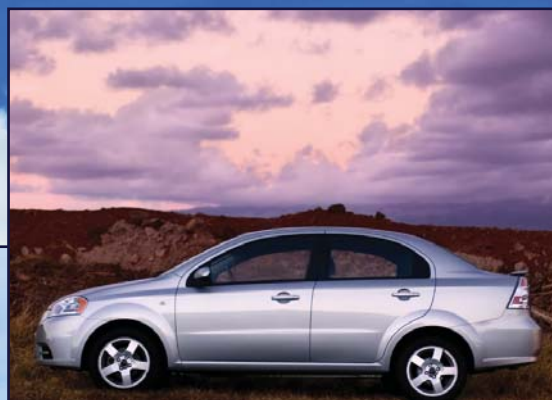


ENERGY INNOVATION

Summer 2009



PENNSTATE



EARTH AND MINERAL SCIENCES
ENERGY INSTITUTE
COLLEGE OF EARTH AND MINERAL SCIENCES

One of Penn State Institutes of Energy and the Environment

Energy Innovation Summer 2009

Energy Innovation is an annual publication from the EMS Energy Institute in the College of Earth and Mineral Sciences. The EMS Energy Institute is a leading research and development organization focused on energy science and engineering

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U.Ed. EMS 09-109

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Letter from the Director



Welcome to the inaugural newsletter of the EMS Energy Institute at Penn State. This publication will provide an avenue for us to keep our friends and partners current on energy research and developments, outreach efforts, and faculty and student achievements. The first issue will also provide an overview of the EMS Energy Institute.

The mission of the EMS Energy Institute is to conduct research for developing advanced sciences and technologies for production, conversion and utilization of energy resources, and for energy-related environmental protection. An important part of this mission is to support EMS faculty research efforts, provide research training of graduate and undergraduate students and young researchers for developing tomorrow's energy professionals (page 12), and to facilitate energy outreach to society at large (page 20). Our research focus is three-fold: generating and utilizing energy in a more environmentally-friendly and efficient manner, diversifying the nation's energy production and utilization, and promoting the use of our indigenous resources of energy.

The EMS Energy Institute was established in 1997 based on the former Energy and Fuels Research Center under the leadership of Prof. Alan W. Scaroni from 1992-1998 and further developed under the leadership of Prof. Harold H. Schobert from 1998-2006. It has been a privilege and honor for me to serve the college and the Institute as the Director since May 2007. With the support of the College of Earth and Mineral Sciences (EMS) and the central administration of Penn State, the EMS Energy Institute has made major contributions to advancing energy sciences and technologies through externally funded research projects totaling over \$30 million in the last three years as a result of the dedicated efforts by faculty, staff, and students. Our ongoing research covers fossil, renewable and nuclear energy and involves a broad range of topics such as advanced coal-based jet fuels, clean coal-based electric power, oxy-fuel combustion, IC engines emission control, fuel cells, fuel desulfurization and reforming for fuel cells, alternative transport fuels, biomass conversion, bio-gas and bio-fuels, hydrogen production, hydrogen storage, catalysis for clean fuels and chemicals, petroleum processing, materials synthesis and characterization, computer modeling, coal science and technology, carbon materials, NO_x, SO_x and PM control, CO₂ capture, sequestration and utilization.

I am pleased to see the major accomplishments of the growing number of faculty and students performing research at the EMS Energy Institute. Currently there are 150 people affiliated with the Institute including EI researchers and staff, and faculty and students from the Departments of Energy & Mineral Engineering, Materials Science & Engineering, and Geosciences in EMS, and the Departments of Mechanical & Nuclear Engineering and Chemical Engineering, and the Propulsion Engineering Research Center in the College of Engineering. In 2008, the EMS Energy Institute became affiliated with the new Penn State Institutes of Energy and the Environment (page 17). In 2009, we are looking forward to continuing these collaborative partnerships and working with the diverse group of faculty and students to advance energy research, education and outreach.

Our collaborations extend across the university and our sponsors and partners include many federal and state agencies and a large number of companies (page 27). One of our major ongoing initiatives, which began in Oct 2007, is a research alliance with Chevron Energy Technology Company to develop clean liquid fuels from coal (page 14). One of our major outreach initiatives, which began in 2008, is the Conoco Phillips-Penn State Energy Prize, which is a national energy award program for promoting nation-wide energy innovation (page 16).

As the EMS Energy Institute takes on supporting more researchers, more students and more projects, we face some obstacles and our number one hurdle is that we have outgrown our space. With the strong support of Dean Easterling to resolve the space issue for the EMS Energy Institute and the Department of Energy and Mineral Engineering to carry out the "Clean Carbon Energy" initiative, Penn State recently acquired a building and the EMS Energy Institute and its affiliate faculty and students will be the primary occupant. We sincerely thank the EMS College and Penn State leadership teams for this new "energy building" and we are in the process of planning to make the best use of the new space in support of energy research by EMS faculty and students.

Energy has become a top priority for the US and the world. Working together, we can contribute to solving the energy problems for the world. We really appreciate the support and cooperation of all current and future friends, partners and sponsors and always welcome your suggestions and comments.

Dr. Chunshan Song
Director, EMS Energy Institute
Associate Director, PSIEE
Professor of Fuel Science and Chemical Engineering

Remarks from the Dean



The College of Earth and Mineral Sciences (EMS) is a world leader in energy and fuel science, and engineering. As energy security for the nation is severely tested in coming decades, research to develop new sources of energy and to make more efficient use of existing ones will be essential. I have implemented a major new energy strategy for EMS, called “Clean Carbon Energy” that is designed to propel the College into even greater international prominence in energy. The College is in an excellent position to lead Penn State toward becoming the world’s premier energy university.



The EMS Energy Institute will play a major role in assisting the College in achieving the objectives of this new initiative. The EMS Energy Institute is committed to providing academic and technical leadership in research and development of clean energy technologies, furthering the energy mission of the University, and educating the public on these technologies. The EMS Energy Institute provides Penn State students with the experience of conducting research within a diverse community of faculty and staff, while fostering strong relationships with industries and government agencies – relationships critical to nurturing career opportunities. The EMS Energy Institute also plays an increasing role in energy outreach.



The EMS Energy Institute works closely with faculty in the Energy and Mineral Engineering, Materials Science and Engineering, and Geosciences departments. The number of faculty, graduate students, and undergraduate students performing research at the EMS Energy Institute is growing. Several new energy faculty have been hired by EMS in conjunction with the Penn State Institutes of Energy and the Environment over the last two years and many perform their research at the EMS Energy Institute. Research dollars are on the rise at the EMS Energy Institute. Highlighting new projects is a five-year \$17.5 million strategic alliance with Chevron Corporation to develop liquid fuels from coal. This initiative is University-wide, but to-date, the majority of the research is being conducted at the EMS Energy Institute because of the Institute’s vast coal expertise. With more researchers, students and new projects come space and facility constraints. Recognizing this, I have worked with the Provost in the acquisition of a new ‘energy building’, with the primary occupant being the EMS Energy Institute. I am anticipating that the space will be available this summer.



