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The Energy Challenge

Turning Glare Into Watts

By MATTHEW L. WALD
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An Acciona solar thermal power plant, located south of Las Vegas.

BOULDER CITY, Nev. — At first, as he adjusted pumps and checked temperatures, Aaron Boucher looked like any technician in the control room of an electrical plant. Then he rushed to the window and scanned the sky, to check his fuel supply.

Mr. Boucher was battling clouds, timing the operations of his power plant to get the most out of patchy sunshine. It is a skill that may soon be in greater demand, for the world appears to be on the verge of a boom in a little-known but promising type of solar power.

It is not the kind that features shiny panels bolted to the roofs of houses. This type involves covering acres of desert with mirrors that focus intense sunlight on a fluid, heating it enough to make steam. The steam turns a turbine and generates electricity. The technology is not new, but it is suddenly in high demand. As prices rise for fossil fuels and worries grow about their contribution to global warming, solar thermal plants are being viewed as a renewable power source with huge potential.

After a decade of no activity, two prototype solar thermal plants were recently opened in the United States, with a capacity that could power several big hotels, neon included, on the Las Vegas Strip, about 20 miles north of here. Another 10 power plants are in advanced planning in California, Arizona and Nevada. On sunny afternoons, those 10 plants would produce as much electricity as three nuclear reactors, but they can be built in as little as two years, compared with a decade or longer for a nuclear plant. Some of the new plants will feature systems that allow them to store heat and generate electricity for hours after sunset.

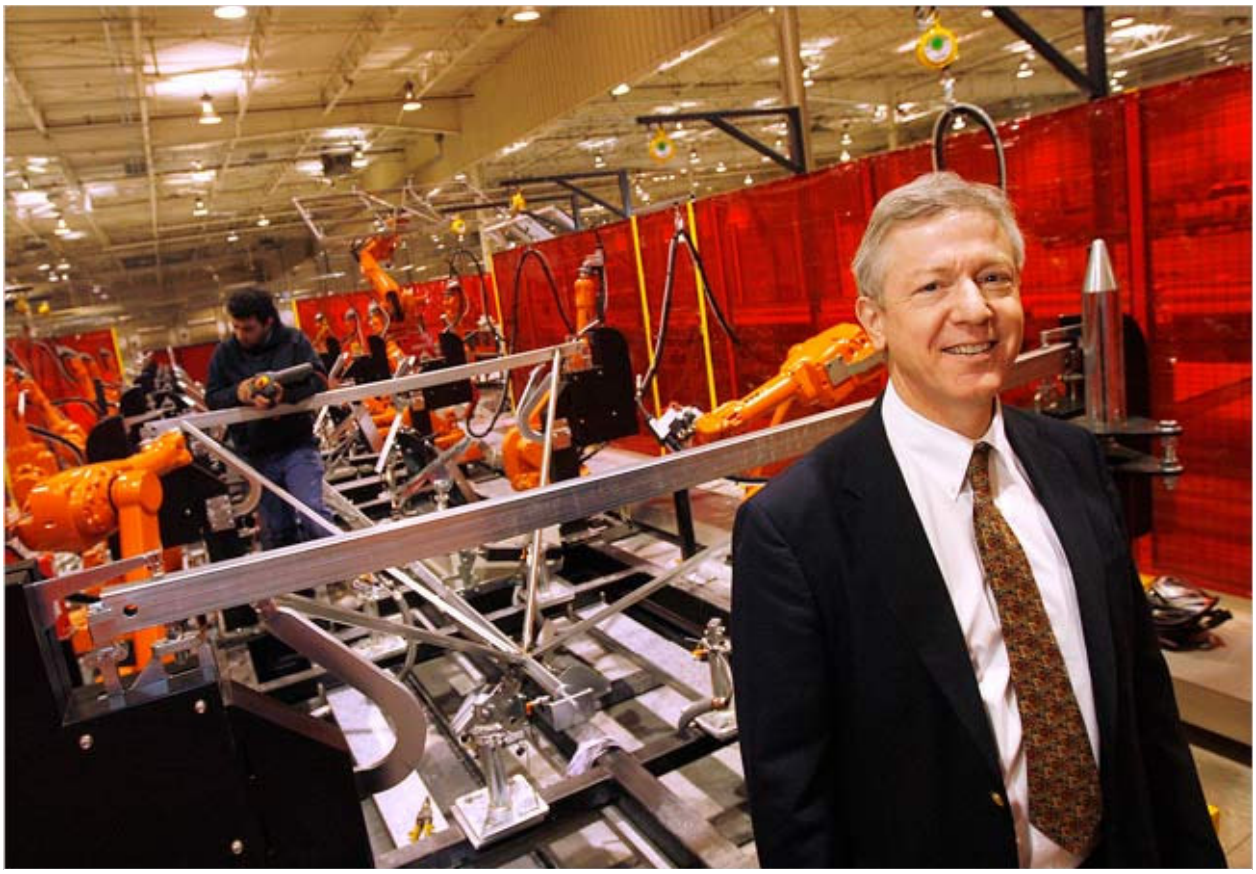
Aside from the ones in the United States, eight plants are under construction in Spain, Algeria and Morocco. Another nine projects are in various stages of planning in those countries as well as Israel, Mexico, China, South Africa and Egypt, according to a count kept by Frederick H. Morse, formerly in

Especially in areas of intense sun, an array of reflectors can concentrate sunlight, heating a fluid to create steam and power.

charge of solar energy at the Energy Department and now a consultant. Mr. Morse and others say that solar thermal plants could meet most of the galloping growth in power demand in Phoenix, Las Vegas and the rest of the southwestern United States. In fact, experts say enough sunshine hits the deserts of the Southwest that such plants could theoretically power the entire United States. But that is a far-off dream, since it would require big new transmission cables.

