VATIS UPDATE

New and Renewable Energy

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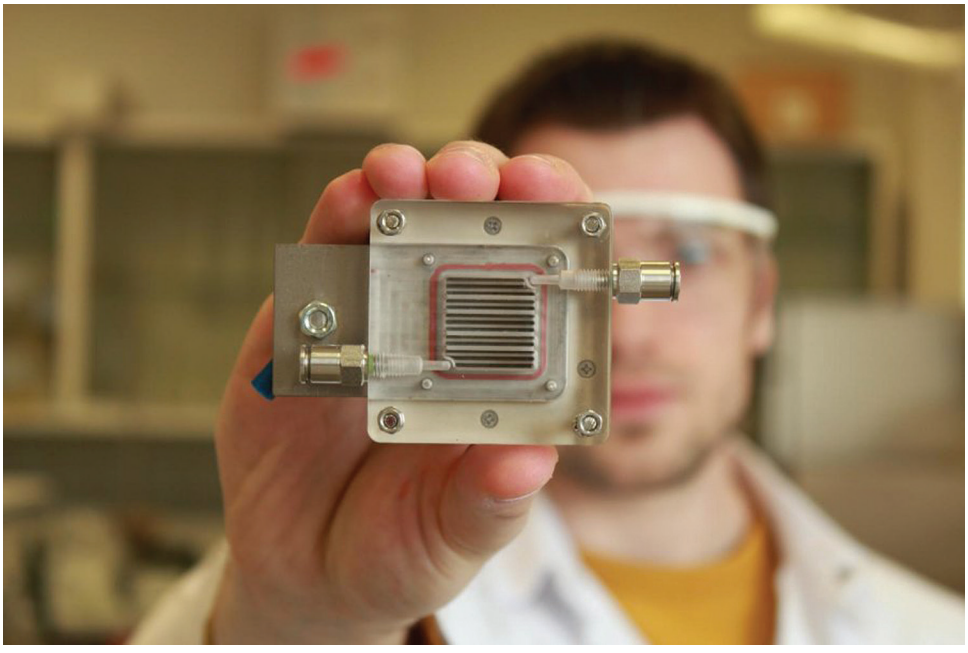
Apprise yourself with the latest technological innovations

Highlights

- Multicrystalline silicon cells
- Floating offshore wind turbine design
- Wave energy generator prototype
- Creating longer-lasting fuel cells
- Nano-powder to produce hydrogen
- Olive mill wastewater converted to biofuel



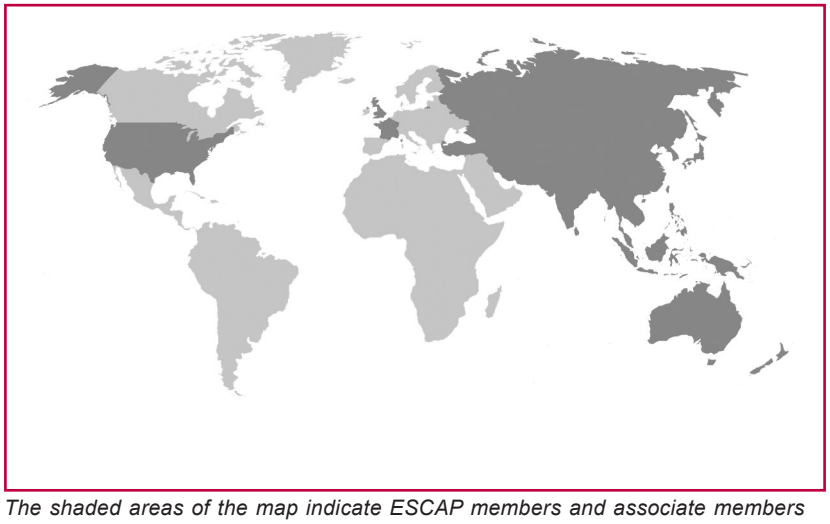
APCTT
Asian and Pacific Centre for Transfer of Technology

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

The **Asian and Pacific Centre for Transfer of Technology (APCTT)**, a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives: to assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.



The shaded areas of the map indicate ESCAP members and associate members

Cover Photo

A team of engineers has developed a new way to look inside fuel cells, in an effort to prevent oxidation that can shorten their lifespans

(Credit: Washington University, USA)

VATIS* Update
New and Renewable Energy
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Demand for wind-turbine blade materials

According to a report from Navigant Research, the United States, the global demand for key wind blade materials, including reinforcement fiber, resins, core materials, adhesives, paint and coatings, and metal blade studs, providing market forecasts for revenue, through 2026. "The wind blade materials market is one of the most competitive, dynamic, and strategically important parts of the wind-turbine supply chain," says Jesse Broehl, at Navigant Research.

Despite the market competition, high growth in wind blade materials is not expected to occur globally during the next decade, according to the report. The United States and China are in a period of peak installation rates, which places downward pressure on the expected 10-year outlook. Country markets with anticipated higher growth, however, include South Africa and numerous countries in Latin America.

The study focuses on revenue estimates for the following wind blade materials: reinforcement fiber (predominantly fiberglass, carbon fiber, and other advanced stitched and woven fabrics), resins (epoxy and polyester), core materials (balsa wood and a range of polymer foam materials), adhesives, paint and coatings, and metal blade studs. Global market forecasts for revenue, segmented by material, region, and country, extend through 2026.

Source: http://www.windpowerengineering.com

Hydropower plant started in Viet Nam

The first hydropower project in Viet Nam financed by the World Bank, the US$412 million 260-MW Trung Son hydropower project, has begun its commercial operation. The facility is located in Trung Son commune, Quan Hoa district, Thanh Hoa province, Viet Nam, and according to the World Bank, it is financing $330 million of the project's cost.

Toshiba Corp., Japan, announced that all four 65 MW Francis turbines and generators at Trung Son were online. In April, project owner Trung Son Hydropower One Member LLC under Power Generation Corp. No. 2 (EVNGENCO2), announced Unit 3 was officially energized and successfully synchronized into the national power grid.

Viet Nam's state-owned utility, Viet Nam Electricity (EVN) owns EVNGENCO2. THPC, Toshiba's Chinese subsidiary for the manufacture, sales and maintenance of hydroelectric equipment, received the equipment supply order from EVN, as a member of a consortium with HydroChina Corp.

Source: http://www.hydroworld.com

India records highest renewable generation

According to research and ratings agency India Ratings, India generated 10.2 Billion Units (BUs) of electricity from green energy sources including solar, wind, biomass and small hydro – 26% more than 8.1 BUs of renewable energy generated last year and 17% more than 8.6 Bus generated in May 2017. The month of June 2017 will go down in the history of India's energy sector recorded the highest monthly power generation from renewable energy sources.

The report analyses data for monthly renewable power generation for two years between August 2015 and June 2017 drawing the data from the Central Electricity Authority (CEA), the power ministry's planning wing. "The monthly data for power generation from renewable sources was not made public by the CEA but one can assume the generation in each of the months prior to August 2015 is lower than the generation for June 2017 as capacity itself was smaller then," said Salil Garg, at India Ratings.

Source: http://www.energy.economictimes.indiatimes.com

Rooftop solar power in Sri Lanka

The Asian Development Bank's (ADB) Board of Directors has approved a $50 million loan to help fund rooftop solar power generation systems in Sri Lanka to increase the share of renewable energy sources in the country's energy mix. ADB will also administer a $1 million technical assistance from the Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility.