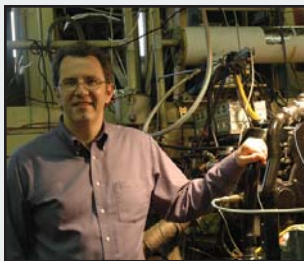
Looking toward the future, I see the EMS Energy Institute as a critical component in helping the College lead Penn State toward becoming the world’s premier energy university. To make that happen, I am devoting resources to the EMS Energy Institute to support facility needs and personnel requirements to further the energy mission of the College.

Williams E. Easterling
Dean, College of Earth and Mineral Sciences

Research Partners within Penn State

The College of Earth and Mineral Sciences

The EMS Energy Institute is a research unit within the College of Earth and Mineral Sciences (EMS) and provides space, facilities, and technical, analytical, and administrative support for faculty and students –undergraduate and graduate – from several EMS departments to conduct a variety of research related to energy. The EMS Energy Institute also provides the opportunity for the faculty and students to collaborate with researchers from other departments and colleges.



The Department of Energy and Mineral Engineering

There is a unique relationship between the Department of Energy and Mineral Engineering (EME) and the EMS Energy Institute with several EME faculty holding joint appointments with the EMS Energy Institute. EME and the

EMS Energy Institute faculty work closely to develop and execute a wide array of energy-based research and educational programs.

The Department of Materials Science and Engineering

EMS Energy Institute researchers also collaborate with the Department of Materials Science and Engineering (MatSE). Research activities include, coal structure, coal conversion, corrosion/erosion studies, fuel cell material development, and nanoscience.

The Department of Geosciences

Some of the EMS Energy Institute's ongoing research is being conducted by faculty and students from the Department of Geosciences. Activities include exploration and extraction of petroleum and natural gas, rock mechanics, and groundwater hydrology.

The College of Engineering

Faculty and students from the College of Engineering also conduct research and collaborate on projects within the EMS Energy Institute.



The Department of Chemical Engineering

The EMS Energy Institute works closely with the Department of Chemical Engineering on research projects related to catalysis, biofuels and photovoltaics.

The Department of Mechanical and Nuclear Engineering

EMS Energy Institute faculty and staff also collaborate with researchers from the Department of Mechanical and Nuclear Engineering. Activities include studies on fundamental heat transfer, fluidized-bed combustion, advanced power generation, fuel cells and internal combustion engine performance.

The Department of Agricultural and Biological Engineering

The Department of Agricultural and Biological Engineering has joint administration with The Colleges of Agriculture and Engineering. The EMS Energy Institute collaborates with the department on research relating to bioenergy.

Propulsion Engineering Research Center

Some of the faculty and students affiliated with the EMS Energy Institute also collaborate on research within the Propulsion Engineering Research Center (PERC).



PERC, which was established with the support and guidance of the National Aeronautics and Space Administration (NASA), conducts fundamental research on a diverse set of propulsion-related problems. Faculty and students collaborating with the EMS Energy Institute conduct research in the areas of gas turbines, diesel engines, internal combustion engines, and performance of coal-derived jet fuels in military applications.

Current Research Programs

The diverse and innovative approaches of the EMS Energy Institute's research help us to meet tomorrow's most critical energy challenges.

Carbon Materials

Current research activities include projects on such materials as graphite, petroleum and metallurgical coke, activated carbon, anthracite, and pitch. An important component of the carbon materials program is the Consortium for Premium Carbon Products from Coal (CPCPC). CPCPC is an industry-driven consortium, which is focused on the development, commercialization, and promotion of technologies needed to produce high value-added carbon products from coal and coal-derived feedstocks.

Clean Fuels and Catalysis

The main mission of the Clean Fuels and Catalysis (CFC) activities is to promote comprehensive, efficient and environmentally-friendly utilization of hydrocarbon resources for making and using clean fuels and chemicals through catalytic and chemical research. CFC research focuses on ultra-clean fuels, chemicals, applied catalysis, reaction chemistry, CO₂ capture, materials and new processing methods related to energy conversion, energy utilization, chemical processing and environmental protection.

Electrochemical Systems

Scientists carry out electrochemical studies on physico-chemical systems for a variety of reasons. They may be interested in obtaining thermodynamic data or understanding the kinetics of a process such as corrosion, or the goal might be the analysis of a solution for trace amounts of chemical compounds. Examples of research are the design of new power generation systems (e.g. fuel cells and batteries) and electrosynthesis of new materials such as metal alloys or oxide films. The objective of the lab research is to promote and facilitate the use of electrochemical probes and systems in different areas of science and technology.

Nuclear Energy

Nuclear energy at the EMS Energy Institute has emerged as another important research area. Investigations are conducted in material/properties-related to nuclear power plants, and heat transfer. One main research focus is the DOE's Nuclear Energy Research Initiative Consortium (NERI), in which Penn State directs and participates.

Petroleum and Natural Gas

The EMS Energy Institute brings together diverse expertise in the areas of domestic petroleum and natural gas extraction, processing, and utilization. A state-of-the-art OMNI-X industrial-based x-ray scanner facility to conduct non-destructive scanning, and rapidly growing industry-driven consortia, the Stripper Well Consortium and the Gas Storage Technology Consortium provide unique partnership opportunities.

Stationary Power

The EMS Energy Institute recognizes that the energy community is extremely diversified and dynamic. This group consists of private industry, governmental agencies, and utilities. Its interests range from fuel development in the front end to flue gas cleanup at the back end. The EMS Energy Institute has in the past and will continue in the future to respond to the diversity in interests and goals of its customers by providing support in identifying and solving existing problems and providing the expertise and facilities to evaluate new technologies and fuels.

Sustainable Energy

Sustainable energy activities include CO₂ sequestration, bioenergy initiatives, and advanced photovoltaics. The EMS Energy Institute was also selected to coordinate the West Penn Power Sustainable Energy Fund's (WPPSEF) sustainable energy program. These programs and partnership enable the Institute to be at the forefront in sustainable energy technologies.

Transportation Systems

Clean efficient power systems are of extreme importance to an energy-intensive, environmentally conscientious society. Nowhere is this more critical to the nation's security than in the transportation sector. Our growing reliance on imported oil threatens our economy and our security. Transportation-related research at the EMS Energy Institute addresses these pressing concerns by focusing on development of advanced internal combustion engine strategies (both spark and compression ignited) and alternative fuels.

Upstream Energy

Current research includes topics such as fluid flows in porous media and geothermal energy. The upstream energy program includes the GeoFluids III Consortium, the third industry consortium of this type. The focus of this consortium is the state and evolution of pressure, stress, and fluid migration in the sub-salt environment, shallow water flow regimes, and thrust belts.



Principal Investigators and Faculty Associates

These pages list the principal investigators and faculty associates who conduct research within the EMS Energy Institute. Detailed profiles for these researchers can be found at www.energy.psu.edu.

André Boehman, *Professor*
Energy and Mineral Eng.

Diesel fuels, diesel combustion, diesel emissions and emission control, alternative and advanced fuels, advanced fuels characterization techniques, soot nanostructure and reactivity, lubricant formulation and fuel-lubricant interactions, engine testing, emissions measurement, gasoline formulation, spark ignition combustion and emission control, flame materials interactions, and catalytic pollution control.



Derek Elsworth, *Professor*
Energy and Mineral Eng.

Computational mechanics, rock and fluid mechanics, and the mechanical and transport characteristics of fractured rocks with application to geothermal energy; the deep geological sequestration of radioactive wastes and CO₂; the recovery of unconventional gas and volcano dynamics.



