Future Power

Solar: Free Energy, at a Price

On a cloudy day near the city of Leipzig in the former East Germany, I walked across a field of fresh grass, past a pond where wild swans fed. The field was also sown with 33,500 photovoltaic panels, planted in rows like silver flowers all turned sunward, undulating gently across the contours of the land. It's one of the largest solar arrays ever. When the sun emerges, the field produces up to five megawatts of power, and it averages enough for 1,800 homes.

Nearby are gaping pits where coal was mined for generations to feed power plants and factories. The skies used to be brown with smoke and acrid with sulfur. Now the mines are being turned into lakes, and power that once came from coal is made in a furnace 93 million miles (150 million kilometers) away.

Solar electric systems catch energy directly from the sun—no fire, no emissions. Some labs and companies are trying out the grown-up version of a child's magnifying glass: giant mirrored bowls or troughs to concentrate the sun's rays, producing heat that can drive a generator. But for now, sun power mostly means solar cells.

The idea is simple: Sunlight falling on a layer of semiconductor jostles electrons, creating a current. Yet the cost of the cells, once astronomical, is still high. My modest system cost over $15,000, about $10 a watt of capacity, including batteries to store power for when the sun doesn't shine.

Like most things electronic, solar power has been getting cheaper. "Thirty years ago it was cost-effective on satellites," says Daniel Shugar, president of PowerLight Corporation, a fast-growing California company that has built solar installations for clients including Toyota and Target. "Today it can be cost-effective for powering houses and businesses," at least where utility power is expensive or unavailable. Tomorrow, he says, it will make sense for almost everyone.

Martin Roscheisen, CEO of a company called Nanosolar, sees that future in a set of red-topped vials, filled with tiny particles of semiconductor. "I put some of that on my finger, and it disappeared right into my skin," he says. He won't say exactly what the particles are, but the "nano" in the company name is a hint: They are less than a hundred nanometers across—about the size of a virus, and so small they slip right through skin.

Roscheisen believes those particles promise a low-cost way to create solar cells. Instead of making the cells from slabs of silicon, his company will paint the particles onto a foil-like material, where they will self-assemble to create a semiconductor surface. The result: a flexible solar-cell material 50 times thinner than today's solar panels. Roscheisen hopes to sell it in sheets, for about 50 cents a watt.

"Fifty cents a watt is kind of the holy grail," says David Pearce, president and CEO of Miasolé, one of many other companies working on "thin-film" solar cells. At that price solar could

compete with utilities and might take off. If prices continued to drop, solar cells might change the whole idea of energy by making it cheap and easy for individuals to gather for themselves. That's what techies call a "disruptive technology."

"Automobiles were disruptive to the horse and buggy business," Dan Shugar says. "PCs were disruptive to the typewriter industry. We believe solar electric systems will be disruptive to the energy industry."

Yet price isn't the only hurdle solar faces. There are the small matters of clouds and darkness, which call for better ways of storing energy than the bulky lead-acid batteries in my system. But even if those hurdles are overcome, can solar really make the big energy we need?

With solar now providing less than one percent of the world's energy, that would take "a massive (but not insurmountable) scale-up," NYU's Hoffert and his colleagues said in an article in Science. At present levels of efficiency, it would take about 10,000 square miles (30,000 square kilometers) of solar panels—an area bigger than Vermont—to satisfy all of the United States' electricity needs. But the land requirement sounds more daunting than it is: Open country wouldn't have to be covered. All those panels could fit on less than a quarter of the roof and pavement space in cities and suburbs.