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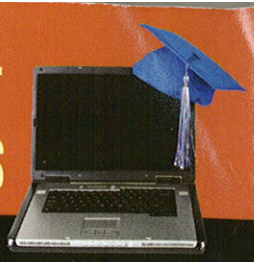

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APRIL 2009

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Next-Generation GREEN

By Amy Westervelt

We've all heard about electric vehicles, Energy Star appliances and compact fluorescent light bulbs, but university and private researchers are developing the next generation of green products that will be both energy-efficient and affordable.

Solar for All. The increasing attractiveness of power purchase agreements (PPAs) to solar-power system installers leads us to believe that widespread residential use of solar power is nearing reality. Under the terms of a solar PPA, a company pays for and installs a solar-power system on a resident's roof in exchange for the right to sell excess power to the local utility and to collect a related tax credit of 30 percent. Homeowners lock in a fixed rate for the power that they use for 15 to 30 years (typically lower than what electricity from the utility costs over the course of the agreement) and pay none of the upfront costs. Meanwhile, solar power continues to become more efficient. By using an ultrathin layer of aluminum oxide, Bram Hoex, a physicist in Germany, converted an average of 23 percent of collected solar heat to electricity. The previous record was 21.9 percent.

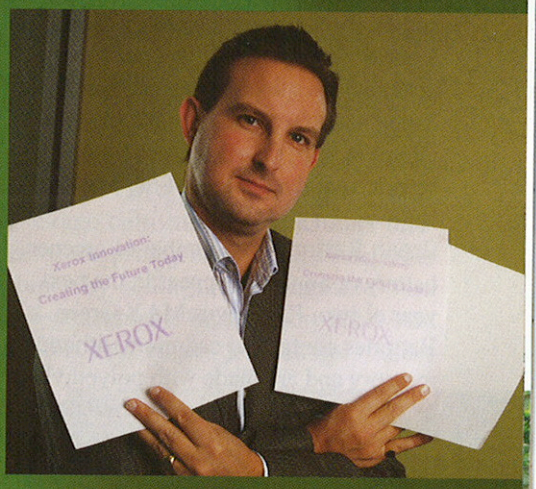
Green Quotient: Solar power is a constant, renewable resource. Having a static, locked-in rate would mean that your power bill wouldn't spike whenever the price of energy fluctuates, like it can now. Another benefit is that you never have to worry about blackouts or brownouts.

Seeing Red: Not all utilities will buy excess power from a "solar provider," so this option won't be available everywhere. There's also the question of how to deal with the PPA-financed solar-power system on your roof if you decide to sell your home. With most PPAs, you'll need to buy the system from the provider or transfer the lease to the buyer.

Erasable Paper. Xerox has kicked around its erasable-paper idea for a while, but it's showing it more frequently to the press. The company appears to be closing in on a product that it says will hit the market in the next year. The paper is coated with photosensitive chemicals that turn white when hit by light, which will erase a page 24 hours after it has been printed.

Green Quotient: According to Xerox, at least 45 percent of printed paper ends up as trash within 24 hours. Erasable paper allows you to reuse the same sheet and conserve on paper products.

Seeing Red: You'll need to buy the paper and use a special printer from Xerox, which certainly won't come cheaply. Worse, the paper is worthless if



it has been folded or written on with a pen. Also, there are certain printouts that you won't want to erase, so you might need to constantly switch between regular and erasable paper.

Energy-Conscious Appliances. Today's energy-monitoring systems for the home allow you to look at energy use to pinpoint how much electricity is being consumed by an appliance or other electrical device. The idea is that you can opt to manually use the appliance at off-peak times. Internet Protocol-enabled appliances would connect to the monitoring system to automatically turn themselves on and off.

Green Quotient: You can conserve energy and save money, perhaps hundreds of dollars per year, after setting up

your system. It also will help to reduce the risk of widespread brownouts across a utility grid.

Seeing Red: Manufacturers are tight-lipped about the cost of such appliances. Getting them to work well with both a variety of energy-monitoring systems and with the dozens of local utilities throughout the country will dictate when such appliances make it to market. According to Celeste LeCompte, author of the research briefing "The Smart Energy Home," it's only a matter of time before appliance-ready networks entice manufacturers to make smart appliances. Still, the appliances likely will be priced at the top end of the market.