Jeffrey Brownson, *Assistant Professor*
Energy and Mineral Eng.

Director of the Solar Decathlon 2009 Natural Fusion project (<http://www.solar.psu.edu/>). Thin film materials synthesis for photovoltaic devices, design and engineering of System-Integrative Photovoltaics (SIPV), system-scale transient energy simulations for buildings, and research in sustainable materials design (environmental technology).



Semih Eser, *Professor*
Energy and Mineral Eng.

Metal surface effects on coke/deposit formation from petroleum derivatives; carbonization of petroleum feedstocks and mesophase development for needle coke manufacturing; microscopic, spectrometrics, and reactivity analysis of solid carbons; preparation and characterization of activated carbons; and molecular analysis of complex feedstocks.



Caroline Burgess Clifford, *Senior Research Associate*
EMS Energy Institute

Coal liquefaction (thermal extraction and catalytic); conversion of lignin into fuels and value-added materials/chemicals using water/gases/base reactions; thermal stability of jet fuel; and premium carbons from coal/petroleum based carbons by delayed coking and anthracite, to produce graphite, nuclear graphite, and anode carbons.



Mark Fedkin, *Research Associate*
EMS Energy Institute

Electrochemical energy conversion systems, fuel cells, electrolytic processes in thermochemical cycles for hydrogen production, design of high temperature electrochemical cells and probes, design of hydrothermal reactors and processes, high temperature electrophoresis, and interfacial electrochemistry.



Yongsheng Chen, *Assistant Professor*
Energy and Mineral Eng.

Materials characterization, x-ray absorption fine structure spectroscopy (XANES/EXAFS), Raman, XPS, heterogeneous catalysis, catalyst sulfur poisoning mechanism, catalytic structure/performance relationship, catalytic production of hydrogen, and solution chemistry.



Joel M. Haight, *Associate Professor*
Energy and Mineral Eng.

Human factors eng., ergonomics and biomechanics, fire protection, and process optimization of complex industrial systems. Research dealing with these aspects of liquefied petroleum gas handling: sulfur recovery, hydrogen sulfide scrubbing, distillation, crude oil loading, waste and potable water treatment, ammonia refrigeration, batch specialty chemical reactions systems, and oil production and processing systems.



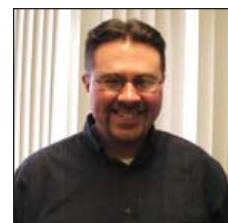
Adri van Duin, *Associate Professor*
Mechanical and Nuclear Eng.

Atomistic-scale simulations of chemical reactions, combustion, coal chemistry, surface chemistry, catalysis, interface structure and chemistry, hydrogen storage, fuel cells, solar cells, high-energy materials, crack initiation and propagation, aqueous-phase chemistry, empirical force field development, quantum chemistry.



Michael Janik, *Assistant Professor*
Chemical Eng.

Computational chemistry for energy conversion processes and materials, catalysis, electrocatalysis, catalytic reforming, multiscale modeling, electrocatalysis of oxygen reduction, borohydride oxidation, SOFC direct hydrocarbon utilization, electrocatalysis in microbial fuel cells, and ionic polymer design for lithium-ion batteries.



Stephen Kirby, Research Associate

EMS Energy Institute

Diesel fuel formulation, combustion, and emissions analysis and control (gaseous and particulate); characterization of both conventional and alternative liquid and gaseous fuels; biofuel conversion and utilization.

**Jonathan Mathews, Assistant Professor**

Energy & Mineral Eng.

Coal structure and coal behavior, including solvent swelling, pyrolysis, coal drying, and chemical and physical transitions; coal characterization by advanced and novel approaches; coal and char molecular modeling and use of molecular models; carbon dioxide sequestration in coal, experimental analyses and modeling.

**Angela Lueking, Assistant Professor**

Energy and Mineral Eng.

Hydrogen storage in carbon nanomaterials and metal-organic-frameworks, fundamentals of hydrogen spillover, synthesis and modification of carbon materials, energy storage, and applications of carbon materials for environmental engineering and sustainability.

**Bruce Miller, Senior Research Associate**

EMS Energy Institute

Coal and biomass utilization (combustion, gasification, pyrolysis), advanced fuels characterization techniques, solid fuel preparation and handling, hardware development and testing, ash deposition, and emissions characterization and control, including SO_2 , NO_x , fine particulate matter, trace elements, and dioxin/furan TEQs.

**Serguei Lvov, Professor**

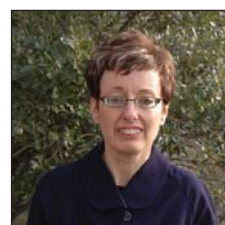
Energy and Mineral Eng.

Electrochemistry and electrochemical engineering; proton exchange and solid oxide fuel cells; low- and high-temp. electrolysis, electrochemical corrosion in high-temp. aqueous solutions, electrophoretic mobility of particulate materials in high-temp. water; and ion exchange membranes in fuel cells and electrolyzer, high-temp. pH/corrosion/conductivity probes.

**Sharon Falcone Miller, Research Associate**

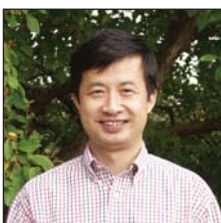
EMS Energy Institute

Coal and biomass utilization (combustion, gasification, and pyrolysis); advanced fuels characterization techniques specializing in inorganic analysis; ash chemistry, formation and deposition; effect of ash on utilization processes; and emissions characterization in utilization systems including SO_2 , NO_x , and inorganic hazardous air pollutants.

**Xiaoliang Ma, Senior Research Associate**

EMS Energy Institute

Adsorption/sorption for fuel processing; ultra-deep desulfurization and denitrogenation of liquid hydrocarbon streams through adsorption, oxidation or hydrotreatment; CO_2 separation from flue gas and fuel gas; clean up of biogas, landfill gas and syngas; and upgrading of coal-liquid, heavy oil and biofuels for clean fuels.

**Gareth Mitchell, Research Associate**

EMS Energy Institute

Coal utilization (carbonization, liquefaction, combustion, pyrolysis); petrographic characterization of coals, cokes and carbons; petrographic application for prediction of coal quality; evaluation of organic sediments; and petroleum exploration. Manage operations of the Penn State Coal Sample Bank and Database.

**Chris Marone, Professor**

Geosciences

Rock deformation, friction, earthquake physics, fault mechanics and fluid flow in geologic materials. Studies include fracture permeability enhancement by dynamic stressing, granular jamming, fracture permeability, earthquake nucleation and dynamic rupture propagation, pressure solution, acoustic emissions, clay friction, and strength and stability of faults.

**Joel Morrison, Research Associate**

EMS Energy Institute

Energy sciences with early experience in mine overburden characterization, sorbent characterization for fluidized-bed boiler systems, and coal water slurry fuel preparation. Manage DOE/NETL's Gas Storage Technology and Stripper Well Consortia. Director of the West Penn Power Sustainable Energy Fund which invests in and deploys clean energy technologies in PA.



Kwadwo Osseo-Asare, *Distinguished Professor*
Materials Science and Eng.
Energy and Mineral Eng.

