Solar-fired electric power

For the first time, a Stirling engine powered by solar energy has produced electricity that can be fed directly into power company lines. The experiments took place in August and November last year at the Advanced Components Test Facility, part of the Georgia Institute of Technology's Engineering Experiment Station in Atlanta.

The 20-kilowatt external combustion engine, developed by United Stirling of Sweden and used in the tests to generate electricity, has pistons driven by heated helium. Georgia Tech engineers designed a cavity receiver to capture concentrated sunlight and heat helium flowing through a heat exchanger outside the engine. A large mirror field consisting of 550 circular mirrors, each 1.1 meters in diameter, concentrated sunlight by a factor of 1,300 to provide the needed solar energy. The engine, operating at 750°C, generated 440-volt, 3-phase alternating current with an efficiency of 20 to 25 percent, better than the efficiency of a comparable solar-fired steam engine or photovoltaic panels.

Facility director C. Thomas Brown says, "An engine of the size we tested here is a good match for the parabolic dishes, 10 to 12 meters in diameter, that are being developed by a number of contractors. That engine placed at the focus would give a very good stand-alone power system." Recently, funding to build and test a number of these units became available.

A solar-powered Stirling engine may be most useful when high levels of electricity are needed, for example, as a supplement in the summer when air-conditioner use is high. Stand-alone units may also be economical for remote areas where the cost of bringing in conventional utility power or fuel would be high. Researchers are also interested in experimenting with higher-power Stirling engines for use with solar power towers.

Commercial coal gas is one step closer

The Great Plains Coal Gasification Project — proposed as the nation's first commercial-scale plant to produce pipeline-quality synthetic natural gas — received regulatory approval in November 1979 (SN: 11/24/79, p. 357). But construction plans have been on ice since then, pending approval of federal loan guarantees needed to back financing of the plant (which is now expected to cost $2.56 billion); those agreements were signed February 2. The plant, to be located near Beulah, N.D., is now scheduled to begin converting by late 1984 some 14,000 tons of lignite per day into 125 million cubic feet of gas.

Synfuels Corp. finally comes to life

The U.S. Synthetic Fuels Corp., created by an act of Congress on June 30, 1980 (SN: 7/5/80, p. 5), at last became operational through an executive order signed February 9 by President Reagan. With an initial budget of $2.66 billion transferred from Energy Department coffers, its first function will be to assume supervision of two shale-oil projects in Colorado sponsored by the Union Oil Co. and Tosco Corp.

Insulation: No wins, same losses

Goose down, wool, polyester and polyolefin all provide similar degrees of insulation, report researchers from the human biology department at the University of Wisconsin, Green Bay, in the Feb. 5 SCIENCE. They used a single heat transfer measurement technique to show synthetic materials were not superior to natural fibers as thermal insulators. They conclude that "factors other than thermal insulation, such as weight, drapability, durability and cost should be the major factors in selecting outerwear containing thermal insulation materials."

A solar answer for cloudy climes

From a distance one might confuse Carlyle Herrick's device with the traditional flat-plate solar collector. But this engineer at the General Electric Research and Development Center in Schenectady, N.Y., would take umbrage, explaining that in his solar collector, "All of the optically active elements — the cover tubes and absorber — are cylindrical in shape." And "its cylindrical difference is what gives this thing its outstanding performance." Laboratory tests indicate the device could offer triple the heat collection of a conventional flat-plate collector during a typical northern U.S. winter. Vacuum tubes — similar to those sheathing a fluorescent light — are fastened together into a panel as the collector's cover (see photo). The vacuum contributes to the system's low heat losses. "We started with two flat sheets and a vacuum between them" as a cover, Herrick says, "but found that the cylindrical geometry let more light in." "I don't know why," he admits, but says this tubular arrangement increases the device's light-collection 15 percent or more when the incident light is normal — coming in at a right angle to the glass, such as might occur at noon for a device mounted flat on the ground. And as the light's angle of incidence becomes more acute, the advantage of the tubular surface increases relative to flat covers. Herrick claims the tubular cover nearly doubles the light available to the absorber over the course of a day.


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Beneath the cover is a cavity filled with a mat of black fiberglass. Its cylindrical fibers collect and transfer heat to warm air circulating through the cavity — for temperatures in excess of 180°F, if necessary. The system's design also minimizes weight and conductive heat losses with a thermally stable, insulating, foam backing.

The result, Herrick told SCIENCE NEWS, is that "heat loss is by radiation only," meaning the system works effectively in cloudy weather. Asked what "effectively" meant, he said "it delivers heat like gangbusters" even during freezing winter weather in the Boston area — where Herrick conducted some of his tests — and in cloud conditions that block out three-quarters of the normal solar radiation.

Protecting plutonium packages

Wood is an important element of a newly licensed shipping container for plutonium that can survive an aircraft crash and fire. The cylindrical container, which takes up less space than a breadbox, was developed by Sandia National Laboratories for the Department of Energy. It weighs about 70 pounds (31 kilograms) and carries up to 15 grams of fissile plutonium or mixtures of plutonium and uranium in solid form.

The package is covered with a thick stainless steel outer shell. Inside is an outer layer of redwood and an inner layer of maplewood. Sandwiched between the wood layers is a quarter-inch-thick titanium container that spreads impact loads throughout the wood and helps dissipate heat. In the center is a baseball-sized sphere of a high-strength iron alloy, hermetically sealed with a copper gasket. An egg-shaped stainless steel capsule, which holds the small brass or aluminum canisters that contain the nuclear materials, nestles within the sphere.

Wood is a major package component because when it burns, the carbon product has insulation properties similar to a space vehicle's heat shield. Wood also has an excellent capacity for absorbing energy due to impact or shock.