kia's fuel cell research, believes that the next generation of FCEVs will be cheaper, more durable and reliable.

Speaking to just-auto during a press visit to Kia's operations in Seoul, he said that the cost of FCEVs will tumble as production increases. "We can say that fuel cell technologies are technically ready for the market. There is a lot of potential for the cost of FCEVs to come down but production volumes is a very dominant factor."

In terms of the durability of the car, Kim expects it will increase from six years as he told us in 2014: "I think we can expect it can go more than ten years," he remarked.

Kim also referred to an industry group calling itself the Hydrogen Council, who met for the first time at the World Economic Forum in Davos, Switzerland last January. The group is composed of 17 CEOs or chair people from energy companies and automakers including Hyundai. Its objective is to "increase visibility around the hydrogen solutions currently available and ... advocate for the important role of hydrogen technologies."

Seoul-based Hyundai Motor Group (HMG) is the parent of both Hyundai Motor Co (Hyundai and Genesis) and Kia Motors Corp (Kia brand). HMG owns 32.8 percent of Kia Motors, having bought what was once its great rival from the receivers following Kia's bankruptcy. The parent group's HMC and KMC divisions operate independently, with each company challenging the other. Kia had a good sales month in its domestic market last September. In the first nine months of the year, however, its global sales were still 6.1% lower at 2,011,697 units compared with 2,142,596 units a year earlier. HMC and KMC hope an improvement in diplomatic relations between South Korea and China will help improve sales in the world's largest vehicle market in coming months.

Source: https://www.just-auto.com/analysis/hydrogen-is-still-the-fuel-of-the-future-says-kia_id179621.aspx

Fuel cell car-sharing fleet planned for southern California

StratosFuel Inc., a developer of hydrogen fueling stations, renewable production facilities and station user interface solutions, has received a notice of proposed award from the California Energy Commission (CEC) for a $684,421 grant to launch a fuel cell electric vehicle (FCEV) car-sharing service.

According to StratosFuel, the proposed award will go toward purchasing 15 FCEVs that will be deployed in east-central Southern California. The award comes after the CEC released a grant solicitation entitled "Innovative Service Mobility Demonstrations with Zero-Emission Vehicles" on March 9. StratosFuel says the grant solicitation made available $3 million in an effort to fund up to four innovative electric vehicle mobility service projects in four specific California regions.

According to the company, the car-sharing fleet of 15 FCEVs will increase zero-emission ridership in disadvantaged communities and increase throughput at public-funded hydrogen refueling stations (HRS). To begin, the cars will be deployed near the Ontario and Riverside hydrogen stations. The fleet will consume 100% renewable hydrogen, furthering StratosFuel's renewable hydrogen initiative.

Jose Magana, COO of StratosFuel, comments, "Having this fleet will be a great opportunity to increase the utilization of our Zero Impact Production facility and to further the use of our cost-competitive renewable hydrogen, furthering our goal of making hydrogen an everyday fuel."

StratosFuel says it will begin sharing cars under the brand name StratosShare. Riders will be able to rent and share vehicles based on location, which can conveniently be booked through a smartphone application. The company claims StratosShare will be competitively priced and include fuel, as well as insurance into the rental fee. Riders will have the option to either rent a vehicle by the hour or day. Further details, including a planned program launch timeline, were not disclosed.

"We want to provide a zero-emission vehicle alternative to the shared mobility sector and do so with convenience," says Jonathan Palacios-Avila, CEO of StratosFuel. "Sharing a FCEV is a great opportunity for drivers to understand the simplicity of driving and refueling an electric vehicle in minutes."

StratosFuel says it plans to expand its FCEV fleet to other regions in California, as well as add more vehicles to the fleet. The Stratos team is currently speaking with cities and other station developers to identify future deployment locations.

Source: https://ngtnews.com/fuel-cell-car-sharing-fleet-planned-southern-california

Riversimple will start trials of its hydrogen-powered car next year

Hugo Spowers has been working on hydrogen-powered cars for more than 15 years. Riversimple, his Powys-based company, is gearing up for the biggest test of its Rasa car

to date. In 2018, it will begin a beta trial of the hydrogen vehicle.

There are 750 people signed-up for the pilot scheme across the Monmouthshire region, according to Spowers. "We should have the first car running in January," he says. "And we should have the 20 built and in operation by June."

During the trial, which is funded by a European Union grant for 12 months, the cars will be tested on a "broad range of users". This includes members of the public, private sector companies and Monmouthshire council. It's unlikely an individual will have a car for the whole 12-month test, with vehicles being shuffled between testers to get the most feedback.

Riversimple had previously said it would test 20 cars in the UK this year, but missed its self-imposed target.

Dubbed the Rasa, Riversimple's two-seater car weighs around 580kg. In the tussle between form and function, the end design is the result of compromise. "It is a low car and it is a very low seat," says Spowers, who was amongst the speakers at WIRED Energy. "We want to see how older people will react to it." Part of the trial in Wales will be to see how different drivers adapt to the car. This, Spowers adds, will help it to decide who to market the vehicle to.

The Rasa is powered by a hydrogen fuel cell and has a range of around 300 miles. The cars aren't designed to drive 300 miles in one trip but cover that distance over a number of weeks and be used for shorter, local, journeys. The fuel cell has already been used by fork lift trucks.

While electric cars are growing in popularity, Spowers believes that as demand for power grows the automotive industry will need to focus on hydrogen fuel cells to prevent the grid from being overloaded by demand from large batteries. "It's really inconceivable to imagine replacing our thousands of filling stations and millions of cars with batteries. Refueling a hydrogen car is similar to a petrol car."

"We're not going against the industry," Spowers says. Elsewhere, Japan is one of hydrogen's biggest proponents. Honda and Toyota both have fuel cell vehicles on the road and the country has even touted the idea of a hydrogen-fueled Olympic torch for the 2020 Tokyo games. Hydrogen trains have also been tested in Europe and ways of producing hydrogen are being refined in laboratories around the world.

Ahead of the Riversimple trial in 2018, the first carbon fiber chassis has been delivered to its headquarters and the structural design has been completed. The Rasa is being constructed in the UK but is mostly built with components manufactured abroad.

"As soon as we've got these cars built, our design program forks," Spowers says. "The production version by-and-large will look the same. The surfaces will be changing slightly, we're going to be doing more aerodynamic work."

Riversimple has set itself the ambitious target of bringing its vehicles to market towards the end of 2020. When this happens, it plans to make the cars available on a subscription basis. Similar proposals have been put forward for autonomous vehicles.

"We're probably the only car company that hopes never to sell a car," Spowers says. A customer would sign-up for a fixed price contract of one to three years, which would include use of the car, insurance and fuel. "They don't have to worry about the maintenance or depreciation," he adds. Once the contract expires, the customer gives it back to Riversimple and in theory the firm would be able to hire it out again.

There are a number of challenges for Riversimple before it gets to this stage. It needs to be able to create the infrastructure to refuel vehicles, ensure the technology can be produced cheaply enough for it to make a profit, and produce the vehicles at commercial scale. In 2018, the firm will take its next big step.

Source: http://www.wired.co.uk/article/riversimple-uk-test-hydrogen-cars-wales

Study: Cars can't yet match electric vehicles on efficiency

If you prefer gasoline-power over a fully electric vehicle, you'll have to buy a car that's a lot more fuel miserly than the one you're probably driving now if you want to try to match efficiency.

A new study by the University of Michigan Transportation Research Institute finds that gas-powered vehicles need to average 55.4 miles per gallon in the U.S. in order to produce fewer greenhouse gas emissions than a battery-electric vehicle.

That's because even most electric cars aren't oil or coal free. Their batteries are charged by electricity generated at power plants, which often are fired by oil or coal.

The disparity between electric vehicles and conventional gas-powered cars depends on what is used to make the electricity that charges a battery. In countries where coal or oil is king, generating electricity for a full charge creates more carbon dioxide emissions than in places where hydroelectric power, for example, is the main source.

Gas-powered cars sold in the U.S. have a long way to go to match electrics. The mileage leaders among subcompact cars in the U.S. are the Ford Fiesta SFE and Toyota Yaris iA at 35 mpg in combined city and highway driving, the U.S. Energy Department and Environmental Protection Agency say. Hybrids, those vehicles with gas and electric power plants that work together, do better.

In weighing the impact, the Michigan researchers Michael Sivak and Brandon Schoettle also considered the impact of extracting and transporting the raw materials for either electricity or gasoline production. The study looked at only fully electric vehicles, which are known as battery electric vehicles—not plug-in electric hybrids—vs. gas-powered cars.

