

### India offers incentives for solar power projects

The Ministry of New and Renewable Energy of India has announced a demonstration programme to support large grid-interactive solar power generation projects, up to a maximum capacity of 50 MW. Any registered company, as project developer, would be qualified to set up solar power projects on "build, own and operate" basis. Proposal from each project developer with a maximum aggregate capacity of 5 MW, either through a single project or multiple projects of a minimum capacity of 1 MW each, would be considered.

Projects with a maximum of 10 MW solar power generation capacity would be considered in a state. Projects from states where the State Electricity Regulatory Commissions (SERCs) have announced or are in the process of announcing solar power tariff would get preference. Projects that are approved and commissioned by 31 December 2009, will receive generation-based incentive from the Ministry – up to Rs 12 (US\$0.30) per kWh for solar photovoltaic power and Rs 10 (US\$0.25) per kWh for solar thermal power fed to the grid by the solar power project developers, after taking in to account the tariff provided by the SERC or the utility. The Ministry will also provide incentive to the concerned utility and the State Nodal Agency, which will be involved in implementation and monitoring of the projects in that state.

*Source: pib.nic.in*

### Capital fund for European energy projects

European Commission said it has launched a Global Energy Effici-

ency and Renewable Energy Fund (GEEREF). The Commission said it will put €30 million into the fund from 2007 to 2010 to kick-start the initiative. It foresees a total initial funding from public and commercial sources of €150-200 million, and is expected to mobilize additional risk capital of at least €300 million, and possibly up to €1 billion, in the longer term. The fund will be used to secure private investments in energy efficiency and renewable energy projects in developing countries and economies in transition.

*Source: www.forbes.com*

### China unveils renewable energy development plan

By 2010, China's annual consumption of renewable energy will reach the equivalent of 300 million tonnes of standard coal, which would be 10 per cent of its total annual energy consumption, under the country's renewable energy development plan for 2006-2010. The plan, released in March by the National Development and Reform Commission (NDRC), says renewable energy consumption in 2010 will be nearly double the 2005 level, which was equivalent to 166 million tonnes of standard coal. That led to an emission reduction of 3 million tonnes of sulphur dioxide and more than 400 million tonnes of carbon dioxide.

Given the dearth of petroleum and natural gas resources and the large share of coal in its energy production, it is difficult for China to sustain its development and protect the environment by relying totally on fossil fuels, NDRC said. China has abundant renewable resources that could be exploited. The plan says that by 2010:

- The nation will have hydropower projects with a combined installed

capacity of 190 million kW and wind power projects with installed capacity of 10 million kW.

- Installed capacity of bio-energy projects will reach 5.5 million kW and that of solar energy projects will be 300,000 kW.
- Domestically produced hydro-power equipment and solar water heaters should become competitive on global markets.
- Wind power equipment manufacturers should put generating units with installed capacities of at least 1.5 MW into mass production.

*Source: news.xinhuanet.com*

### Fiji considers geothermal energy

Fiji is looking for alternative energy sources in the face of record-high fuel prices. The Ministry of Land and Mineral Resources and other stakeholders are studying three options – geothermal, solar and wind – for alternative energy bases, said the Interim Lands Minister, Mr. Netani Sukanaivalu.

Geothermal is the front-runner so far and two companies – Geothermal Electric Ltd. and Mitchell Morgan – have expressed interest in drilling for hot water springs in Fiji. Geothermal Electric reportedly intends to start drilling on state leases later this year, while Mitchell Morgan is expected to start work after completing its lease application. Areas where geothermal energy can be sourced have been identified around the country.

Alternative energy sources, especially geothermal, would help alleviate the high fuel costs, said Mr. Sukanaivalu. Fiji is one of the countries in the hottest geothermal sites in the world because of its location on the Pacific Rim.

*Source: www.upi.com*

## Sri Lanka targets more power from renewable sources

Sri Lanka has set a difficult target to increase non-conventional, renewable energy to 10 per cent from current level of 4 per cent by 2017, said Power and Energy Minister Mr. W.D.J. Senevirathne, addressing the Washington International Renewable Energy Conference for 2008. "Our renewed pledge on renewable energy stems out from the unbearable cost of fossil fuel burdening my country at present," he said.

The Minister emphasised that the shift from fossil fuel to renewable energy and the reduction of energy use are the two options currently available. The Sustainable Energy Authority was the flagship of the host of programmes to achieve the goals of increasing the renewable energy and energy efficiency, he said. The Minister stressed the importance of energy to a developing country like Sri Lanka.

*Source: www.dailynews.lk*

## Bangladesh to tap renewable energy sources

In a massive move to search for alternative fuels for power generation, the government plans to increase power output using renewable resources by 10 per cent. At present, it is only 5 per cent, Power Ministry sources said. Dr. M. Tamim, Special Assistant to the Chief Adviser, said that "we are planning to take some realistic steps shortly" to step up the use of renewable and alternative energy sources like sunlight, wind and biomass for generating electricity.

Dr. Tamim said, "As per declaration we plan to reach a 100 MW pro-

duction target from hydro sources. We are also keen to see the evaluation report on the Kutubdia wind pilot project, as the fate of this project will say what we could do with our islands in so far as electricity is concerned."

The Power Cell in a study paper has said that about 2,200 MW of power could be generated by using alternative energy sources. It said that currently 4 MW of power is being produced by home solar systems and the future prospect of power generation by using solar energy is around 300 MW. It said up to 1,000 MW of power could be generated from wind energy by installing wind turbines along the coastline; at present, only 2 MW of power is being generated by wind energy. It also said that around 600 MW of power could be produced from biomass and 300 MW from co-generation.

*Source: www.energybangla.com*

## Wind energy to address Viet Nam's power shortage

Viet Nam, a country plagued by energy shortages, has great potential for developing wind energy, says an expert. Speaking at a conference in Ho Chi Minh City recently, Mr. Nguyen Hoang Dung, Grid Department head of Power Engineering Consulting Company No. 3, said around 28,000 square kilometres of the country's land had an average wind speed of over 7 m/s at a height of 65 m above sea level. This speed, considered suitable for power generation by international experts, offers a potential of over 110,000 MW, he said.

Viet Nam, a survey by the World Bank revealed, has greater wind energy potential than Thailand, Lao People's Democratic Republic and Cambodia. It can produce 513,360

MW annually – 200 times the output of the Son La Hydroelectric Plant in North Viet Nam, Southeast Asia's largest power plant, and ten times the entire national capacity forecast for 2020. Some coastal areas in the central and central highlands regions are deemed good places to set up wind farms, thanks to high "wind power density" and the wide open land.

Mr. Dung said the government had enlightened policies for harnessing wind energy. It funds programmes, surveys and experiments for the purpose, and allows tax-free import, production as well as transportation of equipment needed for developing technologies for renewable and new energy. But the development and exploitation of wind energy faces a barrier in the form of pricing.

State-owned monopoly power distributor Viet Nam Electricity (EVN) pays only US\$0.45/kWh of wind energy though the cost of generating it is not less than US\$0.60/kWh. Countries developing wind energy often provide subsidies, as costs cannot yet compare with that of traditional electricity. Mr. Dung said it was therefore necessary for the government to work on pricing.

*Source: www.thanhniennews.com*

## Thailand to produce ethanol from cassava

Cassava could be the safest and most economic feedstock for the production of biofuel. Rich in carbohydrate, cassava is food for both humans and animals, and also an ideal crop for biofuels. Researchers are developing new processes and technologies for the cost-effective production of ethanol from cassava.

