

Energy Studies

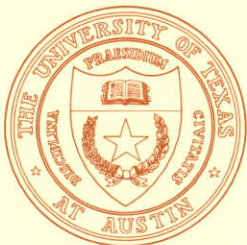
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Newsletter of the Center for Energy
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at Austin

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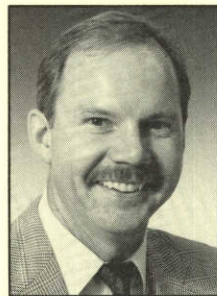
The Center for Energy Studies is a multidisciplinary research center, the central liaison for energy research, education, and public service at The University of Texas at Austin. Dr. John R. Howell is director.

Editor: Jennifer Evans



Center launches program to study energy issues

The Center for Energy Studies has organized its research on energy issues into a new program called the Energy Systems and Economics Program, according to John R. Howell, director of the center. Dr. Howell named Martin L. Baughman to head the program and Krishan Malik to serve as its manager.



Martin L. Baughman

1980 to 1983. His areas of expertise are energy modeling and econom-

ics. Dr. Malik is a senior lecturer in petroleum engineering, with research background in energy economics, oil and gas finance, energy policy analysis, petroleum geology and petroleum engineering. He is a senior research fellow of the center and of the UT Center for Petroleum and Geosystems Engineering.

A third researcher active in the program is Steven P. Nichols, who is an attorney, director of the mechani-

cal engineering Senior Design Projects Program, and deputy director of the center.

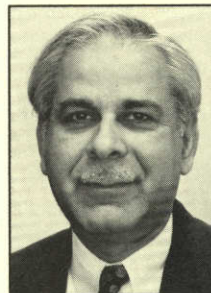
The University of Texas at Austin has a large reservoir of expertise on energy, Dr. Baughman said. A goal of the Energy Systems and Economics Program is to involve many of the UT Austin faculty, particularly in the fields of government, law, economics, and business. Drs. Baughman and Malik are seeking discussions with UT researchers and with potential sponsoring organizations.

The amount of research on energy issues has declined radically in the past five years, Dr. Baughman said. "I see a complacency about energy these days, and this attitude is making us too nearsighted.

"Our energy problems have not gone away. We're getting lots of signals that we may be headed toward some sort of an energy crunch." The greenhouse effect, acid rain, energy price increases, or electricity shortages each might eventually trigger an energy crisis, he said.

Research on energy regulations and similar issues has generally tended to focus on the impacts on the consumers, according to Dr. Malik. "In a complex economy like ours, policy changes may have effects very different from those intended, unless system relationships are first well understood.

"The petroleum industry of the future is likely to be very different from
(Continued on next page)



Krishan Malik

what it has been in the past," Dr. Malik said, "because of structural changes that have occurred in the energy economy."

Four major areas of research have been targeted for the program:

- ◆ Forecasting, pricing, and market analysis
- ◆ Governmental regulations
- ◆ Socioeconomic issues
- ◆ Environmental issues

'Our energy problems have not gone away.'

"I'm particularly interested in topics like productivity measurement and the effects of productivity improvement on economic growth," Dr. Baughman said. "Changes in the competitive environment, particularly in the natural gas and electric utility industries, are fertile areas for research."

The Energy Systems and Economics Program will take an interdisciplinary approach because the problems are interdisciplinary. Dr. Baughman said one valuable approach is for researchers familiar with an energy technology to work with economists who deal with distributing costs and benefits among parties at interest.

Ties with the proposed Environmental Solutions Program, a joint effort of the center and the UT Center for Research in Water Resources, will be a strength of the program, Dr. Nichols said. [See *Energy Studies*, November/December 1989.]

The Center for Energy Studies has a long history of analyzing energy issues. Its first major project of this kind was an evaluation of the nation's energy situation, performed for the Office of Technology Assessment in 1975. The center participated in interdisciplinary evaluations of the national energy plans of the Carter and Ford administrations.

Center researchers have carried out more than 60 studies on social, economic, and governmental issues related to petroleum, electric power, geothermal energy, nuclear, coal,

and energy as a whole. Part of this research has investigated the economic effects of proposed energy regulations. Other studies have dealt with the energy decision-making process, energy issues in European countries, and energy-environmental interactions.

Three current studies are under way or recently completed:

- ◆ A review of the economic analysis used by the Lower Colorado River Authority, a major Texas utility, in its recent decision to switch from locally mined lignite to western coal for part of its electric power generation. The study, under way since November, is funded by PSE, Inc., and is led by Drs. Baughman, Malik, and Nichols.