Aqueous processing. Materials synthesis and processing: particle design, nano-/micro-particle synthesis and assembly; separation science and tech.: hydrometallurgy, envtl. systems, solvent extraction, membrane separations; applied aqueous chemistry: interfacial and colloidal phenomena, surfactant science, microemulsions, semiconductor electrochemistry, thermodynamic modeling.



Harold Schobert, *Professor*
Energy and Mineral Eng.

Conversion of coal to clean liquid and gaseous fuels, carbon materials, or specialty chemicals; behavior of ash and slag in coal conversion and combustion systems; carbon capture and storage processes; chemical reactions of coals and other heavy hydrocarbons; and graphitic carbons.



Paul Painter, *Professor*
Materials Science and Eng.

Spectroscopic studies coal structure and synthetic polymers; studies of coal/solvent interactions and coal swelling; sulfur dehydrogenation process applied to the carbonization of coal; removal of sulfur and mercury from coal using water treatment under critical or near-critical conditions; hydrogen bonding in coal and synthetic polymers; vibrational relaxation phenomena in macromolecular systems.



Chunshan Song, *Professor*
Energy and Mineral Eng.
Dept. of Chemical Eng.

Catalysis and adsorption for fuel processing, desulfurization of fuels and biogas, reforming of hydrocarbons and biofuels for hydrogen production and fuel cells, shape-selective catalysis for chemicals, synthetic clean fuels from coal, heavy oil and biomass, and CO₂ capture and utilization.



Sarma Pisupati, *Associate Professor*
Energy and Mineral Eng.

Computational fluid dynamic modeling of combustors, coal/biomass gasification, biomass based materials for emission reduction, gasification behavior of coals, oxy coal combustion fundamentals, and reduction of NO_x and SO₂ from stationary combustion sources.



Randy Vander Wal, *Associate Professor*
Energy and Mineral Eng.

Developing metal oxide semiconductors for gas sensing and catalyst development for microreactors; carbon nanomaterials as lubricants for polymer composites and as anode material for Li ion batteries; flame synthesis of materials, laser based optical diagnostics and applying electron microscopic and spectroscopic techniques to carbonaceous particulate.



Tim Ryan, *Associate Professor*
Anthropology

Research interests involve high resolution x-ray computed tomography, three-dimensional analysis of complex structures, finite element analysis, and scientific visualization.



Xiaoxing Wang, *Research Associate*
EMS Energy Institute

Catalysis in reforming of liquid hydrocarbons (e.g. diesel fuel) for hydrogen production and fuel cells; gas cleanup and separation, including desulfurization of fuel gases (e.g. biogas) and CO₂ capture from flue gas; and synthesis, characterization and evaluation of novel materials for above-mentioned processes.



Demian Saffer, *Associate Professor*
Geosciences

Understanding factors that control the distribution and magnitude of fluid pressure, particularly at active plate boundaries, and constraining the flow pathways and fluid budgets in these dynamic hydrologic and tectonic settings.



Yaw Yeboah, *Professor*
Energy and Mineral Eng.

Electrocatalysis in fuel cells; coal and biomass thermochemical conversion; combustion and emission control; catalysis in fuel processing/conversion; oilfield scale formation; and flow visualization.



Robert Santoro, *Guillet Professor*
Mechanical Eng.

Combustion of coal-based fuel, soot formation in flames, liquid spray combustion, laser diagnostics, gas turbine combustion, combustion instability, chemical kinetics, rocket propulsion, and rocket-based combined cycle engines.





The EMS Energy Institute
Office Staff

Back Row, from left to right: Ron Nargi, Erin Rogers, Barbara Robuck and Kelly Rhoades

Front Row, from left to right: Cindy Anders, Nicole Rigg, Shea Winton and Elizabeth Wood

EMS Energy Institute Office Staff

Cindy Anders - *Administrative Support Coordinator*

Cindy processes and supervises purchasing, arranges airfare and handles the travel to comply with the University's policy, processes I-9 forms, ensuring the information is valid and complies with University and the U.S. Immigration and Naturalization Service regulations. She is responsible for wage payroll and assisting with Graduate appointments.

Ronald Nargi - *IT Specialist*

Ron is the Institute's "computer geek." He is responsible for the support, maintenance, upgrade, and procurement of our desktops, servers, networks, off-site technology needs, hardware and software systems. Ron also analyzes work-flow challenges at the Institute and proposes, designs and implements IT solutions to meet those challenges.

Kelly Rhoades - *Administrative Assistant*

Kelly administers the grant/contract and accounting area at the Institute. She also assists faculty in preparing and submitting proposals, monitors budgets and expenditures, processes human resource documents, oversees human resource matters and prepares reports for the faculty. In addition, Kelly supervises and hires for various positions.

Nicole Rigg - *Administrative Support Assistant*

Nicky is the assistant to the director. She schedules meeting rooms, conference calls and catering; reconciles purchasing card charges; and handles travel arrangements and reimbursements. Nicky also processes research supply and equipment orders; makes fleet reservations; distributes visitor parking permits; and orders office supplies.

Barbara Robuck - *Writer/Editor & Public Relations*

A 25-year veteran in advertising and promotions, Barb helps to market the WPPSEF, which promotes clean energy generation, energy efficiency and the attraction and establishment of clean energy business; and PA Home Energy, one of WPPSEF's newest programs. Barb is also involved with the Stripper Well and Underground Gas Storage Consortia and the PA Biomass Working Group.

Erin Rogers - *Administrative Support Staff*

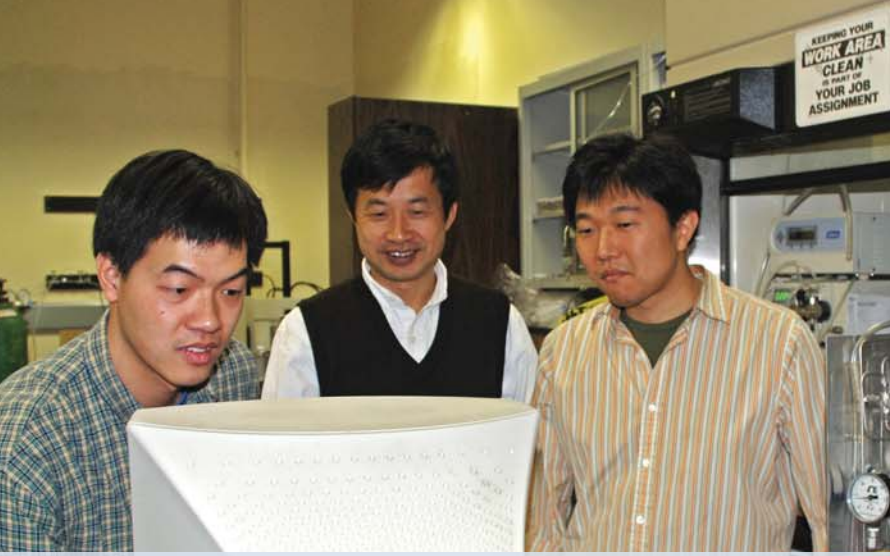
Erin assists with the preparation and submission of proposals, monitors budgets to ensure they comply with sponsor regulations and that the appropriate funds are available, and assists faculty with submitting reports. She also processes all ROCRs and the monthly billing for the entire ARG facility, and acts as the Institute's key custodian.

