TECHNOLOGY

Solar Heater for Arctic Desert

Heat concentrator using brilliant sunlight direct and reflected from snow could operate seven months of the year, saving many barrels of oil now airlifted to Arctic.

By HELEN M. DAVIS

➤ DESERT DWELLERS in one of earth's greatest waste-lands, at the top of the world, on the Greenland ice cap, look to the sun's abundant but as yet unharnessed energy as the only practical means of solving their living problems.

In other sun-baked desert areas, experimental building of solar heating devices lags because even five dollars capital investment in a pilot model seems high to the people living there. But people living in this northernmost of the earth's deserts want solar heaters now, no matter what they cost. They are not Eskimos, but Americans, to the number of a small ship's company, who live 200 miles out on the ice cap in Uncle Sam's "City Under the Ice."

At the "City Under the Ice," the Snow, Ice and Permafrost Research Establishment of the U. S. Army Engineer Corps, known in government circles as SIPRE, has maintained a research station for two summers in order to learn more about the true conditions in this frozen desert at the top of the world. The station is staffed with about 25 scientists each summer.

All Fuel Flown In

Fuel oil must be flown in to maintain practical living conditions for the little band of research workers who are exploring one of earth's last outposts, but only 25 barrels of oil can be brought in as one plane load. The oil is brought from Thule, a three-hour round trip, and a hundred round trips a year are required to bring the necessary fuel.

The cost of such airlift operations has been estimated at $2,000 per hour. Any way to lessen such fuel costs by using the sunshine that pours down abundantly during the 24-hour summer days and the long "twilights" of the spring and fall is economical, no matter what it costs.

"We use enormous amounts of fuel just to keep the domestic water supply liquid," Dr. R. W. Gerdel, chief of the climatological and environmental research branch of the Research Establishment, said, explaining that air temperatures at the Greenland station never go higher than 25 degrees Fahrenheit in summer and may go down to minus 65 degrees in winter.

Dr. Gerdel, whose laboratory in the temperate zone is at Wilmette, Ill., attended the Conference on Solar Energy at Tucson, Ariz., where he reported on peculiarities of the arctic climate that make the readings of instruments built for temperate climates misleading when they are taken north of the Arctic Circle.

Dr. Gerdel went on to the World Symposium on Applied Solar Energy at Phoenix, Ariz., to look over the solar energy heaters and batteries displayed there.

In his opinion, money should be no object in developing a pilot installation in the arctic, since any device that will work will be a money saver and a solution to one of the most serious difficulties to life in the far north.

Scoffing at the common belief in "the" long arctic night," Dr. Gerdel said that at 78 degrees north latitude sunset occurs about Oct. 31, but sunrise follows on Feb. 15. These dates are preceded and followed by a "twilight period," but the sun shines 24 hours a day in May, June, July and August.

In March and April and again in September and October the sunshine averages nine hours per day. Amount of snowfall is equivalent to only five inches of rain per year, which is less than falls in the Mojave Desert.

The precipitation, in the form of snow, may pile up to 30 or 40 inches. In winter the air may be full of blowing snow, representing new layering rather than fresh precipitation.

Fog-like conditions, known as white-outs, occur in summer, but the reflection of the sun even then makes dark glasses necessary. Some way to concentrate this abundant light, even though inefficiently, would be welcomed in this "land of the midnight sun."

Although the year's snowfall is not great in Greenland, on the 700,000-square-mile ice cap, the snow never melts and runs off. Layers of alternate summer and winter snow can be distinguished when digging down through the accumulated drifts of centuries.

A group from Dr. Gerdel's organization, in one excavation, counted down to the snowfall that occurred the year Lee surrendered. Alternating "mild" summers

MIDNIGHT SUN—Energy beams down on the Joint Arctic Weather Station at Mould Bay, Greenland, where the sun sets in October and rises in February. Ways to utilize the vast solar energy resource of the arctic's 24-hour summer days are sought by the Snow, Ice and Permafrost Research Establishment of the U. S. Army Engineer Corps, known as SIPRE, which maintains a staff of scientists each summer at arctic laboratories.

and "hard" winters leaves their records, much as tree-rings in warmer climates trace the record of past seasons.

Seismic soundings taken like those for oil prospecting determine the depth of the huge snowbank that is interior Greenland. Rising 2,000 feet in the first 50 miles above the narrow coastal shelf at sea level, in a steep escarpment, the top of the so-called ice cap has been found to be about 10,300 feet above its base. The base at the "City Under the Ice" near 7,000 feet above sea level lies in a basin now 300 feet lower than the shore line.

Snowcap Is Relic

Greenland's snow cap is an archaeological relic. On the northern part of the ice cap there appears to be more accumulation of snowfall today than there was 100 years ago, or even 50 years ago.

