

Energy Studies

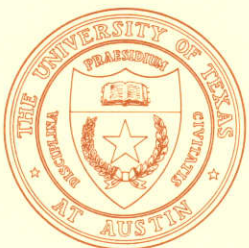
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**Newsletter of the Center for
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sity of Texas at Austin**

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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. Herbert H. Woodson is director.

Editor: Jennifer Evans



Hance invites OPEC President to Texas

Texas Railroad Commission Member Kent Hance told 400 high school students and teachers June 6 that he has invited the president of OPEC to visit Texas in late summer or fall.

The commissioner delivered the keynote address of the Texas Energy Science Symposium at The University of Texas at Austin.

Commissioner Hance, whose attendance at OPEC meetings has been in the news, said the United States should stop sitting on the sidelines when OPEC meets to decide the world price of oil.

"What they decided at the OPEC meeting in Vienna had more effect on the economy of Texas than anything the Texas Legislature did," he said.

Commissioner Hance said he endorses an OPEC agreement to reduce oil production by 500,000 barrels a day and stabilize it there, which would mean a higher price of \$18 to \$19 a barrel.

That change might raise gasoline prices by 3 cents a gallon, he told the group, but is worth it because a stable price would stimulate domestic oil production and help economic recovery of oil-producing states.

More domestic oil production would strengthen national security, according to the commissioner. At present, 40 percent of US oil demand is supplied by foreign governments. Commissioner Hance termed the growing reliance on outside sources "scary" and said the Texas Railroad Commission projects that percentage to rise above 50 percent within 18 months.

The Texas Energy Science Symposium, now in its 28th year, is sponsored by the university and the Texas Atomic Energy Research Foundation. Current chairman of the steering committee is Herbert H. Woodson, director of the center. ■

**Woodson
Named
Texas
Engineer
of the Year**
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Architecture

- ARC 334K Environmental Controls I
- ARC 334L Environmental Controls II
- ARC 134M Environmental Controls Lab
- ARC 384L Environmental Controls II
- CRP 383 Application of Techniques in Environmental Analysis
- CRP 384K Natural Resources/Environmental Workshop

Business Administration

- FIN 390 Economic and National Security Policies (MAN 385, Law 379M)
- BL 372 Oil and Gas Law
- IB 350 International Trade
- IB 363 International Commercial Relations and Policies
- IB 370 World Resources and International Trade
- IB 378 International Business Operations
- IB 395* Multinational Business Operations
- IB 395* International Marketing and Middle Eastern Markets (MES 381)
- MAN 385 Economic and National Security Policies (FIN 390, Law 379M)
- MKT 372 International Business in the Middle East
- MKT 372 Economic Activity and Resource Distribution (GRG 335, IS 320)

Engineering

- CE 341 Environmental Pollution Engineering
- CE 342 Water Pollution Control
- CE 345 Industrial Hygiene and Toxicology
- CE 346K Hazardous Waste Management
- CE 358 Introductory Ocean Engineering
- CE 364 Design of Pollution Control Systems
- CE 377K Environmental Resources and Technological Risk (EE 367L, ME 379M)
- CE 377K Energy Policy and Ethical Conflict (EE 367L, ME 379M)
- CE 385J* Hazardous Waste Management
- CE 385L* Water and Wastewater Treatment
- CE 385N Industrial Wastewater Treatment
- CE 390L* Environmental Analysis
- CE 390N Water Pollution Chemistry
- CE 396L* Air Pollution Chemistry
- CE 397 Geotechnical Waste Disposal

*Graduate course

UT's Energy-Related Courses and Degrees

The University of Texas at Austin offers a wide variety of courses that are energy related—more than 170 undergraduate and 200 graduate courses. Students interested in majoring in an energy-related field will find 40 degrees (or program concentrations) to choose from. These are also listed below.

Not every course is offered every semester. Courses in this list have been offered at least once between spring 1987 and fall 1988, or are planned.

To learn more about earning an undergraduate degree, refer to the catalogue of the college or school in which it is offered (\$1 each). For graduate degrees of all kinds, refer to the graduate school catalogue (\$2). Catalogues can be purchased from the Registrar, MAI 1, The University of Texas at Austin, Austin, Texas 78712.