Shea Winton - *Writer/Editor & Public Relations*

Shea writes a variety of communications for the EMS Energy Institute and the Consortium for Premium Products from Coal (CPCPC), including newsletters, brochures, fact sheets and news articles. In addition, Shea plans meetings, attends and photographs lectures and events, and maintains the CPCPC Web site and sections of the Institute Web site.

Elizabeth Wood - *Multimedia Specialist*

Liz designs posters, brochures, Web sites, ads, booth displays, newsletters, forms, and fact sheets for the EMS Energy Institute, WPPSEF, PA Home Energy, the Office of Student Development, and several Consortia. She also writes coding for the various Web sites and databases, and is the multimedia specialist and photographer at many Consortia events.



Students

In Research



Opportunities Beyond the Classroom

The EMS Energy Institute has an array of research opportunities and internship programs available to graduate and undergraduate students.

Since the EMS Energy Institute attracts faculty from many affiliate departments, there is a diverse selection of research programs from which students may choose. Students can work on research projects related to fossil fuels, including coal oil and gas; renewable energy, including solar, biomass and biofuel; or nuclear energy.

Students interested in conducting research within the EMS Energy Institute should contact the Office of Student Development for more information. Call 814-863-8893, or visit www.energy.psu.edu/osd.

Undergraduate Opportunities

- **Senior Thesis, Independent Study, Wage Payroll** – Students may fulfill a senior thesis with research at the EMS Energy Institute. Faculty and staff act as advisors. They can also use research for an independent study or work as wage-payroll students within the Institute.
- **DOE Technical Career Internship Program** – The Department of Energy (DOE) began this internship program to recruit students from the nation's top earth sciences and engineering universities for internships in fossil energy programs. The mutually beneficial program provides employment for students and employees for DOE's Office of Fossil Energy.
- **Summer Research Opportunities Program** – In this program students stay on campus while they participate in the eight-week summer session. Each student is paired with a faculty mentor who takes them through all the phases of research.

Graduate Opportunities

The EMS Energy Institute welcomes graduate students and has opportunities available in many major research areas in the energy field. At the Institute, students can get vital research experience while building important relationships with industries and government agencies. Graduate students within the Institute work alongside research faculty and are viewed as colleagues.

Other Opportunities

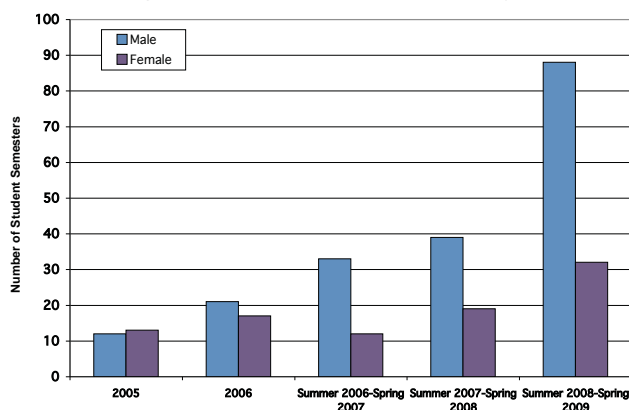
The EMS Energy Institute's Office of Student Development works with industry to facilitate internships for undergraduate and graduate students to gain valuable research experiences. Three such programs are the Student Career Experience Program, the Minority Mentoring and Internship Program, and Science Undergraduate Laboratory Internships.

Currently, there are approximately 63 graduate students and 8 undergraduates working throughout the EMS Energy Institute.

Outreach

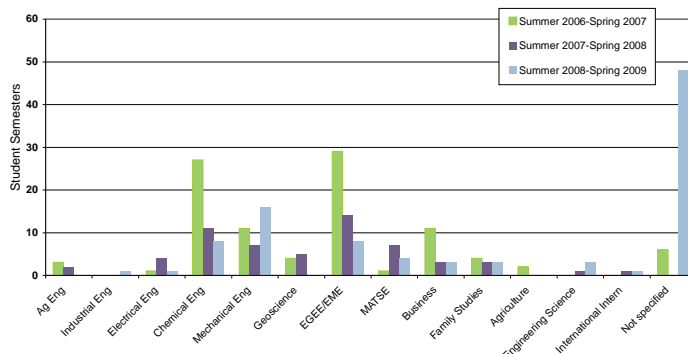
The Office of Student Development also has its hand in several outreach activities. For example, the Institute sponsors the Science Lions, a volunteer organization made up of Penn State students, that holds demonstrations on subjects such as energy for students in grades K-12. The Institute also participates in summer camps sponsored by the College of Earth and Mineral Sciences and other University organizations, and Summer Experience in Earth and Mineral Science (SEEMS) sponsored by Upward Bound Math and Science Center (UBMS) at Penn State.

Undergraduate Student Semesters by Gender*



The EMS Energy Institute has seen an increase in student researchers, since the Office of Student Development was established.

Undergraduate Participation in Research at the EMS Energy Institute by Degree*



The EMS Energy Institute attracts students from many different majors and colleges.

* Student participation is reported as "student semesters." A "student semester" refers to the number of semesters that a student participates in research at the Institute.

Penn State and Chevron

Working together for cleaner coal technologies

In October 2007, Penn State began a major research alliance with Chevron Energy Technology Company, one of the world's leading integrated energy companies.

The strength of this alliance rests on the pillars of history and the prospects for the future. "Penn State has been involved in energy-related research and graduate training for more than a century, beginning with one of the first formal schools of mining engineering in the U.S.," said Penn State President Graham Spanier. "Since that time, Penn State has evolved its coal-related research streams in many directions including conversion of coal to liquid fuels, direct coal liquefaction, modeling and simulation of coal conversion, and carbon dioxide capture and sequestration."

Building upon this historical strength, in 2006, the University Energy Task Force published a report in which it proposed a bold new road map and strategic vision to enhance the existing energy sciences, engineering and policy within the University's academic colleges and institutes. To promote the energy initiative, the University has committed funds for the creation of 24 new faculty positions to strengthen the teaching and research efforts.

Penn State will target key strategic areas: state-of-the art coal conversion and carbon dioxide management technologies; materials and nanotechnology for energy efficiency; biofuels, bioenergy and biomaterials; hydrogen production, storage and transportation for fuel cells; public and social discussions of nuclear power; and conversion of light to do work.

"When Chevron visited Penn State a year ago to learn more about our initiative," said Eva Pell, senior vice president for research and dean of The Graduate School. "They recognized our commitment to areas of interest to them, and became convinced that an alliance would be mutually beneficial."

The joint research initiative with Chevron focuses on coal chemistry and conversion technology, advanced fuels, combustion, analysis methods, reactor science, separations, process technology, and CO₂/greenhouse gas management and conversion. This alliance also integrates research with educational and career opportunities for students and graduates specializing in coal conversion and energy technologies. Under the alliance, Chevron will provide up to \$17.5 million over the next five years to the University.

"When Chevron visited Penn State a year ago to learn more about our initiative, they recognized our commitment to areas of interest to them, and became convinced that an alliance would be mutually beneficial."

