Solar Homes for the Masses

For the sun to compete with fossil fuels (see main text), solar engineers will have to think bigger. Success is "about making square miles of [solar panels], not onesies-twosies," says Ken Zweibel of the Department of Energy's National Renewable Energy Laboratory in Golden, Colorado. "We have to make modules like carpet."

A novel Dutch effort is setting out to do just that. Near Amersfoort, the Netherlands, the NV REMU power company is leading a $13 million project to build 500 houses with roofs covered with photovoltaic (PV) panels. By the time the homes are finished next year, they should be drawing 1.3 megawatts of energy from the sun, enough to supply about 60% of the community's energy needs, with the rest coming from the power grid. The development, called Nieuwland, is the world's largest attempt at "building-integrated photovoltaics" (BIPV). "We want to demonstrate the construction of a solar energy system at the level of a precinct," says project co-leader Frans Vlek, manager of REMU's energy conversion division. "Everything has been designed from scratch."

Amersfoort gets much less sunshine than the world average of 1700 watts per square meter: Nieuwland's homes should be bathed in about 1050 watts worth of energy per square meter. From this Vlek expects they should glean as much as 128 watts per square meter, thanks to nifty PV cells that respond best to light reflected by clouds. Each kilowatt-hour from the solar panels will cost about four times more than electricity supplied by the grid, says Nieuwland co-leader Ingmar Gros, an engineer at REMU. His company and local authorities will subsidize the difference. The cost could come down with refinements in manufacturing PV cells: "We are now still at the level of the blacksmith," says Vlek.

Sunshine on a cloudy day. Nieuwland is the largest effort yet to use solar energy to wean a community from the fossil fuel–fed electrical grid.

Getting more BIPV projects off the ground should help drive technical advances and perhaps make solar energy a commercial winner sometime in the next 5 or 10 years, predicts Zweibel, who heads DOE's Thin Film Photovoltaics Partnership, in which federal and corporate scientists are collaborating to develop better solar cells. One of the partnership's products, PV shingles, could spur BIPV projects in the United States, he says. For an energy source now better known, perhaps, for its failures—satellites losing contact after not having their solar panels oriented toward the sun, for instance—the rise of BIPV communities could be a much-needed success story. **–ALEXANDER HELLEMANS**

Alexander Hellemans is a writer in Naples, Italy. With reporting by Kathryn Brown.

trade association. Incinerating biomass has carved a market niche but gets low grades from environmentalists because of its contributions to air pollution.

For now the spotlight is shining brightest on wind and solar power, which contribute less than 2% of the nation's total energy. Although inching along in the United States, these energy sources are leaping ahead worldwide: Global wind and solar power capacities, in megawatts, have been growing by roughly 22% and 16% a year, respectively, since 1990, according to the Worldwatch Institute, a nonprofit public policy research organization in Washington, D.C. In 1998, for the first time in recent memory, the world's consumption of coal—a stalwart source of energy for electricity—fell 2%, partly because China cut subsidies to its coal producers.

Rising sun. Japan is expected next year to edge out the United States as the leading exporter of photovoltaic cells.

CREDITS: (BOTTOM) PETER MENZEL

Fueling the global gains of wind and solar power are impressive technical achievements. Thanks to more efficient turbine design, wind power costs about 5 cents per kilowatt-hour (kWh), less than a tenth of the 1980 price, and PV power averages less than 20 cents per kWh. (A kilowatt-hour can light a 100-watt bulb all night or run a typical hair dryer for 1 hour. In California, homeowners use about 16 kWh a day and 6000 kWh a year.) These renewable energy costs have met—or beaten—projections made by economists in the early 1980s, according to an April report from Resources for the Future (RFF), a Washington, D.C., think tank.

The advances allow renewables to compete with gas or coal in niche markets: mountains in the southwestern United States, for example, with lots of sun and few connections to the power grid. Mainstream markets are tougher to penetrate, largely because fossil fuel prices have also fallen since the 1970s. "The world has not stood still," says RFF economist Dallas Burtraw. Low costs for shipping coal and a surge in natural gas discoveries have helped drive these sources of electricity down to about 3 cents per kWh.

But thanks to the deregulation revolution now under way, renewables may at last have a chance to compete with fossil fuels. Renewables entered the energy market in 1978, when the Carter Administration—seeking to boost the country's energy independence—won passage of the National Energy Act, which included a bill ordering utilities to buy power from renewable energy producers at favorable rates. In an unrelated trend, big companies, eager to get electricity cheaply, began lobbying states for a competitive market that might lower power prices. On 31 March 1998, California's $20 billion power market opened, giving consumers served by three investor-owned utilities a chance to choose among eight firms, six of which offered alternative energy sources. By February 1999, some 125,000 homes and businesses had switched providers—and analysts suggest that at least half the small customers opted for some mix of renewable energy, either sold by independent power producers like Green Mountain Energy Resources or by standard utilities offering new programs. Santa Monica became the first U.S. city to switch all its public buildings to renewable power.

The new market spurred Enron to build a 22-turbine, 16.5-MW project outside Palm Springs. Installed last month, the turbines will supply enough electricity to light up 5000 California homes. The company is considering wind farms in other states that plan to deregulate, according to Albert Davies, direc-