

VATIS UPDATE

# Non-conventional Energy

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## Highlights

- New flexible silicon solar cells
- Spherical windmill
- Shallow water tidal generator
- Hydrogen fuel cells take to the air
- The road to full-scale hydrogen plant
- Promise of 'green petrol'



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ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY



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Vol. 2 No. 93

Nov - Dec 2008

## VATIS\* Update

### Non-conventional Energy

is published 6 times a year to keep the readers up to date of most of the relevant and latest technological developments and events in the field of Non-conventional Energy. The Update is tailored to policy-makers, industries and technology transfer intermediaries.

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*This publication has been issued without formal editing*

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### Hydrogen-fuelled buses tested at Beijing Games



*A hydrogen battery-powered bus*

During the recent Olympic Games in Beijing, China, some 500 buses using diverse new energies were put into operation. One of the technologies tested was hydrogen fuel. A hydrogen gas station was set up at the energy demonstration park in the Yongfeng High Tech Centre, Zhongguancun. Covering an area of 4,000 m<sup>2</sup>, the hydrogen gas station has advanced gas producing facilities, including hydrogen gas maker, natural gas reformation device and clean hydrogen gas maker. All the fuel battery vehicles demonstrated at the Beijing Olympic Games were maintained and refuelled at the station. It takes about 20 minutes to get a fuel battery car or bus refuelled, for a run as far as 250 km, and this will have to be done approximately once a day.

*Source: www.most.gov.cn*

### Indian cabinet approves national policy on biofuel

In India, the Minister for New and Renewable Energy, Mr. Vilas Muttemwar, said the cabinet approval to the national policy on biofuel will post a new direction to the development of biofuels. The cabinet gave its approval to the National Biofuel

Policy along with setting up of an empowered National Biofuel Co-ordination Committee (headed by the Prime Minister) and a Biofuel Steering Committee (headed by the Cabinet Secretary). The new policy aims to raise blending of biofuels with petrol and diesel to 20 per cent by 2017.

Salient features of the new policy are:

- Biodiesel production will be taken up from non-edible oil seeds on degraded/waste/marginal lands;
- The focus would be on indigenous production of biodiesel feedstock, and import of free fatty acid (FFA) based-bio fuel stock such as oil palm would not be permitted;
- Biodiesel plantations on community/government forestland/waste land would be encouraged, while plantation in fertile irrigated lands would not be encouraged;
- Minimum support price with periodic revision for biodiesel oil seeds to provide fair price to the growers;
- Minimum purchase price for bio-ethanol by the oil marketing companies would be based on its actual cost of production and import price;
- Biofuels may be considered "Declared Goods" by the government to ensure their free movement within and outside the states;
- No taxes and duties to be levied on biodiesel; and
- Thrust to be given to research, development and demonstration, with focus on plantations, processing and production technologies, including second-generation cellulosic biofuels.

*Source: www.pib.nic.in*

### Biofuel use to be a must in Indonesia

Indonesia has issued a ministerial decree that will make the use of

biofuels mandatory from 2009, said Dr. Purnomo Yusgiantoro, Indonesian Energy Minister. The resource-rich nation has been pushing for the use of biofuels to cut the use of expensive petroleum products and to help ensure the survival of its fledgling biodiesel industry. The decree states that for biodiesel, transportation vehicles must use a blend of 1 per cent oil palm-based biodiesel and 99 per cent diesel oil, while industry and power plants must use a blend containing 2.5 per cent and 0.25 per cent oil palm-based biodiesel, respectively.

*Source: www.istockanalyst.com*

### Viet Nam stops sale of ethanol-blended petrol

A new notification by the government in Viet Nam has stopped the sale of petrol mixed with ethanol just a week after trial sales began at two petrol stations in Hanoi. According to Mr. Nguyen Cam Tu, the Deputy Minister of Industry and Trade, the move is aimed at protecting consumer rights, as Viet Nam had not yet set standards for ethanol-petrol blends. "Petrol is a commodity that must meet the state standards and regulations before it is sold widely to the public," he said.

The Ministry's Science & Technology Department had permitted the trial sale of ethanol-blended petrol through March 2009. However, the Ministry later found that this petrol blend was yet to undergo sufficient testing and therefore, failed to meet essential requirements for wider public sale. The decision to pull it from the market was necessary to prevent negative consequences, the Minister said.

"The decision to temporarily stop the sale of petrol mixed with ethanol will not affect much the testing

process of the Petrochemical and Biofuel Joint Stock Company, which is in charge of blending A92 petrol with 5 per cent of ethanol petrol," said Mr. Le Thanh Thai who heads the company's Sales Department.

Source: [www.english.vietnamnet.vn](http://www.english.vietnamnet.vn)

## Philippine Senate approves renewable energy bill

The Philippine Senate approved on the third and final reading an incentives package to attract developers of renewable energy (RE) to invest in the country. The RE proponent Mr. Juan Miguel Zubiri, who authored one of the bills that were eventually consolidated as Senate Bill 2046 (SB 2046), said the measure provides for a seven-year income tax holiday and a 5 per cent gross income tax thereafter to renewable energy developers who invest in the Philippines. Power and electricity from RE resources for the investor's/generator's own consumption or free distribution in off-grid areas will be exempt from universal charges under Section 34 of the Electric Power Industry Reform Act. It was necessary to provide an attractive incentive package to RE investors because RE projects are more expensive than energy plants based on fossil fuel, Mr. Zubiri said.

SB 2046 provides for a government share equivalent to 1 per cent of the gross income of RE developers on the sale of energy produced, as well as other incident income from generation, transmission and sale of electricity generated from renewable resources. Mr. Edgardo Angara, who co-authored and sponsored SB 2046, stated that exploitation and use of RE could bring savings of US\$3.6 billion in fuel purchases by 2014.

Source: [www.abs-cbnnews.com](http://www.abs-cbnnews.com)

## Malaysian action plan on renewable energy

Malaysia is developing a renewable energy (RE) Action Plan, which will spell out in detail the way forward to increase the market share of RE in the generation mix of the country, the Minister of Energy, Water and Communications Datuk Shaziman Abu Mansor said. "We need to come up with policies that can mitigate the impact of the current fuel price volatility. We also need to plan for the interest of our future generation in view of depleting resources by preserving some of these resources for them," he said while addressing the PowerGen Asia 2008 conference.

In this context, Datuk Shaziman said, his Ministry would intensify efforts on RE and energy efficiency so that these two energy management aspects could play a major role in the energy supply mix. He urged greater efforts to encourage the utilization of renewable resources, such as biomass, biogas, solar and hydro for electricity generation. Datuk Shaziman informed that the use of renewable energy for power generation was being given greater emphasis in line with the country's 'Five-Fuel Policy' formulated under the Eighth Malaysia Plan and was being promoted with more emphasis under the Ninth Malaysia Plan.

The Minister said the high cost of RE technology was a reason why the development of RE was rather slow in Malaysia. To enhance RE development in the country, therefore, a premium needs to be paid to developers for the clean energy that they produce, he said. Datuk Shaziman said hydro power would play a more prominent role in the generation mix, with its share going up to 35 per cent in 2030 for Peninsular Malaysia.

Source: [www.bernama.com.my](http://www.bernama.com.my)

## Republic of Korea to boost renewable energy sector

The Republic of Korea would spend 111.5 trillion won (US\$103 billion) through 2030 in developing new renewable energy, in an effort to cut its reliance on fossil fuels and reduce carbon dioxide (CO<sub>2</sub>) emissions. The plan is part of the government's long-term energy strategy and will come on top of other energy policies and resource development plans.