Scientists from Thailand's Kasetsart University and the Cassava & Starch Technology Research Unit of the National Centre for Genetic

Engineering and Biotechnology. The scientists found that the cost and time of cassava-based ethanol production can be minimized through the simultaneous saccharification and fermentation process, as in bio-ethanol production from cereals. Researchers have found cassava to be a better feedstock for the daily production of the two million litres of ethanol required for its 10 per cent fuel substitution plan. Thailand produces 20 million tonnes of cassava a year. The starch chip and pellet industry consumes about 80-90 per cent of the output. The balance is available for ethanol production, unlike sugarcane or molasses, which are in short supply in Thailand.

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

## India to set up National Biofuel Development Board

The Indian government is planning to set up the National Biofuel Development Board, and the Ministry of New and Renewable Energy has been given the responsibility of setting it up. The proposal for setting up of the Board including its draft terms of reference and composition has been submitted for necessary approvals.

Through the National Oilseeds and Vegetable Oils Development Board,

the Ministry of Agriculture is providing subsidy to individual farmers and non-governmental organizations for producing tree-borne oilseeds, including biofuel crops, under the Integrated Development of Tree-borne Oilseeds Scheme. Under this, 30 per cent credit-linked subsidy is provided, which is linked with 50 per cent term loan to be taken from bank, and 20 per cent beneficiary share in the form of land, labour, etc. Furthermore, the Ministry of Rural Development has provided financial assistance of Rs 490 million (US\$ 12.3 million) to nine selected states in 2005-2006 and Rs. 495 million (US\$ 12.4 million) to 15 states in 2006-07 for the purpose of raising *Jatropha* and *Pongamia* seedlings and plantation.

Source: [pib.nic.in](http://pib.nic.in)

## Key developments in China's renewable energy sector

China is displaying surprising progress in renewables: for example, the country trails only Germany and Japan in solar photovoltaic cell output. There are several such examples that repudiate the clichés that circulate about China's green energy potential.

A document released by New Energy Finance Ltd. and the Chinese

Renewable Energy Industries Association shows that China is rolling out some really smart green energy policies. The country has released the Medium to Long-term Development Plan for Renewable Energy, setting national targets for all major renewable energy sectors for 2010 and 2020 respectively. It is implementing a plan to compensate grid companies for the additional cost of purchasing renewable power via a quota exchange system.

In the wind sector, China has made a breakthrough in installations of domestically manufactured wind turbines. Wind turbines made by domestic manufacturers account for 56 per cent of all installed turbines in China in 2007, exceeding those made by foreign and joint venture companies for the first time. At the end of 2007, installed wind capacity in China reached 6 GW. One quarter of this is in Inner Mongolia Autonomous Region, making it the first province/region in the country to have more than 1 GW installed.

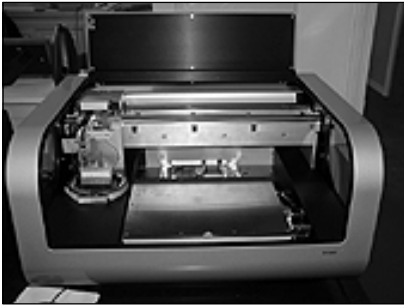
China has kicked off development of grid-connected utility scale PV projects, with the National Development and Reform Commission implementing a plan to build 5 MW and larger solar photovoltaic plants in eight provinces in western China. Jinan, in Shandong province, hosts the first central government sponsored National Solar Heat Utilization Congress in China, which aims to popularize the installation of solar water heaters in buildings across the country.

China has also reformed the bidding system for the fifth round national concession wind projects so as to discourage cut-throat price competition. It has halted the approval of new grain-based biofuel projects and enacted policies to encourage non-grain biofuels development.

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

Filler

### Solar cells created with inkjet technology



*Dimatix printer offers a dedicated materials deposition system*

Using the cartridge-based Dimatix Materials Printer (DMP) from Fujifilm, Konarka Technologies of the United States, has demonstrated the world's-first fabrication of highly efficient solar cells using of inkjet printing technology. The technology operates by propelling variable-size droplets of liquid or molten material onto almost any medium. The most common type of computer printer, inkjet printers are also used in the production of many microscopic articles as well as to form conductive traces for circuits, colour filters in LCD and plasma displays.

The DMP used for the demonstration was a bench-top materials deposition system that uses Fujifilm's inkjet technology and shaped piezo silicon MEMS fabrication processes in depositing picolitre-sized droplets of functional fluids on all types of surfaces. By employing single-use cartridges that researchers can fill with their own fluid materials, the DMP system minimizes waste of expensive fluid materials, thereby eliminating the cost and complexity associated with traditional product development and prototyping. The DMP is suitable for prototyping and low-volume manufacturing, and the technology is scalable from research & development to production.

Konarka says that organic solar cells can be processed with print-

ing technologies with little or no loss compared with "clean room" semiconductor technologies, such as spin coating – a process used to apply uniform thin film solar cells to flat base materials. Inkjet technology also has the advantage of being compatible with various base materials and does not require additional patterning.

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

### Solar cell efficiency increased with popcorn ball design

A new approach creates a dramatic improvement in cheap solar cells now being developed in laboratories. By using a popcorn-ball design – tiny kernels clumped into much larger porous spheres – scientists at the University of Washington (UW) were able to manipulate light and more than double the efficiency of converting solar energy to electricity. This could lead to a significant breakthrough in dye-sensitized solar cells, according to lead author Dr. Guozhong Cao, a professor of materials science and engineering.

Current prototypes of dye-sensitized solar cells can convert just over one-tenth of the incoming sun's energy into electricity. This is about half as efficient as the commercial, silicon-based cells used in rooftop panels and calculators. One of the main quandaries in making an efficient solar cell is the size of the grains. Smaller grains have bigger surface area per volume, and thus absorb more rays. Bigger clumps closer to the wavelength of visible light, however, cause light to ricochet within the thin light-absorbing surface, giving it a higher chance of being absorbed.

The UW scientists made very tiny grains, about 15 nm across (3,500 grains lined up end to end would

equal the width of a human hair). Then they clumped these into larger agglomerations, about 300 nm across. These larger balls scatter incoming rays and force the light to travel a longer distance within the solar cell. The balls' complex internal structure, meanwhile, creates a surface area of about 1,000 sq. ft for each gram of material. This internal surface is coated with a dye that captures the light.

The team expected some improvement in the performance but what the scientists saw exceeded their hopes. The overall efficiency was 2.4 per cent using only small particles: the highest efficiency achieved for this material. With the popcorn-ball design, results showed an efficiency of 6.2 per cent, more than twice the previous performance.

The experiments were performed using zinc oxide, which is less stable chemically than titanium dioxide (TiO<sub>2</sub>) but easier to work with. The team is working to transfer this concept to TiO<sub>2</sub>. Dye-sensitized solar cells based on TiO<sub>2</sub> are now at 11 per cent maximum efficiency. Dr. Guozhong hopes his strategy could push the solar cells' efficiency significantly over that threshold.

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

### Increasing efficiencies for thin film solar cells

Researchers at the United States Department of Energy's National Renewable Energy Laboratory recently announced that they have moved closer to creating a thin-film solar cell that can compete with the efficiency of the more common silicon solar cell. The copper-indium-gallium diselenide (CIGS) thin-film solar cell recently reached 19.9 per cent efficiency in testing at the lab, setting a new world record.