—Eva Pell, senior vice president for research and dean of The Graduate School



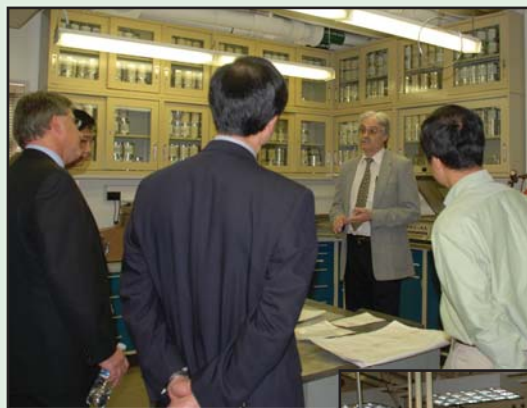
EMS Energy Institute researchers who are doing research related to the alliance with Chevron Energy Technology Company

"Chevron values technological excellence and R&D capability and is impressed with the quality of coal research done at Penn State over the last century. Chevron also has a rich history in coal through our Chevron Mining Company and its predecessor P&M Coal. We will draw on the deep expertise of both institutions to push the front edge of technology and innovation into the 21st century," said Don Paul, vice president and chief technology officer, Chevron Corporation. "We look forward to a highly productive research relationship that will contribute to the technical innovation of clean coal and coal-to-liquid technology."

"Rapid growth of global energy consumption has brought the challenge of sustaining national and global energy security into sharp focus," Spanier said. "With the help of partners such as Chevron, Penn State will continue to step up to the challenge of training new generations of experts in energy, developing fundamental new knowledge and innovative applications, and educating the public about energy issues and options."

Based in San Ramon, Calif., Chevron is one of the world's leading integrated energy companies. The company has about 56,000 employees, and Chevron's subsidiaries conduct business in more than 180 countries. Chevron operates across the entire energy spectrum — exploring for, producing and transporting crude oil and natural gas; refining, marketing and distributing fuels and other energy products and services; generating power; designing and marketing large-scale energy efficiency solutions and commercializing the energy resources of the future, including biofuels and other renewables.

— *Andrea Messer, Penn State Live*



Above: Gareth Mitchell talks to visitors from Chevron during a tour of the EMS Energy Institute facilities

Right: Caroline Burgess Clifford speaks to visitors from Chevron during the tour



Ongoing Projects

Coal Characterization

*Jonathan Mathews and
Gareth Mitchell*

Coal-Solvent Interactions Under Non-Cracking Conditions

Paul Painter

Coal Collection, Preparation and Storage

Jonathan Mathews

Direct Coal Liquefaction Material Handling

*Bruce Miller, Sharon Falcone Miller,
Gareth Mitchell*

Coal Model Representation, Creation and Use

*Paul Painter, Jonathan Mathews,
Harold Schobert*

Coal Drying

Phil Halleck, Jonathan Mathews

Unconventional Resource Characterization Partnership

Turgay Ertekin

EMS Energy Institute Sponsors National Energy Prize with ConocoPhillips

In March, 2008, ConocoPhillips and Penn State partnered to launch the ConocoPhillips Energy Prize, an awards program that seeks to recognize new ideas and original, actionable solutions that can help improve the way the United States develops and uses energy.

The program, which the EMS Energy Institute cosponsors, awards up to \$300,000 in cash prizes and focuses on generating innovative ideas and solutions that help in three areas:

- Developing new energy sources, including new ways to develop alternative energy;
- Improving energy efficiency, such as new methods to significantly reduce the amount of energy consumed in the United States; and
- Combating climate change, including solutions that reduce greenhouse gas emissions.

"Providing adequate, reliable and diverse supplies of energy; significantly improving energy efficiency; and taking action on climate change are challenges that will require innovative technology, resource commitments and responsible stewardship by energy producers and consumers alike," said Jim Mulva, chairman and chief executive officer of ConocoPhillips. "With help from Penn State and its award-winning Energy Institute, the ConocoPhillips Energy Prize is one way to generate excitement and interest in fostering new energy ideas and solutions that will ultimately benefit society."

"Our focus is on developing clean, reliable and affordable energy, and through the ConocoPhillips Energy Prize, we can help spur technology research and development in this area of focus," said William Easterling, dean of Penn State's College of Earth and Mineral Sciences, which houses the EMS Energy Institute. "We are pleased to work with ConocoPhillips on this endeavor, while encouraging the nation's brightest minds to turn their ideas into reality."

2009 marked the second year for the ConocoPhillips Energy Prize. Entries for the program were accepted from February, 16 through May 1. Official rules for the 2009 ConocoPhillips Energy Prize are available at <http://www.conocophillips.com/Tech/energyprize/index.htm>.

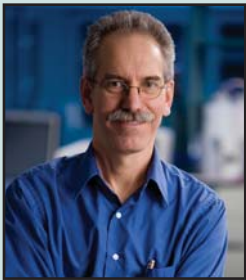
ConocoPhillips is an international, integrated energy company with interests around the world. Headquartered in Houston, the company had approximately 32,600 employees, \$178 billion of assets, and \$187 billion of revenues as of December 31, 2007. For more information, go to <http://www.conocophillips.com>.



PSIEE Incorporates Energy

The Penn State Institutes of Energy and the Environment (PSIEE) was established to coordinate energy and environmental research at Penn State. PSIEE was initially launched as the Penn State Institutes of the Environment. In 2006, the current name was adopted and the focus broadened to incorporate energy. PSIEE is affiliated with all major colleges across the University that are involved in energy and environmental teaching, research and outreach as well as various institutes and centers within those colleges.

Talking with Tom Richard



As the director of the Penn State Institutes of Energy and the Environment (PSIEE), Tom Richard shares some insights into the origin of PSIEE and how it has evolved.

resources available, there are concerns about the environmental impact using these resources will have. For example coal and nuclear power both have environmental concerns associated with them, and in the last two years we have learned that even some renewables like wind and biomass are not immune.

When was PSIEE established and why?

Environmental activity goes back a long way on campus. In the early 1960s, a number of centers started to come together. In 1972 they got a common home in the Land and Water Research Building, where PSIEE resides today. When Graham Spanier came to Penn State, he focused on university-wide interdisciplinary institutes, mandated to encourage cross-college collaborations and provide a common interface for internal and external stakeholders. PSIEE's mission is to coordinate and facilitate that cross-university activity and work with centers that don't have a College home.

How did PSIEE evolve to incorporate energy?

In 2006, inspired by some visionary thinking in the College of Earth and Mineral Sciences (EMS), Eva Pell charged an Energy Task Force, consisting of energy experts from Penn State, with the task of determining the best way to strengthen current energy science, policy and engineering programs and invest in new areas. There was also the question of whether we should create a new Institute for energy or combine it with the current environmental institute. Since many energy issues have environmental dimensions and vice versa, the choice was made to combine them.

A benefit of combining energy and the environment into one institute structure is that we can look at these issues comprehensively, since we don't solve energy problems in an isolated way. One of the challenges with energy in the next 20 years is that, while we clearly have lots of energy

What kind of relationship does PSIEE have with the EMS Energy Institute and the umbrella organizations?

PSIEE exists to make sure there is a real coordinated effort on and off campus in order to take advantage of our strengths. Some of our activities include coordinating tours, alliances, speakers and opportunities to present work away from campus; facilitating collaborations on research between the individual colleges; assisting the colleges with the hiring or co-hiring of new positions; and overseeing facility collaborations around the units within PSIEE.

A recent example of how PSIEE and the EMS Energy Institute work together was the establishment of the major research alliance with Chevron Energy Technology Company to research coal conversion technologies.