Sivak and Schoettle reviewed data for 143 countries, finding wide disparities in those values. Albania, which produces all of its electricity from hydroelectric power, was at the high end of what a gas vehicle's mpg would need to be to beat a fully electric vehicle. At the other extreme were Gibraltar and Botswana, where electricity is produced from either coal or oil. The study relied on data from the Union of Concerned Scientists and the International Energy Agency.

The study did not consider the impact of manufacturing the vehicles, but did note that the Union of Concerned Scientists has found that building a mid-size fully electric vehicle results in 15% higher emissions than building a mid-size gasoline-powered vehicle. Larger battery packs push that gap to 68% higher for full-size vehicles.

The data comes during a time of uncertainty for fuel economy standards and electric vehicle incentives. During a visit to Ypsilanti, Mich., in March, President Trump opened the door to loosening current fuel economy standards that require automakers to achieve have their vehicles collectively achieve 54.5 mpg by 2025.

In addition, the latest tax proposal from House Republicans would end the $7,500 tax credit for electric vehicles, which could put a damper on their sales.

Source:
https://www.usatoday.com/story/money/cars/2017/11/13/cars-need-match-mpg-beat-electric-vehicles-efficien-shockingly-more-efficient-match-electric-vehicle/850295001/

Can California eliminate gas cars?

State leaders are discussing banning the sale of cars that run on gasoline or diesel

More than 25 million cars cruise the roads in California, a testament to the state's love affair with driving. A tiny slice of those vehicles are electric or plug-in hybrid models.

That's not nearly enough for state leaders who want to wage a fierce battle against climate change. They're discussing a move that some consider radical: banning the sale of cars that run on gasoline or diesel.

Gov. Jerry Brown (D) recently asked Mary Nichols, chairwoman of the state Air Resources Board, "Why haven't we done something already?" The message, first reported by Bloomberg, came after China made an announcement to

restrict internal combustion engines.

"Given the existential challenge we face, the administration is looking at many, many possible measures—including additional action on electric vehicles—to help rapidly decarbonize the economy and protect the health of our citizens," the Brown administration said in a statement to E&E News.

Switching to all clean cars would require a herculean transformation in the Golden State. They accounted for less than 5 percent of car sales in the first six months of this year, even as the state offers plum incentives to motorists. Challenges include concerns about how far clean cars can travel and a lack of charging stations.

Lawmakers are also targeting gas and diesel cars. Assembly member Phil Ting (D) plans to offer a bill phasing them out, introducing it when the Legislature convenes in January. The measure he'll draft would ban dealers from selling them starting in 2040. The move is designed to increase the use of zero-emissions vehicles, or ZEVs: plug-in electrics, hybrid plug-ins and hydrogen fuel cell cars.

Ting said it's needed if California hopes to cut its greenhouse gas emissions 80 percent by 2050. Transportation accounts for about 37 percent of state emissions.

"If we don't do something very aggressively on changing people's habits in regards to passenger vehicles, we're not going to be able to come close to meeting our greenhouse gas reduction goals," Ting said in an interview.

In addition to China, officials in France and the United Kingdom have said they're considering banning internal combustion engine vehicles. Neither has approved policies to do that, but Ting said their pledges factored into his thinking.

Right now, California motorists own roughly 334,000 cars that qualify as ZEVs.

That raises the question, is it even possible to get rid of gasoline-powered cars? Experts said it depends on how much you believe technology could advance, how much battery costs might fall, and how the marketplace responds to a world with cheaper clean cars and more charging stations. For now, those are theoretical conditions. There are just 14,000 EV charging stations in the state currently.

Whether it can work "depends on what you're willing to give up," said Jeremy Michalek, director of the Vehicle Electrification Group at Carnegie Mellon University. "Right now, we don't have good, affordable alternative solutions for all uses of automobiles."

Some drivers commute long distances for work, and forcing them to drop gasoline is "a bit of a challenge," he said.

"The electric technology doesn't offer the range to accomplish that," Michalek added. Light-duty trucks would burn through an electric charge by hauling cargo. Fuel-cell vehicles could offer needed range, he said, but the refueling infrastructure doesn't exist.

"Setting a date by which we will ban that technology, with the assumption that other technologies will have closed the gap for all those applications, I'm not sure anybody knows what the state of the technology will be in 2040 and whether that will be something that we can do without other significant trade-offs," Michalek said.

More EVS Coming Soon

The car industry is starting to shift toward more clean cars. General Motors Co. and Volvo are among the automakers saying they plan to embrace electrification.

In the next 18 months, GM will introduce two all-electric vehicles. Those models are among 20 electric cars the company plans to launch by 2023, according to GM spokeswoman Elizabeth Winter.

"We believe in a vision of a world of zero emissions and that this is the right time to show how the company aims to get there," she said.

Source: https://www.scientificamerican.com/article/can-california-eliminate-gas-cars/

Fuel cell technology proves value in hurricane relief efforts

Congress, like most Americans, may not be fully aware of a growing energy source powering industry today, which explains why fuel cell technology isn't being treated fairly. While it's largely out of public view, it was one of the unsung heroes in this year's hurricane disasters.

When Hurricane Irma struck Florida in September, one of Walmart's distribution centers lost its supply of electricity. Fortunately, its fleet of warehouse forklifts were powered by hydrogen fuel cells.

If these trucks had run on traditional lead-acid battery power, the generators would not have been able keep up with the needs, and the fleet would have quickly run out of power.

When Hurricane Harvey flooded the Houston area, outdoor hydrogen pads were submerged. Redundant safety features nevertheless kept hydrogen continuously running to forklift truck operations around the clock.

The ability of hydrogen fuel cells to withstand these natural disasters ensured that the delivery of food, water and other supplies could continue to those in need.

This success builds on a growing record of fuel cells enhancing consumer's resilience to natural disasters. Stationary fuel cells have powered data centers, manufacturers, hospitals and utility customers through everything from a magnitude 6.0 earthquake in California to Super Storm Sandy.

Following Sandy, more and more companies and cities have been utilizing fuel cells to power microgrids for critical infrastructure. The City of Hartford now powers an emergency shelter, supermarket and gas station in the center of the city with fuel cells.

Now, that the next time a storm knocks out the grid, the city can provide shelter, fuel and food to displaced residents.

What makes fuel cells so resilient and relatively immune to the power interruptions that come with major storms and natural disasters is the fact that they generate electricity on site.

A major advantage over traditional lead-acid batteries is that they can refuel much faster and their efficiency allows them to run much longer between charge-ups.

It's important that Congress recognize the critical role that fuel cell technology plays in producing clean and reliable energy. Congress fumbled the ball in December 2015 by extending investment tax credits to solar energy companies until 2024, while letting incentives for fuel cells lapse.

This short-sighted policy decision has unfairly punished fuel cells which are proving their value today and may well revolutionize the way American power is generated in the future. At this point, it doesn't matter how it happened, it matters how to fix it.

The time has come for Congress to place fuel cell technology on an equal footing with solar energy rather than arbitrarily picking winners and losers.

The timing is crucial for this nascent energy source because China has made dominating the industry a priority in its five-year plan. While America is currently the world leader, China's government is subsidizing nearly half of the funding needed for its manufacturers to build their own fuel cell industry.

The recent hurricanes devastating Florida, Texas and Puerto Rico should also give Congress a sense of urgency. Fuel cell-powered networks have proven invaluable in backing up communications systems used by first responders and emergency call operators.

Local fuel cell networks mean that hospitals will have electrical power even when disaster strikes and that refrigeration for blood and medical supplies will continue uninterrupted. In times of national emergency, fuel cells must be there to assure that critical facilities can continue and that supplies of gasoline and clean drinking water will not be cut off.

Congress has an obligation to embrace this resilient and reliable energy technology and place it on equal footing with other energy sources as part of our effort to advance an all-of-the-above energy strategy that delivers more American-made energy.

The House is working to fix this with legislation, led by Reps. Tom Reed (R-N.Y.) and Patrick Meehan (R-Pa.)

that has over 116 co-sponsors. Now, the Senate needs to do the same in their tax reform legislation with Sen. Heller's (R-Nev.) S.1409. We need to allow fuel cell energy to reach its full potential and help power America.

Source: http://thehill.com/opinion/energy-environment/360167-fuel-cell-technology-proves-value-in-hurricane-relief-efforts

ABB to deliver first fuel cell system for Royal Caribbean

Heavy electrical company ABB announced it will deliver its first fuel cell system to be piloted on a Royal Caribbean cruise ship. This will be the first fuel cell system to provide an energy source for a luxury cruise ship.

