international association for hydrogen energy
Clean and Abundant Energy for Sustainability

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China announces ban on gas-powered cars. Is this the end of oil?

For years, China has been scrutinized for its lenient emissions targets and regulations, and for good reason. However, Tianjin, Xin Guobin, the Vice Minister of Industry and Information Technology, just announced that the Chinese government is working on a timeline to *completely* end the production and sale of gas-powered automobiles.

The government allegedly plans to implement strict regulations and "something like a cap-and-trade program" on fuel and emissions, which is a method of controlling overall emissions in which a "cap" on emissions is enforced. If certain corporations don't reach their allocated maximum amount, or cap, they can sell the difference to buyers who require more emissions, thus creating a new market.

Though these programs haven't always worked well in the past because they often don't inspire all that much change, it's still a step in the right direction for China. But, a ban on the production and sale of all gas-powered cars? Now, that could really cause some positive change.

China represents the world's largest new car market, selling 28.03 million units last year alone, and is responsible for approximately 30% of the world's vehicle sales. So, it's easy to imagine how a ban on gas-powered cars could drastically affect the gas industry.

Despite China's poor reputation amongst environmental activists, this announcement didn't necessarily come out of nowhere. The international community has been pressuring China to tighten its environmental regulations for years, and the government has been complying somewhat by issuing "new energy vehicle" subsidies to automakers to promote switching to electric cars. Plus, China had already vowed to cap carbon emissions by 2030.

The Chinese government is expected to carry out a "zero-emission vehicle mandate," similar to that of California, whereby automakers will have to build a certain percentage of electric and fuel cell vehicles.

What Would This Mean for Oil and Gas?

Let's be honest: Oil and gas are dying industries. They're headed for the grave, as they're being threatened by technologies that might not only be cheaper, but are *renewable.* What we often forget is that these are finite resources—they will run out, and the sooner we figure out a plan for when that happens, the better.

Plus, these alternatives are environmentally-friendly, as opposed to contributing to the destruction of the environment like oil and gas do, which is ultimately the most important factor here. We cannot live in a world that is polluted or destroyed; it's our home, and we should not only be respecting it, but preserving it as well.

A recent article published in *Bloomberg* explained how much of an impact China's recent decision to phase out gas cars could have on the sale of new cars as well as the oil and gas industries. New projections estimate that nearly 80% of the global auto market is anticipated to phase out gas cars and replace them with electric cars. It's no question that if and when that time comes, demand for gasoline and diesel will plummet.

China's auto industry plan was published in April of this year and revealed that new energy vehicles, including electric and hybrids, will make up all the future growth sales in the country. It's expected that sales of these new energy vehicles will skyrocket to 7 million annually by 2025, and that approximately 800,000 new charging stations for electric cars will be built in this year alone.

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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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China isn't alone though, as many other countries have plans to phase out gas cars as well. For example, Dutch parliament motioned to end all gas and diesel car sales by 2025, India hopes to end gas and diesel car sales by 2030, Norway has agreed to do so by 2025 (though 40% of their newly registered vehicles were already hybrid, electric, or hydrogen this year), and Britain and France both plan to do so by 2040.

Final Thoughts

Yes, oil and gas have helped us progress immensely over the past century and they're still important elements of society and the global economy, but their time is nearing its end. Renewable energy is our future, and it's important that we acknowledge this fact and understand how crucial it is that we start to transition toward these technologies.

It's also important to note that there's no telling whether electric cars will completely replace gas cars any time soon or not, especially given that they don't even represent a significant part of the auto market yet. There were just under 700,000 electric vehicles sold last year, in comparison to the 84 million new vehicles sold worldwide. Let's hope that these regulations and policies actually come into fruition!

Source: http://www.collective-evolution.com/2017/09/19/china-announces-ban-on-gas-powered-cars-is-this-the-end-of-oil/

Hydrogen and Fuel Cell Day is October 8

How to Celebrate Hydrogen and Fuel Cell Day

Hydrogen and Fuel Cell Day, aptly celebrated on October 8 to represent the atomic weight of hydrogen (1.008), brings together industry, academia, national labs, government, and other stakeholders to increase awareness of hydrogen and fuel cell technologies. This year marks the third Hydrogen and Fuel Cell Day; last year stakeholders issued dozens of industry announcements and press releases, hosted events like ride-and-drives, generated hundreds of social media posts, and reached hundreds of thousands of people around the world.

We encourage you to celebrate with us and offer some suggested activities:

- Social media posts about or photos of your project (include the hashtags #FuelCellsNow and #HydrogenNow)
- Media announcements and press releases about project milestones
- Outreach to stakeholders about how your project will affect them
- Announcements or briefings on project progress and impact
- Tours of facilities or other events.

Potential social media posts can include:

- *October 8 is Hydrogen and Fuel Cell Day! Show your support for fuel cells and hydrogen #FuelCellsNow #HydrogenNow*
- *Atomic weight of hydrogen is 1.008 – Join us and celebrate Hydrogen and Fuel Cell Day today on 10.08! #FuelCellsNow #HydrogenNow*
- *[COMPANY NAME] is proud to support Hydrogen and Fuel Cell Day #FuelCellsNow #HydrogenNow*

Share the knowledge and download our Increase Your H2IQ 101 Training Resource for a general audience today!

This year, Hydrogen and Fuel Cell Day falls on the Sunday before Columbus Day, so we have activities planned for the week leading up to and through the long weekend. Join us in commemorating this special day.

-US Department of Energy, Fuel Cell Technologies Office

B.C. fuel cell company to receive federal funding

A Vancouver-based company is highlighting a federal effort to boost innovation, reduce pollution at West Coast ports and diversify Western Canada's economy.

In a joint press conference held August 3 in Burnaby, Navdeep Bains, minister of innovation, science and economic development, announced $25 million in funding for Western Economic Diversification Canada (WD), an agency promoting business development, innovation and diversification of Western Canada's economy. At the same time, Vancouver hydrogen fuel cell company Loop Energy announced that its new system to extend the range of fuel-cell-powered heavy-duty yard trucks typically used in ports and distribution centers has become operational.

Loop received $760,000 of $14.8 million in federal funding for B.C. companies announced last March. It previously was granted $7.5 million by the government to deploy its new fuel cell module, which acts as an on-board power generator to charge batteries and capture energy through regenerative braking, allowing for extended range and faster refueling. The development was aimed at addressing the limitations of battery-electric trucks for short- and regional-haul freight markets while providing an economically viable replacement for diesel engines.

"As the ports of Los Angeles and Long Beach, and others around the world, strive to eliminate polluting diesel trucks from the movement of goods, Loop is ready to help clean the air," said Loop Energy president and CEO Ben Nyland.

Nyland said yard trucks powered by the new module have "the potential to substantially reduce emissions from port operations while achieving cost targets demanded by trucking operators, without subsidies."

The Loop Energy announcement highlights a new federal emphasis on technology in economic development, in which regional agencies across the country, including WD, will focus on strengthening innovation capacity by supporting small and medium-sized businesses in adopting new technology; nominating 50 firms across the country to participate in a program aimed at helping them expand; investing $100 million annually in clean technology; and supporting 250 Indigenous economic diversification projects.

"There is no one-size-fits-all approach to diversifying the economy as each region has their own unique advantages," Bains said. "By providing departments like Western Economic Diversification Canada with the tools and funding to do their job, we are working towards building a stronger, more innovative and inclusive economy."

In 2015, Western Canada contributed 38 percent of Canada's real economic output, and since November 2015, WD-funded projects have generated 8,200 jobs, approximately 3,400 of which are in B.C.

Source: http://www.jwnenergy.com/article/2017/8/bc-fuel-cell-company-receive-25-million-federal-funding/

South Australia launches tender for hydrogen plant, buses

The South Australian government has called for tenders for hydrogen infrastructure proposals, and for the supply of hydrogen-fueled buses, as part of its plan to transform the state into a zero carbon "hydrogen economy," based on its nation-leading wind and solar assets.

The tenders—which are part of the government's plan to build a South Australian hydrogen production facility and refueling station—are part of the Weatherill government's Hydrogen Roadmap, launched on Friday under its $150 million Renewable Technology Fund.

The government is also seeking to trial at least six hydrogen cell buses in the Adelaide Metro fleet, and is calling for proposals to supply those, along with necessary refueling and hydrogen fuel production infrastructure.

Developed with industry—including Siemens and Advisian (a part of the WorleyParsons Group)—the Roadmap outlines how the state's nation-leading renewable wind and solar capacity can attract international investment in hydrogen production.

South Australia's move into hydrogen comes as the state bounds ahead on large-scale wind and solar, having passed its 50 percent renewable energy target last year, eight years ahead of schedule.

Hydrogen Economy News

Hydrogen can be produced from surplus renewable sources such as wind or solar through a process called electrolysis, which splits clean water into hydrogen and oxygen. That hydrogen can then be used in a hydrogen fuel cell to power vehicles, or exported around the world.

"The beauty of Hydrogen is that it can be made using excess energy capacity driven by renewables and then used in a vast range of business applications," said Siemens Australia and New Zealand chief, Jeff Connolly on Friday.

"South Australia's abundant renewable resources and renewable targets lends itself to hydrogen solutions," he said.

"Hydrogen offers an opportunity to create a new industry in South Australia where we can export our sun and wind resources to the world," said state energy minister Tom Koutsantonis in a statement on Friday.

"Our Hydrogen Roadmap aims to have South Australia at the forefront of hydrogen development in this region within the next decade," he said.

Koutsantonis said that, in line with the Roadmap, Adelaide commuters would be able to ride on the first of a fleet of hydrogen-powered buses using locally-produced fuel within two years.

And within three years, the state aims to have the capacity to export its first hydrogen supplies produced using local renewable energy assets.

"Within a decade South Australian motorists should be able to drive from Ceduna to Mt Gambier in a hydrogen-fueled vehicle topping up at a state-wide network of refueling stations," the minister said.

"If Australia can find a way to export renewable energy then we can build on our coal and gas export businesses and maintain our role well into the future as a regional energy export superpower," Connolly added.