- CHE 322 Thermodynamics
- CHE 352 Chemical Process Economics and Management
- CHE 357 Technology and Impact on Environment
- CHE 363 Unit Operations II—Separations Processes
- CHE 372 Reactor System Plan and Design
- CHE 373K Process Planning and Design
- CHE 376 Process Analysis and Simulation
- CHE 381N* Fluid Flow and Heat Transfer
- CHE 388K* Separations Processes
- EE 325 Electromagnetic Eng. I
- EE 325K Electromagnetic Eng. II
- EE 335M Electrical Machines and Magnetic Devices
- EE 341 Electromechanical Systems I (EE 335M)
- EE 264 Electrical Engineering Lab II
- EE 379K Power Electronics
- EE 464K Electrical Engineering Projects Lab

- EE 367L Environmental Resources and Technological Risk (CE 377K, ME 379M)
- EE 367L Energy Policy and Ethical Conflict (CE 377K, ME 379M)
- EE 368 Electrical Power Transmission and Distribution
- EE 369 Power Systems Engineering
- EE 379K Environment, Resources, and Technological Risk
- EE 379K Technological Innovation and Bioethics
- EE 383L* Electromagnetic Field Theory
- EE 394* Power Transmission and Distribution Topics
- EE 394* Economic Operation of Power Systems
- EE 394J* Applied Solar Energy (ME 394J*)
- EE 394J* Economic Analysis of Power Systems (ME 394J*)
- EE 394J* Energy Conversion Engineering (ME 394J*)
- EE 394J* Power Systems Eng. I
- EE 394J* Power Systems Eng. II (ME 394J*)
- EE 395M Electrical Machines and Magnetic Devices
- EE 397K* Advanced Studies: Introduction to Plasma Dynamics
- EMR 396* Seminar in Energy and Mineral Resources
- ME 320 Applied Thermodynamics
- ME 326 Thermodynamics I
- ME 328 Thermodynamics II
- ME 335K Principles of Comfort Control
- ME 337 Nuclear Engineering: Introduction to Nuclear Power Systems
- ME 339 Heat Transfer and Rate Processes
- ME 351K Engineering Considerations in Fusion Reactor Design
- ME 360N Intermediate Heat Transfer
- ME 361E Nuclear Reactor Engineering
- ME 361F Nuclear Engineering: Introductory Lab
- ME 361G Nuclear Reactor Operations
- ME 361M Thermodynamics of Materials
- ME 362K Readings in Engineering (problems of society, technology, and energy)
- ME 363L Energy Systems Laboratory
- ME 364K Air Conditioning and Refrigeration
- ME 374L Design of Thermal Systems
- ME 374S Solar Thermal Applications
- ME 379K Combustion Engine Processes
- ME 379M Environmental Resources and Technological Risk (CE 377K, EE 367L)
- ME 379M Energy Policy and Ethical Conflict (CE 377K, EE 367L)
- ME 381Q* Advanced Thermodynamics
- ME 381R* Conduction Heat Transfer
- ME 381R* Convective Heat Transport
- ME 381R* Radiation Heat Transfer
- ME 382Q* Solar Thermal Energy System Design
- ME 382R* Fundamentals of Combustion Science

Undergraduate Degrees

(Selected Programs or Options in Parentheses)

Architectural Engineering (Environmental Systems)

Architectural Studies

Architecture

Business Administration

(Engineering Route to Business, Petroleum Land Management, International Business)

Chemical Engineering (Environmental Engineering)

Chemistry

Civil Engineering (Environmental Pollution)

Economics

Electrical and Computer Engineering (General Electrical Engineering, Power Systems and Energy Conversion)

Engineering Science (Environmental Engineering, Geological Engineering, Nuclear Engineering, Ocean Engineering)

Geography

Geological Sciences

Government

Mechanical Engineering (Energy and Fluids Systems Engineering, Nuclear Engineering)

Petroleum Engineering (Oil and Natural Gas Reservoir Engineering, Oil and Natural Gas Production Engineering, Petroleum Finance and Management)