The country will "lower the portion of fossil energy to 61 per cent by 2030 from the current 83 per cent, while bumping up the portion of new renewable energy to 11 per cent from 2.4 per cent," the Ministry of Knowledge Economy revealed in a statement. Under the plan, power generation capacity for solar, wind, bio and geothermal energy will be expanded. The statement came after an Energy Committee meeting presided over by the President Mr. Lee Myung-bak. The country also plans to boost its energy self-sufficiency rate to 40 per cent by 2030 from the current 4.2 per cent. The Republic of Korea is the world's 10<sup>th</sup> largest energy consumer and the 5<sup>th</sup> largest crude oil importer.

Source: [www.ccchina.gov.cn](http://www.ccchina.gov.cn)

### Global Renewable Energy Policies and Measures Database

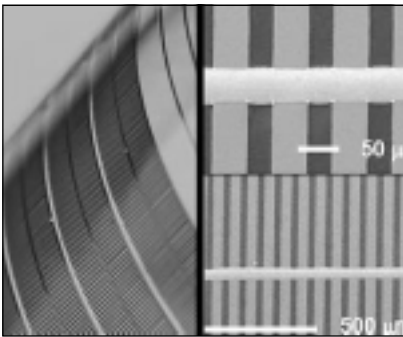
The database provides information on policies and measures taken or planned to encourage the uptake of renewable energy. It covers measures in International Energy Agency (IEA) member countries, members of Johannesburg Renewable Energy Coalition (JREC), and Brazil, China, the European Union, India, Mexico, Russia and South Africa.

For more information, access:

<http://www.iea.org>

## New flexible silicon solar cells

In the United States, researchers at University of Illinois at Urbana-Champaign and Northwestern University have developed a new type of silicon solar cell that is flexible enough to be used on a curved surface or fabric. Currently, most solar cells are rigid because of the use of plastic in their production. Moreover, unlike the thin-film solar cells produced by Q-Cells and Sharp, the new technology uses highly efficient single crystal silicon.



Flexible solar cell, magnified (right)

The flexible, see-through solar cells could be used as a solar skin on top of buildings or aircraft, as windows on cars or buildings, or even as a tinting film on sunroofs. Prof. John Rogers from the University of Illinois, who led the study, says, "You can make the solar cells in the form of a grey film that could be added to architectural glass." The technique – which involves slicing silicon very thinly and then transferring it onto plastic, with the resulting cells one-tenth the thickness of existing models – also results in flexible solar panels.

Sources: [www.cleantechnica.com](http://www.cleantechnica.com) & [www.lowcarboneconomy.com](http://www.lowcarboneconomy.com)

## Solar cell exhibits 40 per cent efficiency

In the United States, researchers at the National Renewable Energy

Laboratory (NREL) of the Department of Energy have developed a photovoltaic cell that converts 40.8 per cent of solar radiation – the highest confirmed conversion efficiency to date. Measured under concentrated light of 326 suns, the inverted metamorphic triple-junction solar cell uses compositions of gallium-indium-arsenide and gallium-indium-phosphide to split the solar spectrum into three equal parts that are absorbed by each of the cell's three junctions for higher potential efficiencies. The new design – forged, fabricated and independently measured by NREL scientists – exceeds the previous record holder's performance, creating a thinner, cheaper and more potent photovoltaics.

Spectro Lab had held the previous world record for conversion efficiency at 40.7 per cent, while the last conversion record of the inverted triple-junction cell was achieved by NREL and stands at 38.9 per cent. The new triple-junction solar cells are the likely candidates for space-based applications with a potential to be introduced in terrestrial markets as their design and operation become more functional.

Source: [www.pcmag.com](http://www.pcmag.com)

## New design for efficient solar cells

Focusing on creating autonomous power systems based on flexible thin-film solar cells, researcher Prof. Seshu Desu from Binghamton University, the United States, wants to increase efficiency through novel design and restructuring of the cell itself. When materials collect into much smaller dimensions as nanoparticles, the number of surfaces is increased. This, in turn, increases the capacity to interact with the environment without increasing the size of the basic unit. Materials also have other unexpected and

often beneficial properties when their sizes reduce to nano levels. Prof. Desu's work will leverage these as yet unknown properties in constructing the next generation of thin-film solar cells, in which nanoparticles cover a large surface area to maximize generation efficiency, reduce the cost and increase reliability.

"Potential for solar energy utilization can be maximized when the solar cells are integrated with highly efficient energy storage supercapacitor devices that could accommodate the accelerated power needs," Prof. Desu said. His team produced supercapacitors with significantly high energy and power densities with extremely long cycle lifetimes using the advantages of nanostructuring and thin-film nanocomposite materials. To achieve high-energy density and prevent self-discharge through open circuit reactions, organic and inorganic solid-state electrolytes as were developed as membranes or gels with ionic conductors that were biologically derived.

Source: [www.isa.org](http://www.isa.org)

## Silicon solar cells show 20 per cent efficiencies

The United States-based Suniva Inc., a manufacturer of high-value crystalline silicon solar cells, says that its R&D team used a patented combination of simple cell designs and screen printing technologies to develop several silicon solar cells with more than 20 per cent conversion efficiencies. According to the company, this development exhibits that its advanced technologies in diffusion, surface passivation and contacts can increase conversion efficiency while reducing processing time and maintaining low cell cost. The technology is reported to reduce the number of steps in the

production process and incorporate advanced design features that boost the cell's power output.

Suniva's ARTisun cell technology has recorded an efficiency of 18.5 per cent in the lab, as verified by the National Renewable Energy Laboratory. The company plans to focus on moving this technology from lab-sized cells to the production line and to commercialize the cells as soon as it is "possible and practical". It also has three new pending patents, which relate to structural design, fabrication process, module integration and the efficient use of low-cost heterojunction solar cells.

Source: [www.eetimes.com](http://www.eetimes.com)

## New approach for cheaper solar cells

In the United States, University of Utah researchers are working on a novel approach to slice thin wafers of germanium for use in the most efficient type of solar power cells. Mr. Dinesh Rakwal, a doctoral student in mechanical engineering, believes that the new method can help lower the cost and weight of such cells by reducing the waste and breakage of the semiconductor.

Mr. Rakwal, along with Mr. Eberhard Bamberg, an assistant professor of mechanical engineering, describes the new method as wire electrical discharge machining. They say that the method wastes less germanium and produces more wafers by cutting them thinner than normal, with less waste and cracking. The method employs an extremely thin molybdenum wire with an electrical current running through it. According to the researchers, this tool has been used previously for machining metals during tool-making.

Germanium serves as the bottom layer of the most efficient existing type of solar cell, but is primarily



Mr. Rakwal and Mr. Bamberg in the lab

used on NASA, commercial and military satellites because of the high expense: 4 inch wide wafers used in solar cells cost US\$80-US\$100 each. Germanium-based solar cells are used on spacecraft because they are more efficient and lighter than silicon-based solar cells, says Mr. Bamberg. Making it more economically attractive would promote the use of efficient germanium solar cells on rooftops and elsewhere.

Source: [www.thaindian.com](http://www.thaindian.com)

## Second-generation thin-film solar cells

Sharp Corp., Japan, has completed installation of a second-generation thin-film solar cell production line at its Katsuragi plant using large-size glass substrates measuring 1,000 x 1,400 mm, about 2.7 times the area of conventional substrates (560 x 925 mm). The facility plans to expand production capacity for thin-film solar cells to 160 MW/year.

Photovoltaic modules that use the second-generation thin-film solar cells manufactured on this production line feature 9 per cent module conversion efficiency and high 128 W power output. Also, making the substrates larger and raising power output ensures fewer modules are required for a given installation than before, making it possible to reduce the cost of installed systems. This can be expected to lower the cost of generating electricity.