Source: http://reneweconomy.com.au/south-australia-launches-tender-hydrogen-plant-buses-77090/

Hydrogen Vehicle News

Electric vehicles have an energy problem—hydrogen may be the answer

To grasp the magnitude of the problem facing electric vehicles, we should consider what it would take to power a world full of them. Let's start with your local corner store fueling station.

The gas station that you visit routinely has underground fuel tanks with enormous gasoline fuel capacity, typically 10,000 to 20,000 gallons. This equates to an electrical energy capacity of 500 megawatt-hours.

By comparison, Tesla's Mira Loma 80 megawatt-hour battery energy station in California, the largest such installation in the U.S., sits on 1.5 acres. To match the energy storage capacity of gasoline fueling stations with batteries would require a 10-acre battery farm. In other words, gasoline allows us to put a lot of energy in a small space.

The hope for electric vehicles is that we don't have to store all the electricity at your local fueling station. We can simply pull the required power from the grid. But can we? Yes and no.

It seems simple enough with DC fast chargers, but to match the equivalent energy transfer rate of a gasoline fuel pump, an electric car charger would need to deliver multi-megawatt levels of power. Considering the fastest Level 3 chargers are rated at 0.1 megawatt, there is a massive energy transfer advantage for gasoline fuel pumps.

Most electric vehicle proponents assume the wide-scale adoption of electric vehicles would likely come with a change in consumer behavior. But are consumers willing to make those changes?

Not all automakers believe they are. Instead of placing bets on batteries alone, several large automakers are going all-in on hydrogen fuel cell vehicles. Fuel cell vehicles

leverage all the advances of batteries and electric motors in recent years and are, at their heart, battery-powered electric vehicles themselves. However, they can store considerably more energy in the vehicle via hydrogen, and the energy can be transferred to the vehicle in the amount of time we are used to spending at gas stations.

By storing energy in the form of hydrogen gas, the fuel cell vehicle has a range and refueling time on a par with gasoline automobiles, resulting in little change to the consumer mindset, behavior or convenience factor.

Proponents on the side of battery-only electric vehicles argue that charging your car at home is more convenient. I am inclined to side with them, but it still takes several hours, which no matter the location is not all that convenient.

Battery-only electric vehicle proponents also cite the high costs of fuel cells and fueling stations as a barrier. To be fair, an electric vehicle recharging "substation" with the same charging capacity and rates would not be cheap either, and as with batteries and electric vehicles during the past five years, we know the cost of advanced technologies will fall over time as demand increases.

So, in the battle between battery-only and fuel cell electric vehicles, we are comparing two technologies with different hurdles. For fuel cells, it comes down to cost, as the technology is fully capable of replacing your gas-guzzling car or truck today. While in the case of electric vehicles, we are still searching for a better battery.

Globally, during the past decade, there has been significant investment to improve performance and reduce the cost of batteries. At the 2017 meeting of the World Economic Forum, 13 companies including automakers Toyota, Honda, BMW, Daimler and Hyundai, as well as oil companies Shell and Total, promised to invest about $1.5 billion per year to help drive down the cost of hydrogen.

Under President George W. Bush, a strong push was made in hydrogen fuel cell technology research and development. With President Barack Obama, the focus shifted to batteries for electric vehicles. Moving forward, we have the opportunity to build on nearly 20 years of research.

California is taking the lead, with investments in dozens of hydrogen fueling stations, but California will only serve as a test bed. To move the needle and make fuel cell electric vehicles truly viable, other states and the federal government must buy in as well.

Source: https://news.utexas.edu/2017/09/19/hydrogen-may-be-the-answer-to-evs-energy-problems

Mercedes commits to hydrogen fuel with GLC F-Cell hybrid

Mercedes-Benz is getting back into the hydrogen fuel cell game.

The German auto giant announced at the just-convened Frankfurt International Motor Show that it would begin selling the GLC F-Cell in the U.S. by late 2019.

Mercedes, which calls the hybrid SUV "the world's first electric vehicle with fuel-cell/battery powertrain," said the new F-Cell will have an all-electric battery range of 30 miles and a total hybrid range of 271 miles.

The German company joins a host of vehicle manufacturers that, in anticipation of tougher future European emissions standards, are moving away from diesel and gasoline engines and toward alternative fuel machines.

Last week, BMW and Jaguar Land Rover announced plans to ramp up production of electric vehicles, joining Volvo, Volkswagen and Ford in the group of automakers that have said they are anticipating the end of internal combustion engine production.

More recent reports say that the government in China, the world's fastest growing automotive market, plans to ban sales of all gasoline- and diesel-powered cars and trucks.

The new Mercedes vehicle will be fitted with a 4.4-kilogram hydrogen fuel storage tank paired with a 13.8-kilowatt-hour lithium-ion battery.

The two power sources will push an electric motor capable of 147 kilowatts of thrust, Mercedes said. The F-Cell will be able to go as far as 30 miles on battery power alone before tapping the stored hydrogen for greater range.

The vehicles will make the equivalent of 197 horsepower and 258 pound-feet of torque, Mercedes said, and run at an electronically limited top speed of 99 miles per hour. The electric battery will be able to receive a full charge in about 1.5 hours.

Driving modes will allow the operator to run the car on hydrogen only, battery only, or in hybrid mode — making it possible for the hydrogen side to recharge the battery side, among other things.

The battery can also be recharged like a traditional plug-in, connected to a home wall plug or a commercial charging station.

The GLC F-Cell joins a small collection of hydrogen fuel cell cars on U.S. roads, among them Toyota's Mirai, Honda's Clarity and Hyundai's Tucson.

Those cars, along with a previous Mercedes-Benz fuel cell B-Class vehicle, were powered by hydrogen fuel cell alone, and did not include an on-board battery capable of electric-only range.

They are popular among a small but passionate population of drivers because they run silently, do not produce toxic emissions and can be refueled in three to five minutes, just like gasoline-powered cars.

But sales and leases of those cars have been slow, in part because of the continued scarcity of hydrogen fueling stations.

Not all observers were applauding. Karl Brauer, senior analyst at Kelley Blue Book, while lauding Mercedes' efforts to develop more alternative fuel vehicles, said the world still isn't ready for widespread use of cars requiring hydrogen fuel.

"Hydrogen fuel cell cars are too expensive, and too limited in their functionality," Brauer said. "They still can't compete, largely because there aren't enough stations."

Mercedes did not provide information on pricing.

Source: http://www.latimes.com/business/autos/la-fi-hy-mercedes-fuel-cell-car-20170912-story.html

More fuel cell buses coming to SARTA, fuel cell electric cars on the horizon

CANTON, Ohio—The Stark Area Regional Transit Authority is adding two more buses to its 11-bus fleet of electric buses powered by hydrogen fuel cells.

A $1.75 million grant from the Federal Transit Administration will pay for the buses, which produce no emissions other than water, and which do not pull power from the electric grid.

Consider the grant a down payment on a future fuel cell car that won't be built in large numbers until there are enough fuel cell vehicles on the road to justify building hydrogen filling stations.

And SARTA wants to help make that happen. The transit authority has been working with the Ohio State University Center for Automotive Research and a private, California clean transportation company to solve this chicken-and-egg issue.

The collaborative earlier this month issued a "Hydrogen Road Map" for the Midwest, arguing that with enough early investment the region could see 135,000 fuel cell vehicles—buses, trucks and cars—during the next 15 years and 250 hydrogen filling stations.

And that would mean a lot of jobs in Ohio.

"If we can position ourselves, the modeling [used in the study] suggests that we can create up to 65,000 new jobs," said Kirt Conrad, executive director and CEO of SARTA.

Ohio already has a strong position in manufacturing components for fuel cells and fuel cell systems, and that's one of the reasons for the road map's optimism.

The road map targets metropolitan areas as the best place to start building fuel cell filling stations. And that's where SARTA is at the forefront. SARTA's is committed to becoming a refueling station for other businesses and consumers who drive fuel cell vehicles, said Conrad.

Conrad said the SARTA fuel cell fleet's operating problems have been few and have not involved the fuel cells themselves but some of the sub systems.

"Any time you have a new vehicle the bugs have to be worked out. We've had some problems, but not with the fuel cells, but with the blowers [compressors]. I think we have pretty much got those system problems worked out."

The basic electro-chemistry of the fuel cells on the buses is nothing new. But the sophistication and durability of the fuel cells, which are made by Ballard Power Systems of Canada, is what has moved fuel cells from laboratories to vehicles.

The 150 kilowatt (150,000 watts) fuel cells on the SARTA buses combine hydrogen with oxygen from the air in a chemical reaction that produces water only water as an "emission." There is no combustion.

The current flows into a high-tech lithium-ion battery system and then to the drive motors, which are part of a sophisticated drive system that includes "regenerative" braking.

If that seems incredibly complicated, it's because it is. And expensive. But as more fuel-cell buses are manufactured, the cost of each bus has been falling, said Conrad.

"We have already seen the price of new [fuel cell] buses come down from $2.5 million to $1.4 million. And we can see the glide path to $650,000 to $700,00 (about the price of a diesel bus)."

The buses have a range of about 260 miles in typical city driving. They average about 9 miles per gallon equivalent compared to 4 to 4.5 miles per gallon for diesel buses and 3.8 miles per gallon equivalent for compressed natural gas powered buses.

All of the fuel cell buses are equipped with data loggers that collect performance data for the National Renewable Energy Laboratory.

"They monitor costs and fuel issues and overall performance, the cause of any breakdowns and ease of use for passengers. NREL has been doing this for 12 years," Conrad said.

Source:
http://www.cleveland.com/business/index.ssf/2017/09/more_fuel_cell_buses_coming_to.html

Nikola Motor Company and Bosch team up on long-haul fuel cell truck

Salt Lake City-based Nikola Motor Company and German auto components giant Bosch are teaming up to build the Nikola One and Nikola Two—a pair of hydrogen-electric, long-haul trucks that will compete with the handful of other low-emissions trucks and powertrains that have been announced in mid-2017.

The Nikola One truck isn't a new development, but the startup's partnership with Bosch is. Last December, Nikola Motor Company announced that it would build a hydrogen-electric truck that would be able to travel 1,200 miles on a tank of hydrogen and deliver 1,000 horsepower and 2,000 foot-pounds of torque. The company said at the time that its truck, deemed the Nikola One, would be market-ready by 2020.