This will help build capacity, increase awareness of stakeholders, and support the project's implementation in Sri Lanka. ADB's Rooftop Solar Power Generation Project will boost access to clean and reliable power in Sri Lanka. Specifically, the project will finance rooftop solar power subprojects equivalent to additional capacity of 50 megawatts while building capacity and awareness of relevant authorities, private sector partners, and customers.

It will also develop a market infrastructure and bankable pipeline of subprojects for the solar power systems through greater cooperation with private financial institutions and the establishment of technical guidelines and standards for the system. Total cost of the project is $59.8 mil-

lion, to which the private sector will provide a $9.8 million equity contribution. The project's expected completion date is the end of 2021.

Source: http://www.finchannel.com

China raises use of geothermal energy

According to a plan formulated by Chinese government agencies including the National Development and Reform Commission (NDRC) and the National Energy Administration (NEA), China plans to raise the annual utilization of geothermal energy to 70 million tonnes of coal equivalent by 2020 as the country seeks to ease reliance on coal and curb pollution.

The annual utilization of geothermal energy for heating purposes should reach 40 million tonnes of coal equivalent by 2020. By the end of 2020, renewable energy facilities will supply 1.9 trillion kilowatt-hours of electricity, accounting for 27% of total power generation, according to the government's 2016-2020 plan for renewable energy.

Official data showed China's energy structure has continued to improve in the first half of 2017 amid the government campaign for greener growth. Coal consumption, which stood at around 1.83 billion tonnes in the first six months, accounted for 59.8% of the overall energy use during the period, down 0.6%age point from the same period last year.

Source: http://www.news.xinhuanet.com

Control tower for renewable energy in Korea

The Republic of Korea will establish a centralized "control tower" to manage its renewable energy policies and prepare backup facilities for solar and wind power plants for stable power supply. The government plans to increase the ratio of renewable energy from the current 1.9% to 20% by 2030. The details on how to reach the target to be included in the energy road map to be announced within this year.

For efficient management of energy demand and supply, the government will establish a pilot program for the renewable energy control tower in the coming months and test its ability to manage the power supply in the next two years, with a goal of full operation in 2020. Under the program, power providers will have to submit their estimated electricity output based on the weather forecast to allow the control center to regulate energy supply and demand.

Source: http://www.koreaherald.com

Rules on renewable energy in Philippines

The Philippines National Renewable Energy Board (NREB) will endorse to the Department of Energy (DOE) the proposed rules on renewable portfolio standards (RPS), which requires distribution utilities (DUs) to source a portion of their power supply from eligible renewable-energy (RE) sources. RPS is intended to contribute to the growth of the RE industry. If implemented, this will help the agency attain its goal of maintaining the RE share in the national energy mix to at least 35% by 2030.

The scope of proposed RPS rules include the following: types of RE sources; yearly minimum RPS requirement; annual minimum incremental %age of electricity sold by each mandated participant, which is required to be sourced from eligible RE resources and which shall, in no case, be less than 1% of its annual energy demand over the next 10 years; and means of compliance by the mandated participant set by the government to meet the RPS requirements.

A composite team will determine the minimum annual RPS requirement per mandated participant. The members of the said team will be composed of representatives from the NREB, Electric Power Industry Management Bureau, Renewable Energy Management Bureau, Legal Services and Energy Policy and Planning Bureau. The minimum annual increment in the RPS level shall be initially set at 2.15% to be applied to the actual total supply portfolio.

Source: https://www.businessmirror.com.ph

Viet Nam's renewable potential

According to the figures released in the Viet Nam Energy Outlook Report 2017, Viet Nam has the potential to generate up to 40 GW of electricity from solar sources by 2035. Additionally, wind energy has power generation potential of about 12 GW, and the potential of biomass for power generation is about 3.7 GW by 2035. The details were shared at an event co-organised by the Ministry of Industry and Trade and the Embassy of Denmark in Hanoi.

The report, compiled by Viet Nam's Ministry of Industry and Trade (MoIT) and Denmark's Ministry for Energy, Utilities and Climate, aims to provide an analysis of available data in order to formulate an energy plan for the future. The report focuses specifically on the integration of renewable energy into the national power grid.

Source: http://www.vietnamnews.vn

Waterproof, wearable photovoltaics

Scientists from RIKEN, Japan, and the University of Tokyo, Japan, have developed ultra-thin photovoltaics wrapped in stretchable and waterproof films, which can continue to generate solar electricity even after being soaked in water or being exposed to mechanical stress, such as cleaning in a washing machine. As ultra-thin and stretchable material that can be woven into wearable textiles is often permeable, the scientists have come up with a coating made of acrylic-based elastomer, which prevents water infiltration, while allowing light in.

The researchers have subjected the photovoltaics to a variety of tests, finding first that it had a strong energy efficiency of 7.9%, producing a current of 7.86 mW/cm², as the current density was 13.8 mA/cm² at 0.57 V, based on a simulated sunlight of 100 mW/cm². The efficiency of double-side-coated devices decreases only by 5.4% after immersion in water for 120 minutes. Furthermore, the efficiency of the devices remains at 80% of the initial value even after 52% mechanical compression for 20 cycles with 100 minutes of water exposure.

The extremely thin and flexible organic photovoltaic cell is based on material called PNTz4T, which the scientists had developed in earlier work. “These cells could be used to provide power to health monitors woven into clothing, which are able to record heartbeats and body temperature, and provide early warning of medical problems. These healthcare textile-implantable devices need a steady power supply of several milliwatts or more to continuously collect data,” said Takao Someya, at University of Tokyo.

Source: https://www.pv-magazine.com

Multicrystalline silicon cells

Research organization Fraunhofer, Germany, has managed to exceed the world record for multicrystalline silicon cells. The new cells convert an impressive 22.3% of incident solar energy into electricity, and the researchers think that the limits have not yet been reached. Given that the previous world record was also set by Fraunhofer just a few months, we wouldn’t bet against it being able to raise the bar even higher.

Monocrystalline solar cells are the most efficient cells that are used today, but the large amount of energy needed to manufacture them makes them expensive to produce. Multicrystalline cells are produced by melting silicon and then cooling it, which uses less energy and makes the cells cheaper as a result. The downside is that multicrystalline cells are less efficient. You can find a detailed account of the different types of solar PV in our recent article outlining predictions for the industry.

Holding a market share of 57%, multicrystalline cells are the most commonly used cell in the photovoltaic industry. Narrowing the gap in efficiency between monocrystalline cells and multicrystalline cells therefore has huge benefits. This work by Fraunhofer has the potential to further reduce the cost of solar electricity and would have a wide-reaching impact. Fraunhofer achieved the record by making adjustments that focused on the needs of the multicrystalline material in the cell processing steps and in crystallization, and by using a highly pure silicon

Source: https://www.cleantechnica.com

Magnetic electrodes increase solar cell efficiency

An international research group led by the Ikerbasque researcher Luis Hueso (leader of CIC nanoGUNE’s Nanodevices Group), Spain, and which has had the participation of the China Academy of Sciences, the Max Planck Institute, Germany, and nanoGUNE itself, has developed a photovoltaic cell in which magnetic materials such as electrodes are used for the first time to provide current.