Green Batteries. A number of greener battery options will appear in the next year or two. Fuji EnviroMAX Green Batteries contain no cadmium, lithium or mercury and are made with polyethylene terephthalate plastic and recycled paper. That makes them safer to dispose of than conventional batteries. Rayovac is releasing rechargeable lithium batteries this year, while Ritz Camera recently joined with California-based PowerGenix to release its Quantaray Super Z nickel-zinc AA rechargeable battery set. "It's important to look broadly at energy storage—not just batteries—and it is completely unclear right now what form of energy storage will win out," says Rob Day, a clean-tech investor who looks for such innovations. "But what is clear is that there are lots of choices, and the options will keep getting better."

Green Quotient: Reducing the amount of lithium, cadmium and mercury in landfills reduces the risk that these toxic chemicals will end up in our water supply or soil. Rechargeable batteries also reduce overall waste.

Seeing Red: Green batteries aren't rechargeable, and rechargeable batteries still contain toxic chemicals. Some combination of the two would be ideal.

Fuel-cell-powered Electronics. Several companies are making strides in creating fuel cells to power portable electronics. Department of Transportation has approved the use of methanol fuel cells onboard aircraft after tests proved their safety at high altitude, which means that

Fuel-cell-powered cellphone charger

fuel-cell-powered electronics products could be used on a flight. That's a necessity for such devices. MTI Micro and PolyFuel plan to sell methanol-fueled cells for electronics this year. Glenn Croston, energy expert and "Renewable Energy Weekly" columnist, points out that the fuel-cell market has concentrated on cars. "Electronics is really where people should be starting with fuel cells," he says. "Lifetime and reliability aren't as big of an issue, because most people aren't hanging on to their laptop or cellphone for five to ten years the way they are with a car."

Green Quotient: Methanol fuel cells rarely need to be replaced. You can keep inserting new cartridges (about 2 inches long and one-quarter of an inch in diameter) into the cell. The fuel cells can keep your products running for 2,700 continuous hours.

Seeing Red: MTI and PolyFuel claim that the cartridge plastic can be recycled, but both still use virgin plastic.

Next-generation Biofuels. Pilot plants are turning algae, switchgrass, paper pulp and trash into fuel by using *fermentation chambers* (bioreactors), enzymes and organisms that are found in the remotest corners of nature. Coskata, a company that claims to turn almost any matter (including trash and even old tires) into biofuel, hopes to sell fuel for $1 a gallon by 2012. Thanks to a partnership with GM and a massive influx of investment, it just might do it. Coskata is using *gasification* (read: high temp, low air incineration) to produce *syngas*, which it ferments to produce ethanol. "There's nothing new about either process but the combination is unusual," says Dan Rapka, professor of mechanical engineering at New York Institute of Technology. "I'd think there are better things to do with syngas than turn it into ethanol, though. For example, it can be combusted directly to produce electricity via a steam turbine." Chevron and Shell also are exploring algae-based biofuel.

Green Quotient: Fuel that comes from trash at $1 per gallon or biofuel made from algae that essentially eat carbon dioxide to survive could revolutionize transportation in this country and provide a steady supply of fuel that has a stable price.

Seeing Red: Getting such fuels to the pump is a challenge, and it has proven difficult to produce these fuels at the scale necessary to fulfill the nation's transportation and power needs. It will be a tough sell until vehicles are designed that can handle these fuels.

Residential Energy Service. Energy service companies (ESCOs) exist in the corporate world. They determine where your office loses energy and improve its efficiency. ESCOs split the energy savings with your company as part of their payment. In the residential market, ESCOs typically would have to deal with too many small customers to make it worthwhile. But a handful of investors are examining the possibility of grouping houses to make it a reality. "It's impossible for most people to get money to do energy-efficiency renovations on their homes right now given the lending market, but residential ESCOs would offer lenders a guaranteed low-risk, high-return investment," says Michael Kinsley, a senior consultant with sustainability consulting firm and think tank Rocky Mountain Institute.

Green Quotient: Low-cost energy-efficiency upgrades, lower electricity bills and less greenhouse-gas emissions would result from widespread use of ESCOs.

Seeing Red: Retrofits might have stipulations. In other words, you'd have to make certain changes to qualify. ◐

Amy Westervelt contributes regularly to Earth2Tech blog and Sustainable Industries magazine, for which she recently won an award for her feature "Algae Arms Race," on the potential of algae-based biofuels.