Now, that market-ready date has been pushed back to 2021, but adding Bosch's experience into the mix no doubt helps firm up Nikola Motor Company's projections. According to a press release from the startup, the class 8

Nikola One and Nikola Two will now be built on Bosch's eAxle—an integrated unit blending motor, power electronics, and transmission. Bosch's eAxle was only just announced this January.

The Nikola trucks will both pair hydrogen fuel cells with a 320kWh battery pack and offer a payload capacity of 65,000 pounds. That number demonstrates just how much bigger long-haul trucks need to be versus short-haul trucks—Daimler announced a new all-electric short haul truck last week, but its payload capacity will be about 7,000 pounds.

At the moment, Nikola Motor Company's primary competitor would be Cummins, the diesel truck engine maker that announced an all-electric powertrain capable of hauling 22 tons, or about 44,000 pounds, on a 140kWh battery pack for 100 miles. Cummins said the power train could be paired with an on-board diesel generator to triple the car's range.

Although battery-only trucks have a much shorter range than hydrogen-electric vehicles, both new technologies are hampered by a similar problem, that is, where to refuel/recharge. Back in December, Nikola Motor Company added that it would build 364 hydrogen fueling stations throughout North America starting in 2018.

The dual-motor design and the fuel cell system in the Nikola One and Two will also be developed with Bosch's help, with a view to maximizing the truck's range. The truck's controls and software will also be a product of the Nikola/Bosch partnership. Bosch is well familiar with vehicle software, too—notoriously it helped develop the software that Volkswagen diesel vehicles ran to cheat federal emissions tests.

But with fuel cell vehicles, the only emission is water, so it strains the imagination to think of a way to repeat such a stunt. At the moment, prices aren't available for the Nikola One or Two, but the company says the trucks will reflect "a competitive total cost of ownership" compared to traditional powertrains.

Source: https://arstechnica.com/cars/2017/09/nikola-motor-company-and-bosch-team-up-on-long-haul-fuel-cell-truck/

Metropolitan Police trial hydrogen fuel cell scooter

The Metropolitan Police Service, London's world-famous police force, has started trialing hydrogen fuel cell scooters as part of a wider program to reduce its emissions.

Suzuki has loaned the seven Burgman motorcycles to the organization free of charge. They will be based at Alperton Deployment Centre during the 18-month trial and will be used by Police Community Support Officers within the Road and Transport Policing Command.

This type of vehicle uses a fuel cell to convert fuel (in this case, hydrogen) into electricity, which then powers electric motors. The result is a zero-emission vehicle that can be refueled almost instantly, in contrast to conventional battery electric vehicles which require several hours' charging.

Commander Neil Jerome for Territorial Policing said, "Being the UK's largest police service we constantly have vehicles on the roads and therefore it is our aim to make our fleet as clean as we can, whilst maintaining operational capability.

"We are thankful to Suzuki and our partners and look forward with optimism about this trial. Through collaborative partnerships and innovative testing such as this, we can gain real-life experience of how we can progress our ambition and create a cleaner fleet that will benefit London and the service we provide."

The scooters will be refueled from a private filling station, provided by Fuel Cell Systems. They will have a range of around 75 miles on a single tank.

Suzuki GB Managing Director, Nobuo Suyama,

said: "Suzuki are extremely honored to be able to showcase the Burgman Fuel Cell and gain valuable feedback from this important trial with the Met.

"Operational data from the trial will be gathered and used to support Suzuki zero emission vehicle development programmer. Deploying these vehicles into service with the Met marks a significant milestone in the extensive development of this ground-breaking technology.

"Being able to release the Suzuki Burgman Fuel Cell to the Met has only been made possible by the support of a number of technology partners, including Intelligent Energy Ltd, with whom Suzuki has jointly developed the Fuel Cell unit for the scooter."

Unfortunately for the UK's many commuters, the fuel cell Burgman scooter is not yet available commercially, and the hydrogen filling infrastructure currently operational in London remains Weak. However, the clear practical and environmental advantages of hydrogen fuel cell vehicles mean that their uptake is likely to grow.

Source:
http://www.telegraph.co.uk/cars/news/metropolitan-police-service-trial-hydrogen-fuel-cell-suzuki/

BMW fuel-cell vehicles are still on track, including Rolls-Royce cars

With everyone currently focused on electric cars, BMW included, some tend to forget that the German company still has a running joint venture with Toyota in the field on fuel-cell vehicles. The Japanese manufacturer has been at the forefront of the FCV segment and the know-how and technology they have and shared with BMW seems to be heading to production, with the first cars using this tech to step into the limelight in the foreseeable future.

That's what Klaus Frolich, BMW's head honcho of the R&D division, definitely seemed to be hinting at during a press conference held in Munich just the other day, ahead of bringing out a host of new cars at the Frankfurt Motor Show next week. "We intend on building a large car with a fuel cell in 2025," he said. "Fuel cells will happen, but how relevant they will be to BMW, we don't know yet." Therefore, the group is definitely still interested in seeing what fuel-cell cars have to offer but it remains to see whether they can offer the customers what they've grown to expect from BMW.

The challenge here seems to be finding a way of making sure that their character is just as sporty as the rest of the cars in the range and that may be an issue. That's because of the weight the tech needed to convert hydrogen into actual usable power might be too much in the end, compromising the car's handling, something the German engineers will definitely have an issue with. In the case of Rolls-Royce vehicles though, things could be different.

As far as the British luxury brand goes, FCV could work, as they'd offer patrons sitting in the back a comfortable, serene experience, something that's part of the company's DNA just as much as the Pantheon grille up front. Another candidate that would be able to incorporate the tech could be the upcoming BMW X7 which would somewhat explain why the concept will be unveiled using the iPerformance name. Nevertheless, while 2020 seems to be the date when we'll start getting more details about the FCVs being developed in Munich, production cars won't likely show up before 2025.

Source: http://www.bmwblog.com/2017/09/08/bmw-fuel-cell-vehicles-still-track-including-rolls-royce-cars/

Self-sufficient hydrogen boat embarks on 6-year journey around the world

The world watched in anticipation as the groundbreaking Solar Impulse 2 plane circumnavigated the globe last year. Now, the "Solar Impulse of the Seas" has set sail, aiming to demonstrate in a fresh way that clean energy can power our world. Dubbed Energy Observer, the solar-, wind-,

and hydrogen-powered catamaran will sail to 50 countries over the course of six years.

Solar panels line the top of the Energy Observer, and two vertical axis wind turbines harness the power of the wind, but those aren't the only energy sources that make this vessel self-sufficient. The boat is able to generate hydrogen from seawater thanks to an electrolysis system. That hydrogen, stored in tanks, will help the Energy Observer glide through the waves emissions-free. The project was started by French offshore racer Victorien Erussard, accompanied by French explorer and filmmaker Jérôme Delafosse.

The Energy Observer is equipped with technologies like electric motors, lithium-ion batteries, and a hydrogen fuel cell. It's around 100 feet long and 42 feet wide, with solar panels covering 1,400 square feet atop the catamaran. Built in 1983, the Energy Observer has already had a long career as a racing boat, but was recently christened earlier this month by France's environment minister Nicolas Hulot. Energy Observer left Paris this past weekend with mayor Anne Hidalgo aboard.

Erussard said on the boat's website, "There is not one miracle solution to combat climate change: there are solutions which we must learn to operate together. That's what we are doing with Energy Observer: allowing nature's energies, as well as those of our society, to collaborate."

And though the boat draws on different technologies than the Solar Impulse 2, it apparently has the approval of pilot Bertrand Piccard, who was present at the christening ceremony. He said, "Energy Observer, just like Solar Impulse, makes exploration work for a better quality of life. We need to lead people towards the future by showing them solutions instead of depressing them."

You can track where the Energy Observer is here and find out more here.

Source: http://inhabitat.com/self-sufficient-hydrogen-powered-boat-embarks-on-6-year-journey/

2018 Honda Clarity PHEV could be the Chevy Volt's strongest competitor yet

With Honda's revelation of electric range for its 2018 Clarity Plug-in Hybrid just 6 miles shy of the Chevy Volt's, it stands to become the reigning sales leader's toughest competition yet when launched later this year.

Honda Clarity

Since its December 2010 release, the "extended-range electric" Volt has been the best-selling plug-in hybrid in the U.S., although Toyota's cut-rate Prius Prime has vied with it closely from January through August, and it's anyone's guess which could finish ahead for 2017 sales.

Chevy Volt

Even before we know the outcome of the Prius/Volt question, Honda will be releasing its plug-in hybrid Clarity which—like the Volt—will be available in all 50 states. The new Honda is one of three Clarity variants—a battery electric version, hydrogen fuel cell version, and the PHEV.

Clarity PHEV vs. Volt

Unveiled in April at the New York Auto Show, the largish-midsized Clarity will beat Honda's conservative 42-mile e-range estimate it gave when introduced and instead serve up 47 miles on the U.S. EPA cycle.

With PHEVs, every few miles makes a difference when the range champ—the compact Volt—tops the scale at 53 miles, and others are only in the mid-to-high 20s.

Given electric range is the most prominent metric in what is really a balance of many pros and cons buyers choose from, the Clarity's second-best EV range status—Honda says best "in class" for midsized vehicles—is good.

It's also useful enough to get the job done which is avoiding gasoline usage day to day, and meanwhile it's a semi-luxurious, larger car that may be priced competitively—enough.

Under the hood is essentially a variant of the dual motor hybrid system from the Accord Hybrid, albeit with 1.5-liter engine instead of 2.0-liter, and a 17-kWh battery for electric only driving.

Said battery is a bit smaller than the 18.4 kWh unit in the Volt, and as a matter of trivia, the Clarity PHEV's battery is not all that much smaller than the pure-electric Clarity's 25.5 kWh battery which yields 89 short EPA-rated miles range.

The Clarity PHEV's engine is based on a next-generation 1.5-liter DOHC i-VTEC engine first used in the 2015 Honda Fit, according to Honda's Natalie Kumaratne, Environment & Safety Public Relations.