“The device is simply a photovoltaic cell manufactured from an organic material (fullerene C_{60}) and fitted with cobalt and nickel magnetic electrodes,” said Hueso. Fullerene C_{60}, known as Buckyball, is a ball-shaped molecule comprising 60 carbon atoms. What is more, the magnetic electrodes produce current with an added property known as spin. The results of the research have been published in the scientific journal *Science*.

The combination of both is no coincidence since fullerene is known to be a photovoltaic material that could allow the spin direction to be controlled. The use and control of this properly allows the efficiency of the solar cell to be increased, thus making it capable of generating a bigger current. The researchers have confirmed that the use of electrodes of this type increases the photovoltaic efficiency of the device by 14%.

Source: https://www.eurekalert.org

Stable solar cell out of flourine

A group of scientists at Ulsan National Institute of Science and Technology (UNIST), Republic of Korea, have developed highly sta-

ble and cheap solar cells made out of flourine. The team led by Kim Jin-young from UNIST developed the edged-selectively fluorine functionalized graphene nanoplatelets with structure of perovskite solar cells that can achieve a stability of 82%.

A perovskite solar cell is a type of cell which includes a perovskite structured compound, considered a next-generation technology with the potential of achieving even higher efficiency. However, low instability and high production costs have been cited as factors that block such technology from becoming commercially viable.

Source: http://www.koreaherald.com

Stability of perovskite solar cells

A group of researchers from Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, has achieved a higher level of operational stability for cuprous thiocyanate-based (CuSCN) perovskite solar cells. Progress in the development of the durability of the cells was realized after they were exposed to accelerated aging tests.

With a thin layer of reduced graphene oxide, performance fell by less than 5% when the cells were placed under 60°C sunlight for more than 1000 hours. The researchers claim to have achieved the highest stability levels for CuSCN perovskite to date. The cells retained 95% of their initial stability, with an efficiency level of 20%.

The EPFL scientists have conducted research on cheap and stable hole transporters for perovskite solar cells and have concluded that CuSCN stands out as a stable, efficient and cheap option. However, earlier research has produced only moderate efficiency and stability improvements.

Source: https://www.pv-magazine.com

Film-based perovskite solar mini-modules

Toshiba, Japan, has fabricated a perovskite solar cell mini-module with an energy conversion rate of 10.5%, which it claims is now the highest rate that has been reached throughout the world with a multi-cell mini-module. It reached a conversion rate of 10.5% for its 5x5cm film-based perovskite solar cell mini-modules by utilizing a new printing process.

Its advancements will also drive cost reductions for flexible solar panels, particularly for use in building-integrated PV (BIPV) applications. It achieved its results under a research program supported by the New Energy and Industrial Technology Development Organization (NEDO). Toshiba vowed to push forward with its R&D efforts to achieve efficiency rates that surpass those of crystalline silicon PV cells.

It aims to eventually match baseload power generation costs in Japan by generating electricity for JPY 7 ($0.06)/kWh. Toshiba has managed to expand the size of its cells and ramp up energy conversion rates by creating the 5x5cm cells. Its fabrication process for film-based perovskite solar cells involves using a film substrate and scribe method drawn from the production of organic thin-film solar cell modules.

Source: https://www.pv-magazine-usa.com

Semi-transparent solar cell

Researchers at The University of Tokyo have developed a semi-transparent solar cell. Instead of conventional silicon, the cell uses the organic-inorganic hybrid material perovskite to generate electricity. This material efficiently absorbs blue light, while nanocubes of metallic silver improve the capture of red light, letting visually important green light through. Because of the efficient light capture, the perovskite layer can be made very thin, improving its transparency. The cell could therefore be used to coat windows.

The panels are dark, because silicon absorbs light across a wide spectrum of wavelengths, allowing very little to pass through. This makes them efficient generators, but opaque materials, even though the thin silicon layer is coated on glass. Therefore, the challenge is to create a material that absorbs enough light to produce power, yet still admits enough to remain transparent. To tackle this, the IIS researchers exploited the properties of the human eye. As recently reported in *Scientific Reports*, they accounted for the fact that for visual purposes, not all colors are equal. In fact, the eye is much more sensitive to green light, in the middle of the spectrum, than red or blue. According to the rules of "human luminosity," a good supply of green light is the main priority for visibility.

The article, "Semi-transparent Perovskite Solar Cells Developed by Considering Human Luminosity Function," was published in *Scientific Reports.*

Source: https://phys.org

Floating offshore wind turbine design

American Bureau of Shipping (ABS), the United States, a leading provider of classification and technical services to the offshore and marine industries, has completed the design review of the Front End Engineering and Design (FEED) documentation for the 'VolturnUS', a floating offshore wind turbine (FOWT), developed by the University of Maine Advanced Structures and Composites Center, the United States.

"UMaine is pleased that its innovative design became the first floating wind turbine concrete semi-submersible hull to be reviewed by ABS, and found to meet the ABS requirements," said Dr. Habib J. Dagher, at UMaine Composites Center. In 2013, the UMaine team successfully tested the feasibility of the concept by developing a 1:8 scale model and deploying it in Castine, Maine.

Maine Aqua Ventus I, GP, LLC, is now leading a full-scale, two turbine demonstration project called New England Aqua Ventus I, a 12 megawatt (MW) floating offshore wind pilot project to develop a clean, renewable energy source off Maine's shores. This pilot project will demonstrate the innovative VolturnUS at full-scale as a viable and economical alternative for offshore wind developments in water depths greater than 50 meters.

Source: http://www.windpowerengineering.com

Floating offshore wind turbines

Energy company Statoil, Norway, has setup the fifth and final floating wind turbine secured off the coast of Scotland in a trial that will power 20,000 homes. The Hywind project is the result of more than 15 years of work of Statoil. It's yet another clean energy technology being shown off at a time when Australia signals a move away from previous clean energy goals.

The trial wind farm, known as Hywind, is located 25km from Peterhead on Scotland's east coast Statoil has developed the technology for the floating turbines. The turbines, each weighing 10,500 tonnes and measuring 253m from blade tip to base, were constructed in Norway and then shipped to the Scottish coast for installation.

Existing offshore wind farms are tethered to the seabed at depths of approximately 50m, while the Hywind turbines are currently floating in waters up to 129m deep, with the potential to work in depths of up to 800m. With 80% potential offshore wind sites in depths of more than 60m, this technology opens the door for governments around the world to build wind farms in locations that were previously unfeasible.

Source: https://www.gizmodo.com.au

Wind turbine pitch system

Moog, the United States, a design and manufacturing company of high-performance motion control products, solutions, has earned a safety certification from TÜV Rheinland for the new Moog Pitch Servo Drive 3. TÜV Rheinland is a global testing service provider and specialist for functional safety. Moog's new Pitch System 3 is responsible for guaranteeing the safe operation of wind turbines.

The feathering safety function supplied by the Moog Pitch System 3 Servo Drive alters a wind turbine's blade pitch at the rotor hub to minimize the torque applied by the wind, avoiding excessive speed of the turbine. As a result, the pitch servo drive is classified as a safety component. "The safety built into Moog Pitch System 3 helps wind farm operators in three important ways," said Dr. Tobias Theopold, at Moog.

Moog established the benchmark for safety with its previous versions of the Moog Pitch Servo Drive when these were certified by TÜV Rheinland in 2012. With the Moog Pitch Servo Drive 3, Moog has received independent validation that this product will also perform outside the specification at extreme environmental conditions and in cases of unexpected failure.