Source: [www.techon.nikkeibp.co.jp](http://www.techon.nikkeibp.co.jp)

## Concentrated photovoltaic module

Concentracion Solar La Mancha S.L., Spain, has designed and developed a concentrated photovoltaic (CPV) module, which has a housing moulded from DuPont™ Rynite® polyethylene terephthalate (PET). CPV uses mirrors or lenses to concentrate or focus light from a relatively broad collection area on to a small area (as small as 1 cm<sup>2</sup>) of active semiconductor PV material. These systems show very high cell conversion efficiencies of over 36 per cent. The CPV module developed by Concentracion Solar has six concentrator elements and automatically tracks the Sun's movement across the sky to within 0.2° of accuracy. This precision enables them to achieve efficiency levels of 20-24 per cent in terms of electricity production, compared with 15-16 per cent for modules with conventional silicon cells.

The elements are housed and supported in a frame moulded using DuPont Rynite 935 BK505, a mica and glass-reinforced grade of PET. Rynite 935 BK505 was selected as an alternative to powder-coated aluminium, and because of its exceptionally low warpage, very high stiffness and excellent electrical insulating properties. Exposed to around-the-clock outdoor weather conditions, the material had to have high heat resistance (temperatures of up to 85°C) and ultraviolet rays, and provide the structural support required for the entire CPV module to withstand high winds. *Contact: Concentracion Solar La Mancha S.L., Poligono Industrial Calle D s/n, 13200 Manzanares (Ciudad Real), Spain. Tel: +34 (926) 647 414; Fax: +34 (926) 620 674; E-mail: [info@cslamancha.com](mailto:info@cslamancha.com).*

Source: [www.innovations-report.com](http://www.innovations-report.com)

### Two-blade wind turbine with hydrostatic drive



*The Norwind two-blade wind turbine that won the Red Dot design award*

The Switzerland-based Borawind AG, which holds 50 per cent share in Nordwind Energieanlagen GmbH, Germany, aims to become a major international player in decentralized (non-grid connection) wind power by launching a series of two-blade wind turbines with a hydrostatic drive and synchronous (grid-independent stabilizer of energy flow) generator. The turbines, though non-grid, could be connected to the grid, if needed.

The hydrostatic drive is a fluid solution to address wind variability. The technology is robust and proven, and the operating principle of the hydraulic drive is simple: a pump, connected to the rotor, generates the flow to drive a hydraulic motor, which is connected to a generator. If the displacement of the pump and motor are fixed, the hydrostatic drive simply acts as a gearbox to transmit power from the rotor to the generator. Nordwind utilizes a fixed rotor with variable motor design. In the event of a wind gust, excess pressure can be vented through a pressure valve. The hydrostatic drive

has fewer components and weighs less than a traditional gearbox. As such, this drive is expected to have higher performance and lower costs than traditional gearboxes.

Two-blade systems are lighter than three-blade systems, but owing to lower solidity, must spin faster to perform the same amount of work. Faster rotor speed translates into less torque, which causes less wear and tear on gearboxes and other components. Components can be designed less robustly, as they face less stress than the higher torque three-blade systems. This can also contribute to lower capital and maintenance costs. Installation is much simpler with two blades, and transportation of smaller turbines is less arduous, a feature that is useful in rural locations.

Nordwind is focused on developing turbines with hydrostatic transmission systems in the following power ranges: (1) Falcon class: 15-30 kW; (2) Milan class: 150-300 kW; and (3) Condor class: 850-1,500 kW. *Contact: Mr. Andreas Schweitzer, Vice Chairman, Borawind AG, See-strasse 1, CH 6330 Cham, Switzerland. Tel: +41 (22) 716 5409; Fax +41 (860) 792 116 560; E-mail: as@borawind.com.*

*Source: www.borawind.com.*

### Protection of wind generators during voltage dips

At the Public University of Navarre, Spain, a member of the INGEPER Research Team has proposed two protection techniques that will enable wind generators continue to be operative despite breaks in electricity supply. In the case of a voltage dip, there is a risk of the electronic part of wind generators burning out or otherwise be destroyed, unless a protection system is installed. The

end-product of the research by Mr. Jesus Lopez Taberna is a model rotor that enables anticipating how the wind power unit will behave in these situations.

Mr. Lopez has patented two techniques of protection, and one of these has already been transferred to a manufacturer who will exploit it at international level. This system allows the turbine generator to remain in operation during voltage dips and thus prevent the wind energy converter from ceasing to function. The other method requires changing of elements inside the machine and continues to be developed for applications in new wind generators.

*Source:*

*www.innovations-report.com*

### Spherical windmill

The Energy Ball<sup>®</sup>, designed and built by Home Energy in the Netherlands, differs from most wind turbine designs in that it sports a spherical structure. This design reportedly enables much higher aerodynamic efficiency to be achieved (40 per cent better efficiency) as compared with traditional designs. The Energy Ball's design constricts the wind, thereby causing the pressure to drop inside the "ball". This sucks in air flowing around the ball and helps turn the rotor blades. Owing to this suction, such Venturi-based turbines utilize more of the wind – and can therefore be 40 per cent more efficient – than a propeller-style turbine of the same diameter, according to research by Technical University of Delft, the Netherlands.

The low-noise turbine is characterized by the six curved rotor blades, which are attached to the rotor hub with both ends. When the Energy Ball rotor turns, it resembles a ball. A distinct feature is that the wind blows parallel to the rotor hub via the rotor. This wind flow direction

forms a key contrast with classic sphere-shaped Darrieus turbines, wherein the wind hits the blades perpendicular to the rotor shaft or rotor hub. Because of the unusual and exceptional aerodynamic characteristics of the turbine, it creates a wind flow pattern that first converges and then accelerates through the rotor, resembling the rapids in a river (Venturi effect). This provides a higher aerodynamic efficiency than conventional wind turbine designs.

At present, two models are available, the 0.5 kW Energy Ball V100 with a diameter of 110 cm and the 2.5 kW Energy Ball V200 with a diameter of 198 cm. Home Energy reports that the V200 can meet half the electricity needs of a typical home, while the V100 is more a supplement to other energy sources. Both produce power at wind speeds of 3 m/s to 40 m/s. *Contact: Home Energy International, Buys Ballotstraat, 94507 DA, Schoondijke, The Netherlands. Tel: +31 (23) 5580 022; Fax: +31 (23) 5581 870; E-mail: projects@home-energy.com.*

*Source: www.peswiki.com*

## Multi-megawatt wind turbine

Spain-based Acciona Energía's wind turbine manufacturing and supply division, Acciona Windpower, has introduced its AW-3000 machine to the market. The wind turbine with 3 MW rated capacity expands the company's range of products in the multi-megawatt market segment. Designed to leverage the proven strength and high reliability of the company's AW-1500 machine, the AW-3000 is reportedly offers a superior power performance in a wide range of wind resource conditions to optimize investment.

Designed for different wind classes (IEC Ia, IEC IIa and IEC IIIa), the



*Acciona's AW-3000 wind turbine*

AW-3000 will be manufactured with three rotor diameter options, depending on the characteristics of a specific site – 100, 109 and 116 m. This represents a swept surface area of up to 10,568 m<sup>2</sup>, the largest in the market for this capacity. The turbine is supplied with a concrete tower of 100 or 120 m hub height. Ease of operation and maintenance is another advantage claimed.