"However, for the application to the Clarity Plug-in Hybrid the engine has been optimized for the unique requirements of a plug-in vehicle using the Atkinson cycle, where it functions primarily to generate electricity," said Kumaratne, "but can also serve as a direct power source under certain driving conditions in parallel with the electric motor."

The EPA rating now revealed for this engine is less than the Accord Hybrid's however—40 mpg city, 40 highway, and 42 mpg combined.

Its miles per gallon equivalent (MPGe) for electric use, by the way, is 110 MPGe versus the Volt's relatively close 106 MPGe

Fuel efficiency for the Volt in hybrid mode is close, with the same 42 mpg combined rating based on 43 mpg city, 42 mpg highway.

For 2016, the second-generation Volt introduced an aluminum 1.5-liter Ecotec engine with direct injection, 12.5:1 compression ratio, cooled exhaust gas recirculation and a variable displacement oil pump, and is rated for 101 horsepower at 5,600 rpm which is is added to by potent electric motor drive.

The Clarity's horsepower otherwise compares to the compact Volt's electrically augmented 149 system total horsepower and higher 298 pounds-feet. Its electric motor produces 181 horsepower and 232 pounds feet of torque. The battery recharges in 2.5 hours when fed 240 volts suggesting a faster on-board charger than what comes in the Volt which takes 4.5 hours to recharge its 18.4-kWh battery.

Acura Level—Almost

The Clarity Plug-in Hybrid is significantly roomier than the Volt and has Acura-level refinement and features.

Both the Volt and Clarity are well contented, but the Clarity may prove more refined.

Initial drive reviews of the Clarity Fuel Cell vehicle already on the market have won it praise as being nice enough to be an Acura, and the Plug-in Hybrid is expected to be the same.

Materials such as ultra suede, and standard Honda Sensing suite of advanced safety and driver-assist tech make it a premium package indeed, but where it is hands down the winner is interior volume.

Honda will release more specs later this year, but the three Clarity variants were built to satisfy focus groups who said a sedan should comfortably fit five.

The compact Volt technically fits five, but knee room is less, and space in the back seat is all around tighter. Honda media rep Chris Naughton also let on the Clarity is a bit roomier than the Accord Hybrid which is on the large scale of a midsized class car.

Martin emphasized also the Clarity will top the Volt in cubic feet for cargo and passenger by a significant margin.

"We expect it will have the most interior volume of any of the versions of Clarity," said Martin of a provisional pro-

jection of around 121 cubic feet of passenger plus cargo space topping the Volt's 100.9 total cubic feet, "and the cargo volume, the Volt is 10.6; we're at 19.1."

Aesthetics

In the looks department, the call may be closer, though time will tell.

The Volt is more "mainstream" and mirrors a Cruze with hints of the Honda Civic, Kia Forte, and other vehicles by automakers conspiring to make vehicles both attractive and ordinary all in one stroke.

That is, they blend in, while the Clarity stands out with semi-faired-in rear wheel reminiscent of the original Insight which set the tone 17 years ago as an odd looking green car.

Some will like the originality, others may see it as awkward or stylistically tone deaf, if not as much as some have disliked Honda's Japanese rival's car, the Toyota Prius.

Not hurting anything however is a Honda, and loyalists have been known to see beauty where others do not, and Honda has a fair number of loyalists.

Driving Dynamics

Based on the same chassis as the Clarity fuel cell vehicle, the Clarity Plug-in Hybrid uses a stiff body structure with strategic use of high-strength steel, optimized weight distribution, and it promises a relatively controlled drive experience.

It may yet do alright as the Accord is a solid, if not in sports car territory, and the Clarity is in league. Further, if you haven't noticed, a lot of family sedans these days are competent handlers.

The Volt's fans like to emphasize it has a fun-to-drive factor, but both it and the Clarity are eco cars focused on efficiency, and may be within realm.

Brand

Chevrolet has proven the Volt's quality and this is stated preemptively because people with long memories may otherwise sneer at a GM product or American brand in general. To those who think along those lines, just the fact the Clarity is a Japanese Honda is enough to settle any question.

Beyond that constituency, Chevrolet has won more awards than an other brand for the past three years, and it is on a mission to remake its name after GM's federal bailout and restructuring embarrassment of last decade.

The Volt is a pinnacle product and so if you are just catching up, it actually is the more proven of the two. Now in its second generation, among plug-in fans it is a premium nameplate, even if there is a "bowtie" on the front of the grille wearing silver "braces."

Price

The Volt starts at just below $34,000 and is eligible for a $7,500 federal credit and state incentives as the case may be. Honda says the Clarity, eligible for the same subsidies, will start in the mid 30s, so that may mean very close or a couple thousand or more above the Volt.

Enthusiasts are speculating after credits it could be below the critical $30,000 mark, but this is not definite until Honda tells us.

More to Come

We sought more info, such as whether the Clarity's battery is liquid cooled like the Volt's is, and other details to make a closer comparison, but such data is on hold.

Honda says more will be revealed closer to launch, and it will remain to be seen how well the car is marketed and received.

On paper so far, it is plain why Honda says the plug-in model will sell the most among its low-range EV, and limited-market FCV.

Whether it wins more buyers than the Volt will depend on the total value proposition, so we shall see.

Source: http://www.hybridcars.com/2018-honda-clarity-phev-could-be-the-chevy-volts-strongest-competitor-yet/

New liquid-metal membrane technology may help hydrogen fuel cell vehicles

While cars powered by hydrogen fuel cells offer clear ad-

vantages over the electric vehicles that are growing in popularity (including their longer range, their lower overall environmental impact, and the fact that they can be refueled in minutes, versus hours of charging time), they have yet to take off with consumers. One reason is the high cost and complexity of producing, distributing, and storing the pure hydrogen needed to power them, which has hindered the roll-out of hydrogen refueling stations.

Engineers have long recognized the power—and limitless availability—of hydrogen, the most abundant element in the universe. Hydrogen occurs naturally in the environment, but it is almost always chemically bound to other elements—to oxygen in water (H_2O), for example, or to carbon in methane (CH_4). To obtain pure hydrogen, it must be separated from one of these molecules. Virtually all of the hydrogen produced in the United States is obtained from hydrocarbon fuels, primarily natural gas, through steam reforming, a multi-step process in which the hydrocarbons react with high-temperature steam in the presence of a catalyst to produce carbon monoxide, carbon dioxide, and molecular hydrogen (H_2).

The hydrogen can then be separated from the other gases through a cumbersome, multi-step chemical process, but the cost and complexity of hydrogen production can be reduced by using a membrane to do the separation. Most of the hydrogen separation membranes currently being developed use the precious metal palladium, which has unusually high hydrogen solubility and permeance (which means that hydrogen easily dissolves in and travels through the metal, while other gases are excluded). But palladium is expensive (it currently sells for about $900 per ounce) and fragile.

For these reasons, chemical engineers have long searched for alternatives to palladium for use in hydrogen separation membranes, but so far, no suitable candidates have emerged. A pioneering study led by Ravindra Datta, professor of chemical engineering at Worcester Polytechnic Institute (WPI), may have identified the long-elusive palladium alternative: liquid metals.

A host of metals and alloys are liquid at the standard operating temperatures found in steam reforming systems (around 500 degrees C), and most of these are far less expensive than palladium. In addition, a membrane made with a film of liquid metal should not be prone to the defects and cracks that can render a palladium membrane unusable.

The WPI study, published in the *Journal of the American Institute of Chemical Engineers*, is the first to demonstrate that in addition to these advantages, liquid-metal membranes also appear to be significantly more effective than palladium at separating pure hydrogen from other gases, suggesting that they may provide a practical and effective solution to the challenge of supplying affordable hydrogen for fuel-cell vehicles. "The recent shift to electric cars is irreversible," said Datta. The next step after electric vehicles, he and others believe, is hydrogen-fuel vehicles—if the hydrogen supply puzzle is solved.

Like battery-powered electric cars, fuel-cell vehicles have electric motors. The motors are powered by electricity generated inside the fuel cell when hydrogen and oxygen combine in the presence of a catalyst (the only "waste" product is water). While they can pull oxygen from the air, the cars must carry a supply of pure hydrogen.

Many researchers have focused on bringing the cost of that hydrogen down by making better and thinner palladium membranes. Some of the most advanced membranes were produced by retired WPI chemical engineering professor Yi Hua "Ed" Ma, who, with considerable funding from industry and the U.S. Department of Energy, pioneered a process for binding palladium to a porous steel tube, resulting in palladium layers as thin as 5 to 10 microns.

Making the palladium layer thin increases the membrane's flux, or the rate at which pure hydrogen moves through it. "But if a membrane is too thin," Datta said, "it becomes fragile or it develops defects. And the membranes need to be defect-free. If they develop even a hairline crack or a micropore, you have to start over."

Six years ago, Datta and his students began to wonder whether liquid metals might overcome some of palladium's limitations—particularly its cost and fragility -- while also, potentially, offering superior hydrogen solubility and permeance. "Besides chemical affinity, permeance depends on how open a metallic crystal structure is," he said. "Liquid metals have more space between atoms than solid metals, so their solubility and diffusability should be higher."

After a literature review revealed no previous research on this topic, Datta successfully applied for a $1 million award from the U.S. Department of Energy to study the feasibility of using liquid metals for hydrogen separation. he and his team, graduate students Pei-Shan Yen and Nicholas Deveau (Yen earned her PhD in 2016; Deveau received his in May), decided to begin their exploration with gallium, a nontoxic metal that is liquid at room temperature.

They conducted fundamental work that revealed that gallium was an excellent candidate, as it demonstrated significantly higher hydrogen permeance than palladium at elevated temperatures. In fact, laboratory studies and theoretical modeling conducted by the team showed that a number of metals that are liquid at higher temperatures may have better hydrogen permeance than palladium.

While liquid gallium showed great promise as a material for hydrogen separation, creating a functioning membrane with the metal proved challenging, Datta said. "It turns out that liquid metals are very reactive," he said. "You cannot place gallium on a porous metal support, as Professor Ma did with palladium, since at higher temperatures it quickly forms intermetallic compounds that kill the permeability." The team discovered that the metal will also react with a number of ceramic materials commonly used as supports in palladium membranes.