Source: http://www.windpowerengineering.com

Constructing offshore wind turbines

Researchers at University of Delaware, the United States, along with its industry partners, have developed a new method for constructing offshore wind farms and proven that it is cheaper, faster and could make possible offshore wind deployment at a scale and pace able to keep up with the region's scheduled retirements of nuclear and coal-fired power plants.

The researchers calculated that their innovative process will cost up to $1.6 billion less per project than conventional approaches and take half the construction time. "In planning for offshore wind power, the big question is how we generate electricity cost-competitively, and at a scale that is both a relevant replacement for aging power plants and also applicable to climate change," said Willett Kempton, at College of Earth, Ocean, and Environment (CEOE).

The key insight that allowed Kempton's team to make such considerable optimizations in cost and deployment speed was that the entire structure, from seafloor mounting to the top of the turbine, can be assembled in one piece in port, moved as a unit, and in one step placed into the sea floor. It may seem like a simple idea, but it was by no means obvious that it would work with existing equipment until completing the detailed engineering and cost analysis.

Source: https://www.pddnet.com

Wind turbines suspended high in the sky

Researchers at King Abdullah University of Science and Technology (KAUST), Saudi Arabia, led by Georgiy Stenchikov, have identified the most favorable areas for high-altitude wind-energy systems in the Middle East. The results confirm that there is abundant wind energy up there that could feasibly be harnessed, bringing the possibility of high-altitude power generation a step closer. "We are very enthusiastic about taking this work forward," said Udaya Gunturu, at KAUST.

Wind turbines on the Earth's surface suffer from the very stubborn problem of intermittent wind supply. This has led researchers and energy companies worldwide to look upwards and explore the possibilities of the strong and reliable winds at high altitudes. Flying a wind turbine on a kite-with the electricity being delivered to the ground through its tether-may seem an unlikely scenario, but several companies worldwide are already testing prototype systems.

These developments attracted the attention of the Saudi Basic Industries Corporation (SABIC), which funded the KAUST research to explore the opportunities in the Middle East. The researchers used information on wind strengths at different altitudes that were already available from the NASA. They processed this raw data to identify the most favorable areas for airborne wind-energy systems, and the optimal heights at which the turbines would need to fly.

Source: https://www.phys.org

Virtual mission control for wind farms

Engineers at Brunel Innovation Centre (BIC), the United Kingdom, are developing a digital platform that ramps up efficiency and halves costs. WindTwin will act like a pilots' control panel for wind farm managers, giving them live condition checks on each turbine's working parts. It will feed data from sound sensors on the turbines' gearbox, generator and other mechanical parts into a 3-D virtual model or 'digital twin' that predicts which need fixing – and when.

That lets companies scrap scheduled maintenance and replace or repair broken parts before they do damage. "The data this software generates has huge potential benefits for the wind turbine industry," said Dr. Miltiadis Kourmpetis, at BIC. The savings could be vast – by 2025, running 5,500 offshore turbines could cost a yearly £2bn – almost the same service bill as UK passenger planes.

The digital twin platform will use big data analytics and advanced visualisation and analysis to draw a real-time picture of the turbine's condition. This will help maintain and optimise real wind turbines, cutting upkeep costs by up to 30%, researchers calculate. Early breakdown detection will up reliability by as much as 99.5% and reduce losses from downtime by 70%. It also lets workers monitor and control entire wind farms digitally and remotely.

Source: https://www.phys.org

Vertical axis wind turbines

According to a prediction made by the U.S. Department of Energy (DOE), wind energy could provide 20% of electricity in the U.S. by the year 2030. This has motivated researchers from the University of Utah, the United States, to investigate the performance capabilities and financial benefits of vertical axis wind turbines (VAWTs) in urban and suburban areas.

A VAWT is a wind turbine design where the generator is vertically oriented in the tower, rather than sitting horizontally on top. While there are many VAWT designs, the one used in this study is called the straight-blade Darrieus type or H-rotor turbine. According to the researchers, small VAWTs possess the ability to effectively operate in the presence of high turbulent flow, which makes them ideal energy harvesting devices in urban and suburban environments.

The study's results indicate that an optimally designed VAWT system can financially compete with fossil-fuel based power plants in urban and suburban areas, and even spearhead the development of a net-zero energy building or city. To establish their results, the team input actual, time-resolved wind speed data into a numerical simulation that determined the total amount of energy captured by a turbine over a year of operation.

Source: https://www.techxplore.com

Wave energy generator prototype

Marine Power Systems (MPS), the United Kingdom, has revealed a quarter-scale prototype of its wave energy generating device, 'WaveSub', which has been developed with the aim of addressing major challenges regarding the generation of energy at sea. The device is set to be towed to the FaBTest marine test site in Cornwall, England, to demonstrate its power-generation capacity in a broad range of sea environments.

The test is also expected to determine the device's installation speed and price, as well as maintenance costs and survivability during the harshest weather conditions. WaveSub has been developed over a 9-year period via an investment of more than £5m from a combination of private investment and competitive grants. The device was manufactured and assembled at MPS' site in Wales, and is designed to operate by capturing wave energy approximately 10km from the shore.

It leverages the continual orbital motion of waves to drive an improved power-take-off (PTO) system and can transfer its resulting output to land using an undersea cable. The full-scale, 100m-long WaveSub system will feature a power rating of 5MW and will be able to power roughly 5,000 homes, which is comparable to the energy produced by a very large offshore wind turbine. The device is equipped with depth-adjustable capability to 'hide' from storms.

Source: http://www.power-technology.com

Tidal prototype

Tidal energy company GKinetic Energy Ltd, Ireland, has been developing a unique technology for 'off grid' locations around the world to develop its first commercial device after the successful completion of its prototype testing programme. "GKinetic will develop its first 25kW commercial device after its 8kW unit generated outputs 'above international industry standards'," said the company. The device will be capable of generating enough electricity to power up to 15 homes.

The GKinetic device, which will replace dirty fuels like diesel, operates in rivers and its differentiator is that its turbines – placed at either side of a vertical cylinder – exploit the natural phenomena that occurs when water accelerates around an obstacle. Research shows that the power available through this acceleration is twice that of natural water flow. The compact design and size of the GKinetic device also means that it is easily deployed in rivers, operating in depths as shallow as 2m and widths of 3m.

This means remote, off-grid communities in locations such as Canada, Siberia, Polynesia and a host of African, and South American nations, now having the option of this ground-breaking, green solution for their energy requirements. Its 8kW prototype has been successfully tested at the Shannon Foynes Port Company (SFPC) operated Limerick Docks for the past year. The 25kW device will also be tested at Limerick Docks prior to being deployed at certified river or estuary test sites.

Source: http://www.maritimejournal.com

Tidal currents to produce electricity

REAC Energy GmbH, Germany, have developed the 'StreamCube', a scalable, cube-shaped water wheel that might be what the market has been waiting for to make tidal power commercially viable. The device is similar to the conventional water wheel, only it's anchored deep underwater and uses currents to produce energy. The module works using vertical rotor axes that are set in motion by the pressure of inflowing water.

Depending on the positioning of the rotor, the blades fold on or off. The StreamCube units can also be lined up or stacked depending on what they are being used for. REAC recently completed testing the StreamCube in Orkney with the help of international marine contractors, Leask Marine. This location, off the north coast of Scotland, has become a hot-spot for testing wave and tidal devices.