The pilot installation, including control, converter and transformer technology from ABB, will generate 100 kW of energy, and has been fully developed, marinized, assembled and tested by ABB Marine & Ports. ABB selected an FCvelocity® proton exchange membrane (PEM) pure hydrogen fuel cell engine from Ballard Power Systems for its pilot system.

"Our goal is to take the smoke out of the smokestacks", said Harri Kulovaara, Executive Vice President of Maritime and Newbuilding, Royal Caribbean Cruises Ltd. "We are dedicated to innovation, continuous improvement, and environmental responsibility, and using fuel cell technology gives us the opportunity to deliver against all three of these pillars."

This test installation is part of Royal Caribbean's drive to include emissions-free fuel cell technology as part of the powering for its forthcoming Icon-class ships.

Source: https://www.royalcaribbeanblog.com/2017/11/13/abb-deliver-first-fuel-cell-system-royal-caribbean

Hydrogen fuel cell e-bike takes 2 minutes to fill and has a 60+ mile range

The αlpha electric bike, from Pragma Industries, is another attempt at using hydrogen as a battery in transportation, but it might only make sense for fleets.

Considering its abundance in the chemical makeup of the universe, hydrogen really seems like it ought to be more of a key player in the energy transition away from the much more finite fossil fuels. But alas, it's exceedingly more complex than that, because we can't just scoop up hydrogen like we can coal. If we could, perhaps we'd all be zooming around in hydrogen fuel cell electric cars right now, as many of the hydrogen boosters predicted not that long ago.

However, as Lloyd reminds us, hydrogen isn't really an energy source, it's a battery: "That's because you can make it in two ways: steam-methane reformation, which means that it is a fossil fuel, and the source for 95 percent of hydrogen) or electrolysis of water, which makes it essentially a battery storing electric power."

If, and it's a big if, we could couple renewable energy with hydrogen production, and if (and it's another big if) we had the infrastructure in place for consumer hydrogen filling stations, and then had affordable fuel cell electric cars readily available, then hydrogen 'batteries' could play a bigger part in transportation. However, there are some indications that some of those moves are already being made, such as this zero-carbon hydrogen fueling station that generates hydrogen onsite with excess electricity from renewable energy sources, and then dispenses to consumers just like any other gas station. There are arguments to be made for its suitability as a clean 'fuel' and equally vocal arguments against it

When it comes to adapting that same technology to electric bikes, by using fuel cells fed with hydrogen and air to produce electricity (plus water and a little heat) to charge the batteries, there seems to be a resurgence of interest. The last time we covered the topic was 7 years ago, but there have been advances made over the last few years, such as this one, from Germany's Linde Group (which is a major world supplier of industrial gases, including hydrogen).

More recently, Pragma Industries, a fuel cell company, released details about its own version of a fuel cell electric bicycle, with one of the major selling points being its ability to enable a long range and a quick refueling time, which might be a big plus for fleet or commercial use. However, there's still the sticky question about where the electricity to power the electrolysis unit to produce the hydrogen comes from in the first place. If it actually takes more electricity to produce the hydrogen from the grid than it would to just charge an electric bike battery directly, and if that grid is powered mostly by fossil fuel sources, it's most likely just more convenient for the rider than it is a better clean transport option.

The Pragma Industries αlpha electric bike, which the company says is "The first commercially available electrically assisted bike with a fuel cell" and worthy of a category of its own (FC-Pedelec), integrates the company's fuel cell technology into an e-bike that has "an unrivalled range of 100km on a single charge." The αlpha has a Brose 36V electric motor rated to 250W, which is fed by a "bridging" lithium-ion battery pack with 150 Wh of capacity, which in turn is charged by the onboard 150 W PEM fuel cell. The fuel cell runs off of a 2-liter compressed hydrogen gas cylinder, which can be refilled in about 2 minutes at a filling station made by Atawey, which Pragma contrasts with the several hour process of charging a conventional e-bike battery.

In addition to its boast of a long range and quick refueling time, Pragma Industries also lays claim to another benefit of its technology, which is its immunity to decreased performance in cold weather. It's true that low temperatures can affect battery performance, but it's not clear to what extent an average e-bike rider would actually be affected by either very low or very high temperatures.

"Whereas battery-powered Pedelecs are adversely affected by low temperatures, Alpha2.0 provides constant range and performances in every weather conditions. Equipped with a best-in-class H_2 gauge, it accurately indicates the remaining energy to the user." - Pragma Industries.

There isn't a whole lot of detailed information available about the αlpha fuel cell electric bike, but the "Light mobility" page on the Pragma Industries website seems to indicate that the bike isn't targeted to individuals so much as it is to fleets:

Captive fleet operators, your battery management nightmares are over! αlpha offers a complete electric solution while eliminating batteries logistics which can be highly time-consuming and costly.

- Public services
- Territorial staff mobility
- Corporate staff mobility
- Last mile delivery
- Tourists rental
- Bike sharing programs

If you're interested in learning more, there's a great explanation of fuel cells on the Pragma Industries website, which may not turn you into a hydrogen economy booster if you're not already in that camp, but it does offer some insight into the science and potential applications for this technology.

Source: https://www.treehugger.com/bikes/hydrogen-fuel-cell-e-bike-takes-2-minutes-fill-and-has-60-mile-range.html

Sub base to house fuel cell park

Navy and energy officials on Thursday celebrated a deal being reached to site a 7.4 megawatt fuel cell park on the Naval Submarine Base.

The multi-million dollar fuel cell project, which has been years in the works, will supply electric power to the base and the local power grid. The location of the two fuel cells on base will strengthen its energy security and reliability, officials said at an event marking the 20-year purchase power agreement between the Navy and the Connecticut Municipal Electric Energy Cooperative, or CMEEC.

The fuel cell park will eliminate energy losses over trans-

mission lines, keep energy investment dollars within the state and region, and preserve local economic and military value in the event of a grid outage, said Drew Rankin, executive director of CMEEC.

Danbury-based FuelCell Energy designed the power plants, will manufacture them in Connecticut, will manage the installation of the plants, and will then sell the power to CMEEC, said Kurt Goddard, vice president of investor relations with FuelCell Energy.

The project is made possible through an enhanced use lease, in which construction or renovations on federal property is funded by a private developer leasing property, in this case a small parcel of land adjacent to the base's power substation, with rent paid by the developer in the form of cash or in-kind service such as power and equipment upgrades.

Energy expenses are the single largest cost for Navy installations, according to Capt. Paul Whitescarver, commanding officer of the sub base, which has $10 million-plus in energy costs per year, about 25 percent of the annual operating budget.

Cost savings through projects such as this "free up dollars that can be used in the fleet to support operations and improve the tactical performance of forces," Whitescarver said.

In addition to the fuel cell park, the base continues to pursue the development of a micro grid, "which will enhance our power diversification, our physical and energy security, and most certainly our community collaboration," Whitescarver added.

Energy costs were a huge factor in determining military value during the 2005 Base Realignment and Closure, or BRAC, process, said U.S. Rep. Joe Courtney, D-2nd District.

The base narrowly escaped closure then.

Courtney noted that Congress was in the "final strokes" of a defense bill that doesn't include a BRAC round, which the Pentagon has repeatedly asked for in recent years. "[But that]doesn't necessarily mean that's a perpetual state of affairs," he said, noting a report released Wednesday by Defense Secretary James Mattis on excess infrastructure capacity in the military.

Bob Ross, executive director of the state's Office of Military Affairs, which was set up to defend the base against any future closures or downsizing, said with the fuel cell project "we now have in place a way to address power vulnerability." No one in Connecticut should fear BRAC, he said in an interview after the event.

In remarks during the event, Ross estimated that 250 to 300 people, a combination of government and private sector officials, had been involved in the project in some capacity.

"It's been a long haul," he said.

Whitescarver challenged Mike Bishop, chief financial officer of FuelCell Energy to complete the project by the time his tour ends in January 2019 "[B]ecause I'm the finishing guy."

Bishop said his company was "[A]bsolutely up for this challenge."

The event closed out, as they often do at the base, with a cake. This time with the words "Celebrating Another Energy Milestone" written in icing on top.

Source:
http://www.theday.com/article/20171019/NWS09/171019249

Hydrogen could deliver one fifth of world cuts by 2050: industry group

Increasing the use of hydrogen in power, transport, heat and industry could deliver around one fifth of the total carbon emissions cuts needed to limit global warming to safe levels by mid-century, a report by the Hydrogen Council said on November 13.

To encourage industries to use hydrogen, Toyota and Air Liquide helped set up the Hydrogen Council, a global lobby launched in January this year.