Through modelling and experimentation, they compiled a list of materials, including carbon-based materials like graphite and silicon carbide, that do not chemically react with liquid gallium but that are also wettable by the liquid metal, meaning that the metal will spread out to form a thin film on the support material.

Aware that the surface tension of liquid metals was likely to change in response to variations in temperature and the composition of the gases they were exposed to, potentially producing leaks, they decided to insert the metal between two layers of support material to create a sandwiched liquid-metal membrane or SLiMM. A membrane consisting of a thin (two-tenths of a millimeter) layer of liquid gallium between a layer of silicon carbide and a layer of graphite, was constructed in the lab and tested for stability and hydrogen permeance.

The membrane was exposed to a hydrogen atmosphere for two weeks at temperatures ranging from 480 to 550 degrees C. The results showed that the liquid gallium film was up to 35 times more permeable to hydrogen than a comparable layer of palladium and that diffusion of hydrogen through the sandwiched membrane was considerably higher than for a typical palladium membrane. The test also showed that the membranes were selective, allowing just hydrogen to pass through.

"These tests confirmed our hypotheses that liquid metals may be suitable candidate for hydrogen separation membranes," Datta said, "suggesting that these materials could be the long-sought substitute for palladium. There are a host of questions that still need to be answered, including whether the small membranes we constructed in the laboratory can be scaled up and whether the membranes will be resistant to substances present in reformed gases (including carbon monoxide and sulfur) that are known to poison palladium membranes.

"But by demonstrating the feasibility of sandwiched liquid-metal membranes, we have opened the door to a highly promising new area of hydrogen energy research," Datta added, "for there are many other metals and alloys, beyond gallium, that are liquid at 500 degrees C. It is a vast open field, in terms of what materials you might use. Also, it poses a host of interesting scientific questions."

Source:
https://www.sciencedaily.com/releases/2017/08/170828164114.htm

How off-grid renewable energy came to the rescue in India's flood zones

Recently, deadly floods in India and South Asia and powerful storms in United States knocked out power to millions. But when people's lives are thrown into chaos by devastating natural disaster, using alternative energy source may not seem like an obvious response. However, since energy grids are often the first to fail when a disaster hits, and outages hamper recovery efforts, energy entrepreneurs believe that off-grid renewable energy could provide an instant source of power to those who need it most.

"After a natural disaster hits, it can take weeks or longer for power to be restored and the expense of repairing

transmission lines can be very high. Solar and battery mini-grids are a more resilient solution, as it allows local and remote communities to regain access to power, clean drinking water, medical facilities and communications immediately," says William Brent, director of Power For All, a coalition of 200 public and private organizations campaigning to deliver universal energy access by 2030.

"Also, in the case of renewable mini-grids, the fuel—the Sun—is local, unlike diesel generators, which are subject to disruption in fuel supply because of a disaster," adds Brent

In August, Bihar, one of the poorest states in India, faced its worst flooding in decades, affecting 13 million people. With uncertainty about the availability of grid power, renewable energy mini-grids—Tara Urja and Desi Power—stepped up to provide back-up power and assist with relief operations in eight villages, including Nabiganj, Siwan and Araria. Tara Urja and Desi Power are private energy service companies working with the Smart Power India, an initiative funded by Rockefeller Foundation to help scale mini-grids in India.

"In Bihar, mini-grids and battery energy ensured relief operation was not hampered due to power outages, and the affected villages were not plunged into darkness by night," says Mukesh Khandelwal, COO of Tara Urja, "Our electricians maintained a round-the-clock watch during the peak days of flooding to make sure that the village-level office received electricity through a feeder line to coordinate relief operations," adds Khandelwal.

In Araria, a village in Bihar that was under three feet of water, Desi Power provided over 16,000 people to power a range of standard appliances. "Even when villages were submerged and grid connectivity was off, we also had to shut down the grid, but the plant was kept open to help people access essential services such as charging mobile phones and solar lantern from our battery backup," says Kunal Amitav, COO for Desi Power. "The plant area was also opened up to provide shelter to people, as it was on a slightly higher ground."

Source:
https://www.forbes.com/sites/suparnadutt/2017/09/15/how-off-grid-renewable-energy-came-to-the-rescue-in-indias-flood-zones/#4f9dde72bc49

Nanotechnology applications that can change the world: Alternative energy sources

"Nanotechnology" is defined by the National Technology Initiative as science, engineering or technology that involves manipulating matter with at least one dimension that falls in the range between 1 and 100 nanometers. A nanometer is one billionth of a meter which is a scale that is almost impossible to comprehend. Jennifer Kahn in an article in National Geographic tried to express this tiny distance on a more human scale by comparing it to the amount an average man's beard grows in the time it takes him to raise his razor to his face.

Interest in nanotechnology is driven in large part by the fact that properties of materials that are stable and familiar at the macroscale we experience can change radically at the nanoscale. Understanding and harnessing these changes promises to transform our everyday world in ways that may sound like science fiction but may happen in the not-so-distant future.

Here are some recent achievements in the nanotechnology of alternative energy sources.

Producing energy from air pollution

Hydrogen is an attractive alternative source of fuel because burning hydrogen in combination with oxygen produces water, not carbon dioxide and other air pollutants as a "waste product". The energy needed to create pure hydrogen is a limiting factor in developing hydrogen as a fuel source.

Researchers at the University of Antwerp and the University of Leuven in Belgium have devised an alternative method for producing hydrogen that has the potential to reorient our approach to solving several global environmental problems.

The researchers created a device with two compartments separated by a membrane created from nanomaterials. Air pollutants are broken down in one of the compartments. Some of the chemicals produced as a result of the breakdown are passed through the membrane.

The nanomaterials in the membrane extract hydrogen which is collected in the second compartment. This hydro-

gen can be harvested and stored as a potential fuel source. The device runs on solar power eliminating the burning of fossil fuels that other methods use to produce pure hydrogen.

Imagine how different the world would look if a system based on this technology was operating at scale. Existing air pollution and its negative effects on health and climate change would be reduced. Cleaning the air would produce a clean-burning fuel that reduces the need to rely on the dangerous fuel sources that polluted the air in the first place. The cities with the highest levels of air pollution would become the most abundant sources of clean energy.

Producing energy from motion

How much fun do you have making sure your cell phone is charged every day? How would you like it if all you had to do to keep your phone charged was put it in your pocket? Researchers at Vanderbilt University have built a system that can make this possible by harvesting electricity from human motion.

The researcher's system uses sheets of black phosphorous that are only a few atoms thick. Bending or pressing the black phosphorous nanosheets produces a small electrical current that can be harvested and stored in a battery.

The nanosheets have two properties that make energy-harvesting clothing possible. The first is that the sheets are so thin they can be incorporated into clothing without changing the look or feel of the material. The second is that they are able to harvest electricity at the low frequencies that characterize human motion.

While piezoelectric techniques for extracting energy from motion generally work best at movement frequencies above 100 Hz (100 cycles per second), human motion normally occurs at 10 Hz or less. The nanosheets are capable of producing an electric current at movement speeds as low as 0.01 Hz (one movement cycle every 100 seconds). This is more than sufficient for harvesting energy from everyday activities such as sitting, standing and walking.

The energy harvested from the nanosheets could power electronic textiles in addition to devices like cell phones. This opens the door to creating clothing with built in sensors to monitor health or fitness metrics, or clothing that uses an app to change patterns and colors.

Researchers at the University of Texas at Dallas and Hanyang University in South Korea have developed an alternative approach to harvesting energy from motion. Rather than rely on sheets of black phosphorous, they spun carbon nanotubes into yarn and tightly twisted the yarn to make it elastic. The yarn was then coated in an electrolyte. When the yarn is stretched, it produces an electric current.

The researchers sewed the yarn into a shirt that produced an electrical signal when the person wearing the shirt breathed. The signal could be used to power a sensor that measures respiratory rate.

They also demonstrated how the yarn could be used to harvest energy from repetitive natural motions such as waves in the ocean. A sinker was attached to a balloon with a 10 cm strand of yarn and placed in the Gyeongpo Sea off the coast of South Korea. The sinker tethered the balloon to the sea floor. Passing waves lifted the balloon which stretched the yarn producing a measurable current.

It's worth emphasizing that these applications of nanotechnology are not theoretical or "in-principle" achievements. The hardware exists. The problems associated with the tech don't lie in finding out if it will work, they lie in finding out if it will scale. If and when the scaling solutions are found, the world will look quite a bit different than it does today.

If you found this article interesting, here is another that is part of this ongoing series about nanotechnology.

Source:
https://www.forbes.com/sites/kevinmurnane/2017/09/06/nanotechnology-applications-that-can-change-the-world-alternative-energy-sources/#5303fa007193

Essential Science: Graphene holds the key to next-gen fuel cells

Scientists in the U.S. have developed nanocrystals wrapped in carbon atoms, which they report are critical for the safe storage of hydrogen for new fuel cell technology. The invention is important for future fuel technology.

The work has come from the U.S. Department of Energy's

Hydrogen News of Interest

Lawrence Berkeley National Laboratory (the Berkeley Lab). The aim of the research is to improve ways for safely storing hydrogen ready for use with fuel cells for vehicles. This comes down to a better understanding of the atomic details of the ultrathin coating put onto nanocrystals. This coating functions as selective shielding; the coating also enhances the performance of hydrogen storage.

The research required the synthesizing and coating of magnesium crystals (tint structures which measure just three nanometers (billionths of a meter) across. This required the application of X-rays and the development of complex computer simulations into order to study how the nanocrystals and the carbon coating (formed from graphene) functioned in synchronicity. The X-ray device used was the Advanced Light Source (a synchrotron). This is one of the world's brightest sources of ultraviolet and soft X-ray light, a synchrotron light source (which is a source of electromagnetic radiation produced by a storage ring). The device provides multiple and extremely bright sources of intense and coherent short-wavelength light. The computing power came from the supercomputers housed at Berkeley Lab's National Energy Research Scientific Computing Center (NERSC).