This is because of the many natural tidal currents around the archipelago and its connection to the Scottish grid. The results from the trial will help REAC finalize the full-scale prototype before it progresses towards commercialization. REAC claim their device has a low cost, is easily transportable and has little impact on the environment, amongst other benefits.

Source: https://thenextweb.com

Tidal energy used to produce hydrogen gas

In mid-September, the European Marine Energy Centre (EMEC) announced that it had successfully completed its project to produce hydrogen gas using electricity generated from tidal energy in Orkney – the first initiative of its kind anywhere in the world.

The initiative, dubbed the Surf'n'Turf project, fed power from the Scotrenewables SR2000 and Tocardo TFS and T2 turbine prototype tidal energy converters currently testing at EMEC's tidal energy test site into an innovative 0.5MW rapid response ITM Power electrolyser unit located alongside EMEC's onshore substation.

This unit was then used to generate hydrogen – which can be stored and moved for use as

needed. "The electrolyser splits water into its component elements - hydrogen and oxygen - in an electrochemical process. Whilst generating hydrogen isn't a new process, this is the first time that it has been generated from tidal energy," said Jon Clipsham, at EMEC.

Source: http://www.maritimejournal.com

Turbine to tame shoreline waves

Researchers from the Okinawa Institute of Science and Technology Graduate University (OIST), Japan, have outlined plans for a wave energy turbine that could provide protection for the shore while also generating power from the waves. The project being developed by OIST team involves placing turbines at key locations near the shoreline, such as nearby tetrapods or among coral reefs, to generate energy.

Each location allows the turbines to be exposed to ideal wave conditions that allow them not only to generate clean and renewable energy, but also to help protect the coasts from erosion while being affordable for those with limited funding and infrastructure. According to OIST, the turbines themselves are built to withstand the forces thrust upon them during harsh wave conditions as well as extreme weather, such as typhoons.

The blade design and materials are inspired by dolphin fins – they are flexible, and thus able to release stress rather than remain rigid and risk breakage. The five-blade turbine has a diameter of about 0.7 meters. Its blades rotate on their axis when influenced by ocean wave. The axis is attached to a permanent magnet electric generator that transforms the ocean wave energy into usable electricity.

Source: http://www.tidalenergytoday.com

Underwater kite to harness tidal energy

Minesto, the United Kingdom, has developed a revolutionary concept for producing electricity from the ocean. The technology, called 'Deep Green', unlocks an untapped renewable energy resource. It is a prototype kite, very different to those used for flying. Its design allows it to glide underwater at speeds up to ten times faster than the tides themselves.

The sea inlet of Strangford Lough, Northern Ireland, the largest in the British Isles, covers 150 square kilometers. Its tides regularly rise to an amplitude of four meters at speeds averaging 1,4 meters per second. For these natural reasons, researchers studying how to produce energy from tides chose this location to test the first submarine glider of its kind.

"It's a kite, and it's tethered to the sea floor. In a tide we have a lifting force: the water pushing. The wing making it fly forward; it actually accelerates, so it makes the turbine spin. And when the turbine spins, you produce electricity," explained Heije Westberg, at Minesto. The kite is heavily equipped with sensors and communication tools.

Source: http://www.euronews.com

Prototype 'ocean energy' generator

Engineering giant IHI Corp. of Japan has unveiled an "ocean current power generator" prototype. The device, which harnesses ocean energy using currents found in oceans, will be tested in a demonstration experiment off the coast of Kuchinoshima, an island in Kagoshima Prefecture. It follows an experiment relating to wave-power generation that Mitsui Engineering and Shipbuilding Co. announced in April.

In the case of IHI, the ocean-driven machinery consists of propellers in the sea that are rotated by ocean currents, which in turn move turbines that generate power. It is a reliable form of energy as the fairly constant speed and direction of ocean currents means that energy can be generated throughout the year. Ocean energy differs considerably to other forms of renewable energy such as solar and wind power, which are both heavily dependent on climate.

Since fiscal 2011, IHI has collaborated with the New Energy and Industrial Technology Development Organization (NEDO) to harness the energy of ocean currents, and together they came up with the prototype. In mid-August the prototype is set to be used in the world's first verification test in Kagoshima Prefecture. The machine, unveiled on July 7 in Yokohama, consists of two tubular generators about 20 meters long with two propellers, about 11 meters in diameter, attached to them, along with a transformer. The generated power is carried through a cable on the sea bed to a power receiving facility, with a power generation capacity of 100 kilowatts.

IHI aims to turn its prototype into an actual product by 2020. The company wants each generator to produce 2,000 kilowatts of energy, enough to provide 3,000 homes with power. Shigeki Nagaya, a director at IHI, says, "We're not just thinking about selling this device, but also believe that a business model based on ocean power generation is possible."

However, while the concept sounds impressive, there are some issues that need to be addressed. First, the cost of the equipment is very high. Nagaya explains that the current prototype is "too expensive to be compared" to solar power and wind power, which cost between 20 to 40 yen per kilowatt-hour. In addition, to put a product on the market, it is also necessary to assess the possible effect on ecosystems, and also coordinate with local communities about issues such as fishing rights.

Source: https://mainichi.jp

Lithium-ion batteries

Researchers from the Queensland University of Technology (QUT), Australia, have produced what they claim are the first Australian facility capable of such production. The facility – located within QUT's pilot plant precinct at Banyo on Brisbane's northside – contains low humidity electro-manufacturing dry rooms, which the university also claims is a first in Australia.

"The lithium-ion batteries, commonly used in electronic devices such as smartphones and drones, are the same format as those used in Tesla vehicles. Importantly, as part of this project we identified the bes-owned lithium-ion batteries after establishing a manufacturing t lithium-based powders to use to create a battery of the highest energy-efficiency standards possible. The powder is a combination of lithium and other compounds," said Peter Talbot, at QUT.

The technology and processes developed at QUT as part of the 3-year AU$4 million project – funded by the Auto Cooperative Research Centre and conducted in conjunction with the Malaysia Automotive Institute – can be used by commercial battery manufacturing companies. The newly-developed method instead uses high-performance, low-cost catalysts, produced through the control of the composition, size, and crystallinity of metal oxides of elements such as iron, cobalt, and nickel.

Source: http://www.zdnet.com

Commercialization of fuel cell vehicles

A team of engineers at the University of Delaware (UD), the United States, has developed a technology that could make fuel cells cheaper and more durable, a breakthrough that could speed up the commercialization of fuel cell vehicles. The UD team made a catalyst of tungsten carbide, which goes for around $150 per kilogram. They produced tungsten carbide nanoparticles in a novel way, much smaller and more scalable than previous methods.

"The material is typically made at very high temperatures, about 1,500 °C, and at these temperatures, it grows big and has little surface area for chemistry to take place on," said Dionisios Vlachos, at UD. The researchers made tungsten carbide nanoparticles using a series of steps including hydrothermal treatment, separation, reduction, carburization and more. Next, the researchers incorporated the tungsten carbide nanoparticles into the membrane of a fuel cell.

Automotive fuel cells, known as proton exchange membrane fuel cells (PEMFCs), contain a polymeric membrane. This membrane separates the cathode from the anode, which splits hydrogen (H_2) into ions (protons) and delivers them to the cathode, which puts out current.

