** THIS EDITION OF ENERGY STUDIES IS NOW OUT OF PRINT. PLEASE ACCEPT THIS COPY INSTEAD.

ces ENERGY STUDIES

Volume 1, Number 2

Fall 1975

Solar Energy: Fuel of the Future

What fuel will we use when we run out of oil and natural gas? That is the main question raised by the energy crisis. This nation has been spending its most popular fossil fuels at an alarming rate and is now faced with the prospect of their total depletion.

Although many alternative energy sources are now being examined more closely, only solar represents a free energy supply available in useful quantities nearly everywhere. Solar radiation falls on the earth's upper atmosphere at about 170 trillion kilowatts per minute. Although some of this power is reflected back into space, absorbed by the atmosphere, and diffused by water droplets or dust particles, approximately half of the energy reaches the earth's surface.

Collecting Solar Energy

There are basically two types of solar collectors designed to capture different kinds of solar radiation: focusing collectors and flat plate collectors. Focusing collectors concentrate the sun's rays by the use of large parabolic or spherical mirrors. They can achieve much higher temperatures than the flat plate collectors, but they are more difficult to construct and can only work when the sky is relatively clear.

Flat plate collectors, on the other hand, capture both direct and diffuse solar radiation. They work best in full sunshine but can produce limited output even on cloudy days.

Flat plate collectors are large flat surfaces coated with a dull black substance that easily absorbs the sun's rays. When the collector's surface absorbs the radiation, it heats up, and the heat is transferred from the surface to a cooling fluid which circulates on the back of the sheet.

Using Solar Heat

Most collector schemes are designed to produce hot water, hot air, or steam. The steam is obtained almost exclusively from focusing collectors, and the hot water or air from flat plate collectors. Hot water from a solar collector can be used directly for washing or bathing in the home or as low-grade process heat in businesses. A hot water or hot air system can also be used to heat or cool working or living areas.

Heating buildings by solar energy requires a solar collector and thermal storage as well as piping, pumps, and a radiator or heat exchanger similar to conventional heating systems. Cooling buildings by solar power, however, is more complicated, and the technology is not as well developed. Both solar heating and cooling systems depend to some extent on an auxiliary energy source for extended cloudy periods.

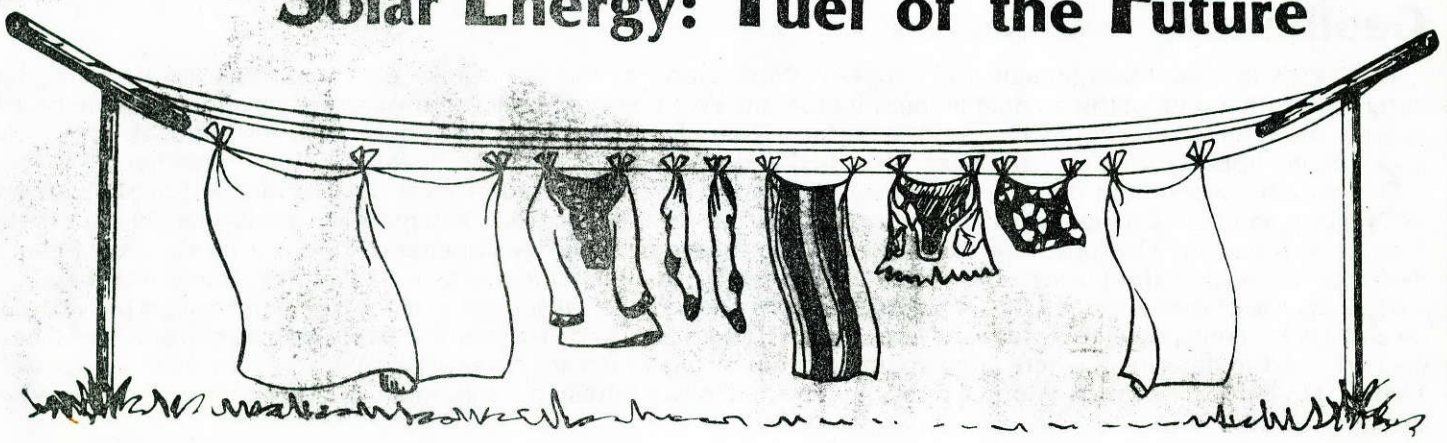
Storage

Since solar radiation is not constantly available, some kind of device is necessary to store the energy for use when and where it is needed. One popular storage scheme is to blow air warmed by solar heat over a pile of rocks which, in turn, become warmed. Later, when warm air is needed, cool air from the home or office is blown over the warm rocks, picks up heat, and is ducted into the desired areas. Another popular method is to use a tank of hot water in place of the pile of rocks.