Its 27 members include automakers Audi, BMW, Daimler, Honda and Hyundai, and energy firms such as Shell and Total.

The council said using hydrogen for transport, energy generation, energy storage, industry, heat and power

could cut annual carbon emissions by 6 billion tons by 2050.

"This would ... contribute roughly 20 percent of the additional abatement required to limit global warming to two degrees Celsius," the council said in a report released on the sidelines of a U.N. climate conference in Bonn.

To achieve a two-degree limit this century agreed by governments in Paris in 2015, the world must reduce energy-related carbon emissions by 60 percent by 2050.

The report said one in 12 cars sold in California, Germany and Japan were expected to be powered by hydrogen by 2030.

By 2050, hydrogen could power 400 million cars, 15 million to 20 million trucks, around 5 million buses, a quarter of passenger ships and a fifth of non-electrified train tracks, as well as some airplanes and freight ships.

Achieving this shift in transport and other sectors would require investment of $280 billion by 2030, with about $110 billion to fund hydrogen output, $80 billion for storage, transport and distribution, and $70 billion to develop products.

So far the take-up of hydrogen vehicles is tiny and industry experts say their wider use is years away, with high purchase prices and a lack of refueling stations the major barriers.

But some firms, such as miner Anglo American and carmaker Toyota, are pushing for fuel cell cars to play a role even with the rise of battery-powered electric vehicles (EVs).

Woong-chul Yang, vice chairman of automotive research and development at Hyundai said EVs and hydrogen fuel cell cars were needed because EVs were better for city driving and fuel cell vehicles were better for longer journeys.

Some countries have set targets for hydrogen use, such as China, which aims to have 1 million hydrogen fuel cell vehicles by 2030. Britain has a 23 million pound ($30 million) fund to accelerate the take-up of hydrogen vehicles.

Some Chinese firms are interested in joining the Hydrogen Council, Pierre Etienne Franc, vice president of the hydrogen initiative at Air Liquide, told Reuters. "Most probably we will have a Chinese member in the next six months," he said.

The council believes that, with the right policies, the investment needed was "feasible" and the hydrogen market could see revenues of more than $2.5 trillion a year.

Source: https://www.reuters.com/article/us-climatechange-accord-hydrogen/hydrogen-could-deliver-one-fifth-of-world-carbon-cuts-by-2050-industry-group-idUSKBN1DD25F

In the future, zero emission hydrogen boilers could heat your home

In Italy, one business is looking to use hydrogen to help heat properties. The Giacomini Group's Federico Fioroni told CNBC that the company's work on hydrogen dates back to the early 2000s, as part of a wider project looking at different sustainable sources of energy.

"The aim of the project was to develop a sustainable, zero emissions system for heat production," Fioroni said.

One of the results of the project has been the development of what Fioroni said was a "catalytic boiler which converts hydrogen into heat power."

Giacomini has developed a catalytic combustor that it says is a condensation boiler based on an "innovative catalytic hydrogen burner."

This burner is powered by gaseous hydrogen, which is used as a fuel, and atmospheric air. A catalytic reaction takes place, combines the hydrogen and oxygen and produces both heat and water in the form of steam. Giacomini's Samuele Molina described it as a "real zero emission system."

To become fully self-sufficient, the boiler has been placed in an integrated system, the Solenco Powerbox. Electricity from solar panels on the roof is used to produce and store hydrogen. This hydrogen is used to fuel the boiler.

Hugo Vandenborre, president and CEO of Solenco Power, said that the Solenco system was based on three main components. "One is a reversible fuel cell," he said.

"Electricity splits water into hydrogen and oxygen, and the same cell can later use the hydrogen to produce electricity and heat."

Vandenborre said the system also had a catalytic boiler: "This boiler, fueled with hydrogen, produces extra heat. And, of course, we also have a water storage tank in order to provide heat for sanitary applications."

Source: https://www.cnbc.com/2017/10/27/in-the-future-zero-emission-hydrogen-boilers-could-heat-your-home.html

Japan to relax regulations focused on hydrogen fuel stations

Agency will be reworking regulations in order to support the growth of hydrogen infrastructure

The Japanese government will be relaxing regulations concerning the development of new hydrogen fuel stations. The Fire and Disaster Management Agency will be overseeing the endeavor, which aims to make it easier for new fueling stations to be built. New hydrogen fuel stations are meant to provide support for fuel cell vehicles, which are becoming more common throughout Japan as consumers become more interested in clean transportation. These stations will also help Japan accomplish its goals of establishing a hydrogen society.

Revisions will make it easier to develop new hydrogen fuel stations

By making revisions to existing regulations, the Fire and Disaster Management Agency will allow hydrogen fuel stations to be installed closer to existing gasoline stations. This will allow more hydrogen stations to be installed in urban areas, particularly where space is somewhat scarce. These stations will primarily serve vehicles equipped with fuel cell systems. Japan is working to bolster its hydrogen infrastructure to use fuel cells as primary energy generators, however, in an effort to distance itself from fossil-fuels and become more environmentally friendly.

Fuel cell vehicles are slowly gaining traction in Japan

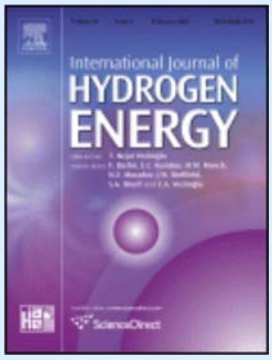
There are still a small number of fuel cell vehicles operating in Japan. As of the end of March of this year, some 1,799 of these vehicles were in use throughout the country. These vehicles are supported by only 90 hydrogen fuel stations. Consumers have been relatively slow to embrace fuel cell vehicles due to the lack of infrastructure support. This problem could be resolved by relaxing regulations that have slowed the development of new fueling stations.

Agency seeks to introduce new safety measures for fueling stations

While the Fire and Disaster Management Agency is looking to relax regulations, the agency is also calling for new safety measures to be put into place. These measures are meant to ensure that fueling stations are more secure and safe to use. The measures are aimed at ensuring the strength of fueling facilities in order to prevent leaks in the future.

Source: http://www.hydrogenfuelnews.com/japan-to-relax-regulations-focused-on-hydrogen-fuel-stations/8533410/

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 NH3, CH4, 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.

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Development of a solar powered hydrogen fueling station in smart cities applications

G. Dispenza*, F. Sergi, G. Napoli, N. Randazzo, S. Di Novo, S. Micari, V. Antonucci, L. Andaloro. Int J Hydrogen Energy 2017: 42(46):27884-27893

Incorporation of hydrogen infrastructure into daily energy use applications is a concern that many have over switching to hydrogen as an energy carrier. This paper takes a look at a case study of an on-site solar powered hydrogen production plant which was developed by CNR-ITAE (National Research Council of Italy – Institute of Advanced Energy Technologies) in association with the Italian research project "i-NEXT". The hydrogen production and fueling plant is connected to a microgrid that is able to receive, as input, the energy from solar radiation, and deliver hydrogen and electricity for fueling both electric and hydrogen vehicle fleets. The plant is divided into 4 sub-sections: 1) hydrogen production and purification module (HPPS), 2) hydrogen compression module (HCS), 3) hydrogen storage module (HSS), and 4) hydrogen refueling module (HRS). The HPPS module involves a water deionization system and an alkaline electrolyzer (KOH + DI water) for hydrogen production. The HCS module is designed to work in two different ways; in the first, during 'normal operation,' the booster draws hydrogen gas from the low-pressure buffer and sends it towards the high-pressure buffer, using a 3 compression stages which brings the pressure up to 360 bar (from ~9 bar as received from the electrolyzer). The second operating mode is dubbed 'refill operation' where a vehicle will be refueled, which only utilizes the last compressor stage to top off the 350 bar level in FCHEV tanks. The HSS stage is the emergency backup facility, composed of three hydrogen storage packs, each with 16 vertical cylinders (50L @ 200 bar). Last, the HRS dispenses the hydrogen fuel to the user. The study analyzed the load on the grid based on refueling a small fleet of vehicles that included a fuel cell hybrid electric minibus, a full electric delivery van and two fuel cell bikes.