The plastic-like membrane wears down over time, especially if it undergoes too many wet/dry cycles, which can happen easily as water and heat are produced during the electrochemical reactions in fuel cells.

Source: https://www.phys.org

Creating longer-lasting fuel cells

An engineering team at Washington University, the United States, has developed a new way to take a look at the rate at which oxidation occurs. Using fluorescence spectroscopy inside the fuel cell, they are able to probe the formation of the chemicals responsible for the oxidation, namely free radicals, during operation.

The technique could be a game changer when it comes to understanding how the cells break down, and designing mitigation strategies that would extend the fuel cell's lifetime. "If you buy a device – a car, a cell phone – you want it to last as long as possible," said Vijay Ramani, the Roma B. and Raymond H. Wittcoff, at the School of Engineering & Applied Science.

The research is the first to utilize an in situ approach to examine the fuel cell's inner membranes. A fluorescent dye is incorporated and used as a marker to ascertain the rate at which damaging free radicals are generated during operation.

Source: https://www.phys.org

Catalyst for hydrogen fuel cells

A new innovation from Ballard Power Systems Inc., Canada, and cleantech firm Nisshinbo Holdings Inc., Japan, could make fuel cells dramatically cheaper to produce. Ballard and Nisshinbo unveiled a newly-developed Non Precious Metal Catalyst (NPMC) based on a carbon alloy material for use in PEM fuel cells. The British Columbia based company plans to launch a 30-watt FCgen-1040 fuel cell stack, which incorporates the cheaper catalyst, for commercial use in late 2017.

The new fuel cell will be an NPMC variant of Ballard's FCgen-micro fuel cell stack, an existing air-cooled product designed for integration into portable applications: such as laptop and cell phone chargers and military devices. The amount of platinum catalyst-coated material used in fuel cells, known as platinum loading, has been successfully reduced over time, but Ballard says platinum still accounts for 10 to 15 per cent of the cost of a fuel cell stack today.

Source: https://www.canadian-manufacturing.com

A pathway toward hydrogen storage

The US Department of Energy's (DOE) Energy Materials Network (EMN) consortium approach to accelerate material discovery and development is starting to pay off. Through theory and experimentation, scientists at Lawrence Livermore National Laboratory (LLNL), the United States, have discovered the key mechanism by which magnesium diboride (MgB_2) absorbs hydrogen and provided key insights into the reaction pathway that converts MgB_2 to its highest hydrogen capacity form, magnesium borohydride ($Mg(BH_4)_2$).

$Mg(BH_4)_2$ is a particularly promising hydrogen storage material because of its high hydrogen content and attractive thermodynamics. "The insights provided by our study are an important step toward unlocking the potential of this material for solid-state hydrogen storage," said Keith Ray, at LLNL. Storage of hydrogen is one of the critical enabling technologies for hydrogen-fueled transportation systems as well as grid resiliency, energy storage and use of diverse domestic resources across sectors, which can reduce oil dependency.

In the new study, the team took an important step toward understanding and improving these shortcomings. They found that in the initial stages of hydrogen exposure, MgB_2 can hydrogenate to $Mg(BH_4)_2$ without the formation of intermediate compounds. Since these intermediates are known to inhibit the speed at which a hydrogen vehicle can be refueled, the possibility of avoiding them is an important development toward making MgB_2 practically viable.

Source: https://www.phys.org

Nano-powder to produce hydrogen

Scientists, including one of Indian origin at US Army Research Laboratory (ARL), have developed an aluminium nano-powder that turns urine into hydrogen instantly, which can power fuel cells and provide clean energy. ARL scientists had earlier announced that their nano-galvanic aluminium-based powder produced pure hydrogen when coming into contact with water.

The researchers observed a similar reaction when adding their powder to any liquid containing water. They also found that adding it to urine releases hydrogen at a much higher rate than with ordinary water. "We developed a new processing technique to synthesise a material, which spontaneously splits water into hydrogen," said Kristopher Darling, at ARL.

Fuel cells generate electricity quietly, efficiently and without pollution. They are more energy-efficient than combustion engines and the hydrogen used to power them can come from a variety of sources. "We have calculated that one kilogramme of aluminium powder can produce 220 kilowatts of energy in just three minutes," said Anit Giri, an ARL researcher.

Source: http://www.economictimes.indiatimes.com

New fuel discovery

Scientists at Cardiff University, the United Kingdom, have discovered a new way of creating greener and cheaper fuel from methane. They have found a way of creating methanol using nanoparticles of gold to initiate a chemical reaction between methane, oxygen and hydrogen peroxide. It can be done in one stage and at temperatures no higher than 50 °C (122 °F). "It could become an alternative to petrol. It is also believed the new system of creating methanol could be used to create chemicals and plastics," said Stuart Taylor, at Cardiff.

Traditionally, methanol is created by converting methane into hydrogen and carbon monoxide at high temperatures, then reassembling them in a different order in a second highly pressurised process. "The current two-stage 'steam reforming' process is very energy intensive, as it requires a lot of fuel to achieve high temperatures, but for over a century no-one has been able to come up with a better system," explained Prof Taylor.

The discovery promises to be not only cheaper, but much more environmentally friendly, as it both reduces energy consumption and conserves dwindling stocks of natural gas. It also opens up the prospect for the first time of easily converting natural gas into methanol at the site where it is extracted, so that it can be piped as a liquid in normal atmospheric conditions. The team's research has been published in journal *Science.*

Source: http://www.bbc.com

Nanocrystals for storing hydrogen

Researchers from the US Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) have synthesized a powdery mixture of metal nanocrystals enveloped in single-layer carbon atom sheets. The mixture seems to be propitious for safe storage of hydrogen to be used in fuel cells of passenger vehicles and other applications. Moreover, at present, an innovative research offers in-

depth knowledge related to atomic composition of the ultrathin coating of the crystals and the way they function as selective shielding at the same time also improving their performance in storing hydrogen.

The research involved a wide array of lab proficiency and potentials to develop and coat the magnesium crystals with a width of just 3-4 nm (where 1 nm is one-billionths of a meter), to analyze their nanoscale chemical composition by using X-rays, and to develop supportive theories and computer simulations to have a better knowledge of the way in which the crystals and their carbon coating act in congruence.

The discoveries made by the researchers can provide in-depth understanding of the way similar coatings can improve the stability and performance of other materials just known to be propitious for hydrogen storage applications. The study is one among various attempts made by a multi-lab R&D effort called as the Hydrogen Materials – Advanced Research Consortium (HyMARC).

Source: https://www.azonano.com

Researchers extract hydrogen from seawater

Researchers from the University of Central Florida (UCF), the United States, have developed an inexpensive method to extract hydrogen from seawater, which could result in a more efficient way to power fuel cells. The team has developed a new hybrid nanomaterial that harnesses solar energy to generate hydrogen from seawater that could be used for a new source of clean-burning fuel, while easing the demand for fossil fuels.

"We've opened a new window to splitting real water, not just purified water in a lab," said Dr. Yang Yang, at UCF. The researchers used a photocatalyst – a material that spurs a chemical reaction using energy from light – durable enough to handle the biomass and corrosive salt of seawater. To achieve this, they used a catalyst that was able to not only harvest a much broader spectrum of light than other materials but also stand up to the harsh conditions of seawater.