How Much Will It Cost?

Solar heating and cooling systems with a lifetime of fifteen to twenty years are now available. However, their costs are not yet competitive with conventional systems.

Continued on page 4



Solar *Gary C. Vliet*

A solar-powered heating and cooling system designed and constructed by students at UT-Austin won the Energy Resources Alternatives (ERA) award for combined solar cooling and hot water at the Student Competition on Relevant Engineering (SCORE) in Albuquerque, New Mexico, in mid-August. The UT team was captained by Michael Hart, a graduate student in Mechanical Engineering. Faculty advisor was Dr. Gary Vliet.

The unit developed by the UT team is based on the idea of solid desiccant dehumidification/cooling. It uses five flat plate collectors and a 100-gallon storage vessel. The system has been reassembled in Taylor Hall on the UT-Austin campus for further testing under solar conditions (see picture on p. 3). It is available for inspection by the public.

The project was supported by SCORE, CES, and the UT College of Engineering.

Social Systems Research *Sally Cook Lopreato*

In a scope-of-work project to identify needed research on geothermal energy, an overview of the socioeconomic nature of the Texas Gulf Coast has been compiled. Those data are now being examined to determine whether any major problems will derive from geothermal development—either for the region as a whole or for specific communities where the resource is located—and to suggest optimal strategies of utilizing the resource for the area.

Two pretests of a questionnaire designed for Southern Union Gas Company to investigate energy conservation attitudes and behavior were conducted during the summer. A significant question on the pretests was how rising utility bills have affected consumers in the Southwest. The following responses were obtained:

	Electricity	Gas	Gasoline
It really had no effect on me.	17%	23%	14%
I had to make a few adjustments, but my style of life was not affected.	42%	50%	50%
My life was less comfortable and convenient, but it was not serious.	37%	17%	32%
I had to make serious changes in my daily habits.	4%	0%	4%

End-Use Conservation *Jerold W. Jones*

Recent price increases for natural gas and electric energy are encouraging people to conserve energy by reducing their usage or making it more efficient. The energy conservation section of CES is presently conducting studies to determine methods for residential and commercial consumers to reduce their energy consumption most effectively.

Electric energy consumption for lighting can be reduced significantly by turning off lights when they are not needed and by using the proper size and type of light for the specific task. For instance, a fluorescent light can produce as much illumination using half as much electric power as an incandescent light. Also, the fluorescent light produces less heat, which must be removed by the air-conditioning system during the cooling season.

Energy Modeling *Martin L. Baughman*

The energy modeling division of the center develops and applies analytical methods for energy policy analysis and forecasting. It tries to improve existing energy computer simulation models and to produce new models to project more effectively the future consequences of present energy-related decisions, trends, and events.

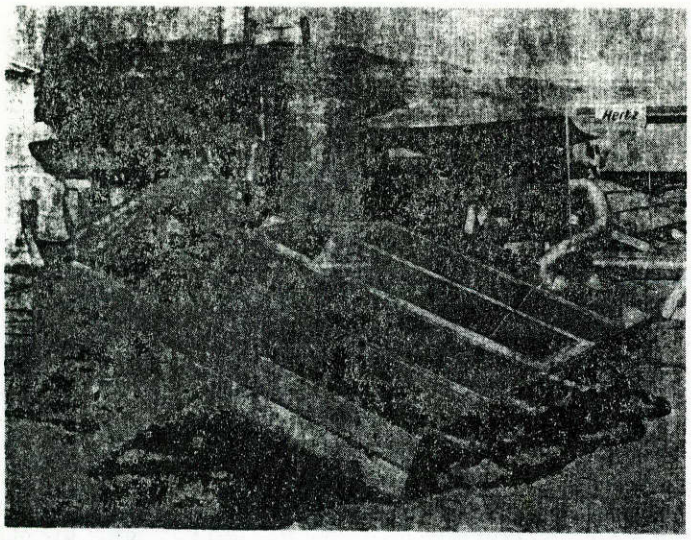
Current models in use include the Regionalized National Electricity Supply/Demand/Financial Model, the Mathematical Programming Model of World Oil Supply and Demand, and a Multisectoral Growth Model of the U.S. Economy.