- ◆ An evaluation of the federal proposal to build a monitored retrievable storage facility for temporary processing and storage of the

country's high-level nuclear waste. This study was largely carried out by researchers in the UT LBJ School of Public Affairs and was led by Marlan Blissett.

- ◆ A Delphi poll survey of 98 nuclear experts on the future of nuclear power in the United States. The study, the dissertation project of Charles H. Davis IV, is nearing completion.

To receive a brief description of the Energy Systems and Economics Program, and to find out further information, please telephone or write
 Dr. Martin L. Baughman, Program Head, (512/471-5376) or
 Dr. Krishan Malik, Program Manager (512/471-7792 or 1283)
 Center for Energy Studies
 The University of Texas at Austin
 10100 Burnet Road
 Austin, Texas 78758 ■

UT Austin Energy

Texas universities begin \$16-million study to increase oil production on state lands

A four-year, \$16-million study being conducted by a consortium of four Texas universities could add more than \$1 billion to the state's Public School Fund, geologists at The University of Texas at Austin say.

The study by researchers at UT Austin, Texas Tech University, Texas A&M University, and the University of Houston focuses on increased oil and gas production on state lands, much of which will be derived from lands in the bays, lagoons, and offshore regions of the Gulf Coast.

The Public School Fund receives royalties of one-eighth to one-sixth for oil and gas recovered on approximately 13.5 million acres of state lands. The royalties form the principal of the fund, which is administered by the General Land Office for part of the state's educational funding.

The UT Austin Bureau of Economic Geology will serve as prime contractor for the project. The Center for State Lands Energy Resource

Optimization at the bureau will coordinate the overall program and perform most of the research. Researchers from the bureau and UT's departments of geological sciences, petroleum engineering, and chemistry will participate.

"This study is designed to take the expertise of the universities and put it together in a very structured way toward the lands that are owned by the people of the state and add revenue to the state's school fund," said William Fisher, director of the Bureau of Economic Geology and chairman of the Department of Geological Sciences. "This grant, along with existing significant programs at the Bureau of Economic Geology and in petroleum engineering, makes the oil and gas recovery effort at UT Austin by far the largest in the nation." (Continued on page 5)

Correction: In the November/December 1989 issue, Dr. Mina Mohammadioun was mistakenly left off the list of researchers participating in a UT study on stabilizing US oil prices.

CES Update

Office of Director

UT Austin students building a solar car to compete in a national cross-country race in July hope to test-drive their entry in March, but are finding their biggest difficulty is money.

"We could have designed a bag of bolts that can go, but we're building a car to win," said Matt Cranor, a senior in mechanical engineering and leader of the student team.

The UT students and their car will compete against cars built by students at 31 other US universities in a race from Florida to Michigan sponsored by General Motors. A General Motors car won World Solar Challenge race across Australia in 1987. This year GM will sponsor the top three United States student teams in the 1990 World Solar Challenge in Australia in November.

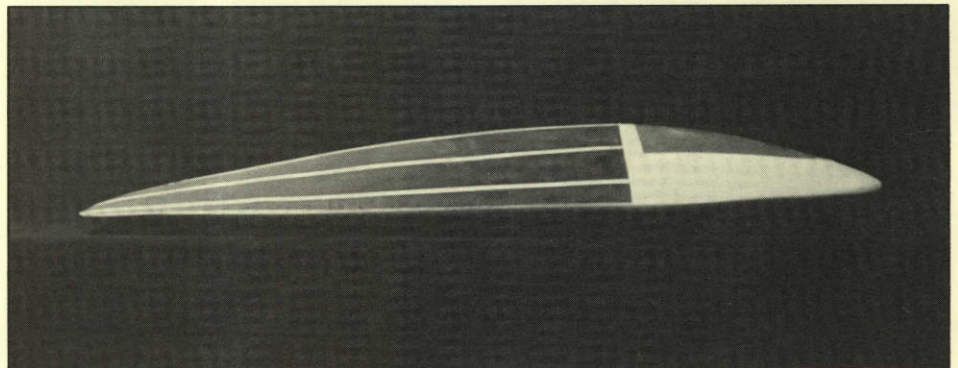
The students say they need to raise \$100,000 more to pay for the car's high-tech components and the cost of sending the twelve- to fifteen-person team on the ten-day race. The UT Engineering Foundation and the UT Ex-Students' Association are appealing for donations on behalf of the student team.