Fuel cells are of great importance for meeting future energy needs, especially in relation to transport in the wake of dwindling (and environmentally polluting) fossil fuels. A fuel cell is a type of electrochemical cell that converts the chemical energy from a fuel into electricity via electrochemical reactions. The reaction is typically with the hydrogen-containing fuel reacting with oxygen.

A fuel cell differs from a battery in that the fuel cell needs a continuous source of fuel and oxygen in order to sustain the necessary chemical reaction. In contrast, a battery uses chemical energy from chemicals already present in the battery. Theoretically, a fuel cell can produce electricity continuously.

Aside from spacecraft, the main future application of fuel cells is with vehicles, which makes fuel cell development something of interest to vehicle manufacturers and those running large fleets. The use of hydrogen-oxygen fuels cells in vehicles has benefits. This includes zero emissions of carbon dioxide; lower reliance on fossil fuels; and lower ruining costs. Vehicles running from fuel cells are classes of electric vehicle that use a fuel cell, instead of a battery, or in combination with a battery or supercapacitor, to power its on-board electric motor. One of the most common business uses of fuel cell vehicles is forklift trucks used in warehouses.

There are many different types of fuel cells, including polymer electrolyte membrane fuel cells; direct methanol fuel cells; alkaline fuel cells; phosphoric acid fuel cells; molten carbonate fuel cells; solid oxide fuel cells and reversible fuel cells. These fuel cells are classified by the kind of electrolyte they employ. The grouping determines the type of electro-chemical reactions that take place in the cell; other factors include the kind of catalysts required, the temperature range in which the cell operates, and the fuel required.

The coating used with the new research is reduced graphene oxide (or rGO), which resembles graphene (a one-atom-thin sheet of carbon, which is arrayed in a honeycomb pattern). The rGO carting consists of nanoscale holes that allow hydrogen to pass through while trapping larger molecules at bay. The purpose of the carbon wrapping is to prevent the magnesium from reacting with its environment, which leads to inefficiencies. The resultant layer creates a better solution for trapping more hydrogen.

One of the researchers, Dr. David Prendergast explains to Controlled Environments magazine that the current generation of hydrogen-fueled vehicles power fuel cell engines via compressed hydrogen gas. "This requires bulky, heavy cylindrical tanks that limit the driving efficiency of such cars." With the new research, Dr Prendergast notes the nanocrystals offer a strong possibility for eliminating such bulky tanks by storing hydrogen within other materials.

Overall the wrapped nanocrystals can chemically absorb pumped-in hydrogen gas at a far higher density than is currently possible using a compressed hydrogen gas fuel tank at the same pressures.

The new research into coatings forms part of the Hydrogen Materials-Advanced Research Consortium (HyMARC) , which was established as part of the Energy Materials Network by the U.S. Department of Energy's Fuel Cell Technologies Office. The consortium is composed of composed of Sandia National Laboratories, Lawrence Liver-

more National Laboratory, and Lawrence Berkeley National Laboratory. The HyMARC research activities focus on the thermodynamic and kinetic limitations of storage materials. This area includes mass transport, surface chemistry, and processes at solid-solid interfaces.

A next phase of the research is to use materials that are ideal for real-world hydrogen storage applications. This includes looking at complex metal hydrides, which can also be wrapped in a protective sheet of graphene. These are being considered to boost the hydrogen storage capacity, according to the lead researcher Dr. Liwen Wan.

The research is published in the journal *Nano Letters*, with the research paper titled "Atomically Thin Interfacial Suboxide Key to Hydrogen Storage Performance Enhancements of Magnesium Nanoparticles Encapsulated in Reduced Graphene Oxide."

In related graphene news, scientists have devised a simple, sturdy graphene-based hybrid desalination membrane. The device can provide clean water for agriculture and one-day human consumption.

Source: http://www.digitaljournal.com/tech-and-science/science/essential-science-graphene-holds-the-key-to-next-gen-fuel-cells/article/502682

Fuel cells could boost Europe's energy security, conference hears

Europe could boost its energy security through existing hydrogen and fuel cell technology, according to industry experts.

The discussion took place at a recent conference in Tallinn, Estonia titled *The Role of Fuel Cell and Hydrogen Technology in Delivering Energy Security for Europe*. The conference was organized by Estonia's National Institute of Chemical Physics and Biophysics (NICPB), Finnish technical research center VTT and European solid oxide fuel cell company Elcogen, which makes micro- and industrial fuel cell combined heat and power (CHP) systems.

According to the conference speakers, existing hydrogen and fuel cell technologies have proved their potential for Europe's energy mix but the challenge is now to ensure their large-scale market adoption.

Needed to achieve this aim are further research into reducing costs and durability, continuing current European co-operation across industry, academia and government, ensuring that public funding is maintained, and focusing such funding towards addressing issues involved in implementation, commercialization and mass manufacturing.

Conference speaker Prof Robert Steinberger-Wilckens of the UK's University of Birmingham said the main issue for Europe was "energy imports which we have to get away from.

"Integrating more renewables is the key, with hydrogen being one of the options for storage.

"The other thing is the threat to infrastructure, whether that's natural disaster or storms or malignant interference. In Germany there was a snowstorm, three or four years ago, and some parts of the country were without any energy supply for three weeks in winter. In a case like Florida where everything is flooded, decentralized energy production could have helped—it makes the whole energy system much more resilient."

And Enn Õunpuu, CEO of solid oxide fuel cell manufacturer Elcogen, added that "to be independent of imported primary energy we should increase local production. Storage is still a challenge and, although batteries are seen as the main storage technology, fuel cells and solid oxide fuel cells in particular are the most efficient technology for electrolyzing and storing energy in the form of hydrogen."

Source: http://www.decentralized-energy.com/articles/2017/09/fuel-cells-could-boost-europe-s-energy-security-conference-hears.html

Muslim nations pledge to push renewables, energy storage, micro grids

Officials from 56 Muslim-majority nations have come together to pledge new climate-related technology goals that included promoting micro grids, energy storage and renewable energy targets.

The Islamic world's first ever Science and Tech summit, which ended last night in Astana, Kazakhstan, involved heads of state and government ministers from 56 Muslim majority nations. All countries pledged to increase investment in science as a way of addressing energy, food, wa-

ter, health and climate change challenges. The summit included the presidents of Turkey, Pakistan, Bangladesh, Uzbekistan and Afghanistan among others.

The countries have pledged to reduce greenhouse gases by targeting 10% renewable energy shares in the national energy mixes of the Organization of Islamic Cooperation (OIC) States by 2025.

They also plan to introduce micro grids and encourage distributed standalone systems for small communities.

The countries will also design and develop energy storage systems such as fuel cells and batteries using lithium-ion and vanadium redox technologies for small-scale energy storage applications.

Other pledges by the OIC nations involved nuclear energy, addressing food and water shortages, space exploration, managing big data, education and health.

OIC assistant secretary general for Science and Technology ambassador Naeem Khan, said: "As more people in the Islamic world emerge out of poverty, energy demand is increasing. This is being aggravated by climate change, with many OIC countries inhabiting climate-sensitive regions already facing desertification and degradation of land and water. Several studies have also shown a link between climate change and the subsequent effect on drought, food prices and the outbreak of conflict.

"Energy consumption and production is a major challenge in the Islamic world where many of the OIC's 57-member states are well placed to harness the power of renewables, yet also still rely heavily in traditional fossil fuels."

"In order for OIC member states to create a diverse energy mix that incorporates renewable energies, scientific and technological advancements will be essential. That includes advancements in energy storage technologies, greater use of distributed micro grids to integrate renewable energy and research efforts into solar cell efficiencies."

Source: https://www.energy-storage.news/news/muslim-nations-pledge-to-push-renewables-energy-storage-microgrids

Exxon Mobil's futuristic fuelcell carbon capture just might work

Exxon Mobil Corp.'s foray into carbon capture and storage technology with FuelCell Energy Inc. "is making progress," Cowen & Co. analyst Jeffrey Osborne wrote in a research note in September. The technology has moved from the lab to a commercial test at a power plant in Alabama.

The beauty of capturing carbon from coal or natural gas-plant exhaust is that routing the fumes through fuel-cell systems generates additional electricity. While the U.S. is retiring dozens of unprofitable coal plants, the fuel still provides 30 percent of the country's power.

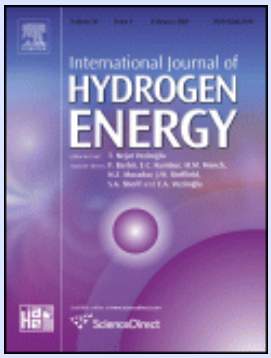
The technology could be licensed globally to help countries reach greenhouse-gas reduction targets, Cowen analyst Sam Margolin wrote in a note. "We view a successful launch of this technology, albeit in the outer years, as material to the outlook for natural gas demand," Margolin said.

Cowen researchers don't include it in revenue forecasts for FuelCell because they "always assumed it was one of many futuristic growth options," Osborne said.

For FuelCell Energy, the market opportunity could be huge. Capturing 90 percent of the emissions at just 1 percent of U.S. coal plants would require 2,160 megawatts of fuel cells, equal to about $6.5 billion in sales and $9.7 billion in service revenue, Osborne estimates. The company posted sales of $108 million in fiscal 2016.

Source: https://www.bloomberg.com/news/articles/2017-09-19/exxon-mobil-s-futuristic-fuelcell-carbon-capture-just-might-work

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.

Most Cited IJHE Articles (past 5 years)

1. **A comprehensive review on PEM water electrolysis**
   Carmo, M, Fritz DL, Mergel, J, Stolten, D. Int J Hydrogen Energy 2013;38(12):4901–34.
2. **Hydrogen from renewable electricity: An international review of power-to-gas pilot plants for stationary applications**
   Gahleitner, G. Int J Hydrogen Energy 2013;38(5):2039–61.
3. **Nanoscale and nano-structured electrodes of solid oxide fuel cells by infiltration: Advances and challenges**
   Jiang, SP. Int J Hydrogen Energy 2012;37(1):449–70.
4. **Non precious metal catalysts for the PEM fuel cell cathode**
   Othman, R, Dicks, AL, Zhu, Z. Int J Hydrogen Energy 2012;37(1):357–72.
5. **Ammonia and related chemicals as potential indirect hydrogen storage materials**
   Lan, R, Irvine, JTS, Tao, S. Int J Hydrogen Energy 2012;37(2):1482–94.
6. **Green methods for hydrogen production**
   Dincer, I. Int J Hydrogen Energy 2012;37(2):1954-1971.
7. **A review of gas diffusion layer in PEM fuel cells: Materials and designs**
   Park, S, Lee, J-W., & Popov, B. N. Int J Hydrogen Energy 2012;37(7):5850-5865.