What do you anticipate the future holds for PSIEE?

Clearly, Penn State is recognized as a leading university in the areas of energy and the environment. There is a lot that we're doing already so the challenge is in growing the program, finding the right people, and improving the quality of space and facilities. In addition, our educational programs are strong but they are still evolving.

Penn State has an organized structure to deal with interdisciplinary collaborations, which other universities envy, but we have to work to make it seamless and to make sure the connections are strong and robust. Penn State really has what I see as a step forward in solving these challenges, perhaps the most important challenges for this next century.

PSIEE Timeline

1963

Institute for Research on Land and Water Resources founded.

1986

Environmental Resources Research Institute was formed by the merger of the Institute for Research on Land and Water Resources and the Center for Air Environment Studies.

January 2000

Environmental Consortium formed.

January 2003

Penn State Institutes of the Environment was formed by a merger and expansion of the former Environmental Consortium and Environmental Resources Research Institute.

November 2006

Energy focus added and name changed to PSIEE

Public and Private Partnerships: DOE Consortia

As part of its outreach initiatives, the Penn State EMS Energy Institute manages three consortia for which the Department of Energy's National Energy Technology Laboratory (DOE/NETL) provides the base funding. Supplemental funding for the consortia is provided by industry cost share. For example, the New York Energy Research and Development Authority provides funding to the Stripper Well Consortium, and the Gas Technology Institute and Pipeline Research Council International provides funding to the Gas Storage Technology Consortium.

In each consortium, members compete for funding and the executive council selects the projects while Penn State manages and executes the contracts. To learn more about these consortia, current research and membership visit www.energy.psu.edu.



Consortium for Premium Carbon Products from Coal

The Consortium for Premium Carbon Products for Coal (CPCPC) was established in 1998. Since that time, it has engaged over 100 companies and provided funding for 95 projects, totaling almost \$11 million. Members of the CPCPC propose research initiatives in areas they identify as being strategically important to the coal and carbon/graphite industries.

Coal is the largest domestic fossil hydrocarbon resource of the U.S. and it is estimated to last over 200 years at its present usage. However, many premium carbon products developed and manufactured in the U.S. are derived from fossil hydrocarbon sources other than coal, mainly petroleum, creating a dependence on foreign imports to manufacture essential carbon products for the domestic market.

The majority of CPCPC's research is on producing high-value carbon products from coal. Current research activities include projects on such materials as graphite, activated carbon, needle coke, carbon fibers, carbon black, carbon foams, and carbon from coal-fired power plant ash.

Stripper Well Consortium

The Stripper Well Consortium (SWC) is an industry-driven consortium focused on developing, demonstrating and deploying technologies to improve the production performance of the nation's natural gas and petroleum stripper wells. The SWC offers full, endorsing, affiliate, and supporting memberships and is comprised of natural gas and petroleum producers, service companies, industry consultants, universities, and industrial trade organizations.

The SWC solicits, reviews and selects co-funded research projects that will lead to an improvement in the production from natural gas and oil stripper wells in four broad areas, including reservoir remediation, wellbore clean-up, surface system optimization and environmental. Since its establishment in September 2000, the SWC has funded 95 projects for a total of over \$9.26 million.

To combat the premature abandonment of marginal wells, research and technology programs are key components. According to the U.S. Department of Energy, "one out of every six barrels of crude oil produced in the U.S. comes from a marginal well – a well whose production has slowed to 10 barrels a day or less, or 60 thousand cubic feet (Mcf) of gas or less. There are over 400,000 of these wells in the U.S., and together they produce nearly one million barrels of oil per day, or about 19 percent of the U.S. production." The SWC strives to support getting technological advances into the field to assist our independent producers and individual entrepreneurs.



Gas Storage Technology Consortium

Gas storage is a critical element in the natural gas industry. Having a safe and reliable supply of natural gas to meet domestic demand is vital to our nation. Producers, transmission and distribution companies, marketers, and end users all benefit directly from the load balancing function of storage.

The objective of the Gas Storage Technology Consortium (GSTC) is to provide a means to accomplish industry-driven research and development with a mission to assist in the development, demonstration, and commercialization of technologies to improve the integrity, flexibility, deliverability, and cost-effectiveness of our nation's underground natural gas/hydrocarbon storage facilities to meet domestic demand. Projects are funded based on those that best accomplish the Consortium goals in several focus areas: mechanical, well-bore and reservoir, operations, and salt Cavern.

The consortium offers full memberships for businesses and individuals, affiliate memberships for trade associations and university/college memberships. Since its inception in June 2004, the GSTC has awarded over \$3 million to co-fund 27 projects.



Outreach

The EMS Energy Institute in industry and the community

The EMS Energy Institute has an office dedicated to outreach efforts within the industrial, commercial and residential sectors of Pennsylvania. These outreach initiatives range from providing technical assistance and print resources to holding workshops and courses, participating in energy camps and visiting schools. Below are some of the ongoing initiatives in which the Institute is involved.

Coal Sample Bank

Penn State has collected over 1,400 samples since 1967. Over 1,100 of those are still available for distribution. The EMS Energy Institute also maintains the Penn State Coal Database, which contains information on all of the samples.

Hardgrove Grindability Index (HGI) Standard Reference Samples

Penn State is the world's sole producer and supplier of HGI reference samples, which are samples of coal used to calibrate instruments that are designed to determine the ease with which coal can be pulverized.

Center for Quantitative Imaging

This research facility combines state-of-the-art X-ray Computed Tomography (CT) equipment with advanced computational facilities and data mining expertise to provide three-dimensional internal maps of materials and processes.

Pennsylvania Technical Assistance Program (PennTAP)

PennTAP is a program that helps Pennsylvania companies, especially smaller firms, improve their competitiveness by providing a limited amount of free technology assistance.

The EMS Energy Institute's involvement consists of assisting with energy efficiency programs for industries. Specifically, the Institute does solar assessments for businesses, which look at building orientation, roof stability, the surrounding environment and more to determine if solar energy is feasible.

Pennsylvania Biomass Working Group

The PA Biomass Working Group is a collection of businesses, universities, government agencies, foresters, economic development partners and environmental advocacy groups working together to help residents of PA and the Northeast learn how renewable fuels can reduce costs and build community self-reliance in an environmentally sound way.

The group promotes renewable energy projects that encourage the use of locally produced sustainable fuels to displace foreign energy purchases and cycle money back into the local economy. The group's activities are focused around four fuel alternatives: PA biodiesel productions, PA ethanol production, energy from wood and anaerobic digestions.



One house at a time — helping PA become more energy efficient

Now, more than ever, energy and the need to be more energy efficient is on the minds of leaders in Pennsylvania and the Nation. For example, the recently approved economic stimulus plan appropriated over \$41 billion for energy related spending. In addition, the State of Pennsylvania, with assistance from PA Home Energy, has just launched a program allowing homeowners to apply for loans with the intent of making energy efficiency home improvements.

With all the attention surrounding energy efficiency, it seems appropriate that a significant portion of the EMS Energy Institute's outreach efforts revolve around energy efficiency.