There does not seem to be any recession of the Ice Age in that part of the world, and this relic of conditions which once were more extensive is not going to melt away very soon.

Greenland is therefore a laboratory where present day scientists can be transported back thousands of years in time, to experience conditions once prevalent over the whole of Canada and the United States as far south as the Ohio River, and over a corresponding part of Europe.

Possibly the Greenland ice cap is also a forerunner of what is in store for inhabitants of Europe and North America in the not-too-distant future if, as some geologists think, we are already past the midway point of an interglacial epoch.

In addition to its arctic establishment and its highly developed low temperature laboratories in Wilmette, SIPRE has a very large field research station in northern Michigan on the Keweenaw peninsula that juts out into Lake Superior.

Cooperative Facilities Provided

Here, in an area of uniformly low winter temperatures and lots of snow, preliminary studies are made before undertaking an ambitious program in the arctic. Here also facilities are provided, on a cooperative basis, for other military agencies and industrial concerns to test out ideas for equipment for arctic use.

Here, in the old copper-mining regions, the weather stays cold long enough to get the data necessary for these tests. For 30 consecutive days, at a minimum, and on the average for 59 days, the thermometer in the dead of winter never gets above the freezing point. The Keweenaw peninsula is right in the path of the winter cold that circles down from "Medicine Hat."

The Snow, Ice and Permafrost Research Establishment, of which Dr. Gerdel heads the climatological and environmental research branch, was established in 1949 by a directive of the Research and Development Board, Department of Defense, to acquire a backlog of knowledge about snow, sea ice, lake ice, and seasonally and permanently frozen ground in the cold regions of the world.

This knowledge was to be used to aid in planning military operations and maintaining military establishments in the arctic area.

Such problems as the effect of different kinds of snow and different weather conditions on the movement of tractor trains are studied. Trains of sleds pulled by tractors take supplies to many remote stations in the far north.

The potential capacity of sea ice and lake ice for construction of landing fields for aircraft is a matter of great interest in the arctic, and SIPRE has participated in the construction of landing strips of processed snow, which has been heated and rolled to make it hard and smooth.

Intensive aerial studies are made of distribution of all types of snow, ice and frozen ground. This constitutes a part of the climate and environment phase of the Establishment's research efforts. From this information, knowledge gained in one location may be transferred to another.

Both long term and short term military planning in the arctic is thus aided.

Building on Permafrost

Permafrost areas are those where the ground areas may be frozen to a depth of a thousand feet. Only a foot or so of the surface soil melts during the summer.

Construction of a permanent building on ground of this kind requires a special foundation. If such a building is heated, the ground under it melts and the building sinks. But even if the building is not heated, it may trap the large amount of solar radiation available in the summer, and melt its way into the ground anyway.

SIPRE has carried out a number of research projects in the permafrost field that are providing information on the construction of buildings, airstrips and other structures on permafrost.

One of its important programs is measurement of solar radiation. From this measurement, a solar radiation index is computed that is used in forecasting the "trafficability" of the snow.

When the snow is very cold, more radiation from the sun means better trafficability, because warming makes cold snow more readily compacted, and so the tractors get along better because they do not bog down in the cold loose snow.

Traffic on Warm Snow

When the snow is warm, however, more radiation brings worse traffic conditions, because it makes the snow melt and coats the surface of the snow with a water film that acts as a lubricant and reduces friction of the tractor tracks on the snow.

Then arctic snow is like a winter snow during a January thaw in the temperate zones, and tractors skid as they try to pull supplies up the long ice ramp to the top of Greenland's snow cap, to the little band of hardy adventurers in the "City Under the Ice."

These young men work in the tradition of the great polar explorers of the past, braving many hardships to learn more about this big frozen desert at the top of the world. It represents man's last chance for true exploration on our crowded planet.

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PHYSICS

Nobel Winner Predicts Seven Heavy Elements

➤ SEVEN MORE HEAVY elements, 102 through 108, will be created in the next five to fifteen years, Dr. Glenn T. Seaborg, Nobel Laureate at the University of California and co-discoverer of plutonium, has predicted.

The most likely production method, he said, is in an atom smasher such as the one now being constructed in Berkeley with Atomic Energy Commission funds. This is the "hilac," heavy ion linear accelerator, which will speed up very heavy nuclei, like neon, with an atomic weight of 20.

By hurling relatively large nuclei into the "hearts" of heavy atoms like uranium, it should be possible to build up the heavier elements. With lighter atomic bullets, the scientists have produced elements up to 101, discovered earlier this year.

Dr. Seaborg says elements 102 through 105 should be stable enough to identify chemically. Elements 106 through 108 probably will decay so rapidly they can be analyzed only from their radioactivity.

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