The overall equipment is able to produce and store 8.5 kg of hydrogen at 350 bar in 10 ½ hours with a peak load of 35kW and a base load of 10 kW. The energy consumption and the time period of the overall system operation is compatible with the on-site solar energy production levels required for refueling the i-Next fleet. Taking into account the energy management from the battery energy storage system and the demand side management of the electrolyzer, the energetic autonomy of the micro-grid developed and the capability of the micro-grid to minimize the electricity exchange with the mains is demonstrated in this study.

http://www.sciencedirect.com/science/article/pii/S0360319917327842#! *-By Cyrus Daugherty*

Techno-economic and thermodynamic analysis of pre-cooling systems at gaseous hydrogen refueling stations

A. Elgowainy, K. Reddi, D. Lee, N. Rustagi, E. Gupta. Int J Hydrogen Energy 2017: 42(49): 29067-29079.

Hydrogen fuel cell electric vehicles (HFCEVs) have realized a surge in attention since they provide a much longer driving range and shorter fueling time compared to the most conventional electric vehicles. However, a lack of adequate hydrogen delivery infrastructure is a major barrier to a large-scale deployment of HFCEVs. The cost of hydrogen in early HFCEV markets is dominated by the cost of refueling stations, mainly due to the high cost of refueling equipment, small station capacities, lack of economies of scale, and low utilization of the installed refueling capacity. At present, with existing modes of hydrogen transportation and distribution, hydrogen refueling stations (HRSs) accounts for about 50% of the fuel cost at the pump.

A typical HRS is comprised of a compressor, a hydrogen storage unit, a dispenser, a precooling unit (PCU), and control/safety equipment. The precooling unit cost constitutes about 10% of the station's total equipment cost, and a deeper understanding of its cost component is necessary to achieve the maximum possible HRS cost reduction. The existing body of systems analysis literature on HRSs provides detailed information on compressor and storage systems, as well as their operating strategies and interactions. In contrast, relatively limited information is available on PCU designs, costs, energy use, or performance.

This paper identifies and examines key factors that contribute to the cost and energy use of PCUs at HRSs. A techno-economic and thermodynamic analysis of PCUs at hydrogen refueling stations has been developed and a cost-minimizing design algorithm for the PCU observing the SAE J2601 refueling protocol for T40 stations (requiring -40° C precooling temperature) is proposed.

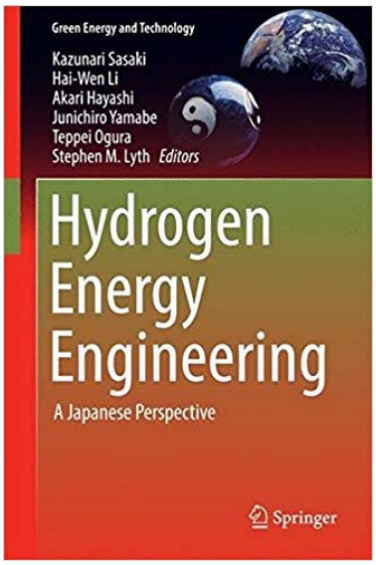
http://www.sciencedirect.com/science/article/pii/S0360319917337497 *-By Yasser Ashraf Gandomi*

From the Bookshelf

Hydrogen Energy Engineering: A Japanese Perspective

Editors: Sasaki, K., Li, H.-W., Hayashi, A., Yamabe, J., Ogura, T., Lyth, S.M

This book focuses on the fundamental principles and latest research findings in hydrogen energy fields including: 1) hydrogen production via steam reforming, PEM water electrolysis, alkaline water electrolysis; 2) hydrogen storage via interstitial hydrides, high surface area absorbents and liquid hydrogen carriers; 3) state of the art in fuel cells: PEFCs, SOFCs, AFCs; 4) hydrogen safety; 5) economics, and 6) the impact on society. Further, the book introduces the latest development trends in practical applications, especially in commercial household fuel cells and commercial fuel cell vehicles in Japan. This book not only helps readers to further their basic knowledge, but also presents the state of the art of hydrogen-energy-related research and development. This work serves as an excellent reference for beginners such as graduate students, as well as a handbook and systematic summary of entire hydrogen-energy systems for scientists and engineers.



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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

Fuel Cell and Green Energy Lab

Overview:

The Fuel Cell and Green Energy Laboratory, is located at the University of Waterloo, directed by Professor Xianguo Li, focuses on the understanding of fundamental and applied green energy conversion technologies using analytical modeling, numerical simulation, and experimental observation.

Current research topics include the characterization of heat and mass diffusion of Polymer Electrolyte Membrane Fuel Cell (PEMFC) materials, modelling of PEMFC catalyst layer manufacturing, and the characterization of biodiesel fuel spray droplet formation.

The major ongoing projects and collaborations include the following areas.

Mitacs Accelerate—Water and Thermal Management in PEM Fuel Cells

One of the major issues yet to be addressed in polymer electrolyte membrane (PEM) fuel cells is water and thermal management. This critical engineering issue directly influences the performance of PEM fuel cell stacks. Fundamental understanding via mathematical modeling and experimental diagnostics is required for engineering the operation of PEM fuel cells. Due to the significance of this project, it is being supported by Mitacs Accelerate.

Mitacs Accelerate is Canada's premiere research internship program. It connects companies with over 50 research-based universities through graduate students and postdoctoral fellows, who apply their specialized expertise to business research challenges.

Interns transfer their skills from theory to real-world application, while the companies gain a competitive advantage by accessing high-quality research expertise.

Catalysis Research for Polymer Electrolyte Fuel Cells Network

The Catalysis Research for Polymer Electrolyte Fuel Cells (CaRPE-FC) Network is a Pan-Canadian academic network with active participation from 8 universities, 4 subject matter experts (SMEs), an industry association and 3 government departments.

The network focuses on developing fundamental understanding of topics in electrocatalysis and transport phenomena in catalyst layers for polymer electrolyte fuel cell, with an aim to lower the amount of platinum group metal (PGM) requirements. The network is comprise of a multidisciplinary team of 20 researchers from universities and government laboratory across Canada. The research team is working together in close collaboration with participating industry partners.

Green Auto Power Train (GAPT)

Green Auto Power Train project aims to advance the state of the art in hybrid engines to power Ontario's transportation sector with near, medium and long term technological solutions to reduce/eliminate emissions and wean the dependence on fossil fuels while generating new Intellectual Property and competitive advantage for Ontario's auto sector. The ultimate goal also is to facilitate the development of commercializable products.

Green Auto Power Train is a multi-institutional research project funded by Ontario's Ministry of Economic Development and Innovation through the Ontario Research Fund.

The institutions are University of Windsor, McMaster University, University of Toronto and the University of Waterloo serving as the lead institution. The program of research includes support from private industry and government.

Contact Info:

The Fuel Cell and Green Energy Laboratory is located on the 3rd floor of the Energy Research Centre Building (ERC), Room 3023/3003 at University of Waterloo.

Laboratory Director
Xianguo Li Email: xianguo.li@uwaterloo.ca

Laboratory Administrator
Grant Unsworth Email: grant.unsworth@uwaterloo.ca

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CALL FOR ABSTRACTS

We would like to invite you to submit your research on clean and sustainable energy to ICCE-2018. Please follow the web site of the conference for the deadlines. The conference is organized under the auspices of University of Miami, Eastern Mediterranean University and Fredonia State University of New York. More information is available at the conference web site.

Selected papers will be published in world renowned Journals

Conference Topics

- Fuel cells
- Smart grids
- Nuclear energy
- Waste-to-energy
- Energy economics
- Hydrogen economy
- Biomass and biofuels
- Multi-generation systems
- Hydrogen energy storage
- Wind energy technologies
- Photovoltaic
- Energy and Law
- Energy efficiency
- Solar desalination
- Solar thermal energy
- Energy and buildings
- Solar energy materials
- Passive solar buildings
- Energy and environment
- Financing energy projects
- Hydrogen energy production
- Intelligent or smart buildings
- Sustainable building solutions
- Energy management and policy
- Investment appraisal of energy projects
- Exergetic and exergoeconomic analyses
- Renewable energy storage technologies
- Control systems for energy management
- Renewable energy technologies and systems
- Economic viability of renewable energy systems

Energy Research Center (ERC)
of Eastern Mediterranean University

Clean Energy Research Institute (CERI)
of University of Miami

Grand Renewable Energy 2018
International Conference and Exhibition

ISES International Solar Energy Society

Advanced Technology Paths to Global Sustainability

www.grand-re2018.org

Conference: June 17 (Sun) - 22 (Fri), Exhibition: June 20 (Wed) - 22 (Fri)

Venue: Pacifico Yokohama, Yokohama, Japan

How to accelerate Renewable Energy Integration

Chairperson's Message

The Paris Agreement in COP21 is the agreement applicable to all participants of parties for the first time in history and serves as a turning point with an eye toward a decarbonized society. Under the Agreement, the greenhouse gas emissions are to be reduced dramatically to almost zero by the end of this century. With this long-term goal in the Paris Agreement, it is important for us to accelerate strategic efforts and initiatives carbon emission reduction in energy demand and supply.