GTE Spacenet donated 66 nickel-hydrogen batteries normally for use in satellites, which are valued at \$1 million. Bell Helicopter has contributed design advice and materials. Gleasman Corp. has allowed the students free use of a patented, high-efficiency, continuously variable transmission. A half-dozen UT faculty members are advising. Several cash contributions have been made: General Motors (\$5,000), US Department of Energy (\$2,000), and the Venezuelan oil research institute INTEVEP (\$1,000). Additional support has come from the UT College of Engineering, Department of Mechanical Engineering, and the Center for Energy Studies.

The students are working in five teams on the car's structure, drive train, suspension, power system, and



Engineering students work on the plaster mold from which the solar car's hull will be cast.



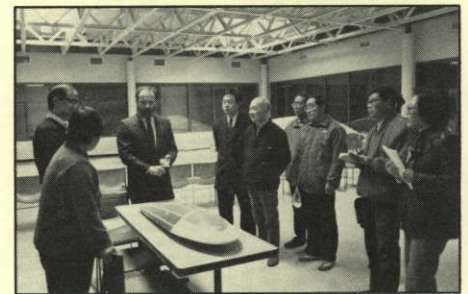
No gasoline: a model shows the long photovoltaics panels (upper rear surface) that will power the UT car.

driver controls. The group is in the process of casting the lightweight hull of carbon fiber and epoxy, the same composite used in fighter jets. The design borrows a lot from bicycle technology, Mr. Cranor said.

The car will run on electricity from photovoltaics panels mounted on the upper rear surface. The UT solar car will probably cruise at an average speed of 50 miles per hour and be able to reach 70 mph on flat road, said Mr. Cranor.

All the students are undergraduates, and most are members of the Society of Automotive Engineers. They are working on the car in a Center for Energy Studies lab at night and on weekends, often until midnight, Mr. Cranor said.

Steven P. Nichols said he was amazed at the hours the students have put in working on the solar car, on top of their school work. "They do



Steven P. Nichols, center deputy director, explains the solar car project to engineering professors from China.

it because they simply enjoy engineering. This experience is invaluable in their engineering education."

John R. Howell, director of the center, has been named an associate editor of the *Journal of Thermophysics and Heat Transfer*, published by the American Institute of Aeronautics and Astronautics.

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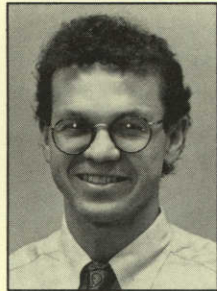
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The 1988-89 annual report of the Center for Energy Studies is available free upon request. The 48-page book covers the research and public service activities, publications, and budget of the center.

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

■
Three faculty members associated with the center have been made full professors, effective September 1990: Martin L. Baughman and John A. Pearce, electrical and computer engineering; and Dale E. Klein, mechanical engineering. Theodore L. Bergman likewise has been promoted to associate professor of mechanical engineering.

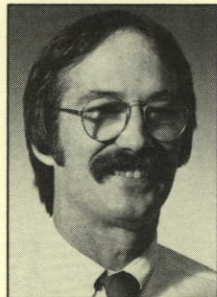
Combustion

Ronald D. Matthews, combustion researcher and associate professor of mechanical engineering, has



Ronald D. Matthews

been named Outstanding Faculty Advisor by the national Society of Automotive Engineers. The UT Austin SAE group is one of 165 student chapters in the country.



Matthew Hall

■
Matthew Hall has joined the Combustion Research Group as a research fellow in the area of laser diagnostics in engines.

Electric Power

Japan and the United States share some striking similarities in their electricity use, and some differ-

ences, according to a study recently completed that compared the two nations' electricity patterns.

Martin L. Baughman, associate professor of electrical and computer engineering, and Tatsuhiro Takatsuka, graduate student in the Energy and Mineral Resources Program, surveyed Japanese and United States electric power use and supply patterns.

Both nations are large consumers of electricity and both are unusual among developed countries in that about three-fourths of their electricity comes from utilities that are privately rather than publicly owned. In Japan electricity costs about twice as much as in the United States, and about half as much per capita is consumed. A typical Japanese home uses only about one-third the electricity of an American home, due in large part to its smaller size and few appliances. Energy is more costly in Japan and conservation receives more effort because the country has no major energy resources of its own and must import nearly all its energy.