This is still far from the 42.8 per cent efficiency, achieved in July 2007 by a consortium of researchers led by the University of Delaware, using a technology that adds multiple innovations to a very high-performance crystalline silicon solar cell platform. However, there are big differences in the manufacturing costs of these two technologies, as well as in their potential fields of application.

Improvements in CIGS modules do not only come in increased efficiencies of the modules but also in other forms. SoloPower and Ascent Solar say that their modules will be flexible rather than on glass (flexible metal foil for SoloPower, high temperature plastic substrate for Ascent Solar) thus increasing the versatility and variety of potential applications.

Optimization of solar cell technologies is tackled in a different way at the Oak Ridge National Laboratory (ORNL). The ORNL pulse thermal processing is a revolutionary enabling technology for functionalizing nanomaterials due to its ability to control diffusion at the nanoscale. It employs a unique high-density plasma arc lamp, which is a very powerful radiant arc lamp. Power densities of 20,000 W/cm<sup>2</sup> can be achieved over broad areas (up to 1,000 cm<sup>2</sup>) and can be pulsed in 1 millisecond. The inherent characteristics of this technology – high heating rate, short processing time and larger processing area – enable unique thermal annealing capabilities that can potentially revolutionize PV material systems.

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

### World's most efficient multicrystalline silicon solar cell

Mitsubishi Electric Corp., Japan, has scored a world record conversion ef-

iciency rate of 18.6 per cent in a multicrystalline silicon (Si) solar cell. The cell uses the company's new technology called "honeycomb texture". The National Institute of Advanced Industrial Science & Technology, a public standards agency in Japan, measured the efficiency rate.

Thus far, the highest conversion efficiency rate of a multicrystalline Si solar cell was 18.5 per cent. This was achieved by the cell with a new electrode structure called the "back contact", which was developed by Kyocera Corp. Mitsubishi's latest development indicates that a cell with a standard electrode structure can provide higher conversion efficiency than that of a back contact cell. When the cell conversion efficiency improves from 16 per cent to 18 per cent, the output rises by 0.4 W per 150 mm square cell. With the use of a module composed of an array of 50 cells, the module conversion efficiency will increase by 20 W.

For forming a honeycomb textured structure, 100 million holes must be made by laser beams on a SiN film formed on the surface of a 150 mm square cell. One of the issues for mass-production is to improve the throughput of laser equipment, which

will be developed in-house. The improvement in throughput will lead to a reduction in the production cost per output.

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

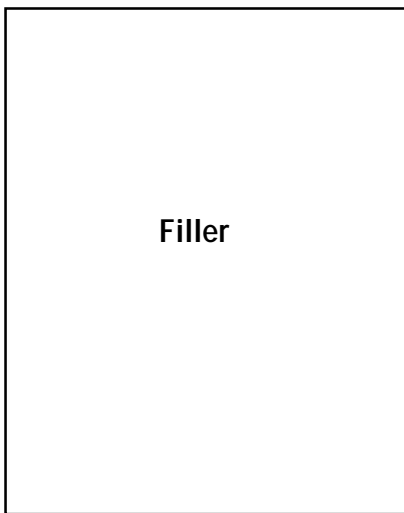
### Cheap and more efficient solar cells

Plants can transport absorbed solar energy over long distances, typically about 15-20 nm, to a location where it is converted into chemical energy. This is because the chlorophyll molecules in their leaves are arranged in optimal sequence. Ms. Annemarie Huijser, working on her PhD at the Technology University, Delft, the Netherlands, attempted a partial recreation in solar cells of this process as found in plants.

She focused on dye-sensitized solar cells, which are similar to Grätzel cells. These comprise a semiconductor, such as titanium dioxide, covered with a layer of dye. The dye absorbs energy from sunlight and creates energy parcels known as excitons. These then need to move towards the semiconductor. Once the excitons reach there, they generate electric power.

"Excitons need to move as freely as possible through the solar cells in order to generate electricity efficiently," says Ms. Huijser. Studying the best sequence of dye molecules enabled her to increase the average distance that the excitons move in the solar cell by twenty times, up to a distance of approximately 20 nm, comparable to systems found in nature. This greatly increases the efficiency of the cells. However, in order to make this new type of solar cells commercially viable, the mobility of the excitons needs to be increased further by a factor of at least three. Ms. Huijser believes that this is possible.

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



## Modular wind turbine



Modular wind turbine system installed on a parapet

AeroVironment (AV) Inc., the United States, has developed a modular wind turbine system designed for installation on buildings in urban and suburban areas. AV defines a new category of wind energy systems that adds value to buildings and demonstrates clean energy at work by eliminating the support tower, reducing noise and vibration, as well as creating a sleek and adaptable housing that installs quickly and easily onto buildings, without penetrating the roof.

Property owners can integrate the Architectural Wind™ systems easily into new and existing buildings, as they present a colour-matched, sleek series of specially designed, highly efficient and low profile wind turbines. These wind turbines are designed to install easily onto the building parapet, operating in plain site as an attractive complement to the building's architecture. Furthermore, these turbines rotate at low wind speeds to generate clean energy. Architectural Wind turbine is claimed to be designed to offer cost per kW of installed capacity and an attractive return on investment. *Contact: AeroVironment Inc., Corporate Headquarters, 181 W. Huntington Drive, Suite 202, Monrovia, California, CA 91016, United States of America. Tel: +1 (626) 357 9983; Fax: +1 (626) 359 9628; E-mail: info@avinc.com.*

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

## World's first hybrid excitation wind turbine

Baotou Huiquan Rare Earth Industry Group, a Chinese conglomerate, is working on grid wind turbine at the megawatt level in collaboration with Inner Mongolia Science and Technology University and Baotou Aineng Control Engineering. The collaboration has resulted in the first ever dual armature hybrid excitation wind turbine.

The prototype generator was installed in July 2007 in the Baitou City for trial operation. The trial operation, which ran for more than 3,600 hours, showed that the new generator meet all technical indicators required, and is ready for mass-production. The conglomerate is currently working on the same type of generator at 1.5 MW and 2.5 MW levels. The 1.5 MW generator is expected to be off the assembly line by mid-2008. According to a plan, the conglomerate will produce 300 sets of 1 MW and 1.5 MW wind turbine this year, and will expand to 500 sets in 2010.

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

## Commercially integrated wind turbines

The world's first-ever integrated wind turbines, installed on the Bahrain World Trade Centre, have begun to produce power. These turbines are the first to be integrated on a commercial building and are expected to meet 11-15 per cent of the power needed by the whole structure. The output of the turbines, as they work 50 per cent of the time, would be analysed in the next few months.

The elliptical shape of the two buildings is said to even accelerate the

wind towards the turbines. As the Bahrain World Trade Centre is in direct path of the onshore breeze blowing from the Gulf coast, there will be no shortage of wind. According to the project manager, the cost of turbines was reduced to 3.5 per cent of the whole project's costs. This means that, if the turbines work as expected, the project would be financially viable.

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

## Floating wind power

Advances in floating platforms can take wind farms far from coasts, to reduce costs and skirt controversy. Technology developers have begun to step up work in floating turbines to make such off-shore farms feasible. Several companies are on their way to demonstrating systems by borrowing heavily from oil and gas offshore platform technology.

The Dutch floating-turbine developer Blue H Technologies launched a test platform off Italy's southern coast last December. Recently, the company announced that it would install another test turbine off the coast of Massachusetts, the United States. The test platform that Blue H towed put up in Puglia, Italy, is called a tension-leg platform. It is a conventional off-shore oil and gas platform design that floats below the surface, held rigidly in place by chains running to steel or concrete anchors on the seabed. Installed on top is an 80 kW wind turbine fitted out with sensors to record the wave and wind forces experienced 10 km off-shore. Much bigger floating versions – 2.5 MW and 3.5 MW – are under construction by Blue H.