Electricity is generated at medium voltage (12 kV), which cuts production losses and transformer costs. The main shaft of the turbine is installed on a double frame to reduce loads on the gearbox and extend its working life. The AW-3000 can operate at variable speeds with an independent pitch system for each blade, thereby reducing loads on the unit and optimizing power production. The machine is equipped with a number of intelligent control and monitoring systems: a control and power unit, a condition monitoring system for key components, an automatic lubrication system for the main shaft, generator and blades, etc. *Contact: Acciona Windpower, Avenida Ciudad de la Innovación, 5, Sarriguren, Navarra 31621, Spain.*

*Source: www.environmental-expert.com*

## New wind drive train concept unveiled

GE Drivetrain Technologies, a division of the multinational GE Transportation, has developed a system engineered to take the wind energy

industry to a new level. IntegraDrive integrates in one system the company's proven planetary gearing and medium-speed generator technologies. The product is an integrated, geared generator that is lighter and more compact than conventional three-stage gearbox generator systems. With fewer gears and bearings it is more reliable and efficient, according to the company.

*Source: www.nawindpower.com*

## High-performance shrouded wind turbine

FloDesign Wind Turbine Corp., the United States, has developed and patented FloDesign FD700 shrouded turbine that reportedly outperforms existing turbines by a factor of three or more in a much wider range of wind resources. The prototype being built will be 3.65 m in diameter and produce 108 kW of power. If it performs as expected, models suitable for commercial wind farms will be developed with a diameter of 15 m across and with the capability to produce 700 kW or more of power each, enough electricity to power about 500 homes.

The FloDesign wind turbine includes an ejector system comprising a lobed, supersonic primary nozzle and a convergent/divergent ejector shroud. The lobed nozzle is just upstream from the ejector shroud, such that there exists an annular space between the nozzle and shroud for admitting a secondary flow. While operating, a flow of high-pressure steam or air is directed through the primary nozzle, where it is accelerated to supersonic speeds. This primary flow then exits the nozzle, where it entrains and gets mixed with the secondary flow, creating a low-pressure region (vacuum). The ejector shroud subsequently decelerates the combined flow while increasing the flow pressure, which

increases suction performance and reduces energy loss. Because the primary nozzle mixes the two flows, the ejector shroud is able to have a length-to-entrance-diameter ratio much smaller than typical shrouds/diffusers, which decreases the system size and improves performance. *Contact: FloDesign Wind Turbine Corporation, 380 Main Street, Wilbraham, MA 01095, United States of America. Tel: +1 (413) 5965 900; Fax: +1 (413) 5965 355; E-mail: info@flodesignwindturbine.org.*

Source: [www.peswiki.com](http://www.peswiki.com)

### Wind turbine with semi-rigid blade



Electric pinwheel with semi-rigid blade

Electric Pinwheels LLC, the United States, designs and manufactures a novel wind turbine/generator with a semi-rigid fabric blade. With a lightweight structure and a blade that flexes upon impact, the wind turbine provides an aesthetically pleasing and safe alternative to other forms of wind power. The wind turbine, targeted at the residential and portable markets, permits the colours and patterns of the blades and tail to be customized.

The company plans to soon launch a downwind Horizontal Axis Wind Turbine (HAWT) in a 3-blade configuration. The blades are arranged around a hub that rotates on a fixed shaft. Wind power is converted to electrical power with an axial flux

permanent magnet alternator. The patent-pending blade design consists of a fabric / vinyl blade sleeve pulled over the top of a composite rod structure. The result is a semi-rigid aerodynamic wing with camber and twist, providing the lift required to generate power. This structure has a high degree of stiffness in the direction of wind flow, yet flexes easily in the direction of rotation upon impact as the supporting rods slide within the hub. This allows the device to be safely stopped by hand, and is intended to address safety concerns as more wind turbines are installed close to people and buildings.

High-wind protection is accomplished through flexing of the blades, which greatly reduces wind loading. Blade pitch and curvature can be changed by moving the leading edge supporting rod through a modified arc. This adjustment can be made manually or automatically with an optional variable pitch device. As residential and portable uses usually present less-than-ideal wind conditions, so the variable pitch feature is essential to gather the maximum amount of power in low and variable winds.

Source: [www.peswiki.com](http://www.peswiki.com)

### Wind rescue system

Gravitec Systems Inc., fall protection industry specialists based in the United States, has released the G4 Wind Rescue System. The product addresses the need for a user-friendly, high-angle rescue system that can be used to quickly rescue or evacuate service personnel from high locations on turbines. G4 is an assembly of rescue equipment specifically selected for use in wind turbines to handle four basic rescue functions, including lifting, hauling, evacuation and assisted rescue. It can be configured to facilitate one- or two-person rescues, using overhead anchorages. G4 can also be employed to manipulate casualties around corners or to lift, lower or drag an incapacitated worker.

Each G4 system is enclosed in a weatherproof PVC storage bag and is individually numbered for ease of tracking. Unlike other rescue systems, G4's design eliminates rope entanglement in windy conditions. A detailed user manual and plasticized, quick-view instruction cards illustrating G4's configurations for rescue or evacuation are also incorporated into the system.

Source: [www.nawindpower.com](http://www.nawindpower.com)

## SWERA

The **Solar and Wind Energy Resource Assessment (SWERA)** programme provides easy access to high quality renewable energy resource information and data to users all around the world. Its goal is to help facilitate renewable energy policy and investment by making high quality information freely available to key user groups. SWERA products include Geographic Information Systems (GIS) and time series data, along with links to energy optimization tools needed to apply these data.

Data products such as 'Resource Information' and 'Analysis Tools' are offered through a team of international experts and their in-country partners. New datasets are made available on a continuing basis.

For more information, access: <http://swera.unep.net>

### Commercial tidal energy installation

Realizing the first commercial-scale turbine farm built under the ocean is a step closer. A deal to acquire Current Resources by Singapore-based tidal energy developer Atlantis Resources will allow the latter to scale up its operations and deliver its first large project by combining its technological know-how with the expertise of Current Resources in project development.

Atlantis manufactures two types of sub-marine turbines: the 400 kW Nereus, a horizontal axis turbine, is meant for shallow (under 25 m) waters; and the more powerful 500 kW Solon, a ducted horizontal axis turbine with a unique blade design, is for water depths exceeding 40 m. Their impact on the surrounding habitat and wildlife is negligible, and the turbines can be connected off-grid, even in remote locations, just like offshore wind installations. Both technologies have been extensively tested and developed with the intent of deployment in commercial-scale installations. The company reports the turbines have been independently rated as the top two tidal energy technologies for performance and efficiency.

Source: [www.venturebeat.com](http://www.venturebeat.com)

### Turbine rides underwater currents like a kite

Mechanical engineers at the Energy Systems Research Unit (ESRU) of University of Strathclyde, the United Kingdom, have developed a turbine that will ride the tide while latched to the seabed by a cable – like a kite flying on a windy day. The goal of the ESRU team is to create a device that literally goes with the flow rather than resting on the sea



ESRU's contra-rotating marine turbine

bottom like an underwater windmill. The contra-rotating marine turbine (CoRMaT) is designed to facilitate placing tidal turbines in deep water, where the stronger current has the potential for providing greater power but also makes it very difficult to plant a turbine in the seabed.

Another key feature of the ESRU design is that the turbine has two rotors – one in front of the other – that turn in opposite directions on a single axis. The rotor blades are made of either solid aluminium alloy or glass-reinforced plastic, depending on their sizes. By having the rotors turn in opposite directions, Dr. Andrew Grant and his team are trying to cut down on reactive torque (which pushes the turbine in the opposite direction) so that the unit can be attached to a relatively simple mooring system even in very deep water.

Source: [www.sciam.com](http://www.sciam.com)

### Shallow water tidal generator

Pulse Tidal, the United Kingdom, has successfully deployed a test version of its tidal generator in the Humber estuary, capable of providing adequate energy to power 70 homes. The device represents the first tidal generator in the world to deliver power directly to a commer-

cial customer – Millennium Inorganic Chemicals plant. A director of the company, Mr. Howard Nimmo, said that the device, which has been specifically designed to operate in shallow waters where tidal streams tend to be at their fastest, will operate in waters just 5 m deep.

