

ENERGY TRENDS

Solar concentrator powers windows with sunlight

A solar concentrator in which light is collected over a large area and concentrated at the edges has reportedly been developed at the Massachusetts Institute of Technology, Cambridge. Rather than covering a roof with expensive solar cells, the cells only need to be around the edges of a flat glass panel. In addition, the focused light increases the electrical power from each solar cell by a factor of more than 40.

Because the system is simple to manufacture, it could be implemented within three years. It could even be added onto existing solar-panel systems to increase their efficiency by 50% at minimal additional cost. That, in turn, would substantially reduce the cost of solar electricity.

The MIT solar concentrator involves a mixture of two or more dyes that are essentially painted onto a pane of glass or plastic. The dyes work together to absorb light across a range of wavelengths, which is then re-emitted at a different wavelength and transported across the pane to waiting solar cells at the edges.

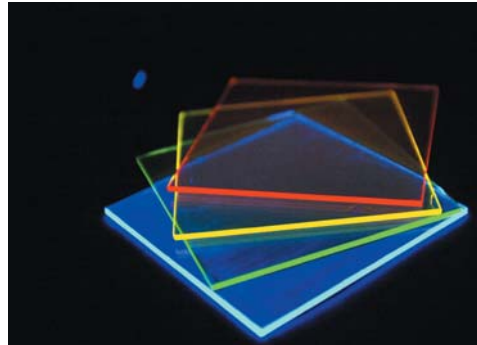
The dyes are mixed in specific ratios, applied only to the surface of the glass. This allows some level of control over light absorption and emission. Light transport losses are substantially reduced, resulting in a tenfold increase in the amount of power converted by the solar cells.

First HTS power transmission cable applied in electrical grid

The world's longest and most powerful superconductor power transmission cable has been connected to the commercial power grid in Holbrook, New York, United States, by the Long Island Power Authority and American Superconductor. The 600-meter long cable is cryogenically cooled thanks to the advanced technologies of Air Liquide. This project demonstrates the operation of a high-voltage superconductor cable in an urban commercial power grid.

Capable of transporting up to 2400 amps (574 MVA in a 138 kV system), the superconductor cable is the first such high-voltage electric cable in the world to operate in a real transmission system. This cable transports more energy than all of the previously demonstrated high-temperature superconductor cables together, and is capable of powering 300,000 homes.

Air Liquide is providing its innovative cryogenic technologies in operating and maintaining cryogenic systems. The Long Island project involved public and private partners, including the U.S. Department of Energy and Nexans, the worldwide leader in the cable industry. www.airliquide.com; American Superconductor, www.amsc.com.



Organic solar concentrators collect and focus different colors of sunlight. Solar cells can be attached to the edges of the plates. By collecting light over their full surface and concentrating it at their edges, these devices reduce the required area of solar cells and consequently, the cost of solar power. Stacking multiple concentrators allows the optimization of solar cells at each wavelength, increasing the overall power output. Photo by Donna Coveney, MIT.

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Co-gasification combines coal and biomass to generate energy

Co-gasification is a process in which various types of coal and biomass are put together and converted into a gaseous product stream that can be used to produce electricity, hydrogen, chemicals, and liquid transportation fuels, say researchers at the Dept. of Energy's National Energy Technology Laboratory. The process produces a product stream called synthesis gas, which has great flexibility. NETL is looking at how best to couple the coals and biomasses that make sense in various geographic locations.

For example, a specific type of coal might be abundant in a particular location, together with a particular type of



BRIEFS

Areva and **ArcelorMittal** have signed an agreement for a \$110 million investment aimed at increasing ingot production for the nuclear industry from 35,000 to 50,000 tons per year at the **Industeel** steel plant. In addition, the two companies will implement a joint three-year metallurgy research and development program. www.arcelormittal.com

Argonne National Laboratory has patented a catalyst that can reliably and economically reduce nitrogen oxide (NOx) emissions from diesel-fueled engines by 95 to 100%. Argonne has licensed the Diesel DeNOx Catalyst technology to Integrated Fuel Technologies Inc. www.anl.gov