Blue H turbine uses a two-bladed rotor – a design that lost out to the three-blade design in the 1990s as the wind-turbine industry scaled up. The noise and jarringly high rotation speeds that made two-bladers a

loser on land are either irrelevant or an advantage off-shore. Faster rotation offers benefits. The 30-35 rpm frequency – twice that of a three-bladed turbine – is less susceptible to interference from the back-and-forth swing of the platform under wave action. Faster rotation also means less torque, meaning that the structure can be built lighter. The rotor, gearbox and generator are lighter than the lightest of comparable machines. The turbine and platform are cheaper to build. The net result is a highly competitive energy source. Blue H's wind farms are expected to deliver wind energy for US\$0.07-0.08 per kWh, roughly matching the cost of natural gas-fired generation and conventional wind energy.

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

### Windmill for seawater desalination

A traditional windmill that drives a pump: that is the simple concept behind the combined wind power and reverse osmosis seawater desalination system developed by the Delft University of Technology (TU Delft) in the Netherlands. The system involves a high-pressure pump, which pushes water through a membrane at a pressure of approximately 60 bar. This reverse osmosis membrane produces fresh water directly from seawater. The windmill is suited for use by, for instance, small villages in isolated and dry coastal areas.

The combination of windmills and desalination installations is already commercialized. The windmills produce electricity from wind power. The electricity is stored and subsequently used to drive the high-pressure pump for reverse osmosis. However, the storage of electricity is very expensive and energy is lost during conversion. In the TU Delft

system, the high-pressure pump is driven directly by wind power. Water storage can be used to overcome calm periods. The storage of water is a great deal cheaper than that of electricity.

The windmill employed is one that is normally used for irrigation. These windmills turn relatively slowly and are very robust. Based on the windmill's generation capacity at varying wind speeds, it is estimated that it will produce 5-10 m<sup>3</sup> of fresh water per day – enough drinking water for a small village of 500 inhabitants. The first prototype built is already working at a location near the A13 motorway near Delft.

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

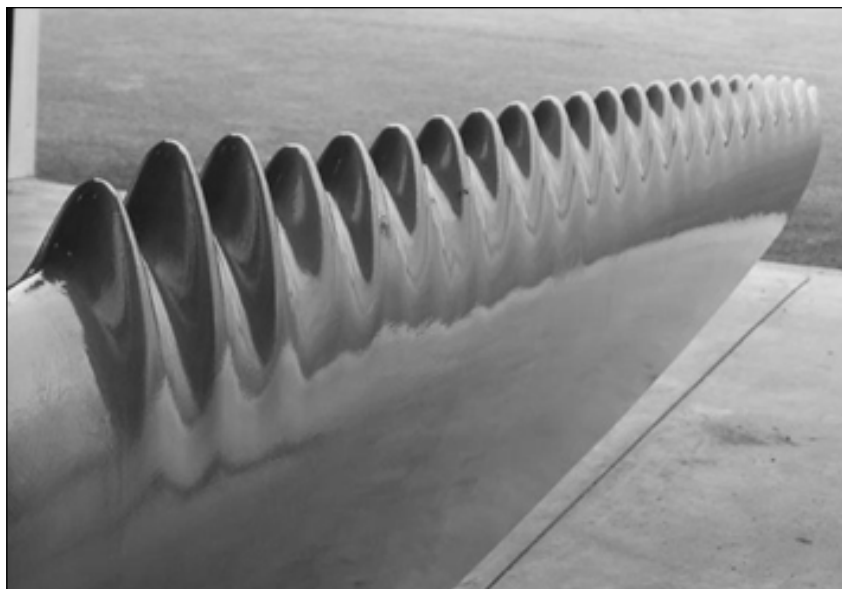
### Wind turbine design inspired by whales

Marine scientists have long suspected that humpback whales' incredible agility comes from the bumps, known as tubercles, on the leading edges of their flippers. Scientists at Harvard University in the United States have now come up with a mathematical model that helps ex-

plain this hydrodynamic edge. The work gives theoretical weight to a growing body of empirical evidence that similar bumps could help make more stable airplane designs, submarines with greater agility, and turbine blades that capture more energy from the wind and water. The study was carried out by Mr. Ernst van Nierop, a PhD student at the School of Engineering and Applied Sciences at Harvard, mathematics professor Dr. Michael Brenner and researcher Dr. Silas Alben.

The advantage of the humpback-whale flipper seems to be the angle of attack it is capable of – the angle between the flow of water and the face of the flipper. When the angle of attack of a whale flipper – or an airplane wing – becomes too steep, the result is a stall.

In aviation, stall means enough air is not flowing over the top surface of the wing, resulting in increased drag and reduced lift, a situation that can cause a sudden loss of altitude. Previous experiments have shown, however, that the angle of attack of a humpback's flipper can be up to 40 per cent steeper than that of a smooth flipper before stall occurs.



*A turbine blade design inspired by humpback whale's flipper*

The Harvard research team showed that the tubercles change the distribution of pressure on the flipper so that some parts of it stall before others. Since different parts of the flipper stall at different angles of attack, abrupt stalling is easier to avoid. This effect also provides the whale more freedom to attack at higher angles and the ability to better predict its hydrodynamic limitations. The team found that the amplitude of the bumps plays a greater role than the number of bumps along a flipper's leading edge.

Already, attempts are being made to incorporate the tubercle design into commercial products. WhalePower, Canada, has begun demonstrating the advantages of tubercles when they are integrated into the leading edges of wind-turbine and fan blades. Prototypes of wind turbine blades have shown that the delayed stall doubles the performance of the turbines at wind speeds of about 17 mph and enables the capture of more energy out of lower-speed winds. Tubercle-lined blades are also more stable, quiet and durable than conventional blades.

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

## New software for wind turbine design

Romax Technology, a global software and consulting firm based in the United Kingdom, has released its latest RomaxDesigner software package, Release 12.6. The new edition includes a completely new wind turbine-specific product line called RomaxWIND and several additional features within the Romax Durability and Romax Bearing product ranges. RomaxWIND provides an "all-in-one" software tailored for wind turbine applications and encompasses the design, sizing and optimization of drive-train systems.

It is also designed to be integrated within the design process and to harness existing investment in software tools. RomaxWIND provides interfaces to common analysis tools used up and downstream in the design, such as Simpack for more multi-body simulation and Garrad Hassan's Bladed for whole turbine dynamics.

Source: [www.windtech-international.com](http://www.windtech-international.com)

## Modified clutch helps to halve wind turbine weights

A novel mechanical power transmission system for wind turbines has cut their weight by about 50 per cent, as well as made them more efficient. The new system, based on a modified over-running sprag clutch and V-pulley assembly, was developed by Renold Clutches & Couplings of Cardiff in the United Kingdom. The modified assembly is connected to a gearbox via a torsionally rigid coupling. This allows the gearbox to change the pitch angle of the turbine's rotors to suit different wind conditions.

In general, wind turbines use fixed-speed rotors and in high winds, they have to cope with large torque fluctuations that can cause variations in generator output power of up to 100 per cent. The new design counters this problem by using a gearbox and clutch combination that allows the rotor speed to be adjusted by varying the pitch angle of the blades. This allows the generator output to be at a constant level, regardless of fluctuations in wind speed. If an overspeed occurs, the rotor reaches a fully feathered position and cuts out, but the clutch allows the generator to continue running.

