Energy Studies

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Newsletter of the Center for Energy Studies of The University of Texas at Austin

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The Center for Energy Studies is a multidisciplinary research center, the central liaison for energy research, education, and public service at The University of Texas at Austin. Dr. John R. Howell is director.

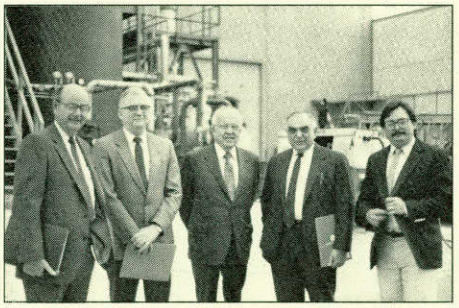
Editor: Jennifer Evans

Center wins $2.6 million in research competition

The Center for Energy Studies will receive $2.6 million for research from the state's Energy Research in Applications Programs, the Texas Higher Education Coordinating Board decided January 27 in Austin.

The coordinating board awarded $14.75 million to sixteen Texas universities and research institutes. Of the total, 32 percent, $4.73 million, went to UT Austin, and 38 percent, $5.28 million, went to Texas A&M University and its associated groups.

The Coordinating Board received 329 proposals for funding. The proposals were evaluated by a panel of energy experts from out-of-state federal, academic, and industrial organizations. Fifty proposals were funded.



The chief executive officer of Sematech toured the Process Energetics Program and Separations Research Program January 18 and met with program leaders. From left: Herbert H. Woodson, UT dean of engineering; Turner Hasty, Sematech director of external resources; Willis Adcock, UT professor of electrical and computer engineering; Sematech CEO Paul Castrucci; and Jose Luis Bravo, manager, Separations Research Program. Sematech is a consortium of fourteen US semiconductor manufacturers aimed at regaining US leadership in the world semiconductor market.

The Energy Research in Applications Program was created by the 70th Texas Legislature and funded from oil overcharge settlements. Companies that violated federal petroleum price controls from 1973 to 1981 were required to return the overcharges. Texas has funded this program and several others from the $250 million it has received so far.

"We're very pleased. The state recognizes our contributions to energy research," said John R. Howell, director of the center.

Herbert H. Woodson, UT dean of engineering, said, "We're pleased about the number of proposals funded through the Center for Energy Studies. They were all quality proposals."

The nine center projects are two- to four-year investigations dealing with combustion, energy conservation in buildings, industrial energy efficiency, pollution control, and electric power. One project is a consortium, or joint, effort with the Texas Engineering Experiment Station at Texas A&M.

Center for Energy Studies projects funded

Development of a Numerical Knock Model for Design of Advanced Fuel-Efficient Machines, Ronald D. Matthews and Steven P Nichols, $241,236

Development of Burners using Porous Ceramics for the Efficient Combustion of Natural Gas, John R. Howell and Philip L. Varghese, $190,000

(Continued on page 4)

CES Update

Office of Director

Steven P. Nichols, deputy director of the center, has been appointed cochairman of the American Bar Association's Division of Physical Sciences. The division is a committee that will study the effects of law on engineering and make recommendations to the ABA. Dr. Nichols is a faculty member in mechanical engineering and an attorney.

Conservation and Solar Energy

Solar energy researchers have measured and analyzed 1985, 1986, and 1987 **solar radiation data for Austin,** Texas, and their results show that solar patterns vary considerably from month to month and year to year.

Gary Vliet, mechanical engineering professor who led the study, said that fluctuation in solar energy is common. How well a solar installation will perform in a certain locale cannot be predicted accurately from a year or two of weather data, he said.

In the past, only partial data and predictions calculated from Austin cloud cover data and solar data from nearby cities were available for Austin's solar resource.

The City of Austin electric utility has funded the solar data collection since 1984. Dave Panico, alternative energy engineer with the utility, said the city uses the information to predict how well different solar technologies will perform in Austin. The statistics will also be used to predict future electricity generation from the city's two 300-kilowatt photovoltaic plants.

Mechanical engineering graduate student Chrys Hadjimarkos checks a shadow-band pyranometer on the roof of the Engineering Teaching Center.

The City of Austin operates a tracking photovoltaic plant, the first in the country to be built by a utility without a federal subsidy.

With funding from the US Department of Energy, a second photovoltaic plant is being built jointly by the city and 3M atop a parking garage at the new 3M facility west of Austin. The $2 million plant contains 720 computer-controlled photovoltaic panels that track the sun and concentrate its rays. The system is scheduled to be completed by early summer, according to Mark O'Neill, vice-president for engineering of ENTECH, the Dallas firm building it.

Those who evaluate the performance of solar systems generally rely on three kinds of measurements:

- direct normal, the energy that comes directly from the sun, usually measured as normal (hitting a surface perpendicular to the sun)
- diffuse, the solar energy that arrives from all other directions, primarily the rest of the sky
- global horizontal, all solar energy (direct and diffuse) hitting a surface parallel to the ground

To take these measurements, three pyranometers on top of the UT Engineering Teaching Center are used.

