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DISCOVERY, Research and Scholarship at The University of Texas at Austin, vol. 9, no. 1, Fall 1985, pp. 11-13.

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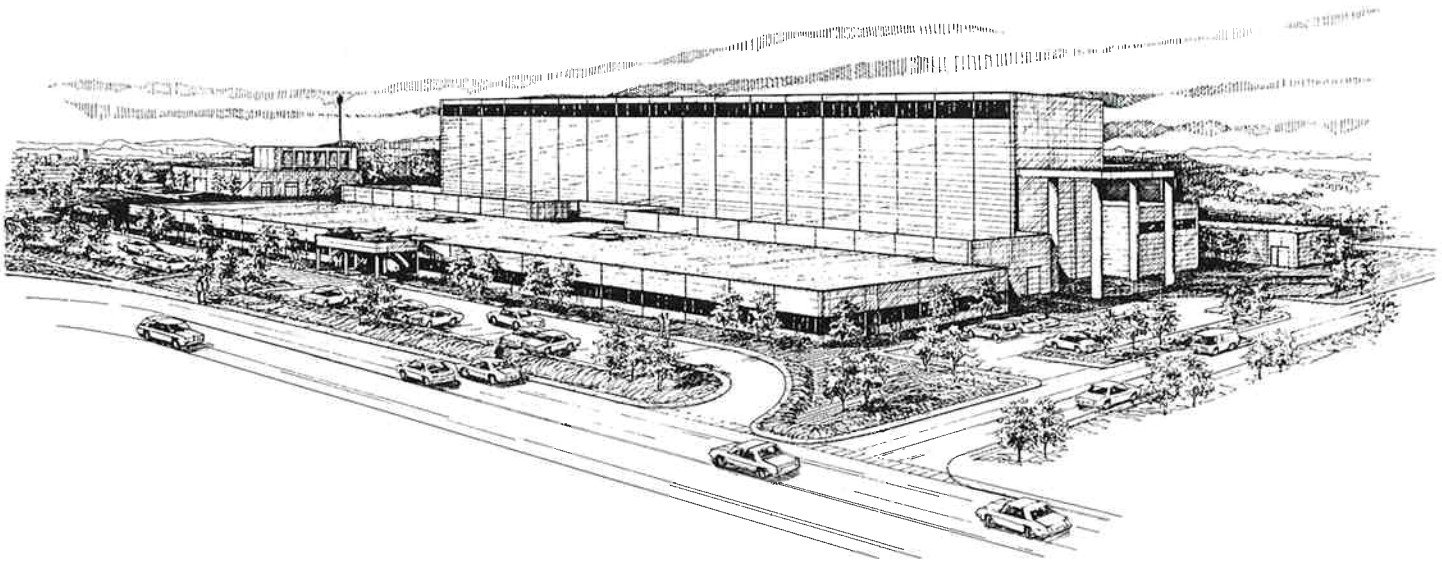
Energy Research

New laboratory for the Center for Energy Studies now makes it possible to conduct energy research on a large scale



This new University research facility, as long as a football field, will house the Center for Energy Studies and the Center for Electromechanics. Under construction at the Balcones Research Center, the building is designed for large-scale energy research projects, including studies of chemical separations, energy conservation, solar energy, and industrial applications of electricity.

A research lab the length of a football field and five stories high.

A bridge crane that can lift ten full-grown elephants fifty feet in the air.

An experimental heat sink equivalent to the air conditioning used by 400 homes.

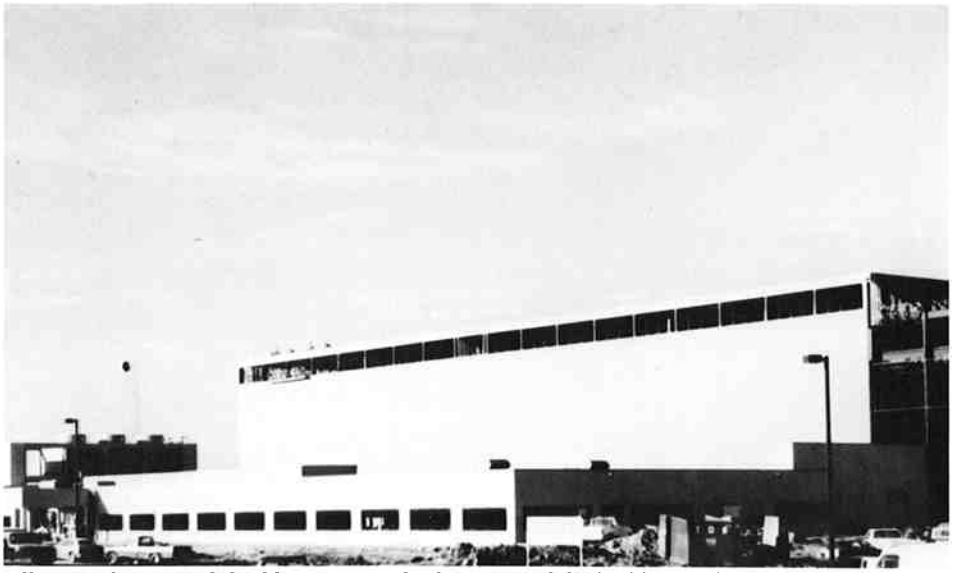
A power supply for one building that will eventually exceed the present supply for the entire University of Texas main campus.