Physics

ME 387Q*	Thermodynamics of Materials	PEN 383*	Petroleum Engineering
ME 388Q*	Nuclear and Neutron Physics	PEN 383*	Advanced Drilling Fluids
ME 388Q*	Nuclear Reactor Theory I	PEN 383*	Economics of Mineral Engineering
ME 388R*	Dynamics of Nuclear Systems	PEN 383*	Thermal Recovery
ME 388R*	Nuclear Power Engineering	PEN 383*	Two-Phase Flow in Pipes
ME 388R*	Nuclear Radiation Shielding	PEN 383*	Instrumentation and Experimental Methods
ME 389R*	Design of Nuclear Systems	PEN 383*	Modern Drilling
ME 394J*	Applied Solar Energy (EE 394J*)	PEN 383*	Production Logging
ME 394J*	Economic Analysis of Power Systems (EE 394J*)	PEN 384*	Volume and Phase Relationships in Oil and Gas Mixtures
ME 394J*	Energy Conversion Engineering (EE 394J)	PEN 385M*	Advanced Well Logging and Correlation
ME 394J*	Power Systems Engineering II (EE 394J*)	PEN 386K*	Advanced Fluid Flow in Porous Media
ME 397*	Current Studies in Gas Radiation	PEN 387*	Secondary Recovery of Petroleum
ME 397*	Electric Power and the Environment	PEN 387K*	Fundamentals of Enhanced Oil Recovery I
ME 397*	Electrothermal Energy Conversion	PEN 387L	Fundamentals of Enhanced Oil Recovery II
ME 397*	Studies in Advanced Experimental Methods for Thermal and Fluid Systems	PEN 392K	Numerical Simulation of Reservoirs I
ME 397K*	Seminar: Thermal/Fluid Systems		
ME 397K*	Seminar: Thermosciences		
ME 397K*	Seminar in Nuclear Engineering		
PEN 102	Introduction to Petroleum Engineering		
PEN 320	Petroleum Exploration and Production		
PEN 323	Fluid Flow in Porous Media		
PEN 323	Petroleum Exploration and Production		
PEN 324	Petrophysics and Fluid Flow Lab		
PEN 326	Thermal and Phase Behavior of Hydrocarbon Reservoirs		
PEN 430	Drilling and Well Completions		
PEN 331	Fundamentals of Reservoir Engineering		
PEN 362	Production Technology and Design		
PEN 363	Land-Leasing, Royalties, Conservation, Environment		
PEN 364	Natural Gas Engineering		
PEN 365	Petroleum Economics and Valuation		
PEN 367K	Surface Production Systems		
PEN 368	Fundamentals of Well Logging		
PEN 369	Quantitative Well-Log Analysis		
PEN 373	Petroleum Engineering Design		
PEN 376	Special Problems in Petroleum Engineering		
PEN 379	Studies in Petroleum Engineering—Advanced Drilling and Well Completion		
PEN 280*	Advanced Petroleum Lab		
PEN 380*	Advanced Petroleum Lab		
PEN 680*	Advanced Petroleum Lab		
PEN 381K	Engineering Analysis		
PEN 382K	Theory and Application of Reservoir Transients		
PEN 382L*	Numerical Methods in		

*Graduate course

Law

LAW 341L*	Environmental Law
LAW 263P*	Advanced Oil and Gas
LAW 374N*	Taxation of Natural Resources
LAW 379M*	Continuing Legal Development: Economic and National Security Policies (FIN 390, MAN 385)
LAW 390*	Oil and Gas
LAW 397S*	Law Seminar—International Competition for Oil and Minerals
LAW 397S*	Law Seminar—International Energy Transactions
LAW 397S*	International Environmental Law

Liberal Arts

AMS 321	Environmental History
ANS 361	Human Use of the Earth (GRG 346, IS 320)
ECO 330K	Energy Economics
ECO 360	Government Regulation of Industry
GOV 314	Introduction to the Middle East (MES 301K, OAL 312K)
GOV 337M	Government and Politics of Mexico
GOV 356L	Government and Politics of the Middle East and North Africa
GOV 365N	Politics of the Middle East
GOV 365P	Politics of Oil (IS 320, MES 322)
GOV 381L*	Energy Policy
GOV 390L*	Political Systems of the Middle East and North Africa
GOV 390L*	Comparative Theory and Middle Eastern Politics
GOV 390L*	Politics of Mexico (LAS 384L*)
GRG 325	Geography of Texas