Most Downloaded IJHE Articles (Aug-Oct 2017)

1. **CO methanation over Ni catalysts supported on high surface area mesoporous nanocrystalline γ-Al_2O_3 for CO removal in H2-rich stream**
   Alihosseinzadeh A, Nematollahi B, Rezaei M, Nemati Lay E. Int J hydrogen Energy 2015; 40(4):1809-19
2. **Hydrogen and fuel cell technologies for heating: A review**
   Dodds PE, Staffell I, Hawkes AD, Li F, Grünewald P, McDowall W, et al. Int J Hydrogen Energy 2015;40(5):2065–83.
3. **A comprehensive review on PEM water electrolysis**
   Carmo M, Fritz DL, Mergel J, Stolten D. Int J Hydrogen Energy 2013;38(12):4901–34.
4. **Thermal Hydrogen: An emissions free hydrocarbon economy**
   Moore J. Int J Hydrogen Energy 2017;42(17):12047-63
5. **Changing the fate of Fuel Cell Vehicles: Can lessons be learnt from Tesla Motors?**
   Hardman S, Shiu E, Steinberger-Wilckens R. Int J Hydrogen Energy 2015;40(4):1625–38.
6. **Effect of hydrogen-diesel fuel co-combustion on exhaust emissions with verification using an in-cylinder gas sampling technique**
   Talibi M, Hellier P, Balachandran R, Ladommatos N. Int J Hydrogen Energy 2014;39 (27):15088-102
7. **Study on method of domestic wastewater treatment through new-type multi-layer artificial wetland**
   Lu, S., Pei, L., & Bai, X. Int J Hydrogen Energy 2015; 40(34), 11207–11214.

Hydrogen station siting optimization based on multi-source hydrogen supply and life cycle cost

-H. Sun, C. He, H. Wang, Y. Zhang, S. Lv, Y. Xu. Int J Hydrogen Energy 2017:42(38): 23952-23965.

Hydrogen station siting is an essential component in the implementation of a hydrogen economy. On account of various costs, it is not a simple analog of gasoline refueling stations distribution optimization because in the initial phases of implementing this type of system the costs are much higher. This article presents a model which uses particle swarm optimization (PSO) to account for a variety of factors in site selection for hydrogen fueling stations. One of the major dimensions to the model is the variability in hydrogen sources, which differs from regular gasoline fueling stations.

The journal goes into an in-depth analysis of the Yangtze Delta or the Shanghai-Nanjing-Hangzhou region, which is one of China's top economic zones. This region has developed a chlor alkali industry, where hydrogen can be derived from the byproducts of certain chemical processes, which is both low cost and environmentally friendly. The pricing for pipelines, tube trailers and trucks to transport liquid hydrogen are all balanced against factors such as proximity to unusable land, new sites vs. retrofitting gas stations, etc. The outcome for the study has the optimized distribution mapped onto the highway and pipeline infrastructure of the region. By creating a PSO example for station siting with Shanghai-Nanjing Expressway and constructing a position particle swarm in the form of 5D vector in order to optimize 5 station locations at the same time as well a weight particle swarm in the form of 2D matrix in order to optimize the multi-source hydrogen supply programs, the paper works out optimal station construction locations on condition of multi-source hydrogen supply, multi-source hydrogen supply programs, ways of storage and transport and corresponding hydrogen's optimal life cycle cost.

http://www.sciencedirect.com/science/article/pii/S0360319917330276

-By Cyrus Daugherty

Electrochemical hydrogen storage: Opportunities for fuel storage, batteries, fuel cells, and supercapacitors

A. Eftekhari, B. Fang. Int J Hydrogen Energy 2017: 42(40):25143-25165.

The application of hydrogen as a green source of energy has been increased substantially during recent years. However, the widespread utilization of hydrogen as fuel requires developing safe, robust and reliable storage methods. Available technologies for storing hydrogen includes the utilization of tanks (in the form of liquid or compressed hydrogen) and solid-state storage. The storage in the form liquid or compressed is not suitable for everyday applications since it is relatively low energy density and imposes safety concerns. Therefore, solid-state storage emerges as an alternative approach which eliminates the issues associated with tank-based technologies.

Among possible solid-state methods, electrochemical hydrogen storage is very promising, as can be conducted at low temperature and pressure with a simple device reversibly. Also, electrochemical hydrogen storage is the basis of some other electrochemical power sources such as batteries, fuel cells, and supercapacitors. For instance, available hydrogen storage materials can build supercapacitors with exceptionally high specific capacitance in order of 4000 $F.g^{-1}$. In general, electrochemical hydrogen storage plays a substantial role in the future of not only hydrogen storage but also electrochemical power sources. However, there are some vague points which have obscured the understanding of the corresponding system to be developed practically. This review aims to portray the entire field and detect those ambiguous points which are indeed the key obstacles.

In this work, it is clarified that different materials have somehow similar mechanisms for electrochemical hydrogen storage, which is initiated by hydrogen dissociation, surface adsorption and probably diffusing deep within the bulk material. This mechanism is different from the insertion/extraction of alkali metals, though battery materials look similar. Based on the available reports, it seems that the most promising material design for the future of electrochemical hydrogen storage is a class of subtly designed nanocomposites of Mg-based alloys and mesoporous carbons.

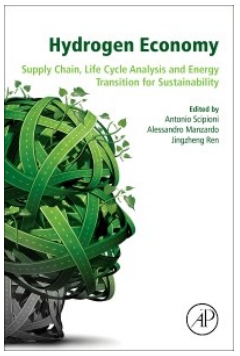
http://www.sciencedirect.com/science/article/pii/S0360319917333529

-By Yasser Ashraf Gandomi

From the Bookshelf

Hydrogen Economy: Supply Chain, Life Cycle Analysis and Energy Transition for Sustainability

Editors: Antonio Scipioni Alessandro Manzardo Jingzheng Ren



Hydrogen Economy: Supply Chain, Life Cycle Analysis and Energy Transition for Sustainability explores the challenges for the transition into a sustainable hydrogen economy. In this book, experts from various academic backgrounds discuss the tools and methodologies for the analysis, planning, design and optimization of hydrogen supply chains. They examine the available technologies for hydrogen production, storage, transport, distribution and energy conversion, providing a cross cutting perspective on their sustainability.

Environmental, social and economic aspects are considered, allowing for a more complete life cycle assessment of the entire supply chain. Methods and frameworks for multi-criteria decision making for the sustainable implementation of hydrogen systems are also covered. Providing a broad overview of the subject and well-recognized tools to manage hydrogen sustainability, this book is a useful resource for engineering researchers and PhD students in energy, environmental and industrial areas, energy economy researchers, practicing hydrogen energy engineers and technicians, energy and environmental consultants, life cycle assessment practitioners and consultants.

Key Features

- Provides a broad perspective of the issues related to environmental, social and economic sustainability of hydrogen energy and its future perspectives
- Presents the current applied research and available tools for managing and assessing hydrogen energy sustainability, such as LCA, optimization, multi-criteria decision making and supply chain optimization

Explores how experts in the field handle all issues related to the application of life cycle assessment for hydrogen production, storage, transport, distribution and end use.

https://www.elsevier.com/books/hydrogen-economy/scipioni/978-0-12-811132-1

Become a Member of IAHE

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

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

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

THE 12th CONFERENCE ON SUSTAINABLE DEVELOPMENT OF ENERGY, WATER AND ENVIRONMENT SYSTEMS
4 – 8 October, 2017, Dubrovnik, Croatia

www.dubrovnik2017.sdewes.org

Organizers:
University of Zagreb, Zagreb, Croatia
Instituto Superior Técnico, Lisbon, Portugal

In co-operation with:
University of Belgrade, Belgrade, Serbia
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University of Dubrovnik, Dubrovnik, Croatia
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University of Sarajevo, Sarajevo, Bosnia and Herzegovina
The Scientific and Technological Research Council of Turkey –
TÜBİTAK, Ankara, Turkey
Warsaw University of Technology, Plock, Poland

Scope and objectives:

The 12th Conference on Sustainable Development of Energy, Water and Environment, to be held in Dubrovnik, Croatia in 2017, is dedicated to the improvement and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development by de-coupling growth from natural resources and replacing them with knowledge based economy, taking into account its economic, environmental and social pillars, as well as methods for assessing and measuring sustainability of development, regarding energy, transport, water, environment and food production systems and their many combinations.