Geothermal *Myron H. Dorfman*

The ERDA-funded Management and Scope-of-Work Study of the U.S. Gulf Coast Geopressured Resource has entered its fifth month of the original six-month program. Working within the general areas of resource assessment, advanced reservoir research and technology, surface technology, and legal, environmental, institutional, and social issues, many important issues have been identified and are being studied by the geothermal researchers.

The resource assessment portion of the overall program is being studied in great detail under a $500,000 two-year ERDA contract to Dr. Charles Groat, CES Associate Director for Resources and Environment and Acting Director of the Bureau of Economic Geology. The evaluation of the subsurface geology is being carried out by Dr. Don Bebout, Research Scientist at the bureau. Dr. Bebout is assisted by graduate students as well as other faculty members.

The purpose of the resource assessment work is to reconstruct the subsurface geology from information provided by oil and gas well records (electric logs and core samples) and from a knowledge of the depositional environments. These data are used to determine where large volumes of hot water, which are potential geothermal resources, are located. To date, Dr. Bebout's work in resource assessment has led to two Bureau of Economic Geology publications and several graduate theses.



Burney Stinson (l) and David Humphrey (r) prepare to test solar heating/cooling system at Sandia Laboratories.

Grants

● The Energy Research and Development Administration has extended its contract with CES for work on partitive analytical forecasting (PAF). Funding totals $52,000 for the year beginning July 1. Dr. John H. Vanston, Jr., Deputy Director of the center, is principal investigator.

The PAF technique aids managers of large research and development programs. Its four steps include determining essential tasks and means; gathering time, cost, and probability estimates from scientists, engineers, and managers involved in the research; designing computer simulations of possible schemes; and analyzing and evaluating results.

● The General Electric (GE) Foundation has renewed a grant of $20,000 to the Center for Energy Studies for the academic year 1975-76. The funds will be used for energy program development at the center.

The GE Foundation was established by General Electric in 1952 primarily to support educational efforts. The foundation made its first grant to the university in the energy area in February of 1974 and renewed it in June of that year for the support of CES.

Conservation Manual

Social systems research and conservation groups of CES are assisting HAM-MER Consulting Engineers, Inc., in an evaluation of a conservation manual prepared by the Federal Energy Administration for building owners and operators. The study is to be completed in November.

Budget

The State Legislature approved a $100,000 budget for the Center for Energy Studies for the academic year 1975-76. At its September 12 meeting, the university Board of Regents allotted the center an additional $200,000 for the same time period.

Energy Briefings

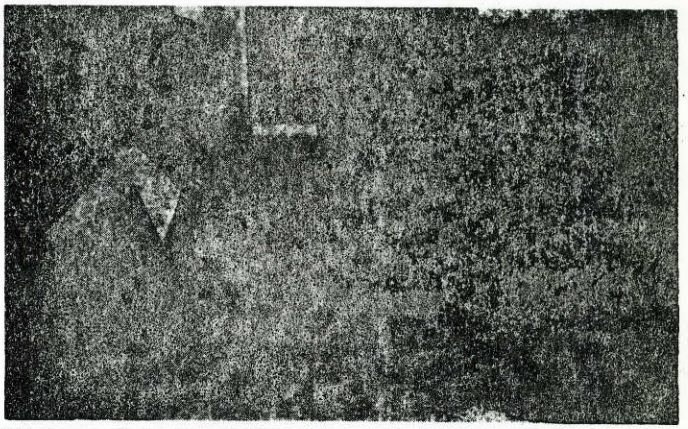
The Energy Information Service of CES conducts semimonthly energy briefings during the fall and spring semesters in which guest speakers review aspects of current energy concerns. The briefings are held on the first and third Wednesdays of each month at 4 p.m. in Cockrell Hall 1.204. They are open to the public.