The practical challenge to achieve is low- carbonization of energy supply, energy conversion, and energy conservation including smart integration of renewable energy in maximum both in supply and demand sides. Financial strategy, policy initiatives and advanced technology development must be associated with them. Intelligence and cutting- edge technologies are indispensable in the fields of electricity, electronics, mechanics, physics, chemicals, biology, architecture, civil, mathematics, meteorology, sociology, systems, finance, and integrated management.

We have great expectation and feel glad to have discussion about these crucial issues through more than 900 papers' presentation covering 12 areas of renewable energies. Plenary session by the invited speakers, more than 15 experts, from all over the world are also programmed. International exhibition is held in parallel.

We, Organizing Committee, welcome all those participating in Grand Renewable Energy 2018 Conference, and look forward to seeing in Yokohama.

General Chair, **Prof. Kazuhiko Ogimoto** (the University of Tokyo), Deputy Chair **Dr. Yoshiro Owadano** (AIST), Oversea Rep, **Dr. Dave Renné** (ISES)

ABSTRACT submission *on going!! through Web*

- Jan. 31, 2018: Due date of Abstract submission
- Apr. 30.2018: Early Bird end of Registration
- Jun. 17-22: Full Paper submission at onsite venue
- Sep. end 2018: Almost all Full Papers in DVD,

Features of Conference

- **Main CASTER:** all those presenting the paper, totaling 1000.
- **Keynotes:** Directors from NREL and Flaunhofer
- **Invited Speakers:** 15 Experts from 12 Logo Areas
- **Special Sessions and Workshop** will be programmed.
- **Exhibition:** about 40,000 visitors for 300 exhibitors

Conference

1. Policy & Integrated Concept
- Policy Instruments, e.g.FIT
- Scenario
- RE and Climate Change, toward CO2 Zero
- RE in the Context of Sustainable Development
- Mitigation Potential and Costs
- Financing and Implementation
- R&D Policy
- Energy Technology Loadmap
- International Cooperation and Collaboration

2. Photovoltaics
- Novel Materials and Concepts
- Silicon Solar Cells
- Compound Semiconductor Thin Film Solar Cells
- III-V Solar Cells, Concentrator and Space Applications
- Perovskite Solar Cells
- Organic Thin Film and Dye-sensitized Solar Cells
- Multijunction Solar Cells
- Module Reliability
- Performance Characterization Method
- PV Systems, BOS Components and Grid Integration
- Operation and Maintenance
- Forecast and Solar Resources

3. Solar Thermal Application
- Solar thermal collector
- Solar based heat pump technology
- Solar Cooling
- Solar-fired power generation
- Solar Binary Power Generation
- Thermal Energy Storage
- Solar-thermally driven chemical processes
- Solar thermal utilization for hydrogen or fuel production
- Solar desalination
- Solar cooker
- Solar thermal detoxification

4. Innovative Bioclimatic Architecture
- Vernacular Architecture / Passive Design
- Zero Energy House/ Zero Energy Building
- Zero Net Carbon
- Affordable Green Housing
- Building Stock Activation / Refinement
- Smart City / ICT
- Comfort and Indoor Climate
- Energy Management System /Commissioning
- Elements and Materials
- Building Evaluation Index/Tool

5. Wind Power
- Offshore Wind Energy
- Advanced Wind Turbine Technology
- Grid Connection and Electrical Systems
- Site Assessments and Forecasting
- Plant Design and Management
- Operation and Maintenance
- Tower and Foundation
- Measurement and Monitoring Techniques
- Acoustics and Noise Issues
- Small/Distributed Wind Power
- COE of Wind Power
- Social and Environmental Issues

6. Biomass
- Biofuels (Bioethanol, BDF including BTL)
- Biomaterials
- Gasification and combustion
- Biomass Refinery
- Marine Biomass including freshwater biomass
- Pyrolysis and carbonization including torretaction
- Anaerobic Digestion
- Carbon Neutrality
- Forestry
- Hydrothermal Technology
- Sustainability

7. Hydrogen & Fuel Cell
- Hydrogen Energy Systems
- Hydrogen Production
- Hydrogen Transportation and Storage
- Hydrogen End-Use Technology
- Technology and Fabrication
- Fuel Cell for Transportation
- Fuel Cell Power Plants
- Fuel Cell for Co-generation

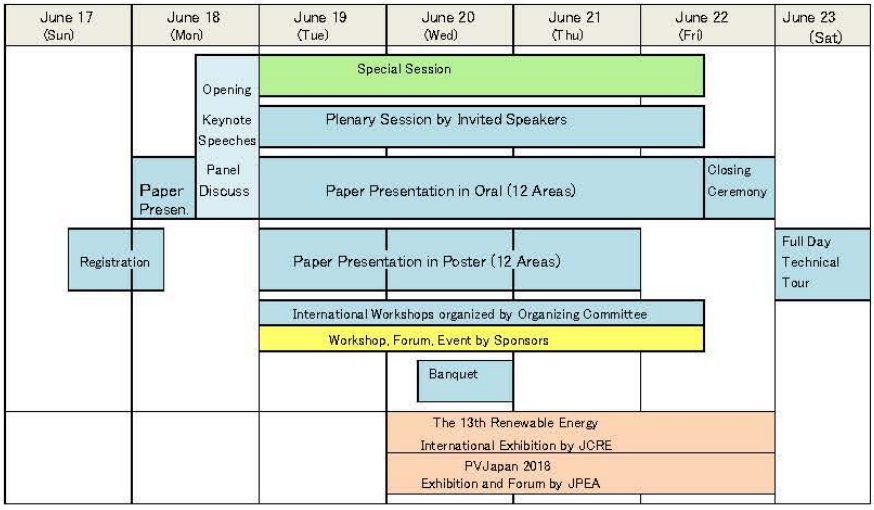
8. Ocean Energy
- Wave Energy
- Tidal Current Energy
- Ocean Current Energy
- OTEC
- Offshore Wind Energy
- Utilization wirh Aquaculture
- Resource Assessment and Monitoring
- Economic Assessment
- Ocean Resources for Energy
- Ocean Marine Biomass
- Deep Sea Water Application

9. Geothermal Energy & Ground-Source Heat Pump System
- Exploration
- Geothermal Field
- Reservoir Engineering
- EGS
- Power Generation
- Public Acceptance
- Geochemistry
- Environmental Aspects
- Geo-Heat
- Ground-Source Heat Pump
- Direct Use
- Geothermal Frontier

10. Energy Network
- Smart Grid
- Micro-grid
- Energy Network
- Distributed Energy Resources
- Power Storage and System
- Vehicle to Grid
- Demand Response
- Power Electronics
- Superconductor and System
- Advanced Electric Car

11. Energy Conservation & Heat Pump
- Air-conditioning/Heat Pump
- Area Energy and Environmental Management
- Combined Heat and Power Utilization
- Energy Conservation and Assessment
- Global Warming/Heat Island and Other Environmental Issues
- Net Zero Energy Building/House
- Refrigeration and Refrigerants
- Renewable Energy Utilization
- Thermal Energy Technology and Storage
- Thermodynamics and Energy Management

12. Small Hydro & Non-Conventional Energy
- Hydropower Development and Utilization
- Practical Examples and Field (Model) Tests
- Micro & Pico System
- Undeveloped Energy for Human Life
- Unused Energy Recovery



Manuscript Procedures

① Abstract Submission
| 2 Pages, Due Jan.31

②Abstract peer review
| February

③Acceptance Notice
| march

④Detail Presen. Notice
| May (When, Where)

⑤Full Paper submission
| June 17–22 at Onsite

⑥Presentation at Venue
| June 17–22 at Onsite

⑦J-Stage Option
| June 17–22 at Onsite

⑧Full Papers Compiling
| Complete by Sep 31

⑨DVD to all participants

Dear colleagues,

The **Economy, Sustainable Development and Energy International Conference (ESDEIC)**, will be held at the Queen Margaret University (Edinburgh, Scotland, UK), from the 25th to the 27th June 2018.

Main dates and details are:

- 15th of April 2018: Submission of abstracts
- 30th April 2018: Notification of acceptance of abstracts
- 30th of May 2018: Submission of full papers
- Early bird registration: 30th of May 2018

For information about the different types of registration fees, please click HERE.