The workability of solar thermal power was established in the 1980s, when developers in California built a series of plants in the Mojave Desert, eventually reaching 354 megawatts of capacity. A megawatt is enough electricity to run 1,000 room air-conditioners at once. The California plants grew more sophisticated and costs shrank as the project progressed. But then the price of a competing fuel, natural gas, collapsed in the 1990s and building new solar plants became uneconomic.

Today, natural gas prices are much higher, and political opposition is rising to construction of new coal-burning power plants. Many states, including California, are imposing mandates for renewable energy. All of that is reviving interest in solar thermal plants. The power they produce is still relatively expensive. Industry experts say the plant here produces power at a cost per kilowatt- hour of 15 to 20 cents. With a little more experience and some economies of scale, that could fall to about 10 cents, according to a recent report by Emerging Energy Research, a consulting firm in Cambridge, Mass. Newly built coal-fired plants are expected to produce power at about 7 cents per kilowatt-hour or more if carbon is taxed.



John S. O'Donnell's company, Ausra, is building a factory in Las Vegas to make mirrors for solar thermal plants.

The solar plants receive a federal tax subsidy, like other types of renewable energy, which makes the economics work for builders but also feeds skepticism about the technology's long-term potential. "Unless there's a subsidy involved, it doesn't seem like a very attractive technology," said Revis James, a renewables expert at the Electric Power Research Institute, a utility industry consortium.

Still, solar plants do tend to produce peak power during the hottest part of the day, when demand is highest and electricity is costly, so at certain times they are already competitive with plants using natural gas. And they have an advantage over the other widely available form of renewable power, wind turbines: they are more predictable.

With California utilities struggling to meet a state quota of 20 percent renewable power by 2010, the state has grown interested in solar plants. Pacific Gas and Electric has committed to building several plants and is expected to make announcements about new solar plants soon. In Phoenix on Feb. 21, the Arizona Public Service unit of Pinnacle West announced plans for a large plant to be built by a Spanish company, Abengoa, and finished in 2011. That one will store heat so that it can continue to produce power for up to six hours after sunset.

Donald E. Brandt, the chief executive of Pinnacle West, said the decision to build the new solar plant was as important as his company's decision in 1973 to build the Palo Verde nuclear plant, the largest and most modern in the United States. "The key is, the solar technology has advanced," Mr. Brandt said. At 280 megawatts, "it's a critical size; it's a real power plant; it's meaningful; it's beyond the demonstration stage."

Companies that build the plants have been working on improving the technology, raising efficiency and lowering costs. A battle among competing approaches is expected over the next few years. The plant here, Nevada Solar One, built by a Spanish company, Acciona, is of a proven design. It uses a mirror in the shape of a parabola to focus light onto a black pipe with a heat-transfer fluid inside. The fluid is used to boil water into steam, which turns a generator that can produce 64 megawatts.

That is small compared with a plant running on coal or natural gas, but far bigger than a typical installation involving solar photovoltaic panels, the type of solar power most people are familiar with. That technology, while good for some uses, is far more expensive than solar thermal power.

Suppliers of thermal systems are gearing up for a boom. In Las Vegas, a company called Ausra is building a factory to make mirrors for one type of solar plant; it will double the world's manufacturing capacity. A German company, Schott, is building a factory in Albuquerque that will make heat-collecting tubes.

The newest solar-thermal technology involves building a "power tower," a tall structure flanked by thousands of mirrors, each of which pivots to focus light on the tower, heating fluid. That design can work even in places with weaker sunlight than a desert. One of the big advantages of these plants is that they can be built with the capacity to store heat in what amounts to a giant Thermos. Experts say that will smooth production and make it easier to integrate the plants into the electrical grid.

If large numbers of plants are built, they will eventually pose some problems, even in the desert. They could take up immense amounts of land and damage the environment. Already, building a plant in California requires hiring a licensed tortoise wrangler to capture and relocate endangered desert tortoises.

"The one thing that's eventually going to raise its head is desert biodiversity, and the land area itself," said Terrence J. Collins, an environmental expert and professor at Carnegie Mellon University.

Building the plants in deserts poses another obvious problem: deserts are not exactly teeming with power lines. "Whatever you do, you've got to have the wiring," Mr. Collins said.

Despite the difficulties, solar thermal plants have an other-worldly beauty as they run.

At Nevada Solar One the other day, Mr. Boucher, 30, ran the computerized control room. Dressed in a T-shirt, sneakers and a Boston Red Sox cap worn backwards, he looked a bit like a teenage gamer as he used a computer mouse to manipulate the plant.

He was trying to produce as much electricity as possible while saving heat to tide the plant over as clouds cast episodic shadows on the solar array. "I've been fighting it all day," he said.

Outside, row after row of U-shaped mirrors, covering nearly a square mile, stretched across the desert. In the center of each U, where the force of the sun was magnified 70 times, ran a pipe painted black, and inside it flowed oil that warmed to hundreds of degrees as it collected the heat needed to run a generator.

The buzz in the control room, as Mr. Boucher worked, contrasted with the sanguine scene beyond the windows. Imperceptibly, in the dusty wind of the high desert, 182,000 mirrors moved from east to west, tracking the sun across the sky.