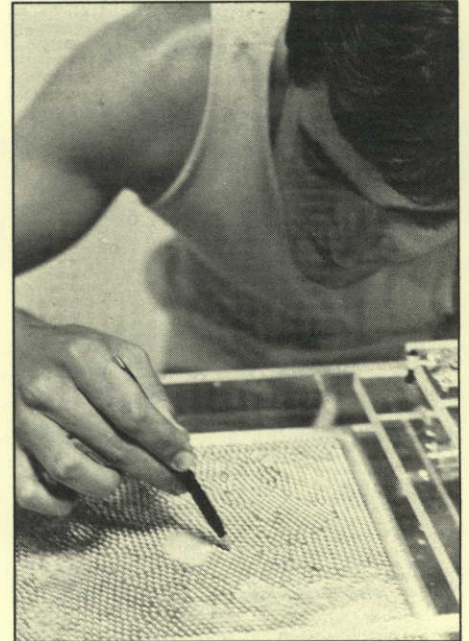
Since 1982 electricity prices have gone down in Japan and up in the United States. Electricity use in both countries has increased since World War II. Demand for electric power is expected to continue to rise and to become a larger fraction of total energy use in both countries.

Even though the United States has more regulations that support cogeneration, Japan has about three times the amount of cogeneration and self-generation: 9.7 percent versus 3.7 percent in 1985.

Process Energetics

Process Energetics researchers have developed methods for measuring and quantifying the effects of **surface roughness in drying** by using an infrared camera and naphthalene sublimation.

The infrared photography approach has proved to be a feasible, nonintrusive way to gather data as moisture dries from a bumpy or complex surface, said Theodore L. Bergman, assistant professor of mechanical engineering.



Student Tom Labiosa prepares a layer of glass beads in a study of the effects of surface roughness on the drying process.

Dozens of tiny temperature probes, which might disturb the experimental material, are not needed when infrared photography is used. Each pixel of the infrared image can be digitized and rendered as a temperature data point.

In the experiments, Dr. Bergman and mechanical engineering graduate student Tom Labiosa examined the drying of a layer of spherical beads saturated with water; beads of sizes ranging from 1 to 12 millimeters were used. The roughest surface

(Continued on page 5)



Austin Mayor Lee Cooke presents a \$3,000 scholarship December 12 to David Shaw, a UT mechanical engineering senior and researcher in the center's Process Energetics Program. The American Public Power Association granted the scholarship for Mr. Shaw's proposal to investigate the use of microwaves to regenerate desiccants in dehumidification air conditioning.

studied was that made up of the largest beads.

As expected, the heat transfer for the roughest surface was about 50 percent higher than that for a smooth surface, Dr. Bergman said. In contrast, mass transfer was about 50 percent lower.

"Under certain conditions, we have shown, the prescriptions used in different models of drying may need to be modified to account for changes in surface roughness as drying proceeds," said Dr. Bergman. He called the project "an incremental step" toward accurate models of the drying process.

For further study of drying, Dr. Bergman and Mr. Labiosa used a second technique that employs the substance mothballs are made of, naphthalene. The beads were embedded in a naphthalene layer. Over several days, the naphthalene sublimated: changed from a solid directly to a gas.

The naphthalene allowed the researchers to examine the mass transfer rates from the surface under conditions more controlled than with water.



A four-day short course entitled "**Industrial Electrification Technology and Economics**" will be offered May 22-25 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 trends affecting their market penetration.

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

Separations

Separations researchers are now **using the video camera** to study



Center researchers are testing distillation components invented by Trent (left) and Byron Parker of Salt Lake City, Utah. Jose Luis Bravo (right), manager of the Separations Research Program, said the testing, done in the center's pilot-scale distillation tower, is sponsored by the US Department of Energy and the National Bureau of Standards.

and record events occurring in pilot-scale experiments on distillation, liquid-liquid extraction, and supercritical extraction.

The videotapes are made through observation ports in the center's pilot-scale research equipment, which is almost unique in the university environment, according to researcher Frank Seibert. Most experts on distillation, liquid-liquid extraction, and supercritical extraction have never witnessed the processes directly.

The program's first video documentation of a research project was published recently, and sponsors are starting to request copies, said

Charles Tischler, who makes the videotapes. He is information coordinator for the Separations Research Program.

Distillation, liquid-liquid extraction, and supercritical extraction involve study of liquids, gases, or both mixing together as fast-moving drops and bubbles. The better the mixing, the more efficient the separation.