In this edition of ESDEIC:

- One award for the best communication (refund of the registration fee and certificate of best communication)
- One award for the best communication by a PhD. student (refund of the registration fee and certificate of best communication)
- Registration fee includes coffee-breaks, lunches, conference dinner, merchandising of the conference, publication of all works in the e-books of abstracts and full papers, certificates of attendance and presentation, and a walking tour to Edinburgh.
- Papers must be written and presented in English.
- Selected papers will be published in the journals associated to the conference
- Selected papers and/or papers not accepted by the journals, will be published in a selected papers e-book edited by the conference

For full details related to the conference, please visit: www.esdeic.com

If you wish to submit your abstract, please click HERE.

For further information, please contact Monica Martins by email: info@esedeic.com

Please, do not hesitate to share this information with your colleagues and contacts.

Best regards:

Dr. Ramon Sanguino Galvan

Co-Chairman of ESDEIC

GIG

10th International Exergy, Energy and Environment Symposium

July 1-4, 2018
Katowice, Poland

IEEES - 10

Contact:

e-mail: ieees-10@gig.eu

tel. +48 32 259 27 00, +48 32 259 25 54

fax +48 32 259 65 33

address:
Central Mining Institut (Główny Instytut Górnictwa)
Poland, 40-166 Katowice, Plac Gwarków 1

www.ieees-10.gig.eu

IEEES-10 Symposium

The 10th International Exergy, Energy and Environment Symposium (IEEES-10) facilitates close cooperation and intellectual exchange with a large number of experts from the academia, leading R&D institutions, government agencies and the industry. It provides a platform for researchers, scientists, engineers, technologists and practitioners to discuss the current challenges, opportunities and future directions in the development of sustainable energy systems.

IEEES-10 covers a wide range of topics, including clean coal technologies, renewable energy technologies, smart energy systems, alternative fuels, hydrogen and fuel cell technologies, nuclear energy, desalination technologies and environmental technologies. A special symposium session will be devoted to hydrogen economy with a particular focus on hydrogen as a new and environmentally friendly energy carrier.

The previous successful editions of the symposium were organized in Izmir, Turkey (2003); Kos, Greece (2005); Evora, Portugal (2007); Sharjah, United Arab Emirates (2009); Luxor, Egypt (2011); Eurasia, Turkey (2013); Valenciennes, France (2015); Antalya, Turkey (2016) and Split, Croatia (2017).

Venue
Central Mining Institute, Katowice, Poland

Founding Chair
I. Dincer, UOIT, Canada

Honorary Chair
T.N. Veziroglu, IAHE, USA

Symposium Chair
A. Smoliński, Central Mining Institute, Poland

- clean coal technologies
- synthetic and alternative fuels
- renewable energy systems
- hydrogen production and utilization technologies
- biowaste utilization
- fossil fuels
- nuclear energy
- exergy analysis and modeling
- energy systems and applications
- environmental impact assessment
- environmental engineering technologies
- life cycle assessment
- refrigeration and heat pump systems
- combustion, pyrolysis, and gasification technologies
- thermal systems and applications
- smart grids
- desalination technologies
- green buildings
- thermodynamic optimization
- heat and mass transfer
- sectoral energy management
- green transportation vehicles
- sustainable communities
- electrochemical devices (fuel cells, capacitors, batteries, etc.)
- new materials for energy applications

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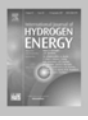

WSSET World Society of Sustainable Energy Technologies

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

ICRIC-2018

16-19 July 2018 / Zagreb, Croatia

2nd International Conference on Research, Innovation and Commercialization

Research-Innovation-Commercialisation (RIC) Concept for Technological Success

CALL FOR PAPERS

GOALS – The ICRIC-18 is a multi–disciplinary international conference on research, innovation and commercialization and will provide a forum for the exchange of latest technical information, the dissemination of the high-quality results on these issues, the presentation of the new developments and methodologies in these areas, and the debate and shaping of future directions and priorities for better industrial, environmental, energetic, and economic sustainability as well as sustainable development for global security. The primary themes of the conference are research, innovation and commercialization, not only in engineering and science but also in all other disciplines (e.g. ecology, education, social sciences, economics, management, medical sciences, political sciences, and information technology). Therefore, papers on related topics are solicited from all relevant disciplinary areas, ranging from current problems, projections, new concepts, new technologies, new methodologies, modeling, experiments, innovation, commercialization, and measurements, to simulations.

FORMAT - The format of the ICRIC-18 will be arranged with the following major elements as general papers presented in oral sessions, keynote papers by invited speakers, and panel discussion and specialized sessions on special topics. There will also be exhibitions, social events and pre- and post-symposium tours. High quality papers of archival value will be considered in extended form for publication in various reputable international journals.

ABSTRACT SUBMISSION - Initial screening will be based on the abstracts, and authors should submit 400-500-word abstracts through website only. Each abstract should contain the title of paper, name of authors and affiliations and complete addresses (along with the phone and fax numbers and e-mail addresses), and summarize the content of the work, objectives and main findings.

Supporting journal:

International Journal of Research, Innovation and Commercialisation

Conference Topics - The topical areas of interest include, but are not limited to:

- Benchmarking and best practices in innovation activities
- Building relationships for technological Innovation
- Business and technological innovation
- Business development and commercialization practices
- Commercialisation strategies and policies
- Company development strategies
- Diffusion of innovation
- Economics of innovation
- Empirical analysis and case studies in business innovation and research
- Energy innovation
- Energy R&D strategies and policies
- Entrepreneurship and innovations
- Environmental issues in technology management
- Family business development in technology-intensive environments
- Gaming policy
- Geography of Innovation
- Industry perspectives on high-tech new ventures creation and development
- Innovation incubation and incubators
- Innovation issues, management approaches, policies and strategies
- Inter-organisational relations and open innovation models
- Knowledge-intensive business services and regional innovation systems
- Managing creativity and innovation culture and its eco-world
- New product and process innovation
- Performance measures and metrics in business innovation and research
- Profits from innovation
- R&D collaboration
- R&D management/policy/strategy
- Research policy
- Research management/policy/strategy, partnerships and innovative approaches
- Spin-off company development
- Strategic innovation
- Strategic planning, business development and commercialisation practices
- Technological entrepreneurship
- Technology alliances and collaboration
- Technology management/policy/strategy.
- Technology transfer and licensing
- Technology transfer offices
- University technology transfers

Founding chair: Ibrahim Dincer, University of Ontario Institute of Technology, Canada
Conference chair: Sandro Nižetić, University of Split, Croatia

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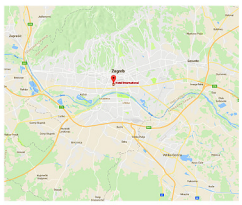
Important dates

ONE-PAGE ABSTRACT DUE:	ABSTRACT ACCEPTANCE NOTICE:	FULL MANUSCRIPT DUE:	FINAL NOTICE OF ACCEPTANCE:
FEBRUARY 01, 2018	FEBRUARY 20 2018	APRIL 01, 2018	JUNE 01, 2018

REGISTRATION FEES	Early registration (Until June 15, 2018)	Late registration (After June 15, 2018)
Student delegate	370 EUR	450 EUR
Full delegate	470 EUR	550 EUR
Accompanying person	200 EUR	250 EUR

Registration fee includes:
- Entrance for all oral and poster sessions,
- Conference materials (Congress bag, abstract book, proceedings, etc).
- Three day lunch and all coffee breaks
- Welcome Banquet & Gala dinner

Venue
The conference will be held at Hotel International (4*)
www.internationalhotelzagreb.com
A special rate for the accommodation units will be ensured for ICH2P-2018 conference participants.



http://www.icric2018.fesb.unist.hr

ICH2P-2018

16-19 July 2018 / Zagreb, Croatia

9th INTERNATIONAL CONFERENCE ON HYDROGEN PRODUCTION

Hydrogen economy for a sustainable future

CALL FOR PAPERS

Goals - The International Conference on Hydrogen Production (ICH2P-17) is a multi–disciplinary international conference on the production of hydrogen through various thermal, chemical, biological and other methods, as well as its use in various systems, including fuel cells. It will provide a forum for the exchange of latest advances and technical information, dissemination of new research developments in the areas of hydrogen production and usage, and debate involving the future directions and priorities in the hydrogen economy for a sustainable future. The conference will have particular value and interest to researchers, scientists, engineers and practitioners who are working in the field of hydrogen production technologies, ranging from policy making and technical development to management and marketing.