Yang fabricated a photocatalyst composed of a hybrid material where tiny nanocavities were chemically etched onto the surface of an ultrathin film of titanium dioxide – the most common photocatalyst. The nanocavity indentations were coated with nanoflakes of molybdenum disulfide – a 2D material with the thickness of a single atom. The new catalyst is able to significantly boost the bandwidth of light that can be harvested.

Source: https://www.rdmag.com

Clean hydrogen fuel from water

Researchers at Osaka University, Japan, have developed new metal-free photocatalyst and show visible and near infrared light-driven production of hydrogen from water. The photocatalyst is not only free of expensive metals but also absorbs a wider range of sunlight than ever before. "We were pleased to find a good amount of hydrogen produced from water using our new composite photocatalyst with graphitic carbon nitride and black phosphorous," said Tetsuro Majima, at Osaka University.

Like graphite, graphitic carbon nitride forms in large sheets, but carbon nitride sheets also have holes that can interact with hydrogen molecules. In the past, photocatalysts based on carbon nitride have needed help from precious metals to produce hydrogen from water. The researchers found the metal could be replaced by a kind of phosphorus, which is a widely abundant and inexpensive element.

They showed that their photocatalyst was effective for producing hydrogen from water using energy from different kinds of light. Most unusually, even near infrared light with low energy could drive the hydrogen production. Studies of the working photocatalyst in the picosecond time scale revealed that strong interactions between the carbon nitride and black phosphorous in the composite promoted hydrogen production.

Source: https://www.eurekalert.org

Liquid metals to create hydrogen fuel cells

A team of researchers at Worcester Polytechnic Institute (WPI), the United States, have replaced palladium – which is typically used to create hydrogen fuel cells – with liquid metals that can yield pure hydrogen. This could be used to create the new wave of energy efficient vehicles. "We are still in the early stage but the application of this is in the distributed generation of hydrogen," said Ravindra Datta, at WPI.

"If you want to have fuel cell cars or you want to have hydrogen fuel cell filling stations you want to be able to produce hydrogen locally rather than transporting it over long distances. You could conceivably have less complex and elaborate plants to produce fuel hydrogen," added Datta. One of the main issues is that while hydrogen is the most abundant element in nature, it is almost always chemically bound to other elements, including with oxygen in water.

Pure hydrogen must be separated from another molecule through 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. The hydrogen can then be separated from the other gases through a multi-step process that comes with a cumbersome chemical process and a high cost.

Source: https://www.rdmag.com

New way to harness wasted methane

Chemistry professor Yogesh Surendranath and three colleagues at Massachusetts Institute of Technology (MIT), the United States, have found a way to use electricity, which could potentially come from renewable sources, to convert methane into derivatives of methanol, a liquid that can be made into automotive fuel or used as a precursor to a variety of chemical products. This new method may allow for lower-cost methane conversion at remote sites.

The findings could pave the way to making use of a significant methane supply that is otherwise totally wasted. The researchers have developed a low-temperature electrochemical process that would continuously replenish a catalyst material that can rapidly carry out the conversion. This technology could potentially lead to "a relatively low-cost, on-site addition to existing wellhead operations," said Surendranath.

The electricity to power such systems could come from wind turbines or solar panels close to the site. This electrochemical process, could provide a way to do the methane conversion – a process also known as functionalizing – "remotely, where a lot of the 'stranded' methane reserves are."

Source: https://www.phys.org

Floating solar rig produce hydrogen fuel

A research team from Columbia Engineering in the U.S. has developed a novel photovoltaic-powered electrolysis device that can operate as a stand-alone platform that floats on open water. Electrolysis, the splitting of water into oxygen (O_2) and hydrogen (H_2) fuel, can be used as a way to convert electricity from the photovoltaics (PV) into storable hydrogen fuel. Dr Daniel Esposito's team have developed a device that they say can be thought of as a "solar fuels rig" that bears some resemblance to deep-sea oil rigs, except that it would produce hydrogen fuel from sunlight and water instead of extracting petroleum from beneath the sea floor.

The researchers' key innovation is the method by which they separate the H_2 and O_2 gases produced by water electrolysis. State-of-the-art electrolyzers use expensive membranes to maintain separation of these two gases. The Columbia Engineering device relies instead on a novel electrode configuration that allows the gases to be separated and collected using the buoyancy of bubbles in water. The design enables efficient operation with high product purity and without actively pumping the electrolyte. Based on the concept of buoyancy-induced separation, the simple electrolyzer architecture produces H_2 with purity as high as 99 percent.

Crucial to the operation of Esposito's PV-electrolyzer is a novel electrode configuration comprising mesh flow-through electrodes that are coated with a catalyst only on one side. These asymmetric electrodes promote the evolution of gaseous H_2 and O_2 products on only the outer surfaces of the electrodes where the catalysts have been deposited. When the growing H_2 and O_2 bubbles become large enough, their buoyancy causes them to detach from the electrode surfaces and float upwards into separate overhead collection chambers.

The team is refining their design for more efficient operation in real seawater, which poses additional challenges compared to the more ideal aqueous electrolytes used in their laboratory studies. They also plan to develop modular designs that they can use to build larger, scaled-up systems.

Source: https://maritime-executive.com

Cheap hydrogen fuel from methane

Researchers have developed a new cleaner and cheaper way to produce hydrogen fuel from methane and electricity in just one step. Hydrogen is an excellent fuel which, due to its high energetic density and zero greenhouse gas emission, is essential in a great number of industrial processes, researchers said. Its combination with oxygen in the atmosphere produces energy and water as its sole by-product, making it one of the main candidates to substitute fossil fuels as a source of energy for the transport sector. Results by researchers, including those from Valencia's Polytechnic University (UPV) in Spain, have applications in the field of hydrogen fuel cell vehicles as well as the chemical industry.

Source: http://indianexpress.com

Olive mill wastewater converted to biofuel

Scientists from the Institut de Science des Matériaux de Mulhouse (IS2M), France, have successfully converted the wastewater from olive oil production into a green biofuel. To create oil, olives are crushed and mixed with water in mills. The oil is then separated out of this mixture, and dirty water and solid residue discarded. The wastewater created can pollute waterways, reduce soil fertility and trigger extensive damage to ecosystems.

In Mediterranean countries, where 97% of the world's olive oil is produced, close to 8 billion gallons of the polluting wastewater is produced each year. Mejdi Jeguirim from IS2M and colleagues have taken a different approach, developing a method to convert olive mill wastewater (OMW) from a polluter into sustainable products such as biofuel, biofertiliser, and safe water for use in agricultural irrigation.

According to the American Chemical Society, the researchers embedded OMW into cypress sawdust, another waste product common in the Mediterranean. This mixture was then rapidly dried and the evaporated water collected to be used to safely irrigate crops. The OMW sawdust was then subjected to pyrolysis, where organic material is exposed to high temperatures in the absence of oxygen.

Source: http://www.bioenergy-news.com

Biofuel waste into commodity

Researchers at Washington State University (WSU) and Pacific Northwest National Laboratory (PNNL), the United States, have discovered a method of converting a biofuel waste product into a usable and valuable commodity in a two-step process. The first, developed by PNNL, applies high pressure and high temperature to algae to create bio oil. The second converts that bio oil into biofuel, which can replace gasoline, diesel and jet fuel.