Viewed in slow motion on tape, the motions, sizes, and patterns of the components can be examined closely and measured, Mr. Tischler said. ■

(Continued from page 2)

Approximately 400 million barrels of proved oil reserves remain on state lands, along with 2 billion barrels of mobile oil, 4 billion barrels of immobile or residual oil, and about 3 trillion cubic feet of natural gas. Mobile oil can be recovered by conventional

drilling, while residual oil requires chemical modification for recovery.

But, current conventional drilling methods result in poor draining of reservoirs. Only an average of 35 percent of the available oil and 65 to 70 percent of the gas is extracted.

Dr. Fisher said the scientists

hope to get as much as 45 percent of the oil and 15 to 20 percent of the natural gas.

Bureau studies show that recovery of just 1 percent more of the oil at one-eighth royalty and \$20 a barrel would add \$150 million to the Public School Fund. ■

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Large solar conference March 19–22 offers exhibits, tours, workshops

The largest US renewable energy conference in years, the National Solar Energy Conference, will take place in Austin, Texas, March 19–22.

For the first time, the country's two major solar events will be held together—the American Solar Energy Society's SOLAR 90 and the Solar Energy Industries Association's SOLTECH 90.

The focus of SOLAR 90 and SOLTECH 90 will be on the latest developments in solar technology and research, according to Bruce D. Hunn, who is head of the center's Building Energy Systems Program and former chairman of the American Solar Energy Society. Twelve workshops, five tours, and more than 180 technical presentations will be given.

Some of the topics of the technical sessions include

SOLAR 90: photovoltaics technology, solar water heating, daylighting, occupant comfort, building envelope, solar ponds, sustainability, passive design, public policy, solar thermal, solar resource assessment, vernacular architecture, microclimate and landscaping, and passive cooling.

SOLTECH 90: photovoltaics, solar buildings, solar thermal power, federal research on photovoltaics, building energy efficiency, solar thermal electricity generation, assessing energy savings in buildings, federal research in solar buildings, renew-

able electricity, and integrated buildings.

A large solar products exhibit organized by the Solar Energy Industries Association will be open to conference attendees. Events will be held at the Austin Hyatt Regency and Palmer Auditorium.

One of the highlights of the meeting will be a speech by Philip Hawes, who is coarchitect of Biosphere 2. Biosphere 2 is a sealed, self-sustaining structure being built near Tucson, Arizona. Six people will live in the structure for two years, generating all air, food, and water from solar energy and the environment inside.

The cost for nonmembers to attend both conferences is \$585 after February 15; SOLAR 90 only, \$360 (includes luncheon and proceedings); SOLTECH 90 only, \$300. Students and members of four participating societies are eligible for discounts.

The public is invited to attend a free educational exhibit on solar energy, other renewable forms of energy, and energy conservation by two dozen organizations. The educational exhibit will be open at the Austin Palmer Auditorium noon–6:30 p.m., March 19; 2–6:30 p.m., March 20; and noon–4 p.m. March 21.

To find out more details, contact the American Solar Energy Society, 2400 Central Ave., Suite B–1, Boulder, Colorado 80301, 303/433-3130,

or the Solar Energy Industries Association, 1730 North Lynn Street, Suite 610, Arlington, Virginia 22209, 703/524-6100. ■

Anyone may register to attend the conferences' workshops and tours (nonmember price given), although space is limited:

March 17:

Basic Photovoltaics, 1–5 p.m. (\$60)
Basic Passive Solar Design, 8 a.m.–1 p.m. (\$50)
Basic Active Solar Systems, 2–5 p.m. (\$50)
Residential Energy Conservation, 8:30 a.m.–noon (\$50)
Xeriscape, 2:30–6 p.m. (\$50)

March 18:

Advanced Photovoltaics/PV System Design, 8 a.m.–5 p.m. (\$120)
Passive Cooling, 1:30–5:30 p.m. (\$90)
Wind Energy and Wind Turbines, 1–5 p.m. (\$50)
Technical Writing, 2–4 p.m. (\$40)
Passive Solar Homes Tour, 9 a.m.–1 p.m. (\$25)
Municipal and University Research Facilities Tour, 9 a.m.–noon (\$25)

March 22:

Commercial and Institutional Passive Daylighting Tour, 1–5 p.m. (\$25)
Photovoltaics Tour, 1–5 p.m. (\$25)

March 23:

Daylighting, 9 a.m.–3 p.m. (\$120)
Computer Applications in Energy Analysis, 3:30–6:30 p.m. (\$50)
Sustainable Cities, 9 a.m.–noon (\$55)
El Paso Solar Pond Research Center and More Tour, all day (call 915/532-4999 for details)