Pulse Tidal's generator differs from conventional tidal turbine designs because it is based on horizontal moving foils or fins, as opposed to windmill-style rotor blades. Consequently, the area of water it draws power from can be maximized in relatively shallow water simply by extending the length of the fins.

Source: [www.businessgreen.com](http://www.businessgreen.com)

### Simpler turbines to harvest tidal energy

In the United Kingdom, University of Oxford researchers have developed a tidal turbine with the potential to harness tidal energy more efficiently and cheaply, using a design that is simpler, more robust and scaleable than current ones. The research team includes Prof. Guy Houlsby, Civil Engineering professor at Oxford, Dr. Malcolm McCulloch of the Electrical Power Group, and Prof. Martin Oldfield from Mechanical Engineering Department.

The team designed, built and tested the horizontal axis water turbine, to intersect the largest possible area of current. The rotor is cylindrical and rolls around its axis, catching the current. A prototype 0.5 m diameter turbine has performed well in tests, proving the benefits of the blade design. A full-scale device will be up to 10 m in diameter, and a series of turbines can be chained together across a tidal channel. The team has calculated that a tidal site 1 km in width could produce 60 MW of energy.

Source: [www.physorg.com](http://www.physorg.com)

## New fuel cell starts up at room temperature

In Japan, researchers have developed a non-humidification polymer electrolyte fuel cell (PEFC) that can generate power at temperatures ranging from the ambient to the intermediate (100°C-200°C). The group of scientists led by Prof. Masahiro Rikukawa at Sophia University used a composite membrane as the solid electrolyte membrane.

PEFCs that are nearly at a practical level have an acid group such as sulphonic acid at the end and protons (H<sup>+</sup>) are carried through water. In contrast, the PEFC studied by Prof. Rikukawa uses a composite membrane of polybenzimidazole (PBI), a basic polymer with an N or NH group, doped with phosphoric acid (H<sub>3</sub>PO<sub>4</sub>). The base in the PBI chain and the doped acid interact with each other and H<sub>3</sub>PO<sub>4</sub> through which protons migrate gets immobilized.

A fuel cell that uses a PBI/H<sub>3</sub>PO<sub>4</sub> composite membrane can eliminate auxiliaries to control water because it does not require humidification, and thus reduces the cost and the size. Furthermore, as the membrane shows ionic conductivity in a temperature range of 100°C-200°C, which is higher than the range (70°C-90°C) that is applicable to existing PEFCs, it has many advantages, such as a high power generation efficiency and a capability to prevent catalyst poisoning.

Source: [www.techon.nikkeibp.co.jp](http://www.techon.nikkeibp.co.jp)

## Hydrogen fuel cells take to the air

The first manned airplane powered solely by a fuel cell during take-off and flying was demonstrated at the German Aerospace Centre (DLR) at Stuttgart airport, Germany. The



Antares DLR-H2 aircraft approaching airport (Credit: DLR)

power for the motor glider Antares DLR-H2 comes from a high-temperature polymer electrolyte membrane (PEM) fuel cell developed by BASF. BASF's Celtec® membrane electrode assemblies (MEAs) technology operates between 120°C and 180°C and tolerates impurities in the hydrogen fuel gas. This factor could be important to future applications in aircraft, where the hydrogen fuel might be generated on board via jet fuel reformation.

Although fuel cells are not expected to be used for large commercial aircraft propulsion, they could prove very useful for on-board auxiliary power supply. Contact: Dr. Isabel Kundler, Manager of Technical Marketing, BASF Fuel Cell GmbH, Industriepark Höchst, G 865, 65926 Frankfurt, Germany. Tel: +49 (69) 3051 5953; Fax: +49 (69) 3052 6600; E-mail: [isabel.kundler@basf.com](mailto:isabel.kundler@basf.com).

Source: [www.energyefficiencynews.com](http://www.energyefficiencynews.com)

## Fuel cells integrating SFC technology

Germany's SFC Smart Fuel Cell AG, with its United States-based partners DuPont and Capitol Connections LLC, announced that two of its portable fuel cell systems integrating different technologies secured prizes in the United States Defence Department's Wearable Power Competition: the M-25 portable fuel cell won the US\$1 million

first prize and the company's Jenny fuel cell got the \$250,000 third prize.

Attached to a standard military vest, the systems were required to provide 20 W of average electric power for 96 hours, meet brief peak-power demand of up to 200 W and weigh no more than 4 kg. Both systems include a fuel cell, a fuel cartridge, a rechargeable Li-ion battery and a DC/DC converter. They can power a wide range of equipment, such as GPS navigation devices, communications equipment, computers, sensors, robots and UAVs. Contact: Mr. Ulrike Schramm, SFC Smart Fuel Cell AG, Germany. Tel: +49 (89) 67 35 92379; Fax: +49 (89) 6735 923 69; E-mail: [ulrike.schramm@sfc.com](mailto:ulrike.schramm@sfc.com); Website: [www.sfc.com](http://www.sfc.com).

Source: [www.marketwatch.com](http://www.marketwatch.com)

## Fuel cells provide marathon power

UltraCell Corporation, the United States, announced that its XX25™ fuel cell systems have successfully powered emergency communication radios at the 12<sup>th</sup> annual United States Air Force (USAF) Marathon.

Included in the emergency communication system for the 130 sq. km marathon operational area were 7 VHF tactical radios powered by two UltraCell XX25 fuel cells. The lightweight, portable XX25 fuel cell systems delivered uninterrupted power, which normally would have required multiple battery replacements. The tactical radio field charging system used included six lithium ion unit chargers, one hybrid XX25 fuel cell system paired with a gel-cell battery and a power distribution system. Contact: UltraCell Corporation, 399 Lindbergh Avenue, Livermore, CA 94551, United States of America. Fax: +1 (925) 455 7750; E-mail: [info@ultracellpower.com](mailto:info@ultracellpower.com).

Source: [www.earthtimes.org](http://www.earthtimes.org)

### Hydrogen breakthrough offers hope in fuel crisis

ITM Power, the United Kingdom, has converted a Ford Focus to run on hydrogen, a move that could revolutionize commuting while cutting fuel costs and carbon dioxide emissions. The company also revealed a hydrogen home refuelling station, capable of producing the gas from water and electricity, which it says could ultimately offer drivers an alternative to conventional fuels and provide a novel power source for homes and businesses. The station overcomes one of the fundamental hurdles to a hydrogen economy – the lack of refuelling infrastructure and utility supply network.

It has taken ITM Power's Sheffield research base, currently Europe's largest electrolyser and fuel cell development centre, eight years to create a low-cost means of manufacturing hydrogen. Its electrolyser-based refuelling station employs a unique low-cost polymer, which dispenses with the need for expensive platinum catalyst, and can be produced at 1 per cent of the cost of traditional membrane materials. The result is a hydrogen production system, small enough to be used in a home, which can generate the gas from a supply of water and off-peak or renewable electricity. The stored hydrogen gas could then be used to fuel converted cars or provide power for other purposes.

The converted car is effectively a bi-fuel vehicle, which can be switched back to petrol if the hydrogen supply is exhausted. The demonstration vehicle can travel 40 km on a single recharge of hydrogen from the refuelling station. If the hydrogen is compressed, the range can be extended to 160 km.