GRG 328 Geography of the Middle East
 GRG 334 Conservation, Resources, and Technology
 GRG 334C Economic Activity and Resource Distribution
 GRG 335 Economic Activity and Resource Distribution (IS 320, IB 370)
 GRG 346 Human Use of the Earth (IS 320, ANS 361)
 GRG 351 Man and Nature
 GRG 383C* Seminar in Environment and Development
 GRG 388* Seminar in Resources and Conservation
 IS 320 Economic Activity and Resource Distribution (GRG 335, RES 325)
 HIS 350L Electrification of the Western World
 IS 320 Human Use of the Earth (GRG 346, ANS 361)
 IS 320 Politics of Oil (GOV 365P, MES 322)
 LAS 384L* Politics of Mexico (GOV 390L*)
 MES 301K Introduction to the Middle East (GOV 314, OAL 312K)
 MES 322 Politics of Oil (IS 320, GOV 365P)
 MES 322K Government and Politics of the Middle East and North Africa
 MES 322K International Business in the Middle East (MKT 372)
 MES 324K Modern Iran
 MES 381* International Marketing and Middle East Markets
 OAL 312K Introduction to the Middle East (GOV 314, MES 301K)

Natural Sciences

BIO 301M Ecology, Evolution, and Society
 BIO 304 Environmental and Population Biology
 BOT 349 Environmental Pollution
 CH 390L Advanced Analytical Chemistry—Electrochemical Methods
 CH 397S* Advanced Chemistry—Electrochemistry
 GEO 330K Petroleum Geology—Basin and Trend Analysis
 GEO 335 Geology and Resources of Texas
 GEO 344K Marine Mining and Minerals
 GEO 368 Energy Resources
 GEO 368N Application of Geology to Energy Resources
 GEO 386L* Geology of Petroleum
 GEO 386M* Petroleum Exploration Methods
 GEO 390M* Thermodynamics of Geologic Processes
 GEO 391* Economic Geology
 GEO 391* Petroleum Geology: Production and Reexploration

GEO 391* Internship in Environmental Geology
 GEO 391J* Mineral and Energy Resources: Geology, Economics, and Policy
 GEO 394* Oil Exploration and Development
 GEO 394* Research in Economic Geology
 GEO 394* Research in Energy Resources
 MNS 440 Limnology and Oceanography (ZOO 440)
 MNS 353 Topics in Marine Studies—Seafloor Mining
 MNS 367K Oceanography: Human Exploration and Exploitation of the Sea
 MNS 380* Research in Marine Science—Marine Mining
 MNS 680* Research in Marine Science—Marine Mining
 PHY 302K General Physics—Technical Course: Mechanics, Heat, and Sound
 PHY 302L General Physics—Technical Course: Electricity, Light, and Nuclear Physics
 PHY 303K Engineering Physics I
 PHY 303L Engineering Physics II
 PHY 609A Elementary Physics for Nontechnical Students: Mechanics, Heat, and Sound
 PHY 609B Elementary Physics for Nontechnical Students: Electricity, Light, and Nuclear Physics
 PHY 316 Electricity and Magnetism
 PHY 317K General Physics I
 PHY 352K Classical Electrodynamics
 PHY 369 Thermodynamics and Statistical Mechanics
 PHY 380L* Plasma Physics—Intro
 PHY 380M* Plasma Physics—Stability Theory
 PHY 387K* Electromagnetic Theory
 PHY 387L* Electromagnetic Theory
 PHY 391S* Seminar in Plasma Physics
 PHY 391T* Special Topics in Plasma Physics: Tokamaks
 PHY 397K* Nuclear Physics
 PHY397S* Seminar in Nuclear Physics
 PS 304 Introductory Physical Science II: Substances, Heat, Electricity
 PS 350 Atomic and Nuclear Phenomena
 ZOO 440 Limnology and Oceanography (MNS 440)
 ZOO 352 Man and the Environment