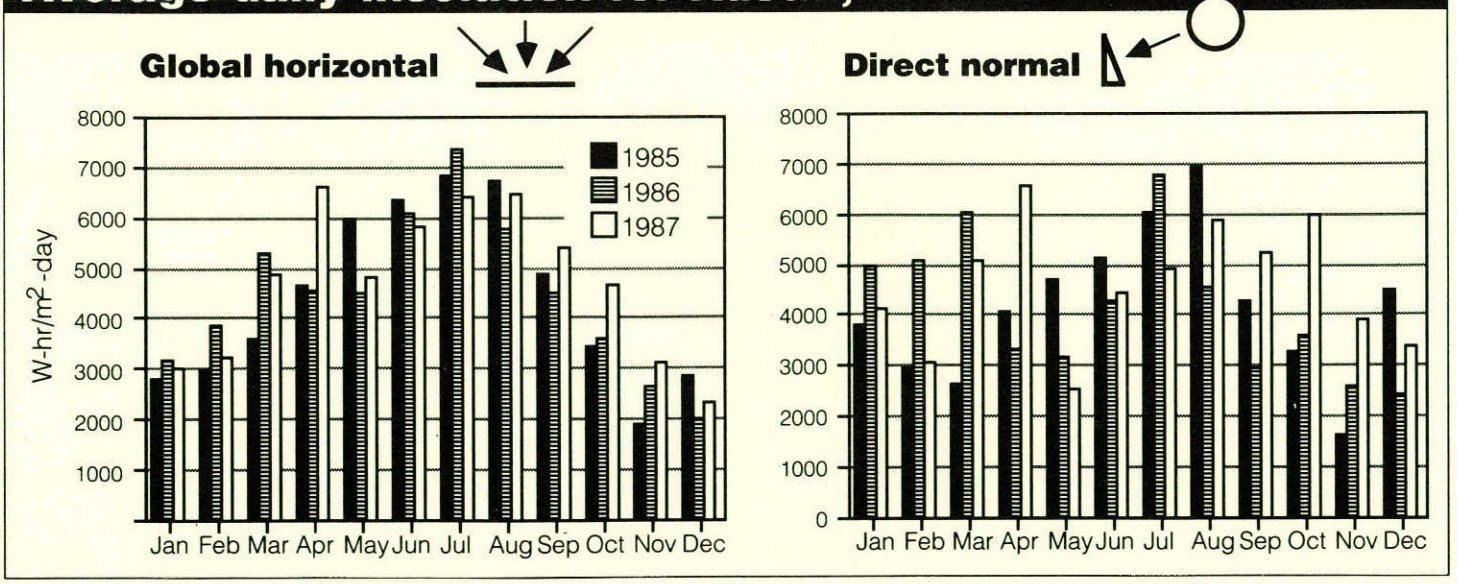
The data have been recorded continuously, except for minor interruptions, since mid-1984, along with other weather data such as temperature and wind speed.

To evaluate solar water heaters accurately, global horizontal radiation data are most useful. Direct normal data are needed for concentrating solar collectors, Dr. Vliet said.

The 1985, 1986, and 1987 Austin data show that direct normal radiation varies much more than global horizontal radiation (see graphs below). While the largest monthly variations in global radiation from year to year were about 20 percent, Dr. Vliet pointed out that direct normal energy for November 1987 was more than twice that for November 1985.

The reason direct normal radiation fluctuates more than global horizontal is cloud cover, he said.

Average daily insolation for Austin, Texas



Clouds blocking the sun reduce direct sunlight considerably more than they reduce global, or total, radiation.

Other participants in the research are Bruce D. Hunn, head of the center's Conservation and Solar Energy Program; and mechanical engineering graduate students Chrys Hadjimarkos and Michael Sloan.

Electric Power

Martin L. Baughman, associate professor of electrical and computer engineering, January 17 was elected chairman of a newly formed task force of the Public Utility Commission of Texas.

The thirteen-member committee, called the Real-Time Pricing and Strategic Rate Design Task Force, will monitor new approaches in the pricing of electricity, keep the commission informed of developments, and encourage research on the topic.

Process Energetics

A study recently completed by Process Energetics researchers Michael R. Sanio and Philip S. Schmidt details the capital and operating costs of **industrial microwave and radio-frequency heating systems.** The study presents a systematic procedure for estimating costs for any given application.

The work was sponsored by the Electric Power Research Institute. The final project report, *Cost Estimation for Industrial Dielectric Heating Systems*, is available. Contact Carlene Wooley, Center for Energy Studies, The University of Texas at Austin, 10100 Burnet Road, Austin, Texas 78758, 512/471-7792.

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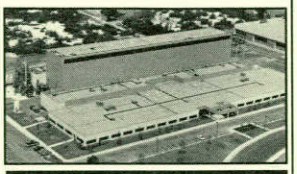
A four-day short course entitled "**Industrial Electrification Technology and Economics**" will be offered May 23-26 in Austin under the sponsorship of the Process Energetics Program.