The new design, incorporated in a wind turbine with a swept blade dia-

meter of 33 m and a top speed of 50 rpm, is about half the weight of conventional designs. This improves the cost-to-weight ratio and reduces operating costs, because only 3 per cent of the rated power is consumed by the components. *Contact: Renold plc., Renold House, Styal Road, Wythenshawe, Manchester, M22 5WL, United Kingdom. Tel: +44 (161) 498 4500; Fax: +44 (161) 437 7782.*

Source: [www.drives.co.uk](http://www.drives.co.uk)

## Gearless wind turbine

Wind Energy Group Inc., the United States, offers a wind turbine with a rated output of 100 kW. The gearless WEG-100 offers a variety of advantages over conventional wind generating systems. Key features of the turbine include:

- Horizontal drive with a permanent magnet variable-speed generator, and horizontal blades and air baffles;
- A low rpm, bi-directional multi-blade system;
- Very little maintenance, including for blades, is required;
- Fewer moving parts;
- Two braking systems, requiring little maintenance (pneumatic and magnetic); and
- No external rotating blades;

Pre-assembled sections as well as lightweight fibreglass blades and less parts to assemble helps make packaging, transportation and installation more efficient and timely saving costs. *Contact: Wind Energy Group Inc., #8001, Irvine Centre Drive, Suite 735, Irvine, CA 92618, United States of America. Tel: +1 (949) 3410 181; Fax: +1 (949) 4531 677; E-mail: [info@windenergygroupinc.com](mailto:info@windenergygroupinc.com).*

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

## High-efficiency domestic fuel cell



Panasonic's PEFCs for domestic use

Japan-based Panasonic has begun pitching fuel-cell technology as a new way to supply homes with electricity and cut their consumption of mains-sourced power. The company, also known as Matsushita, said it would put a domestic-use polymer electrolyte fuel cell (PEFC) system into production in June. It claimed the power pack could run for 40,000 hours and 4,000 start-stop cycles – enough for a ten-year operational lifespan.

Panasonic said its PEFC system, running flat out, has a power generation efficiency of 39 per cent – the highest for this technology. The cell has a heat recovery efficiency of 55 per cent. Panasonic envisages its PEFC units being used alongside traditional electricity supplies, cutting a typical (Japanese) household demand for externally sourced power by 22 per cent, with a carbon emission reduction of 12 per cent.

Households using the technology by participating in Panasonic's test programme used the units to generate between 500 W and 1 kW, the company said. The unit generates an alternating current at 50-60 Hz, producing 100-200 V. The 86 x 78 x 40 cm basic unit weighs 125 kg

and has a fuel capacity of 200 litres. The footprint, including that of the hot water storage unit, is 2.8 m<sup>2</sup>.

In addition to the new inverter, the improvement of natural gas reformer significantly helped to increase the power generation efficiency of the latest model. Panasonic enhanced the reforming efficiency by integrating the reforming unit, the selective oxidation unit and the transforming unit, which were separated in the existing reformer. The reduction rate of the fuel, natural gas, reaches 22 per cent, which is 41 points higher than existing models. The reduction rate of carbon dioxide is 12 per cent on average and 37 per cent on average for thermal power systems.

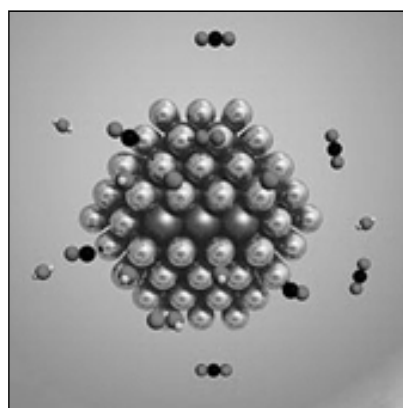
Sources: [www.reghardware.co.uk](http://www.reghardware.co.uk) and [techon.nikkeibp.co.jp](http://techon.nikkeibp.co.jp)

## New battery advances wind energy generation

Lithium Technology Corp. (LTC) of the United States has announced that it will be marketing an advanced lithium-ion battery for pitch control systems of wind generators. The ultra-high power battery, developed in conjunction with Harting Technology Group for a 2.5 MW class wind power generator, was successfully tested in a wind park in Germany. GAIA Akkumulatorwerke (GAIA), LTC's German subsidiary, teamed up with Harting to design the 648 Wh battery consisting of 24 cells of 7.5 Ah each. LTC will develop and manufacture the lithium-ion cells and supply the battery management system, which will be assembled by Harting using its unique connector technology. Harting will also be responsible for marketing, integration into the wind generator's electrical systems, and after sales service.

Source: [www.windtech-international.com](http://www.windtech-international.com)

## New catalyst gives boost to fuel cells



3-D structure of the new UWM catalyst

University of Wisconsin-Madison (UWM) scientists have developed a chemical catalyst that could help pave the way for hydrogen fuel cell vehicles. The catalyst increases a fuel cell's efficiency by purging carbon monoxide (CO) from the hydrogen fuel supply before it enters the reaction chamber. Small amounts of CO are "poison" to the expensive platinum catalyst that runs the fuel cell reaction, said Dr. Manos Mavrikakis, a UWM professor of chemical and biological engineering, and a participant in the research. The UWM catalyst was created by using ruthenium with platinum – a less expensive option.

"We came up with a new material, a catalyst, that will cleanse CO from hydrogen at room temperature," thus saving large amounts of energy, Dr. Mavrikakis said. Dr. Bryan Eichhorn, a University of Maryland (UM) chemistry professor, collaborated in the research. A conventional catalyst in a hydrogen fuel cell must be heated to 70°C to strip CO from the hydrogen. With the UWM catalyst, similar results could be obtained at room temperature, saving energy that could be used to produce electricity rather than wasted heat. The research could help speed up the development of fuel cells for a wide

range of applications, including in automobiles and residential power generators.

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

## Pushing for fuel cells for portable gadgets

For several years, companies have promised that methanol fuel cells for powering cell phones and other gadgets are just around the corner. The fuel cell company MTI Micro in the United States says it has finally become true. The company says it has completed a number of working prototypes last year and will spend 2008 tooling up a factory to mass-produce fuel cells. Then, in 2009, the first ones will appear, said MTI Micro's CEO Dr. Peng Lim.



A radio frequency decoder being powered by MIT Micro's DMFC

"There is still one wire left in portable devices today, and that is the charging wire," said Dr. Lim. "And the battery system is not efficient at all. You talk for three hours on your mobile phone and then you have to charge it for half an hour." With MIT Micro's direct methanol fuel cell (DMFC), the recharge time is almost non-existent. Powering up a fuel cell-based phone only requires squirting in some new fuel or putting in a new cartridge.

DMFCs create energy when oxygen and methanol react with catalysts in a membrane inside the fuel cell. The by-products are electrons, water

and carbon dioxide. Additionally, the company says it has come up with a way to recycle the water within the fuel cell, thereby eliminating the need for a plumbing mechanism to get rid of the water generated. This makes their fuel cell smaller than earlier versions.

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

## New membrane could improve fuel cell efficiency

While there are many fuel cell types, in general, they generate electricity as the result of chemical reactions between an external fuel – hydrogen is the most common – and an agent that reacts with it. The membrane that separates the two parts of the cell and facilitates the reaction is a key factor in determining the efficiency of the cell. Scientists at Duke University's Pratt School of Engineering, the United States, have developed a membrane that allows fuel cells to operate at low humidity and theoretically to operate at higher temperatures.