Public Affairs

PA 882A Policy Research Project (energy topic)
 PA 882B Policy Research Project (energy topic)
 PA 388K Seminar on Energy and Minerals ■

Graduate Degrees (Selected Programs or Options in Parentheses)

Architecture (Computer Applications in Architecture [energy-related])
Business Administration (Management of Technology)
Chemical Engineering (Energy Resources, Environmental)
Chemistry
Civil Engineering (Environmental Health Engineering, Geotechnical Engineering)
Economics (Resource and Energy Economics)
Electrical and Computer Engineering (Energy Systems, Plasma and Quantum Electronics)
Energy and Mineral Resources—a multidisciplinary master of arts degree program
Geography (Environmental Resources)
Geological Sciences (Environmental Geology)
Government
Law
Mechanical Engineering (Energy and Fluid Systems, Nuclear Engineering)
Petroleum Engineering Physics (Nuclear Physics, Plasma Physics)
Public Affairs (Energy, Natural Resources)
Public Affairs and Business Administration—a joint master's degree
Public Affairs and Engineering—a joint master's degree

*Graduate course

CES Update

Office of Director

The Texas Society of Professional Engineers has given its highest honor to **Herbert H. Woodson**, naming him Texas Engineer of the Year for 1988.

Dr. Woodson, an electrical engineer and graduate of the Massachusetts Institute of Technology, has been director of the Center for Energy Studies since it was founded in 1974.

He serves as acting dean of the UT College of Engineering and director ad interim of the UT Center for Fusion Engineering.



Dr. Woodson has been appointed to serve a second two-year term as chairman of the advisory council of the **Electric Power Research Institute**.

He also has been appointed to the Texas Scientific Advisory Council, a new advisory body to the governor of Texas.

Conservation and Solar Energy

Conservation researchers have developed an analytical method for **predicting the energy end-use patterns** (heating, cooling, lighting, water heating, and equipment) of groups of similar buildings.

The project was funded by the Resource Management Department of the City of Austin. The city operates one of the country's leading energy conservation programs.

The method, which is in the form of a computer model, can be used by the city to predict and compare the effect of different incentives for commercial energy retrofits, such as rebates for high-efficiency lighting or air-conditioning, according to Bruce D. Hunn, head of the center's Conservation and Solar Energy Program.

The approach involves creating a prototype that represents the group of buildings, based on their past energy end-use patterns and their thermal characteristics, as well as on climate and other factors that affect

energy consumption.

The method was verified as accurate by applying it to a group of 48 retail stores and comparing the computer predictions of total and peak energy use with the actual energy patterns of the buildings.

Other participants in the project were Scott C. Silver and John L. Peterson, center research engineers.

Nuclear Studies

The American Society of Mechanical Engineers has awarded **Dale E. Klein**, deputy director of the center, its 1988 Edwin F. Church Medal for distinguished service in mechanical engineering education.

Process Energetics

The Process Energetics Program hosted three distinguished visitors in June: **Alain Priou, Peter Jones, and Steven Oda**.

Dr. Priou, associate chief of the microwave department of the Office of National Aerospace Research of France, gave a seminar on microwave curing of composite materials used in aerospace vehicles.

Dr. Jones, a leading dielectric heating expert with the British Electric Council Research Centre, gave the keynote address at the utility symposium on microwave and radio-frequency heating held in Austin June 28-29.

Dr. Oda, who heads the research laboratory of the large Canadian electric utility, Ontario Hydro, visited the program as an advisor.



Theodore L. Bergman, along with Frank P. Incropera and Raymond Viskanta of Purdue University, has been awarded the Melville Medal by the American



Speaker of the House Jim Wright (left) June 14 swears in commissioners of the Monitored Retrievable Storage Commission. From left: Frank Parker, civil engineering professor at Vanderbilt University; Dale E. Klein, deputy director of the Center for Energy Studies; and Alex Radin, former president of the American Public Power Association. The commission will evaluate a monitored retrievable storage facility as part of the nation's nuclear waste management system and prepare a report to Congress by June 1989.