These are some of the features of a new research facility that is being built at The University of Texas Balcones Research Center in Austin. When it is completed in 1985, the two new tenants will move in: the University's Center for Energy Studies and Center for Electromechanics.

The purpose of this remarkable building is energy research on a large scale. The enormous research bay and bridge crane are required to accommodate gargantuan experimental apparatuses, up to the pilot-plant scale. The heat sink is necessary to run experiments in chemical separations, heat pumps, and other topics. The electricity supply will power mainly research devices of the Center for Electromechanics, such as the homopolar generator that produces tremendous, split-second bursts of electricity. Numerous other energy projects and experiments will be carried out in the new facility. At 145,000 square feet, it is one of the largest research buildings ever built at The University of Texas.

The Center for Energy Studies is a child of the 1973 energy crisis. Shortly after Arab nations cut off oil supplies to the United States and then demanded quadruple prices for future oil, a Center for Energy Studies was proposed at The University of Texas at Austin. Realizing the seriousness of the country's energy situation and the value of academic minds studying the problem, UT President Stephen H. Spurr approved establishment of the Center for Energy Studies in 1974.

In the ten years since, the Center has accumulated a long record of energy research. More than 400 research projects have been completed (see related article). But the Center for Energy Studies has had few full-time research staff. It has never had a single laboratory of its own. In-



Offices in the research building occupy the front part of the building. A five-story experimental bay, laboratories, and other offices are located in the rear portion. Cost of the building is estimated at $12.65 million.

stead the Center has supported faculty and graduate students working in the laboratories and other research facilities of the academic departments. The new facility will be a milestone in the Center's development, allowing the Center to create a laboratory research program of its own.

In planning for the Balcones facility, two fundamental questions were asked: What will be the energy problems of the state and nation over the next five to fifteen years? How can the Center for Energy Studies, building on strengths already at the University, contribute to the solution of these problems?

The conclusion was that, although the Center should continue to work on problems of energy supply, the problems the Center is best suited to address anew are *problems associated with energy utilization.*

The basis for this conclusion lies in the radical changes in energy costs that have occurred since the early 1970s. Our basic initial reaction to higher energy costs has been to continue to use proven technologies and practices while increasing their energy efficiency. That approach has been effective in many areas: industrial production, comfort conditioning of homes and workplaces, and transportation.

But oil and gas have risen in cost by an order of magnitude, and the relative costs of other energy sources also have changed drastically. These facts provided an incentive for technology changes beyond energy conservation by itself.

The Center for Energy Studies research activities at Balcones Research Center will address both issues: how to do a more effective job with current technologies and also with new technologies, in terms of energy and cost. The fundamental objectives are to provide desired comfort in our homes and workplaces at the lowest feasible cost and to make our industries more competitive by lowering their costs of production. So far, three areas of research have been planned for the new facility—separations research, conservation and solar energy, and industrial applications of electricity.

Separations Research. The most developed new research area is the Center's Separations Research Program. Processes for separating mixed gases or fluids are essential in many industries. Such processes are often costly and energy intensive. Distillation is a well-known example.

This research effort, led by Dr. James R. Fair and Dr. Jimmy L. Humphrey, involves seven faculty members from chemical engineering and chemistry, several Center staff researchers, and a number of graduate students. The researchers hope to contribute new fundamental knowledge about separations processes, to improve theoretical understanding, and to suggest innovations in separations technology that can be put to use by industry. The main separations processes being studied are distillation, adsorption, absorption/stripping, liquid-liquid extraction, supercritical extraction, membranes, electric-based processes, and separations with chemical reactions. More than thirty companies have pledged support of the program.

Conservation and Solar Energy. In the area of conservation and solar energy, researchers are studying new ways to cool buildings. These include cooling by ventilation, by radiation of heat, by earth contact, and by dehumidification. Cooling is a significant energy demand in Texas and other nearby states because of the warm climate.

Dr. Bruce Hunn heads this effort, with the participation of four mechanical engineering professors, Center researchers, and graduate students.

Evaporative cooling, in particular, is being studied to see if it can be successfully adapted to commercial buildings in humid locales. In gen-

Working on a project to measure Austin solar and wind energy patterns, engineering graduate student Michael Mickalonis adjusts a device that senses diffuse solar radiation.

Dr. Herbert H. Woodson has been director of the Center for Energy Studies since its beginning in 1974. A professor of electrical engineering at The University of Texas, he holds the Ernest H. Cockrell Chair in Engineering. Dr. Woodson has earned numerous professional awards, among them the Nikola Tesla Award from the Institute of Electrical and Electronics Engineers (1984). A member of the prestigious National Academy of Engineering, he chairs the Energy Engineering Board of the National Research Council. Dr. Woodson's research area, in which he has published extensively, is electromechanical and electromagnetic systems. He holds SB, SM, and ScD degrees in electrical engineering from the Massachusetts Institute of Technology.