The Conference will be organised in following sessions:

Sustainability comparisons and measurements methodologies; *Sustainable development as a driver for innovation and employment*; Green economy and better governance; *Decoupling growth from resources*; Decarbonisation; *Energy policy*, Transport policy, *Water policy and the energy-water interaction*; Environmental policy, Agricultural policy; *Environment and corporate social responsibility*; Employment and energy, transport, water and environment systems; *Technology transfer and development*; Social acceptance; *Sustainable resilience of systems*; Sustainable tourism; *Urbanism*; Regional planning and cooperation; *Smart energy systems*; Sustainable islands, regions and cities; *Sustainable shipping*; Research, innovation and development; *Education in sustainable development*; Cooperation for development; *Energy system analysis*, *Water system analysis*, *Transport system analysis*; Life cycle assessment, Environmental impact assessment, Eco-design and Eco-labelling, Product cycle assessment; *Energy planning*; Transport management; *Renewable energy resources*; Primary energy resources; *Water resources*; Food and agriculture; *Renewable electricity generation systems*; Thermal power plants; *District heating and/or cooling infrastructures in future energy systems*; Nano and micro technologies and science for sustainable development of energy, water, and environment systems; *Carbon capture and storage/sequestration*; Nuclear energy; *Advanced sustainable energy conversion systems*; Renewable heat systems; *Biofuels and bio refineries*; Hydrogen production and use technologies; *Hybrid and electric vehicles*; Other alternative fuels; *Water treatment*; Water Desalination; *Wastewater treatment*; Waste treatment, Waste to energy, Recycling waste; *Pollution modelling*; Heat and mass transfer modelling; *Cogeneration*, *Trigeneration*, *Polygeneration*; Storage; *Electricity transmission and distribution*; Energy efficiency in industry and mining, Energy efficiency in agriculture and aquaculture, Energy efficient appliances; *Buildings*; Energy markets, Emission markets; *Political aspects of sustainable development*;

Deadlines:

Abstract due (archival)	December 22, 2016	Archival full paper:	April 20, 2017
		Conference full paper:	September 15, 2017

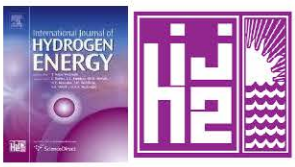
Contact:

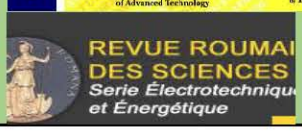
Mailing address: 2017 SDEWES Conference, SDEWES Centre, Ivana Lučića 5, HR-10000 Zagreb, Croatia
Phone: +385 1 6168152 E-mails: sdewes2017@sdewes.org; sdewes@sdewes.org

ACD 2017: 14th International Workshop on Advanced Control and Diagnosis
16-17 November 2017, Bucharest, ROMANIA (www.acd2017. acs.pub.ro)



SPECIAL ISSUES :





The 14th European Workshop on Advanced Control and Diagnosis (ACD 2017) will be held at 16-17 November 2017. The Workshop is hosted by the University of Polytechnique of Bucharest (Universitatea Politehnica din Bucureşti), Faculty of Automation and Informatics (Automatică şi Calculatoare).
The annual Workshop on Advanced Control and Diagnosis has been organized since 2003 to bring together academics and engineers from diverse fields of automation. This workshop will provide the opportunity for worldwide researchers and practitioners to share together the latest developments and new trends in control and diagnosis. Both theoretical and applied papers are welcomed for submission to this event. Keynote speeches are to be conducted by well-known experts in control and diagnosis.

Topics of interest include but are not limited to

Adaptive control Artificial Intelligence Methods for control and diagnosis Condition monitoring, maintenance engineering, Computational intelligence methods, Data-driven diagnosis methods Design for reliability and safety Diagnosis and control of discrete-event systems Fault detection and isolation, Fault-tolerant control,	Maintenance and repair strategies, Model-based diagnosis of linear, nonlinear and hybrid systems, Networked control systems Process supervision Pattern recognition Prognosis and health Management, Robust control, Signal and image processing System identification Vision and robotics.

The main fields of applications are

- Distributed systems Industrial processes
- Intelligent sensors and actuators Transportation systems
- Renewable energy systems

Paper submission

The authors are invited to submit contributions to the **ACD 2017**. Two types of papers are welcome: regular papers and invited papers in the field of ACD interest. All submitted papers will be peer-reviewed (at least two reviewers).
All papers must be written in English and should describe original work. All submitted papers (initial submission and final) are limited to 8 pages (double-column format). The format is available for both LaTeX and MS Word.
The submission site opens on March 28, 2017 and closes on September 15, 2017. To submit a paper an EasyChair system account is needed. Papers in the PDF format are submitted through the EasyChair conference management system via the submission site: https://easychair.org/conferences/?conf=acd2017

Special issues : Accepted papers selected will be published as special issues (ACD 2017) in indexed journals ISI-Thomson.

Invited session proposals are welcomed. Each proposal should include the following information: Title of the proposed session, name(s) and affiliation of the organizer(s) including a short bio, session abstract highlighting its relevance to the ACD2017,
A list of invited papers (5 to 8) including title, authors, and short abstract for each paper.

For further information write to ali.zemouche@univ-lorraine.fr

Important Dates

Submission site opening: *March 28th , 2017*
Invited session Proposal: *September 1st, 2017*
Deadline of papers: *September 15th, 2017 (strict deadline)*
Acceptance notification : *October 9th, 2017* Final version due: *October 23th, 2017* Registration deadline: *October 27th, 2017*

Academia de Stiinte Tehnice din Romania
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- Policy and regulations
- Power-to-gas solutions
- Decarbonisation of the energy sector
- Hydrogen storage improvements
- Security aspects in hydrogen production, storage and distribution
- Monetisation advice and partnership
- Hydrogen mobility applications
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E-JOURNAL ON HYDROGEN AND FUEL CELLS

FOR REGISTRATION PLEASE CONTACT: Adam Kowalewski Tel: +48 616 46 7047 Email: adam@acieu.net
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THE 1st LATIN AMERICAN CONFERENCE ON SUSTAINABLE DEVELOPMENT OF ENERGY, WATER AND ENVIRONMENT SYSTEMS

28 – 31 January, 2018, Rio de Janeiro, Brazil

http://www.rio2018.sdewes.org/

Organizers:

University of Zagreb, Zagreb, Croatia
Instituto Superior Técnico, Lisbon, Portugal
Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil

In co-operation with:

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Industrial University of Santander, Bucaramanga, Colombia
University of Dubrovnik, Dubrovnik, Croatia
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Hamburg University of Applied Sciences, Hamburg, Germany
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Ras Al-Khaimah, United Arab Emirates
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Research Center ICEIM, Skopje, Macedonia
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Vinča Institute of Nuclear Sciences, Belgrade, Serbia
University of Sarajevo, Sarajevo, Bosnia and Herzegovina
The Scientific and Technological Research Council of Turkey – TÜBİTAK, Ankara, Turkey
Warsaw University of Technology, Plock, Poland

Scope and objectives:

The 1st Latin American Conference on Sustainable Development of Energy, Water and Environment, to be held in Rio de Janeiro, Brazil in 2018, is dedicated to the improvement and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development by de-coupling growth from natural resources and replacing them with knowledge based economy, taking into account its economic, environmental and social pillars, as well as methods for assessing and measuring sustainability of development, regarding energy, transport, water, environment and food production systems and their many combinations.

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Deadlines:

Abstract due (archival)	August 15, 2017	Archival full paper:	October 15, 2017
		Conference full paper:	January 9, 2018

Contact:

Mailing address: 2017 SDEWES Conference, SDEWES Centre, Ivana Lučića 5, HR-10000 Zagreb, Croatia
Phone: +385 1 6168152 E-mails: rio2018@sdewes.org; sdewes@sdewes.org

SYMPOSIUM FC

Hydrogen Production and Storage

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The symposium will bring together world leading experts from Physics, Chemistry, Materials Science and Engineering to share up-to-date scientific and technical advances in the field, and to highlight outstanding problems and guidelines for future research. Fundamental aspects of catalysis, separation and purification processes; chemistry and physics of hydrogen bonding, adsorption and release mechanisms; materials synthesis, processing and characterisation; system implementation and performance evaluation including safety and economics issues will be featured.

SESSION TOPICS

FC-1 HYDROGEN PRODUCTION: *Thermochemical; Photoelectrochemical; Photobiological and photo-bio-mimetic; Biomass/waste reforming; Microbial Electrolysis Cells (MEC); Electrolysis from renewable energy; HT electrolysis (Hybrid cycles); Water-gas shift in advanced coal gasification; Hydrogen quality assessment;*

FC-2 HYDROGEN STORAGE: *Metal hydrides; Complex hydrides; Chemical hydrides; Organic hydrides; Physisorption of hydrogen on high surface area adsorbents e.g. carbon based material, metal-organic frameworks and nanostructures; CO2 reduction with hydrogen to synthetic hydrocarbons; Theoretical modelling; Storage testing, leak detection, safety, economic issues, etc.*

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NURER 2018

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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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16th International Symposium on Metal-Hydrogen Systems

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

www.MH2018.cn

Crowne Plaza
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Central District, Science City,
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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

CONTACT
Dr. Liuzhang OUYANG
Email: meouyang@scut.edu.cn
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March 20 - 22, 2018 Hammamet, Tunisia

CALL FOR PAPERS

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

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

SESSIONS

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

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

SCOPES

Submissions may treat various scopes such as:

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

Special Sessions

Special issues of selected papers will be published in top journals

PSVHE	MGIO	WSE	ORER	CPCA	ARE-CA	CRER
«Production, Storage and Valorisation of Hhydrogen Energy»	«Micro-Grids Implementation And Optimization»	«Wind as a Source of Energy»	«Optimization of Renewable Energy Resources»	«Chars Production, Characterization and Applications»	«Advances in Renewable Energy: Conversion And Application »	«Challenges in Renewable Energy Research»
SCI Thomson (IF=3.41)	ESCI Thomson	ESCI Thomson	ESCI Thomson	ESCI Thomson	ESCI Thomson	ESCI Thomson

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Important Dates

Full paper submission
November 25th, 2017
Acceptance notification
December 30th, 2017
Camera ready
February 20th, 2018
Registration
February 25th, 2018

Université de Sfax

ENET'COM

Universidad de Valladolid

ALL PRESENTED PAPERS THAT FULFILL IEEE CONDITIONS WILL APPEAR IN IEEEXPLORE

Upcoming Meetings & Activities

October 2017

World of Energy Solutions
October 9-11, 2017
Messe Stuttgart, Germany
http://www.world-of-energy-solutions.com/startpage.html

eMove 360° Europe
October 17-19, 2017
Munich, Germany
http://www.emove360.com

November 2017

Fuel Cell Seminar & Energy Exposition
November 7-9, 2017
Long Beach California
https://www.fuelcellseminar.com/

14th International Workshop on Advanced Control and Diagnosis
November 16-17, 2017
Bucharest, Romania
http://www.acd2017.acs.pub.ro/

December 2017

European Fuel Cell Conference & Exhibition
December 12-15, 2017
Naples, Italy
http://www.europeanfuelcell.it/

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/

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

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

June 2018

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

September 2018

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)
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Miami, FL 33155, USA

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