Society of Mechanical Engineers.

Their paper entitled, "Transient Behavior of a Radiatively Heated Double-Diffusive System," won the award, for "best current original paper in mechanical engineering." Dr. Bergman is associate head of the Process Energetics Program and assistant professor of mechanical engineering at UT.

Separations Research Program

A private inventor has joined forces with the Separations Research Program to evaluate a **new contacting device for distillations**.

William Trutna, a chemical engineer
(Continued on page 6)



Engineering graduate student Tim Bielek, right, demonstrates curing of lumber with radio-frequency waves to utility visitors hosted by the Process Energetics Program June 29.

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(Continued from page 5)
neer in Houston, Texas, formerly with Dupont, received funding from the Office of Energy-Related Inventions of the National Bureau of Standards to develop the design. Similar to a tray or packing, the contacting device is for use inside a petrochemical distillation column to improve its efficiency.

Josè Luis Bravo, manager of the Separations Research Program, said that in tests conducted in November and June, the device showed a slightly lower efficiency but a higher capacity as compared with high-efficiency packings. The results were promising, and further gains in capacity seem possible, he said.

■
A study of how to **clean oil field brines by means of supercritical extraction** has begun under a \$42,000 grant from Texaco Exploration and Production.

When petroleum is removed from

the ground, salty water often comes with it. Federal regulations require the water to be cleaned before it is reinjected in the ground or, in the case of some offshore wells, released into the ocean.

Today, combinations of skimming, filtering, and other techniques are used to purify the brine. The center researchers will investigate the potential of supercritical extraction to clean the brine more efficiently.

Supercritical extraction involves putting a water stream in contact with a solvent above its critical point. The solvent picks up the contaminants and can be easily removed afterward.

Participants in the project are James R. Fair, director of the Separations Research Program; Josè Luis Bravo, program manager; and researchers Frank Seibert and Chester Little.

■
Ernest F. Gloyna has been appointed by Texas Governor Bill

Clements to the Governor's Committee on Water Resources Management.

The committee is to make recommendations by December on the structural relationships of the Texas state agencies that deal with water resources.

Dr. Gloyna, a separations researcher and former UT dean of engineering, holds the Bettie Margaret Smith Chair in Environmental Health Engineering at the university.

■
Separations researchers **Josè Luis Bravo** and **William J. Koros** were invited to Venezuela by INTEVEP, the nation's petroleum research institute, to present talks June 6-7 at a symposium on membranes.

Dr. Koros explained petrochemical applications of membranes, and Mr. Bravo discussed separations technologies that compete with membranes. ■

UT Austin Energy

Continuing Engineering Offers Energy Short Courses

Seven energy-related short courses and one conference for professional engineers will be offered in 1988 by UT Continuing Engineering Studies.

Each course is led by a member of the UT engineering faculty. To obtain full information on the courses, contact Continuing Engineering Studies, College of Engineering, The University of Texas at Austin, Austin, Texas 78712, 512/471-3506 or 3396.

- ◇ *Biomonitoring for NPDES [National Pollution Discharge Elimination System] Permit Compliance*, July 18-20, Neal E. Armstrong
- ◇ *Advanced Water Pollution Control: Biological Waste Water Treatment*, September 19-23, Joseph F. Malina
- ◇ *Techniques in Nuclear Radiation Shield Analysis* (in Fort Worth, Texas), October 17-20, Nolan E. Hertel
- ◇ *Power Distribution Conference*, October 24-26, William C. Duesterhoeft
- ◇ *Indoor Air Pollution and Radon*, November 2-4, Joe O. Ledbetter and Howard Liljestrang
- ◇ *Below Regulatory Concern (BRC) Radwaste Disposal*, November 7-11, Nolan E. Hertel and Joe O. Ledbetter
- ◇ *Management of Hazardous Waste*, November 14-18, David E. Daniel
- ◇ *Advanced Water Pollution Control: Physical and Chemical Waste Treatment, Sludge Handling and Disposal*, November 28-December 2, Joseph F. Malina ■