The course will be taught by Philip S. Schmidt, head of the program, and Frederick T. Sparrow, director of the Institute for Interdisciplinary Engineering Studies at Purdue University. The primary audience is personnel in electric utility marketing, planning, industrial services, and research, as well as manufacturers interested in new production technologies.

Drs. Schmidt and Sparrow will cover principles and applications of electrotechnologies such as microwave and radio-frequency heating, ultraviolet and electron beam curing, laser materials processing, and induction heating, as well as factors influencing production costs of these processes and market trends affecting the penetration of the technologies.

For more information on the short course, please contact Carlene Wooley at 512/471-7792.



1987-88 Annual Report
Center for Energy Studies
The University of Texas
at Austin

The Center for Energy Studies released its **1987-88 annual report** in January, and copies are available free upon request. The 36-page report summarizes the research, publications, budget, and other activities of the center.

To receive a copy, contact Mary Lindsay, Center for Energy Studies, The University of Texas at Austin, 10100 Burnet Road, Austin, Texas 78758, 512/471-7792.

Rotating Machines and Power Electronics

Herbert H. Woodson, former director of the center, has been named to the External Advisory Committee for the Controlled Thermonuclear Research Division of Los Alamos Laboratory. The committee will advise Los Alamos on its research in magnetic fusion energy. Dr. Woodson is dean of the UT College of Engineering and performs research in the Rotating Machines Program.

Separations Research Program

Philip Morris, Inc., has become a new sponsor of the Separations Research Program.

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A process invented in the lab to improve industrial membranes works well on **hollow-fiber membranes,** separations researchers have learned. The discovery brings the center's patented conditioning process a step closer to commercial usefulness.

In bench-scale testing, a conditioned hollow-fiber membrane allowed about twice as much gas throughput as a similar unconditioned membrane, with no loss in purity, according to UT chemical engineering professor William J. Koros.

The types of membranes being studied are used in separations of mixed gases, such as enriching the nitrogen or oxygen content of air. The hollow fibers are made from a rigid aromatic polymer in asymmetric form. Asymmetric membranes consist of two layers: a thin dense skin over a thick foamlike support.

In industrial systems, when the mixed gas passes through the hollow fibers, molecules of one of the gases escape through the membrane walls of the fibers into a surrounding vessel and are thus separated.

The conditioning process that boosts the performance of the membrane involves putting a penetrant such as carbon dioxide into the membrane, and pressurizing it. The shortest exposure time found to be effective was 15 minutes, but longer times of 2 to 24 hours appear to be more desirable. The penetrant causes the structure of the membrane to swell infinitesimally.

Dr. Koros said future research will deal with conditioning of dense-film, flat asymmetric, and hollow-fiber membranes at the bench scale and

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in a larger continuous-loop system.

The patented process was developed by Dr. Koros and chemical engineering graduate students Susan Jordan and Greg Fleming, with recent work by graduate student Mike Henson. The invention grew out of research funded by IBM, the National Science Foundation, and the Separations Research Program.

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Thirty Venezuelan engineers learned about advances in distillation from Jose Luis Bravo, manager of the Separations Research Program. He was invited to Caracas, Venezuela, December 21-23 to teach a short course on the subject. The course was sponsored by INTEVEP, the country's petrochemical research and development company. ■

Thirty-nine Texas state legislators have asked to receive issues of Energy Studies. The center welcomes these new readers.

(Continued from page 1)

Development of Fabric Shading and Dehumidification for Building Comfort Control, Bruce D. Hunn and Maureen M. Grasso, $270,052

Energy Savings: Supercritical Water Oxidation of Toxic Wastes and Sludges, Earnest F. Gloyna and Keith P. Johnston, $189,838

Improvement of End-Use Electric Power Quality through the Use of Active Power Line Conditioners, W. Mack Grady, $161,690

Minimizing Costs of Air-Conditioning in Texas: Use and Optimization of Thermal Storage Systems, Jerold W. Jones and Martin L. Baughman, $242,338

Performance Testing and Evaluation of Indirect Evaporative Cooling Equipment, Bruce D. Hunn and John R. Peterson, $257,922

Radiatively Enhanced Processing of Complex Materials, Philip S. Schmidt and John A. Pearce, $369,831

Texas Drying Research Consortium (a joint effort by the center and the Texas Engineering Experiment at Texas A&M University), Philip S. Schmidt, $678,610

■ Other UT Austin projects funded

Energy-Efficient Purification Processes using Supercritical Fluids, Keith P. Johnston, $214,710

Explosive Fracturing of Geothermal and Hydrocarbon Reservoirs, Eric P. Fahrenthold, $175,871

Integrated A1 1-x Ga x/Si Multijunction Solar Cell, Joe C. Campbell, $243,746

Maximization of Petroleum Recovery (a consortium with Texas A&M University, University of Houston, and Texas Tech University), Márcus E. Milling, $708,750

Net Energy Analysis of Alternative Transportation Fuels, Jurgen Schmandt, $114,198

Optimization of Surfactants for Mobility Control, $384,840, Robert S. Schecter

Thermochromic Window Treatments for Energy-Efficient Buildings, Rodger M. Walser and Michael F. Becker, $286,000 ■