It's that first step, called hydrothermal liquefaction that produces waste – approximately 25% to 40% of carbon and 80% of nutrients from the algae are left behind in wastewater streams. "The wastewater is generally hard to process because it contains a variety of different chemicals in small concentrations," said Birgitte K. Ahring, at WSU. The results of the team's research are published in *Bioresource Technology.*

Ahring and her team have found that adapting anaerobic microbes – microbes that live without oxygen – to break down the remaining residue is a viable option. Through this process, the material becomes degradable and gets transformed into a bionatural gas without the use of harsh chemicals. The solid material that remains can also be applied as a fertilizer or recycled back into the hydrothermal liquefaction process for further use.

Source: http://www.biomassmagazine.com

Pond scum that could fuel jet planes

A group of scientists at University of Tokyo, Japan, is trying to figure out how to revolutionise the big three needs of human life: food, fuel and pharmaceuticals. For answers, they are looking to one of the tiniest life forms: euglena, a type of microalgae found in fresh and salty water. The man leading the euglena team is Keisuke Goda.

Professor Goda is known for having developed the world's fastest camera, capable of filming tiny processes that happen not only in less than the blink of an eye, but in less than a millisecond (it takes between 300-400 milliseconds to blink). His camera can take a mind-boggling 5 trillion frames per second.

It allows for a range of breakthrough scientific research from being able to see how atoms actually behave in nuclear fission reactions, to spotting cancer cells rushing through the bloodstream before they spread to other organs. But the problem occupying the Goda laboratory at present is that of the heterogeneity of euglena. Not all euglena cells are equal when it comes to their capacity to produce lipids.

Source: http://www.thehindu.com

Efficient biofuel process

Scientists at the US Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) have developed a new solar-powered electrolysis cell which can convert carbon dioxide (CO_2) to biofuels and alcohols at record efficiency levels. According to the scientists it is the first time anyone has been able to rival the productivity of natural photosynthesis.

They believe the discovery, which allows carbon dioxide to be directly converted into ethanol and ethylene, is an important milestone in the effort to move toward sustainable sources of fuel. The researchers achieved this by optimising each component of a photovoltaic-electrochemical system to reduce losses.

"This is an exciting development. As rising atmospheric carbon dioxide levels change Earth's climate, the need to develop sustainable sources of power has become increasingly urgent," said principal investigator, Joel Ager.

Source: http://www.energylivenews.com

Biofuel catalyst from aluminium foil

Ahmed Osman, a researcher at Queen's University Belfast (QUB), Northern Ireland, has developed a revolutionary new method for converting used aluminium foil into a catalyst for the production of biofuel. Osman led a team of engineers in developing a method for obtaining 100% pure single crystals of aluminium salts from waste foil.

Such crystals are used as the building blocks for preparing an alumina catalyst that is used in converting methanol to dimethyl ether that is more effective than the catalyst currently being used. As dimethyl ether is considered among the most promising biofuels developed so far, the implications of this breakthrough could be significant.

In addition, the new catalyst is around half the cost of the current catalyst, and as 20,000 metric tons of aluminium foil is thrown away each year in the UK alone, obtaining raw materials for this new catalyst is significantly easier, considering that the current catalyst can only be obtained from raw bauxite ore.

Source: https://www.aluminiuminsider.com

Cheaper biofuel from potato chip scraps

Researchers at Penn State, the United States, have created a new method to more efficiently convert potato waste into ethanol. The findings may lead to reduced production costs for biofuel in the future and add extra value for chip makers.

Using potato mash made from the peelings and potato residuals from a US-based food-processing company, researchers triggered simultaneous saccharification – the process of breaking down the complex carbohydrate starch into simple sugars – and fermentation – the process in which sugars are converted to ethanol by yeasts or other microorganisms.

The addition to the bioreactor of mold and yeast – *Aspergillus* niger and *Saccharomyces cerevisiae*, respectively – catalyzed the conversion of potato waste to bioethanol. The bioreactor had plastic composite supports to encourage and enhance biofilm formation and to increase the microbial population.

Source: http://www.futurity.org

Turning seaweed into automotive fuel

Engineers at the US Department of Energy's Pacific Northwest National Laboratory (PNNL) are developing a way to mass-produce marine biomass (i.e., seaweed) that can be turned into biofuel and bio-based chemicals. The team is developing a set of modeling tools that will predict the best locations and times to efficiently cultivate seaweed in an open-ocean farm.

The team will combine several existing modeling tools to evaluate seaweed growth potential; nutrient availability; and how natural phenomena such as wind, currents, tides, waves and storm surges could affect a manmade seaweed farm's productivity. This project has received $2 million in funding over the course of two years.

Source: http://www.machinedesign.com

Novel solvent for efficient production of biofuel

In the beginning, biofuel or ethanol is made from food products such as corn, classified as first generation biofuel. To avoid competition with food supply and thus avoid food shortage, agricultural wastes called biomass are then used in ethanol production. This second generation biofuel has a limitation though in its conversion efficiency, in terms of energy, time, and raw materials consumed, and yield.

The solvent used to dissolve the cellulosic material in biomass is highly toxic to a specific bacteria, Escherichia coli, which produce ethanol. In order to reduce the toxicity of the solvent-biomass mixture and allow the bacteria to produce ethanol, it has to undergo additional processes – washing and centrifugation or separation. The overall process is inefficient that the energy consumed is more than the energy produced.

To address the process efficiency problem, Japanese researchers developed a new solvent that allows ethanol production even without the washing and separation steps. The new solvent, carboxylate-based zwitterion liquid, is 17 times lower in toxicity to the bacteria than the conventional solvent, enabling the process to produce ethanol in situ. The conventional solvent is an ionic liquid, that is, it is comprised of molecules that have either a positive charge or a negative charge. The new solvent, on the other hand, is a zwitterion liquid, which is composed of molecules, each having both positive and negative charge, making each molecule's net charge equal to zero.

With the washing and separation steps removed in the process of ethanol production, that is the biomass-solvent mixture directly undergoes hydrolysis and fermentation, all in one reaction vessel, a significant amount of energy, time, and raw materials are saved, resulting to a more efficient ethanol production. The newly developed solvent may also be used in producing third-generation biofuel, those are made from algae. It could be used in dissolving the polysaccharides from the algae and convert it into ethanol.

Source: https://www.greenoptimistic.com

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Contact: Lily L. Chen
(Conference Secretary)
Tel: +86-28-8777-7577
E-mail: icret@young.ac.cn
Web: http://www.icret.org

22-24 Mar
Kitakyushu, Japan

3rd International Conference on Renewable Energy and Smart Grid (ICRESG 2018)
Contact: Ms. Max Chen
Tel: +852-3069-7937
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Web: http://www.icresg.org

4-6 Apr
Daegu, Republic of Korea

International Green Energy Expo Korea 2018
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27-30 May
Shanghai, China

SNEC – PV POWER EXPO 2018
Contact: Shanghai Follow Me Exhibition Service Co., Ltd
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Fax: +86-21-6464-2653
E-mail: service@snec.org.cn

29 May- 1 Jun
Kuala Lumpur, Malaysia

International Conference on Smart Grid and Clean Energy Technologies
Contact: Conference Secretariat,
E-mail: secretariat@icsgce.com
Web: http://www.icsgce.com

17-19 Jul
Kuala Lumpur, Malaysia

Green Energy Expo & Forum 2018
Contact: United Business Media (M) Sdn Bhd
A-8-1, Level 8
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