Source: [www.enviroireland.com](http://www.enviroireland.com)

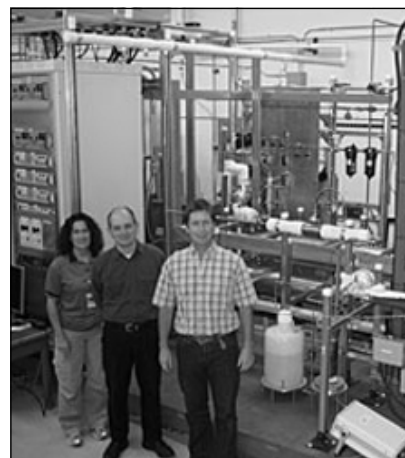
### The road to full-scale hydrogen plant

At Idaho National Laboratory, the United States, a team of engineers is working to split steam into hydrogen and oxygen employing high-temperature electrolysis. Coupled to an advanced nuclear plant, high-temperature electrolysis would use heat and a portion of the plant's electricity to generate hydrogen. "This is a way to produce hydrogen without producing carbon dioxide," says Dr. Stephen Herring, the INL nuclear physicist who heads up the High-Temperature Electrolysis (HTE) project.

INL's HTE team recently completed the first test of its Integrated Laboratory Scale (ILS) experiment, a scaled, high-temperature electrolysis hydrogen plant. When operated at full capacity, the plant will generate roughly 500 g of hydrogen an hour. The experiment will help the team design a full-scale plant that can produce 2.5 kg of hydrogen per second – an automobile equivalent of 10 litres of petrol.

Because water breaks apart more easily when heated, electrolysing water at high temperatures (800°C) is more efficient than conventional electrolysis. But designing components that perform well at such high temperatures can be difficult. To produce hydrogen, Dr. Herring and his colleagues used fuel cell-like materials. In each solid oxide fuel cell, a voltage pulls oxygen ions through a ceramic electrolyte, effectively separating the steam into hydrogen and oxygen. The team is working with Ceramtec Inc. to produce the cells.

The ILS experiment will incorporate 720 cells that will fit in a hotbox the size of a steamer trunk. When running at full power, the ILS plant will consume 15 kW of energy to power



Dr. Stephen Herring flanked by HTE team members

the electrolysis cells that will produce its hourly 500 g of hydrogen. The team is working to reduce that energy by making the electrolysis cells more efficient. They also plan to add heat exchangers to transfer heat from the end of the ILS to heat up water at the beginning. Creating such a cyclical process will reduce the power needed to make steam, enabling the system to use 20 per cent less electricity than it does now.

The biggest challenge is to make corrosion-resistant solid oxide cells. Constant use in a demanding, high-temperature environment quickly reduces the cells' hydrogen production efficiency. The team has tested stacks of cells that have operated for 2,000 hours, or three months. But to make a commercial, high-temperature electrolysis plant cost-effective, Dr. Herring says, the cells must run for two years.

Source: [www.sciencedaily.com](http://www.sciencedaily.com)

### Ammonia borane could store hydrogen

Researchers at the Pacific Northwest National Laboratory (PNNL) of the United States Department of Energy have made progress on developing a simple "one-pot" reaction to make ammonia borane ( $\text{NH}_3\text{BH}_3$ ),

which is a chemical hydrogen ( $H_2$ ) storage material of current interest for use in on-board storage systems.  $NH_3BH_3$  is a stable white powder, which begins to release gas upon heating to more than  $70^\circ C$ . With a gravimetric density of around 194 g  $H_2$  per kg and a volumetric density of around 146 g  $H_2$  per litre, it is a promising chemical hydrogen storage material.

One issue with the material, however, has been insufficient yields in its production. The newly reported PNNL work showed the "surprising" result that ammonium borohydride,  $NH_4BH_4$ , formed in situ by the metathesis of  $NH_4X$  and  $MBH_4$  salts ( $M = Na, Li; X = Cl, F$ ) in liquid  $NH_3$ , can be induced to decompose in an ether to yield  $NH_3BH_3$  in high quantities. The  $NH_3BH_3$  prepared by this one-pot strategy is pure enough to meet the thermal stability requirements for on-board  $H_2$  storage, according to the researchers.

The high yields of  $NH_3BH_3$  surprised the researchers for two reasons. They found that (1) it was not necessary to remove all traces of  $NH_3$  prior to addition of the organic solvent; and (2) it was not necessary to add trace quantities of diborane to get quantitative yields. The research group is currently looking at scaling up the reaction to industrial level.

Source: [www.greencarcongress.com](http://www.greencarcongress.com)

### Silicon nanotubes for hydrogen storage

Researchers have focused on the potential use of carbon nanotubes for storing hydrogen in fuel cell vehicles for years. Despite nanotubes' great promise, they have not been able to meet the hydrogen storage goals set forth by the United States Department of Energy for hydrogen

fuel cell vehicles. A more efficient hydrogen storage material is needed, scientists say.

In a recent study, Dr. Dapeng Cao and his colleagues at Beijing University of Chemical Technology, China, used powerful molecular modelling tools for comparing the hydrogen storage capacities of newly developed silicon nanotubes to carbon nanotubes. They found that, theoretically, silicon nanotubes could absorb hydrogen molecules more efficiently than carbon nanotubes under normal fuel cell operating conditions. The calculations pave the way for tests to determine whether silicon nanotubes can meet government standards for hydrogen storage in hydrogen-powered cars, note the researchers. *Contact: Dr. Dapeng Cao, Beijing University of Chemical Technology, Beijing, China. Tel: +86 (10) 6444 3254; Fax: +86 (10) 6442 7616; E-mail: caodp@mail.buct.edu.cn.*

Source: [www.nanotech.com](http://www.nanotech.com)

### Kit for hydrogen generation

EcoMobil, India, has announced that it will be introducing the "Hfactor" – a hydrogen generator kit, which will help cars run for 3,500 km on a single charge, it is claimed. Hfactor currently costs just about US\$400 and the company expects the price to drop further when it starts manufacturing it in India. The company purchased the Hfactor technology from Mr. Raymond Ross, a pioneer in hydrogen fuel technology, who had earlier worked for Ford Motor Company.

The hydrogen generator sits on the engine of a vehicle and separates water into hydrogen and oxygen. It then infuses hydrogen in the air intake manifold, helping the engine burn fuel more efficiently. The unit

has internal positively and negatively charged components, and a reaction using a chemical catalyst separates hydrogen and oxygen in the water. Introduction of hydrogen reduces the usage of fuel, thereby increasing fuel efficiency. This also reduces carbon monoxide and other emissions.

Another advantage is that the hydrogen cleans the carbon deposits built up over time on the vehicle's pistons and valves. This ensures that fuel is used more for power instead of being absorbed by the carbon deposits.

Source: [www.beyondfossilfuel.com](http://www.beyondfossilfuel.com)

### Hydrogen-on-demand systems

Ronn Motor Company, the United States, is preparing to launch its proprietary H2GO™, a hydrogen-on-demand (HOD) system that can be installed on any existing car or truck. H2GO system is claimed to be an after-market solution that increases fuel mileage and reduces noxious emissions harmful to the environment.

H2GO system produces and blends gaseous hydrogen with diesel or petrol fuel to achieve improvements in fuel efficiency, currently estimated at 20-25 per cent, while increasing power and decreasing green house gases by approximately 90 per cent. It is similar in size to a standard car battery and holds approximately 4 litres of water, which will produce hydrogen as needed for approximately 8,000 km – the equivalent to approximately 10 tanks of fuel for most vehicles. H2GO is adaptable to any internal combustion piston engine vehicle, and is claimed to be suitable for over-the-road fleet trucks and RVs, as well as prop aircrafts and boats.

Source: [www.marketwatch.com](http://www.marketwatch.com)

### Promise of 'green petrol'

Some promising research programmes suggest several ways to get petrol out of plant material, informs Prof. William Schultz of the University of Michigan, the United States. The programmes basically involve changing a biofuel – such as poplar, switchgrass or corn stover – through gasification, deconstruction or pyrolysis to produce precursors to green petrol, says Prof. Schultz, who is also a Programme Director of the National Science Foundation. Such precursors are chemical molecules similar to what is found in crude oil – molecules that can be refined to produce petrol.