EDF Energies Nouvelles has signed an agreement with **MidAmerican Energy** to build the Walnut wind farm in Iowa. This 100.5 MW project is due to be delivered in late 2008. The agreement between **Enxo** (EDF Energies Nouvelles American subsidiary), and MidAmerican Energy covers the construction of a wind farm of 67 GE turbines, each with a capacity of 1.5 MW. www.nawindpower.com

Massachusetts Institute of Technology researchers have developed solar textiles made of semiconductor materials that absorb sunlight and convert it into electricity. Three-dimensional modeling software helps to generate membrane-like surfaces that can become energy-efficient cladding for roofs or walls. <http://web.mit.edu/newsoffice/2008/solar-textiles-0609.html>

Plug Power Inc. has received a \$500,000 contract to support commercialization of its residential micro-combined heat and power (CHP) fuel cell system. The micro-CHP fuel cell provides peak electrical and overall efficiencies, which are expected to save consumers an estimated 30% on their annual utility bills. www.plugpower.com

Sensor Products Inc. has developed Pressurex, a thin sensor film that maps and measures the amount of interfacial stress exerted on honeycomb cores, composite layouts, and bonded surfaces within composite structures. www.sensorproducts.com

biomass. It makes sense to use the abundant materials at the location if they work well together, instead of transporting other materials from elsewhere. <http://www.netl.doe.gov>

Methanol fuel cells to power military laptop computers

A next-generation 25-watt reformed methanol fuel cell for military mobile power applications is to be further developed and field tested by UltraCell Corp., Livermore, Calif. The UltraCell XX25 has received a follow-on contract award jointly funded through the U.S. Army Communications-Electronics Research, Development and Engineering Center Army Power Division; and the Defense Advanced Research Projects Agency.

Providing portable power anywhere, the patented RMFC system internally generates fuel cell-ready hydrogen from a highly concentrated methanol solution. Recognized as the first commercial fuel cell system to be authorized by the U.S. military for power portable devices, the XX25 is designed to run a ruggedized laptop computer for up to eight hours on a single 250 cc fuel cell cartridge. The system can also be configured with large fuel tanks for weeks of runtime in stationary applications such as remote video monitoring, surveillance, and communications equipment. www.ultracellpower.com

Palladium sorbents cut pollution; software models power plants

Sorbents to reduce pollutants from coal-fired power plants and a software tool that can help to design advanced power plants have earned R&D 100 Awards for the Office of Fossil Energy's National Energy Technology Laboratory (NETL).

The palladium-based sorbents capture mercury, arsenic, and selenium at high

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temperature at various stages in the integrated coal-gasification combined cycle power generation process. Compared to low-temperature capture by activated carbons, high-temperature capture of these trace elements retains the high thermal efficiency of the power plants, which form part of a strategy to increase the use of the nation's abundant domestic coal reserves. The palladium-based sorbents have been licensed to Johnson Matthey, a world leader in catalyst manufacture, for commercial development and application.

NETL's Advanced Process Engineering Co-Simulator (APECS) is a one-of-a-kind software tool that provides high-fidelity process and equipment co-simulation together with seamless data/model management throughout a power plant's lifecycle. The process and energy industries can deploy APECS, which is built on the integrated access, workflow, and data services of the ANSYS Engineering Knowledge Manager. It can serve as a complete engineering solution to foster rapid technology development, reduce design times for pilot- and demonstration-scale facilities, and lower the cost and technical risk. www.netl.gov

Miniature compressors and evaporators cool computers

Miniature refrigeration systems small enough to fit inside laptops and personal computers are said to be under development by researchers at Purdue University, West Lafayette, Ind. Unlike conventional cooling systems, in which a fan circulates air through finned heat sinks attached to computer chips, miniature refrigeration would increase how much heat could be removed, says Prof. Suresh Garimella.

The goal is to design miniature compressors and evaporators, which are critical for refrigeration systems. The researchers developed an analytical model for designing tiny compressors that pump refrigerants using penny-size diaphragms, and validated the model with experimental data. The elastic membranes are made of ultrathin sheets of polyimide and coated with an electrically conducting metallic layer. The metal layer allows the diaphragm to be moved back and forth to produce a pumping action via electrical charges, a technology called electrostatic diaphragm compression.

The engineers are among the first to precisely measure how a refrigerant boils and vaporizes inside tiny "microchannels" in an evaporator and determine how to vary this boiling rate for maximum chip cooling.

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