The first two speakers for the fall semester were Dr. Herbert H. Woodson, Director of the Center for Energy Studies, and Mr. Alvin Askew, Executive Director of the Governor's Energy Advisory Council. The program for the remaining fall briefings is as follows:

November 5		
Dean James W. McKie, Social and Behavioral Sciences		Energy and Economic Growth
November 19		
Dr. Charles Groat, Bureau of Economic Geology		Resource Assessment of Texas Lignite
December 3		
Mr. John W. Davidson, Nuclear Reactor Teaching Laboratory		Radioactive Waste Disposal

Southern Union Gas

Southern Union Gas Company has given $3,000 to the center for an attitudinal study of customers. CES dissemination and social systems research groups and the Graduate School of Business have prepared and are administering a questionnaire to a sample of 10,000 consumers to examine attitudes toward energy conservation and to suggest possible incentives for Southern Union customers to adopt and use new forms of energy systems. The survey will be completed in early fall.



CES Research Assistant John Patton stuffs Southern Union questionnaires.

ENERGY STUDIES

Energy Studies is a quarterly newsletter of the Center for Energy Studies, The University of Texas at Austin, Austin, Texas 78712. It is published by CES from funds given to the center by the General Electric Foundation. Copies are available upon request. Address all inquiries to Barbara Graham.

For example, a solar system for the heating and cooling of a 2000-square-foot residence would cost about $10,000 to $12,000 today. However, prices are expected to drop as solar technology develops. According to Dr. Gary Vliet, Associate Professor of Mechanical Engineering at UT-Austin and Acting Associate Director for Solar Studies at CES, the system that costs $10,000 to $12,000 now may sell for $5,000 to $7,000 in five years. If the homeowner bought the system at $5,000, he could break even in nine years and actually save money after that (compared to conventional electric and gas systems).

Such an analysis is, of course, sensitive to fuel escalation rates, interest on debt, and the area of collector needed. Also, it is more expensive to install a retrofitted system on an existing building than to build a solar system into a new building designed for that purpose.

Application

The most extensive application of solar energy has been for domestic water heating in Israel and Japan and to some degree in India and Australia.

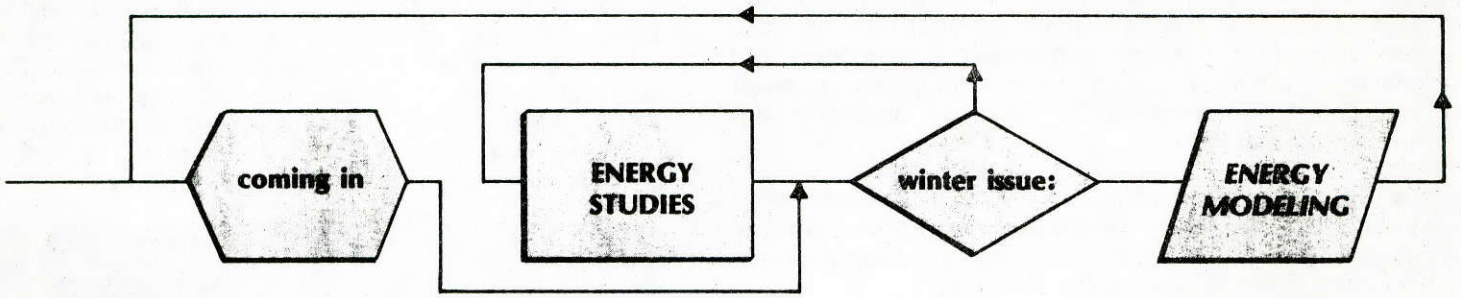
In the United States, there has not been much interest, to date, in solar energy utilization. However, numerous companies offer off-the-shelf collectors, and there are a few companies who install solar water and space heating systems.

There are about 100 solar-heated buildings in this country. A group of 22 homes in El Cajon, California, is probably the world's first solar-heated subdivision. Only one solar cooling system is now commercially available but its cost is prohibitive compared to conventional cooling. It is anticipated that within the next two or three years better and less costly solar cooling systems will become available.

The Future

Much research remains to be done. Solar collectors need to be developed which are more efficient and less expensive. In addition, more compact storage systems need to be developed. Research is underway at The University of Texas at Austin and elsewhere on various systems for solar cooling and on the improvement of auxiliary equipment. Probably the ultimate goal in solar research and development efforts is on-site power generation—the direct conversion of solar energy into electricity.

No fuel holds greater long-term promise than solar energy. In time we may learn how to convert free sunshine into inexpensive energy and make it available year-round in most regions of the world. Then, instead of depending on depletable fuels, we can rely on the harnessed energy of the sun. ■



Center for Energy Studies
Engineering Science Building 305
The University of Texas at Austin
Austin, Texas 78712