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eral, passive and hybrid cooling methods are more likely to prove feasible in large commercial buildings than in small buildings like homes because of economies of scale.

Other research is being performed on heat pumps, computer modeling of the energy performance of buildings, foil radiation barriers in attics, absorption cooling, and dehumidifying air with desiccants. A hybrid solar air conditioner invented by mechanical engineering professor John R. Howell is being developed further.

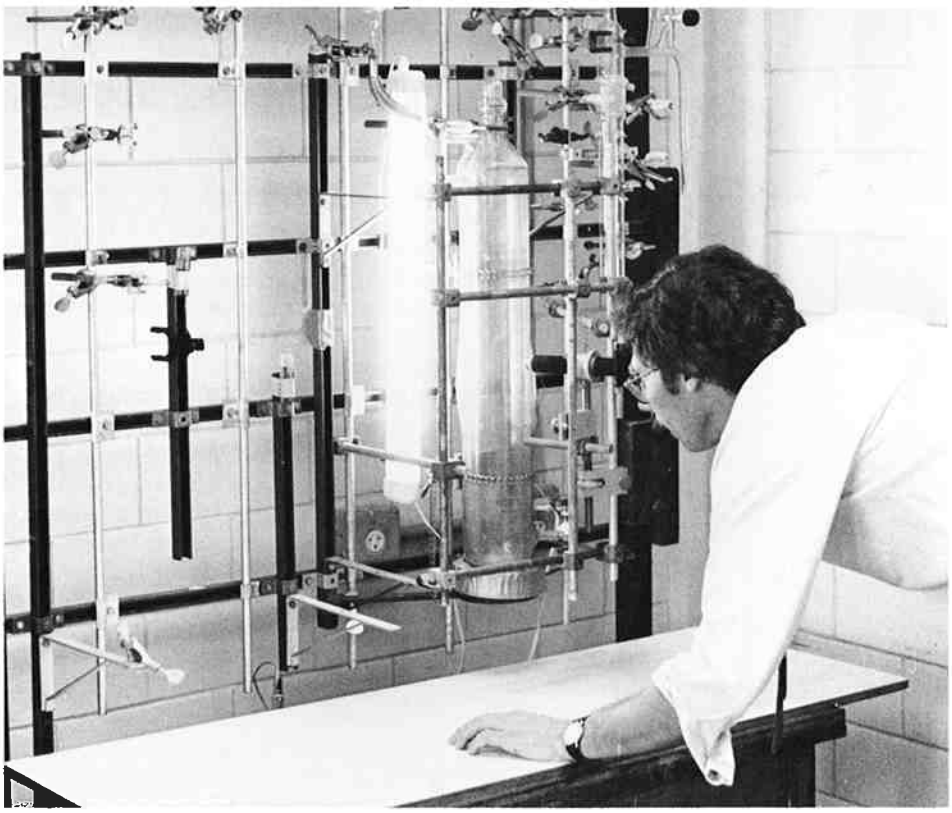
Industrial Applications of Electricity. This program, although not as well developed as the two described above, is especially important for Texas and the surrounding region and will be one of the major research activities at the Center's Balcones facility. Much of this research may be undertaken jointly with the Center for Electromechanics.

The share of industrial energy provided by electricity has steadily increased for several decades. This trend is expected to continue for two reasons. First, the larger the fraction of electricity produced from coal and uranium, the more its cost decreases compared to that of oil and gas. Second, electricity is clean, versatile, and easily controllable which makes it particularly suited to sophisticated technological processes. The effect of increased industrial electrification has been to reduce the cost of production. Center researchers expect to contribute to a continuation of this trend.

Several electricity-based technologies are planned for research and testing in the new facility. Among these are electric-powered heat pumps (both open and closed cycle) to provide process heat less expensively than direct burning of gas or oil in some industrial processes; bulk heating with microwaves to enhance or speed up chemical reactions and to drive moisture out of material more rapidly; electric arcs to produce very high temperatures that can speed chemical reactions and cause new reactions; and variable-speed electric drives with electronic controls to reduce energy consumption and cut production costs in industrial processes.

It is already obvious that the expanded research program of the Center for Energy Studies will be rich in opportunities for faculty research and thesis and dissertation topics. There will also be opportunities for undergraduates to become involved in research. As an extra benefit in the University's classrooms, members of the full-time research staff will be well qualified to teach courses, and they regularly will be available to do so.

The Center's potential for energy research contributions over the next ten years is a challenge. As the Center for Energy Studies meets that challenge, the state and the nation will benefit.



Prof. William Koros, a separations researcher, studies the properties of ultrathin polymer membranes. Some membranes block certain gases or liquids while allowing others to pass through freely. Chemical separation with membranes is a rapidly growing technology that consumes little energy.

Jennifer Evans is a technical writer-editor at the Center for Energy Studies. She is editor of *Energy Studies*, a newsletter published by the center six times a year. She has served on the advisory board to *Spectra*, the journal of the Texas Solar Energy Society, and has been a technical editor with the Texas Governor's Energy Advisory Council. Presently she serves on the steering committee of the Austin Writers' League. She graduated with honors in journalism from The University of Texas at Austin.