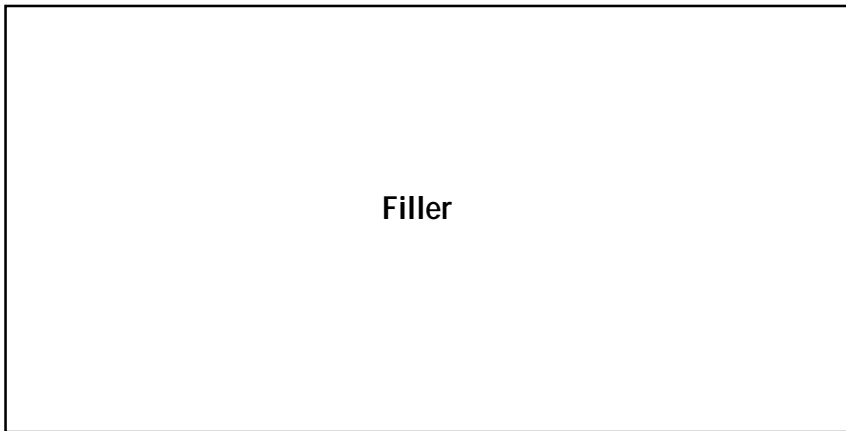
"The current gold standard membrane is a polymer that needs to be in a humid environment in order to function efficiently," said Dr. Mark Wiesner, a Duke civil engineering professor and senior author of the paper. "If the polymer membrane

dries out, its efficiency drops." The Duke team developed a ceramic membrane made of iron nanoparticles that works at low humidities. As the membrane is a ceramic, it will also tolerate high temperatures.

Nafion, the membrane most commonly used today, was discovered in the 1960s. As the temperature rises, the polymer becomes unstable and the membranes dehydrate, leading to a performance loss. Besides its temperature limitations, Nafion is also costlier to produce than the new membrane, said Dr. Wiesner, adding that membranes make up as much as 40 per cent of the overall cost of fuel cells.

According to Dr. Wiesner, the efficiency of current membranes drops significantly at temperatures over 88°C. "However, the chemical reactions that create the electricity are more efficient at high temperatures, so it would be a big improvement for fuel cell technology to make this advance," he said. His team plans to study new ways of fabricating the membrane to improve its durability and flexibility. *Contact: Office of News & Communications, Duke University, 615 Chapel Drive, Box 90563, Durham, NC 27708-0563, United States of America. Tel: +1 (919) 684 2823; E-mail: [duketoday@duke.edu](mailto:duketoday@duke.edu).*

Source: [news.duke.edu](http://news.duke.edu)



### A new compound for hydrogen storage

In the United States, scientists at the National Institute of Standards and Technology's Centre for Neutron Research (NCNR) have shown that a new class of materials could help realize a practical hydrogen fuel tank.

A research team from NCNR, the University of Maryland and the California Institute of Technology studied metal-organic frameworks (MOFs). One of several classes of materials that can bind and release hydrogen under the right conditions, MOFs have some distinct advantages over competitors. In principle, they could be engineered so that refuelling is as easy as pumping gas at a service station, and they don't require the high temperatures.

In particular, the scientists looked at MOF-74 – a porous crystalline powder developed at the University of California Los Angeles. MOF-74 resembles a series of tightly packed straws consisting of mostly carbon atoms with columns of zinc ions running down the inside walls. A gram of the stuff has about the same surface area as two basketball courts. The researchers employed neutron scattering and gas adsorption techniques to determine that at  $-196^{\circ}\text{C}$  ( $77^{\circ}\text{K}$ ), MOF-74 can adsorb more hydrogen than any unpressurized framework structure studied to date.

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

### Tiny buckyballs squeeze in hydrogen

Materials scientists at Rice University, the United States, have made the surprising discovery that tiny carbon capsules called buckyballs are strong enough to hold volumes of hydrogen nearly as dense as at the core of Jupiter. If a feasible way

to produce hydrogen-filled buckyballs is developed, it might be possible to store them as a powder, said lead researcher Dr. Boris Yakobson, professor of mechanical engineering and materials science.

Buckyballs, which were discovered at Rice more than 20 years ago, are part of a carbon molecules family called fullerenes. The family includes carbon nanotubes. Dr. Yakobson said scientists have long argued the merits of storing hydrogen in tiny, molecular containers like buckyballs, and experiments have shown that it is possible to store hydrogen in buckyballs. The new research by Dr. Yakobson and colleagues offers the first method of precisely calculating how much hydrogen a buckyball can hold before breaking. Bonds between carbon atoms are among the strongest chemical bonds in nature.

Using a computer model, Dr. Yakobson's team tracked the strength of each atomic bond in a buckyball and simulated what happened to the bonds as more hydrogen atoms were packed inside. The model promises to be particularly useful because it is scalable and can also tell scientists how overstuffed buckyballs burst open and release their cargo.

Source: [www.media.rice.edu](http://www.media.rice.edu)

### Micro-reactor to generate hydrogen from liquid fuels

After years of development, Innovatek in the United States is testing a hand-sized micro-reactor that can convert virtually any liquid fuel into hydrogen, producing a portable hydrogen stream for use in adjoining fuel cells. Since the micro-reactor units can be linked together, the company has developed systems capable of producing up to 605 l of hydrogen per minute – enough



Innovatek's researchers displaying the micro-reactor

to supply a hydrogen refuelling station or creating on-board hydrogen for fuel-cell powered vehicles. The company wants the technology built into cars, where energy-dense renewable fuels could be converted into motion, bypassing combustion and the production of exhaust gases entirely, and powering a much more efficient engine.

The square piece of shiny steel, weighing less than half a kilogram, houses an array of micro-channels containing patented catalytic sites. Each micro-tube helps convert (or reform) a continuous stream of hydrogen from fuels like petrol, diesel, vegetable oil, biodiesel, propane, natural gas and glycerol (by-product from biodiesel manufacturing). However, InnovTek is very interested in sustainable power, even to the point of preferring biodiesel in their test runs.

Source: [www.gas2.org](http://www.gas2.org)

### Microwaves to produce hydrogen from methane

Dana Corporation, the United States, has a propriety process that uses microwave to extract hydrogen from methane. AtmoPlas microwave atmospheric plasma technology is

unique because the hydrogen recovery rate could potentially exceed 95 per cent, as recent test results have shown. These results make Dana's AtmoPlas technology suitable for fuel cell applications that may need on-demand production capability. Potentially, this process could eliminate some of the hydrogen storage issues in mobile fuel-cell applications. The process is currently being optimized for energy efficiency.

AtmoPlas technology generates and sustains plasma at atmospheric pressure without expensive vacuum equipment to effectively harness microwave energy. AtmoPlas can exceed within seconds plasma temperatures of 1,200°C, and there is no known practical upper temperature limit. This reduces cycle times and can lead to lower energy use. Other key benefits include lower operating and maintenance costs and an overall reduction in capital investment.

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

## Nanoparticles could make hydrogen cheaper than petrol

Nanoparticle coatings could make hydrogen easy to produce at home from distilled water, and ultimately bring the cost of hydrogen fuel cells in line with that of fossil fuels. A new company, QuantumSphere Inc. in the United States, reports that it has perfected the manufacture of highly reactive catalytic nanoparticle coatings that could up the efficiency of electrolysis. Moreover, the coatings could also eliminate the need for expensive metals like platinum in hydrogen fuel cells.