Gasification is the oldest, and has been used to convert coal to petrol, but it is expensive and not very efficient. Pyrolysis employs heat and chemical catalysts to promote the conversion of plants to petrol. It is efficient and can even use waste paper as its raw material, but so far can only produce some components of petrol. Another process starts with sugars, which can be easily derived from plants. It is being developed at a company called Virent Energy Systems. Company founder Mr. Randy Cortright claims the process produces petrol that is better than the standard unleaded petrol.

"Making a fuel – it is a commodity.



Mr. Cortright holds a beaker of biopetrol

You have to have a very highly optimized and integrated process to make a profit. You are competing against petroleum oil that has been around for over 100 years, and the petroleum industry has developed and learned how to economically refine crude oil. Now we need to learn how to economically refine biomass resources," said University of Massachusetts chemical engineering professor Dr. George Huber.

One factor favouring biomass-based petrol is that the chemical production process would be quicker than the biological process used to make ethanol from similar raw materials. Similar to petrol made from crude oil, burning green petrol produces carbon dioxide (CO<sub>2</sub>), a greenhouse gas. But there is no net impact on climate because the CO<sub>2</sub> released comes from CO<sub>2</sub> absorbed from the atmosphere when the plant was growing. Although green petrol is still in being researched, it is building on technologies that have been around for a long time, Prof. Schultz pointed out. Nevertheless, while the chemical process for making green petrol still has a long way to go, so does the breeding of plants specifically designed to be turned into fuel.

Source: [www.voanews.com](http://www.voanews.com)

### Advance in biofuel processing

The University of Colorado at Boulder (CU-Boulder), the United States, has been awarded US\$1 million from the Department of Agriculture and the Department of Energy to develop rapid solar-thermal chemical reactor systems for the conversion of biomass material such as algae and switchgrass to synthesis gas or syngas. The three-year award was made to a team led by Dr. Alan Weimer, professor of CU-Boulder's Department of Chemical and Biological Engineering.

The team will utilize concentrated sunlight to heat biomass like corn stalks, grass, sorghum, and wood waste, leaves and algae to about 1100°C for just fractions of a second. The process will produce an intermediate syngas – a mixture of carbon oxides and hydrogen – that can be easily converted into hydrogen or liquid fuels.

Dr. Weimer said he envisions a totally renewable technology, in which a significant fraction of the nation's fuel supply is provided using solar-thermal processing in marginal lands where the farming of crops such as switchgrass and algae can provide the required biomass. "Since the process is driven by sunlight and converts biomass to fuels, the end result is a process that is carbon negative," Dr. Weimer said. "This provides an opportunity to substantially reduce greenhouse gases in the atmosphere without impacting the food supply."

Source: [www.engineerlive.com](http://www.engineerlive.com)

### New mechanism to produce energy from biomass

Scientists from Spain's Carlos III University of Madrid (UC3M) have developed a technology that can improve the efficiency of the conversion process of biomass to fuel gas that will contribute to more sustainable energy production. One of the scientists – Mr. Mercedes de Vega from Energy System Engineering Group of the Department of Thermal and Fluid Engineering – said that using fluidized beds as chemical reactors would allow for a more efficient conversion by achieving high mixing degrees and high exchange rates of mass and heat.

Fluidized beds have environmental applications because they allow biomass gasification to produce

energy. That is, producing fuel gas from crushed biomass, which can then be used for energy production. This renewable source has great potential – especially in processes of co-combustion, direct combustion and gasification – in industrial applications.

The study analyses the behaviour of a new bed designed with a rotating base. The base consists of a perforated plate where holes represent just 1 per cent of its total area. The study evaluates the performance of the new design, considering the increase in pressure and the quality of the fluidisation. It analyses the effect of the rotation speed of the perforated plate on the performance of the fluidized bed. This type of beds can usually present problems such as agglomeration of solid particles and points of high temperature. But one of the most important conclusions determined that the rotating perforated plate reduces these problems by maintaining a very uniform fluidization.

Source:  
[www.innovations-report.com](http://www.innovations-report.com)

### Coffee waste converted to energy

In the Philippines, the Cagayan de Oro factory of leading coffee brand Nescafe is employing spent coffee grounds to generate energy. The Nestle factory's atmospheric fluidized bed boiler (AFBB) is a state-of-the-art technology that burns and recycles spent coffee grounds into bunker fuel, which the factory uses for its operations. Coffee grounds are the remains of ground roasted coffee after extraction.

Mr. Ed Legasto, Senior Vice President of Nestle Philippines Inc. said that by using biomass or the spent coffee grounds as a substitute for bunker fuel, "We prevent emission

of air pollutants such as sulphur dioxide and nitrogen oxide, which are natural by-products arising from the combustion of fossil fuels." AFBB employs an efficient pollution control device, an electrostatic precipitator, to make the whole system compliant with the Clean Air Act.

The process of recycling the coffee grounds starts after the green coffee beans are roasted. The ground-roasted coffee is processed with hot water using percolation batteries or extraction cells to produce coffee extract. While the coffee extract undergoes spray-drying to produce coffee, the spent coffee grounds are sent to the disposal system to be used as fuel. The heat produced from this process is then used to produce the steam requirements of the factory.

Source: [business.inquirer.net](http://business.inquirer.net)

### Biofuel technology shows potential

Aquaflow Bionomic Corp. from New Zealand has produced its first samples of green-crude from wild and natural algae. The company said its green-crude differs slightly from first-generation biofuels because it is

made solely from algae – the photosynthetic micro-organisms – which absorb sunlight, carbon dioxide and nutrients found in waste streams or agricultural run-off.

"Our proprietary processes maximize the entire biomass value of the wild algae," said Mr. Barry Leay, Aquaflow Chairman. "What this produces is a crude oil equivalent to mineral crude. From this crude we can then fraction out a variety of fuels and chemicals, including aviation fuel," Mr. Leay claimed. The outputs from the samples have shown similar or greater potential compared with existing petroleum products.

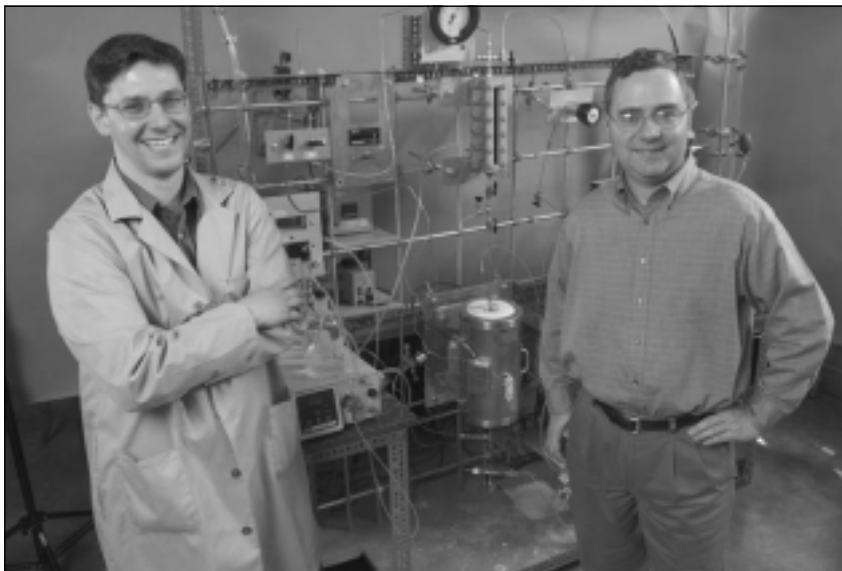
The technology allows the algae to fully optimize the nutrients available in the settling oxidation ponds. The algae is harvested and separated from contaminants, ready to be converted into a usable biofuel, such as biodiesel. The water discharged undergoes a bioremediation to ensure acceptable quality standards. Contact: Aquaflow Bionomic Corporation Ltd., P.O. Box 3295, Richmond, Nelson 7050, New Zealand. Tel: +64 (3) 543 8227; E-mail: [info@aquafllowgroup.com](mailto:info@aquafllowgroup.com).

