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## Bringing Sunlight Inside Mechanical Engineers Create High-tech Solar Panels

May 1, 2007 — Photovoltaic panels have a new design: concentric circles that focus the sun's rays on miniaturized modules. Having the panels automatically sense sunlight and turn towards it also makes these high-tech solar cells more efficient.

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Solar energy technology is advancing daily. Now, a new, high-tech system is working to efficiently harness the power of the sun and drastically reduce harmful carbon dioxide emissions.

Today, there are more than 76 million residential buildings and nearly 5 million commercial buildings in the United States. Combined, they use two-thirds of all electricity consumed in the United States and produce 35 percent of all carbon dioxide emissions.

Anna Dyson, an architectural scientist from Rensselaer Polytechnic Institute in Troy, New York, is leading the way to make

solar energy a real alternative to pollution-emitting fossil fuels. Her system contains rows of thin lenses that track the sun's movement. Sunlight floods each lens and is focused onto a postage-stamp sized, high-tech solar cell. Dyson says, "Really, what we want to do is be capturing and transferring that energy for usable means."

Conventional solar systems are about 14 percent efficient. This system has a combined heat and power efficiency of nearly 80 percent. "What they're doing is very efficiently capturing and transferring that light into electricity and the solar heat into hot water," Dyson explains.

"We basically have a system that can sense where the sun is at any time, and then the modules will basically be facing directly perpendicular to the incoming sun rays," she says. The lenses will be nestled between window panes and all of the pieces will be made of glass.

Michael Jensen, Ph.D., a mechanical engineer from Rensselaer Polytechnic Institute says reducing dependency on fossil fuels is critical. Dr. Jensen explains, "We use fewer fossil fuels, then we are going to put less CO<sub>2</sub> into the atmosphere. We are going to decrease the effects on global warming."

This system will also lower the lighting needs of buildings, as it will provide usable light inside. It could supply as much as 50 percent of the energy needed for a building to operate. The system is set to be installed in the Center for Excellence and Environmental Energy Systems in Syracuse, New York, in 2008, and in the Fashion Institute of Technology in New York City by 2009.

**BACKGROUND:** A team of different types of scientists at Rensselaer Polytechnic Institute has developed a radical new solar energy technology that promises to collect and distribute solar energy more efficiently. Rows, or stacks, of pivoting lenses incorporated into a glass building facade track the movement of the sun across the sky, focusing its rays onto high-tech solar cells. The new system uses high-tech solar-concentrator technology and advanced materials. The full-size prototype will be incorporated into a new building at The Center of Excellence in Syracuse, New York.

**HOW IT WORKS:** The key breakthrough is the miniaturized concentrator solar cell, which uses a lens with concentric grooves to focus collected light. Even though it is only the size of a postage stamp -- compared to the usual solar collector area that spans 4 x 4 feet -- the cell is much more efficient in collecting and reusing solar energy. The lens focuses incoming sunlight onto the solar cell. Microchannels at the base of the module transfer energy in the form of heat

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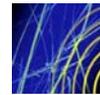
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is competitive with other energy sources, reducing our dependency on fossil fuels.

**ABOUT SOLAR CELLS:** The solar cells on calculators and satellites are photovoltaic cells or modules: groups of cells electrically connected and packaged together. Photovoltaics convert sunlight directly into electricity. Photovoltaic cells are made of semiconductor materials like silicon. When light strikes the cell, a certain portion of the light is absorbed by the semiconductor material. The energy of the absorbed light knocks electrons in the semiconductor material loose, allowing them to flow freely. Photovoltaic cells also all have one or more electric fields that act to force the freed electrons to flow in a certain direction. This flow of electrons is a current. By placing metal contacts on the top and bottom of the photovoltaic cell, the current can be drawn off to be used. For example, the current can power a calculator. However, conventional photovoltaic panels made from silicon to provide electricity are expensive, and thus not cost-competitive with electricity from the power grid.

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