With a surface area 1,000 times that of traditional materials, the coatings can be used to retrofit existing electrolyzers to raise their efficiency to 85 per cent. The scheme holds the

promise of 96 per cent efficiency by the time cars powered by hydrogen fuel cells hit the market. QuantumSphere's nanoparticles are available in four formulations: iron cobalt, nickel cobalt, nickel iron and silver copper. Mr. Kevin Maloney, president and CEO of QuantumSphere, claims that the nanoparticle-coated electrodes make electrolyzers efficient enough to provide hydrogen on demand from a tank of distilled water in the car.

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

## Hydrogen battery technology for portable devices

While hydrogen is an ideal fuel for fuel cells, the key practical issue is storing enough of the gas in the hydrogen battery for it to be useful. There are a several options for storing hydrogen for use in hydrogen batteries, but many have drawbacks.

Compressed hydrogen cannot supply enough fuel from a sufficiently small and light package for a portable device. Metal hydrides are too heavy for portable use, require a local source of hydrogen for reuse and are too expensive to discard after one use. PEM fuel cells require hydration of the membrane. Hydrogen from hydrocarbons (e.g. methanol) via reformation process requires high internal temperatures, have complicated fuel processors and slow start-ups, and results in carbon dioxide emissions.

In contrast, reacting chemical hydrides with water is a great way to generate hydrogen. Millennium Cell Inc., the United States, has developed and demonstrated systems (known as Hydrogen on Demand® or HOD™ systems) using sodium borohydride (NaBH<sub>4</sub>) as a hydrogen storage medium at power levels that range from 2 W to 65 kW.

NaBH<sub>4</sub> is a white solid at room temperature (decomposes only at above 400°C) and stable in dry air. When mixed with water, NaBH<sub>4</sub> gives off pure hydrogen gas. The reaction can be catalysed in a number of ways to obtain the desired hydrogen flow rates to match electrical output demand at the fuel cell. As the highly inflammable hydrogen gas is generated only just before use, it is a safe way of storing hydrogen.

These systems are lightweight, and do not require purifiers, complicated fuel processors or high temperatures; they start quickly and do not emit greenhouse gases. *Contact: Millennium Cell Inc., One Industrial Way West, Eatontown, NJ 07724, United States of America. Tel: +1 (732) 542 4000; Fax: +1 (732) 542 4010.*

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

## High-efficiency hydrogen production process

A new process claimed to be highly efficient in producing hydrogen (from plant sugars) has been developed to power vehicles cheaply with a hydrogen fuel cell. The new process, called "synthetic biology" was developed at the Virginia Tech University in the United States. It is said to be cheap, could be widely available and environment-safe. The new process replicates nature on the lab: complete conversion of carbohydrate and water to hydrogen. This is done more efficiently than current hydrogen-producing methods. The lead researcher, Dr. Percival Zhang, said that the new process takes some starch and water and, under controlled conditions, adds some 13 enzymes that totally degrade the starch to hydrogen.

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

### Promise of a major stride in biofuel production

Research by University of Maryland (UM) that started with bacteria from the Chesapeake Bay has led to a process that may be able to convert large volumes of all kinds of plant products – from leftover brewer's mash to paper trash, into ethanol and other biofuels. The process, developed by UM professors Dr. Steve Hutcheson and Dr. Ron Weiner, is the foundation of their incubator company, Zymetis.



Dr. Steven Hutcheson (right) with Dr. Ben Woodard, director of BSF

The Zymetis process can produce ethanol and other biofuels from all cellulosic sources. When fully operational, it could lead to the production of 284 billion litres per year of carbon-neutral ethanol. The secret to the Zymetis process is a marsh grass bacterium, *Saccharophagus degradans*. Dr. Hutcheson found that the bacterium has an enzyme that could quickly break down plant materials into sugar, which can then be converted to biofuel.

The Zymetis researchers were unable to isolate the bacterium again in nature, but they discovered how to produce the enzyme in their own laboratories. The result was Ethazyme, which degrades the tough cell walls of cellulosic materials and breaks down the entire plant material into bio-fuel ready sugars in one step at a significantly lower cost and with fewer caustic chemicals than current processes. UM

MTECH's Bioprocess Scale-Up Facility (BSF) assisted Zymetis to determine how to mass-produce *S. degradans*.

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

### Breakthrough in biofuel production process

In the United States, researchers have made a breakthrough in the development of a "green" version of petrol – identical to standard petrol yet created from sustainable biomass sources like switchgrass. In April, Dr. George Huber of the University of Massachusetts-Amherst (UMass) and his graduate students reported in a journal the first direct conversion of plant cellulose into petrol components. In the same issue of the journal, Dr. James Dumesic and his colleagues from the University of Wisconsin-Madison (UWM) announced an integrated process for creating chemical components of jet fuel using a green petrol approach.

While the UWM group had previously demonstrated the production of jet-fuel components using separate steps, their current work shows that the steps can be integrated and run sequentially, without complex separation and purification processes between reactors. While it may take about 10 years before green petrol arrives at the pump or finds use in a fighter jet, these breakthroughs have bypassed significant hurdles to bringing green biofuels to market.

For their new approach, the UMass scientists rapidly heated cellulose in the presence of solid catalysts, and rapidly cooled the products to create a liquid that contains many of the compounds found in petrol. The entire process was completed within two minutes using relatively

moderate amounts of heat. The compounds that formed in that single step, like naphthalene and toluene, make up one-fourth of the suite of chemicals found in petrol. The liquid can be further treated to form the remaining fuel components or can be used "as is" for a high-octane blend. Green petrol is an attractive alternative to bioethanol since it can be used in existing engines, and does not incur the 30 per cent drop in mileage seen with ethanol-based fuel.

Besides being a compact and rapid method to treat a great deal of biomass, the process, in principle, does not require external energy. The extra heat that will be released could be used to generate electricity, ensuring virtually zero carbon footprint. "We are currently working on understanding the chemistry of this process and designing new catalysts and reactors for this single step technique," Dr. Huber said.

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

### Technology for biofuel from non-food sources

In the recent past, support for conventional biofuels from food sources – such as rapeseed (canola), maize and soybean – has reached a new low, with many questioning whether they provide any benefits at all. A German firm, Choren Industries, now reports that it has the technology for an advanced fuel made from wood and other non-food biomass. The facility is fairly small – just 13,500 tonnes of diesel fuel a year. It, however, is touted as the only facility of its kind in the world, designed to turn wood into fuel for cars and thus represent a decisive step towards "second generation" biofuels.

The Choren plant in Freiberg uses non-food biomass instead of traditional food crops. It processes wood

(or even straw) as the raw material. According to estimates provided by the German Agency for Renewable Resources, based on a Central European climate, the fuel yield using the Choren process is 4,000 litres per hectare per year, which is up to three times that of previous biofuel production methods. Furthermore, in contrast to production methods using rapeseed oil and ethanol, this technique does not produce fuel of inferior quality. The diesel manufactured is very pure, with virtually no sulphur content and one that meets top emissions standards.

Towards the end of 2008, the plant at Freiberg will go into operation, fed primarily with old, untreated bits of timber and other scrap wood. It will take approximately 5 tonnes of dry material to produce 1 tonne of fuel. The small plant will consume about 70,000 tonnes of waste wood a year. The first of the full-scale refineries Choren is planning to build should go into service in 2012 in the eastern German city of Schwedt. It will produce 200,000 tonnes of biodiesel a year from 1 million tonnes of wood and other dry materials.