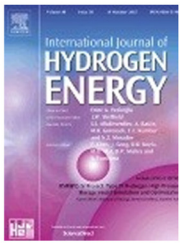
The format of ICH2P-17 will be arranged with the following major elements as general papers presented in oral sessions, keynote papers by invited speakers, and panel discussions and specialized sessions on selected topics. There will also be, social events and symposium tours. High quality papers of archival value will be considered in extended form for publication in various reputable international journals.

Authors are invited to submit their abstract(s), of approximately half a page length (about 250 words). The full paper(s) should be submitted in electronic format. Instructions for abstact and full paper preparations are available at symposium webpages.

The papers accepted and presented at the ICH2P-2018 will be published in a book of abstracts and USB, with ISBN. High quality papers of archival value will be considered in extended form for publication in various reputable international journals:

International Journal of Energy Research (IF 2.59)

Interational Journal of Hydrogen Energy (IF 3.582)



IF: 3.582

IF: 2.59

Conference chair: S. Nižetić, FESB, Croatia
Founding Chair: I. Dincer, UOIT, Canada
Honorary Chair: T. N. Veziroğlu, president of IAHE, USA

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Željka Milanović Croatia

Technical chair: Petar Šolić, University of Split, Croatia

Conference Topics - The themes of the conference will cover topics ranging from the conversion of fossil fuels to the use of renewable energy sources and nuclear power for hydrogen production. Fossil fuel conversion includes processes for the gasification of coal and biomass, thermochemical systems such as steam-methane reforming, and photochemical systems. The electricity produced from renewable energy sources, or nuclear power, could be used to generate hydrogen by the electrolysis of water, and the development of these technologies will be included.

The conference will cover broad areas that extend beyond technical areas, to policy making, hydrogen infrastructure development, environmental concerns, regulatory actions, standards development, safety, storage, commercialization, education, training, and so forth. Therefore, papers on related topics are solicited from all relevant disciplinary areas, including new concepts, modeling, experiments, and simulations. The topics of the conference include, but are not limited to:

- Codes and standards
- Education and training for hydrogen
- Electrolysis
- Energy security related to hydrogen
- Environmental impact
- Fuel cells
- Global warming
- Government policies on hydrogen
- Greenhouse gas mitigation by hydrogen
- Hydrogen economy
- Hydrogen infrastructure
- Hydrogen production methods
- Hydrogen safety
- Hydrogen storage
- Hydrogen technologies
- Hydrogen vehicles
- Innovation and commercialization practices
- International perspectives on hydrogen
- Life cycle assessment
- Life cycle costing
- Materials for hydrogen systems
- Modeling and simulation
- Nuclear-based hydrogen production
- Renewables and their use for hydrogen
- Sustainable development
- Thermochemical and hybrid cycles

Important dates

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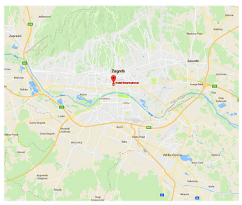

http:/ich2p-2018.unist.fesb.hr

NURER 2018

CALL FOR PAPERS

6th International Conference
Nuclear and Renewable Energy Resources

September 30~October 3, 2018
Jeju, Korea

The 6th International Conference on Nuclear and Renewable Energy Resources (NURER2018) is recognized as one of the major international conference for the exchange of information on scientific, engineering, and other technical aspects of innovative nuclear and renewable energy science and technology. The conference is intended to provide an excellent opportunity to report on recent technical progress, discuss key issues and fostering international collaboration for the promotion of innovative nuclear and renewable energy system development and their synergic collaborations. Papers related to science, engineering, facilities, experiments, modeling, analysis, design and safety are welcome.

Technical Topics

- **Fission Energy**
- **Fusion Energy**
- **Renewable Energy**
- **Hydrogen and Solar Energy**
- **Energy Management and Environmental Issues**
- **Renewable-Nuclear Synergy, International Cooperation and Innovation**
- **Other relevant topics**

The working language of the conference and the proceedings is English. Technical papers will be peer reviewed and accepted papers will be published in a symposium proceedings. The authors are encouraged to send full extended papers to The International Journal of Hydrogen Energy, The International Journal of Energy Research, Fusion Science and Engineering and The International Journal of Renewable Energy after the conference.

Authors are invited to submit a one-page 400 word abstract (text only) to the NURER-2018.

Website: http://nurer2018.org

Due Dates

March 31	**2018**	**Abstract Submission Deadline**
May 31	**2018**	**Abstract Acceptance Notification**
July 31	**2018**	**Early Registration Deadline**
August 31	**2018**	**Manuscripts Submission Deadline**
September 30~October 3	**2018**	**Conference Convened**

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Organizer
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Co-sponsor
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Contact Information
Tel: +82 42 350 8437
Fax: +82 42 350 8437
E-mail: nurer2018@kaist.ac.kr
Website: http://nurer2018.org

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José Manuel Perlado (Universidad Politécnica de Madrid)
Ralph Moir (Lawrence Livermore National Laboratory,USA)
Charles Forsberg (MIT,USA)
Mohammad Reza Nematollahi (Shiraz University, Iran)
Rainer Salomaa (Helsinki University of Technology, Finland)
Kijung JUNG (National Fusion Research Institute, Korea)
Sergi Hong (Kyunghee University, Korea)
Yican Wu (Institute of Nuclear Energy Safety Technology, China)
Askar Zhussupbekov (L.N. Gumelyov Eurasian National University, Kazakhstan)
Waclaw Gudowski (Kungliga Tekniska Högskolan – KTH, Sweden)
Yong Hoon Jeong (KAIST, Korea)
Young-chul Ghim (KAIST, Korea)
Wejdan Abu Elhaija (Al Zaytoonah University, Jordan)

16th International Symposium on Metal-Hydrogen Systems

Oct.28th-Nov. 2nd 2018, Guangzhou China

www.MH2018.cn

Crowne Plaza
No. 28 Ningcai Road
Central District, Science City,
Guangzhou, China

IMPORTANT DATE

Tuesday May. 1, 2018
Open for abstract submission

Saturday Jun. 30, 2018
Deadline for abstract submission

Friday Aug. 31, 2018
Deadline for early bird registration

Sunday Oct. 28. 2018
Registration and conference opening

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Upcoming Meetings & Activities

January 2018

Hydrogen & Fuel Cells Energy Summit
January 24-25, 2018
Brussels, Belgium
http://www.wplgroup.com/aci/event/hydrogen-and-fuel-cells-energy-summit/

1st Latin American Conference on Sustainable Development of Energy, Water, and Environment Systems
January 28-31, 2018
Rio de Janeiro, Brazil
http://www.rio2018.sdewes.org/

February 2018

FC Expo 2018-14th Int'l Hydrogen & Fuel Cell Expo
February 29-March 2, 2018
Tokyo, Japan
http://www.fcexpo.jp/en/home/

March 2018

European Hydrogen Energy Conference 2018
March 14-16, 2018
Costa del Sol, Spain
http://www.ehec.info/

3rd International Hydrogen Technologies Congress
March 15-18, 2018
Alanya, Turkey
http://www.ihtec2018.org/

April 2018

SAE World Congress Experience
April 10-12, 2018
Detroit, Michigan
http://wcx18.org/

May 2018

16th International Conference on Clean Energy
May 9-11, 2018
Famagusta, North Cyprus
http://icce2018.emu.edu.tr/en

233 ECS Meeting
May 13-17, 2018
Seattle, WA
http://www.electrochem.org/233-planning-deadlines

June 2018

CIMTCE 2018
June 4-12, 2018
Perugia, Italy
http://2018.cimtec-congress.org/

22nd WHEC
June 17-22, 2018
Rio de Janeiro, Brazil
http://www.whec2018.com/

Economy, Sustainable Development and Energy International Conference (ESDEIC)
June 25-27, 2018
Edinburgh, Scotland
http://www.esdeic.com/

July 2018

10th International Exergy, Energy and Environmental Symposium (IEEES)
July 1-4, 2018
Katowice, Poland
http://www.ieees-10.gig.eu/

HYPOTHESIS XIII
July 24-27, 2018
Singapore
http://www.hypothesis.ws/

September 2018

European Summer School on Hydrogen Safety 2018
September 17-21, 2018
Athens, Greece
http://www.jess-summerschool.eu/

6th International Conference on Nuclear and Renewable Energy Resources
September 30-October 3, 2018
Ramada Plaza Jeju, Korea
http://nurer2018.org/

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.

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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On the Web

International Association for Hydrogen Energy (IAHE)
http://www.iahe.org
5794 SW 40 St. #303
Miami, FL 33155, USA

International Journal of Hydrogen Energy (IJHE)
The Official Journal of the IAHE
http://www.elsevier.com/locate/he