Source:  
[www.biodieselmagazine.com](http://www.biodieselmagazine.com)



A production system for commercial scale harvesting of wild algae

## A novel chemistry to make fuel from sugar



*Dr. James Dumesic (right) and his former student Dr. George Huber*

At University of Wisconsin-Madison (UWM), the United States, scientists have devised a novel way to transform plant sugars into petrol, diesel or even jet fuel by passing the sugars over exotic materials. This chemical trick uses nano-sized particles to produce plant-based petrol that can be used in existing vehicles in place of petroleum fuels. "You have a conventional fuel that happens to be made from sustainable sources," states Dr. James Dumesic, a UWS chemical engineer who led the research.

Ethanol, the most widely used bio-fuel today, is harder to transport and store than petrol. Pure ethanol is highly corrosive to rubber tubing and many metals. Hence, the compound must be moved in stainless steel tanks instead of existing pipelines. Further, engines must be adapted to run on pure ethanol. These problems go away if petrol or diesel is to be made from plants, Dr. Dumesic says. While the process is not yet ready for large-scale production, UWS team was able to convert almost 65 per cent of the energy in the sugars into petrol using their laboratory-scale process.

An alloy of the precious metals platinum (Pt) and rhenium (Re) triggers the first step of the conversion. Dr. Dumesic and his team deposited 2 nm-wide specks of this alloy onto surfaces made of pure carbon. When

a liquid mixture of water and plant sugar flows over the Pt-Re particles at the right temperature and pressure, the metal atoms act as catalysts to cleave chemical bonds in the sugar, releasing oxygen and leaving behind a mixture of molecules containing carbon and hydrogen – the principal elements in both petrol and diesel.

The molecules produced by the catalytic reactions can be used directly to replace petroleum feedstock that the chemical industry uses to make plastics and other materials. Or, the molecules can pass through another step of previously known catalytic reactions to produce the final fuel. "We would just intercept the sugar and go to petrol," Dr. Dumesic says, "but there is still a lot of work to do on how to go from cellulose to sugar." UWM holds a patent on the new technique.

*Source: [www.sciencenews.org](http://www.sciencenews.org)*

## Researchers study biodiesel tree



*Copaiba – the "diesel tree"*

Dr. Chhandak Basu, a biological sciences assistant professor at the University of Northern Colorado, the United States, has received a grant from the Colorado Office of Economic Development and International Trade to study the viability of using biodiesel derived from a tropical tree. The University will match the funds, bringing the total amount of grant money to about US\$100,000.

Dr. Basu, during a two-year collaborative project under the Bioscience Discovery Evaluation Grant Programme, is cloning the genes that are responsible for the production of oleoresin, a diesel-like fuel, produced in the copaiba or "diesel tree." The genes will then be transferred into plants and algae to determine which plants are compatible and can produce the most biodiesel. The scientist has been working on the project with Dr. C. Neal Stewart Jr., a University of Tennessee-Knoxville professor. According to Dr. Basu, oleoresin from genetically modified plants could potentially be mass-produced and used without further refining fuel automobiles. His focus is on the molecular biology part, the genes responsible for this type of synthesis.

*Source: [www.biodieselmagazine.com](http://www.biodieselmagazine.com)*

## Biofuels Engineering Process Technology

Liberally illustrated, *Biofuels Engineering Process Technology* fully explains the concepts, systems, and technology now being used to produce biofuels on both an industrial and small scale. It provides state-of-the-art information on biofuels processed from fermentations of ethanol, hydrogen, microbial oils and methane. New material on the production of biodiesel from plant and algal oils, as well as the use of microbial fuel cells to produce bioelectricity are examined.

Contact: The McGraw-Hill Companies, 7500 Chavenelle Road, Dubuque, IA 52002, United States of America. Tel: +1 (609) 426 5793; Fax: +1 (609) 426 7917; E-mail: international\_cs@mcgraw-hill.com.

## Deploying Renewables: Principles for Effective Policies

Responding to the Gleneagles G8 call for a clean and secure energy future, this book highlights key policy tools to fast-track renewables into the mainstream. This analysis illustrates good practices by applying the combined metrics of effectiveness and efficiency to renewable energy policies in the electricity, heating and transport sectors. It highlights significant barriers to accelerating renewables penetration, and argues that the great potential of renewables can be exploited much more rapidly and to a much larger extent if good practices are adopted.

Contact: International Energy Agency, Bookshop, 9, rue de la Fédération, 75739 Paris Cedex 15, France. Tel: +33 (1) 4057 6690; Fax: +33 (1) 4057 6775; E-mail: books@iea.org.

## High-Efficient Low-Cost Photovoltaics

This book presents a bird's-eye view of the development and problems of recent photovoltaic cells and systems and prospects for Si feedstock. It focuses on high-efficient low-cost PV modules, making use of novel efficient solar cells, and low cost solar concentrators. Recent developments of organic photovoltaics, which is expected to overcome its difficulties and to enter the market soon, are also included.

Contact: Springer Asia Limited, Unit 1703, Tower I, Enterprise Square, 9 Sheung Yuet Road, Kowloon Bay, Hong Kong. Tel: +852 2723 9698; Fax: +852 2724 2366; E-mail: maurice.kwong@springer.com.

25-27 Feb  
Seoul  
Rep. of Korea

### International Solar Energy Expo & Conference

Contact: Expo Solar Bureau, 3F Hwang-geum Building, 253, Mapo-dong, Mapo-gu, Seoul 121-050, Republic of Korea. Tel: +82 (2) 719 6931; Fax: +82 (2) 715 8245; E-mail: solar@infothe.com; Website: www.exposolar.org.

30 Mar-1 Apr  
Shanghai  
China

### 4th Asia Solar Photovoltaic Exhibition 2009

Contact: Shanghai Aiexpo Exhibition service Co. Ltd., 5F No. 501 Guangyue Road, Shanghai, China 200434. Tel: +86 (21) 6592 9965; Fax: +86 (21) 6528 2319; E-mail: info@aiexpo.com.cn; Website: www.AsiaSolarExpo.com.

8-10 Apr  
Daegu  
Rep. of Korea

### International Green Energy Expo Korea 2009

Contact: Green Energy Expo, 1676 Sangyeok-dong, Buk-gu, Daegu 702712, Republic of Korea. Tel: +82 (53) 601 5375; Fax: +82 (53) 601 5372; E-mail: energy@energyexpo.co.kr; Website: www.energyexpo.co.kr.

21-24 Apr  
Shanghai  
China

### PV Tech Expo China

Contact: Reed Huayin (Shanghai) International Exhibitions, 6th Floor, New HuaLian Mansion, No. 775, Middle Huai Hai Road, Shanghai 200020, China. Tel: +86 (21) 5118 8222; Fax: +86 (21) 5118 8200; E-mail: jolee@reedexpo.com.cn; Website: www.nepconchina.com.

6-8 May  
Shanghai  
China

### SNEC PV Power Expo 2009

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20-23 May  
Bangkok  
Thailand

### Renewable Energy Thailand 2009

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  - Biotechnology (e-version only)
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