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

## New process for biodiesel production

An undergraduate research project might lead to a revolution in biodiesel manufacturing. Mr. Brian Krohn, from Augsburg College in Minneapolis in the United States, worked with his advisor, Mr. Arlin Gyberg, to select a research project on the chemistry of manufacturing biodiesel. Following a literature search, they narrowed down their focus on to esterification catalysed by solid strong acids. With his background in chromatography, which uses columns of chemically active solids to separate mixtures of chemicals, Mr. Gyberg wondered if such a column

could be used to make biodiesel. He contacted Mr. Clayton McNeff, who had invented a chromatography method using zirconia and formed a company to sell it.

Along with their colleague Mr. Ben Yan, Mr. Gyberg and Mr. McNeff built and tested a column that mixed oil and alcohol with the catalyst under high heat and pressure until the mix became supercritical, a state where the mixture contains properties of both a gas and a liquid. Under the right conditions in the column, the oil and alcohol were converted into biodiesel in six seconds. Mr. Gyberg said the column allows for continuous production of biodiesel – as opposed to the current batch method of production. A column of about 10 cm in diameter and 60 cm long will be able to produce nearly 12 million litres of biodiesel per year. The process can also convert glycerine into dimethyl ether, which is more valuable in the current market.

The researchers have applied for a patent on the “Mcgyan process”. For the past several months, a pilot plant using the Mcgyan process has been working with a wide range of feedstocks without any problem, Mr. Gyberg said. A commercial plant, which will start operation this year, will use as the feedstock hydrous ethanol (rather than methanol) and corn oil extract from distiller’s grains. Mr. Gyberg said the Mcgyan process will convert free fatty acids – up to 20 per cent free fatty acids, which renders it almost useless for traditional biodiesel production – to biodiesel.

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

## Biofuels from waste oil and algae

Researchers at Western Michigan University, the United States, are working to develop two biofuel pro-

duction processes. The goal of the first project, Bronco Biodiesel, is to perfect a process to convert trap grease, used vegetable oil from restaurants and other facilities, into biodiesel. The second project will try to find a viable algal strain that could be used for both waste treatment and as a feedstock for biodiesel or ethanol production.

Dr. Steve Bertman, a professor of chemistry, is the lead researcher for both projects. The problem with the fats, oils and greases that Dr. Bertman and his team deal with is that they are very diverse in their origin, their content and their chemical makeup. Bronco Biodiesel is working out a way to standardize the processing for all these so that all the feedstocks can be processed at once. This, according to Dr. Bertman, is the biggest challenge to scaling up to the 1.9 million-3.8 million litres production level.

Dr. Bertman’s team is looking to explore using algae as both a feedstock for fuel and, in keeping with the idea of sustainability, in water treatment applications. The algae project came up when Dr. Bertman and his colleagues started looking at the strain that biofuels are putting on the United States agricultural system from a sustainability standpoint. “Ethanol from algae is the same as ethanol from any other source. If we can make it economically, then certainly there will be a market for it,” Dr. Bertman said. The plan is to cultivate the algae by using it at water treatment facilities where it would feed on the nutrient-rich wastewater, removing content that would need to be removed by other means anyway. From there, the algae would be removed and either drained of oils for ethanol production or used as organic feedstock for biodiesel production.

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

## Wind Energy International 2007/2008

The new edition of this international standard year-book for wind energy includes 66 country reports and 36 special reports. The book is a valuable source of information that could be used by all those interested in wind energy.

Contact: World Wind Energy Association, Charles-de-Gaulle Straße 5, 53113 Bonn, Germany. Tel: +49 (228) 369 4080; Fax: +49 (228) 369 4084; Website: [www.wwindea.org](http://www.wwindea.org).

## Wind Turbine Control Systems

This publication covers the principles, modelling and gain scheduling design of modern wind turbines. It stresses the application of linear parameter varying (LPV) gain scheduling techniques to the control of wind energy conversion systems. This reformulation of the classical gain scheduling problem permits a direct design procedure and simple controller implementation. The book is mainly intended for researchers and students with a control background wishing to expand their knowledge of wind energy systems.

## BioEnergy Research

*BioEnergy Research* fills a void in the rapidly growing area of feedstock biology research related to biomass, biofuels and bioenergy. The journal brings together a unique and broad combination of disciplines that all share a common focus on feedstock biology and science. It publishes reviews, peer-reviewed scientific research, perspectives and commentary, industry news, government policy updates, etc.

## Fuel Cell Technology: Reaching Towards Commercialization

This survey of the state-of-the art research in fuel cells provides in-depth coverage of the two types of fuel cell most likely to become commercialized: the high-temperature solid oxide fuel cell and the low-temperature polymer electrolyte membrane fuel cell. The book also signposts the emerging field of microbial fuel cells.

For the above three books, contact: *Springer Asia Ltd., Unit 1703, Tower I, 9 Sheung Yuet Road, Kowloon Bay, Hong Kong.* Tel: +852 2723 9698; Fax: +852 2724 2366; E-mail: [maurice.kwong@springer.com](mailto:maurice.kwong@springer.com); Website: [www.springer.com](http://www.springer.com).

**30 Jul-1 Aug**  
Tokyo  
Japan

### PVJapan 2008

Contact: SEMI Japan, 4-7-15 Kudan-minami, Chiyoda-ku, Tokyo, Japan.  
Fax: +81 (3) 3222 5757;  
E-mail: [pvj@semi.org](mailto:pvj@semi.org);  
Website: [www.pvjapan2008.org](http://www.pvjapan2008.org).

**21-23 Aug**  
New Delhi  
India

### Renewable Energy India 2008 Expo

Contact: Exhibitions India Pvt. Ltd., 217 B, 2nd Floor, Okhla Industrial Estate, Phase III, New Delhi 110 020, India.  
Fax: +91 (11) 4279 5098/99  
E-mail: [gunjanbhatia@eigroup.in](mailto:gunjanbhatia@eigroup.in);  
Website: [www.exhibitionsindia.com](http://www.exhibitionsindia.com).

**27-30 Sep**  
Changzhou  
China

### The 10th China Solar PV Conference & Exhibition

Contact: Conference Secretary, Changzhou Trina solar Co. Ltd., No. 2, Tianhe Road, Electronic Park, New District, Changzhou, Jiangsu, China 213031.  
Fax: +86 (21) 3408 5282;  
E-mail: [nuogaisi2004@126.com](mailto:nuogaisi2004@126.com);  
Website: [www.chinasolarpv.com](http://www.chinasolarpv.com).

**13-17 Oct**  
Busan  
Rep. of Korea

### Renewable Energy 2008

Contact: Koconex, Suite 520, G-Five Central Plaza, 1685-8 Seocho-dong, Seocho-gu, Seoul 137-070, Republic of Korea.  
Fax: +82 (2) 3476 8800;  
E-mail: [secretariat@re2008.org](mailto:secretariat@re2008.org);  
Website: [www.re2008.org](http://www.re2008.org).

**17-19 Oct**  
Tianjin  
China

### 2008 China International Solar Photovoltaic Industry Fair

Contact: China Industrial Association of Power Sources, No. 18, Lingzhuangzi Road, Nankai District, Tianjin 300381, China.  
Fax: +86 (22) 2338 0938;  
E-mail: [ciaps@public.tpt.tj.cn](mailto:ciaps@public.tpt.tj.cn);  
Website: [www.china-pv.org](http://www.china-pv.org).

**04-08 Nov**  
Shanghai  
China

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