West Penn Power Sustainable Energy Fund

Penn State coordinates the West Penn Power Sustainable Energy Fund (WPPSEF), which invests in the deployment of clean energy technologies throughout the West Penn Power service region in Pennsylvania. Investments are made to promote the use of renewable and clean energy, energy conservation and energy efficiency, and the attraction, establishment, and retention of sustainable energy businesses.

PA Home Energy

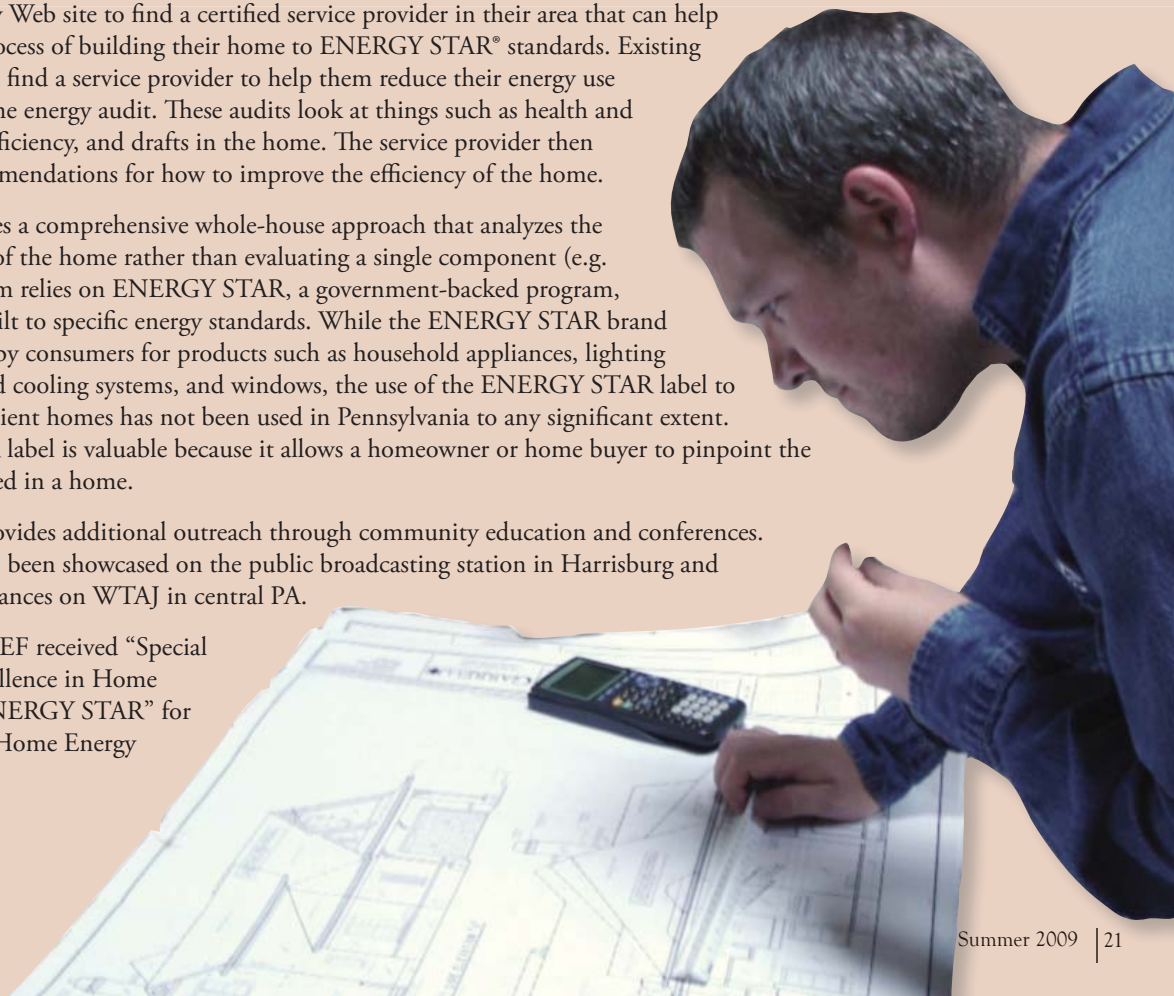
The EMS Energy Institute developed and now manages PA Home Energy, currently the largest state energy efficiency program. The program, funded by WPPSEF, has built a network of service providers throughout Pennsylvania that can help homeowners and home builders understand and reduce their energy use. PA Home Energy requires all of the service providers in this network to receive training and carry specific certifications.

The program is unique because it targets new and existing homes. New home builders can use the PA Home Energy Web site to find a certified service provider in their area that can help them through the process of building their home to ENERGY STAR® standards. Existing homeowners can also find a service provider to help them reduce their energy use through a whole-home energy audit. These audits look at things such as health and safety issues, water efficiency, and drafts in the home. The service provider then makes specific recommendations for how to improve the efficiency of the home.

PA Home Energy uses a comprehensive whole-house approach that analyzes the overall performance of the home rather than evaluating a single component (e.g. furnace). The program relies on ENERGY STAR, a government-backed program, to denote a house built to specific energy standards. While the ENERGY STAR brand is widely recognized by consumers for products such as household appliances, lighting products, heating and cooling systems, and windows, the use of the ENERGY STAR label to designate energy efficient homes has not been used in Pennsylvania to any significant extent. The ENERGY STAR label is valuable because it allows a homeowner or home buyer to pinpoint the amount of energy used in a home.

PA Home Energy provides additional outreach through community education and conferences. The program has also been showcased on the public broadcasting station in Harrisburg and makes regular appearances on WTAJ in central PA.

In March, the WPPSEF received "Special Recognition for Excellence in Home Performance with ENERGY STAR" for its launch of the PA Home Energy program in 2008.



Chunshan Song receives 2007 Herman Pines Award in Catalysis



“I am very honored to have been selected to receive this award in the name of Professor Herman Pines for whom I have great respect, and am grateful to those who have nominated and recommended me for this honor.”

—*Chunshan Song*

Professor Chunshan Song was selected to receive the prestigious Herman Pines Award in Catalysis in 2007. The Herman Pines Award, cosponsored by the Catalysis Club of Chicago (CCC) of the North American Catalysis Society and UOP, LLC, is presented annually by the CCC at its Spring Symposium for outstanding research in the field of catalysis.

Professor Herman Pines, a pioneer in catalytic hydrocarbon conversion and chemistry of acid catalysis was a founding member of the CCC and a towering figure in history of catalysis. The award in his honor is cosponsored by UOP where Herman began his industrial career in 1930 and amassed 145 US patents over a 23-year period. His work revolutionized the general understanding of organic chemistry, particularly the chemistry of hydrocarbons interacting with strong acids.

The award is an external recognition for Penn State research on novel catalysts and sorbents in hydrocarbon conversion for ultra clean fuels and chemicals, especially for “innovative approaches to catalysis and liquid-phase adsorption for desulfurization and fuel reforming of liquid fuels for fuel cells.”

“I am very honored to have been selected to receive this award in the name of Professor Herman Pines for whom I have great respect, and am grateful to those who have nominated and recommended me for this honor,” Dr. Song said.

“This is a recognition for the research accomplishments by a group effort in the EMS Energy Institute involving my former and current coworkers including postdoctoral scholars and graduate students as well as our industrial and academic collaborators, to whom I am thankful. I have been fortunate to be associated with the EMS Energy Institute and EGEE department. I would like to take this opportunity to thank all the faculty and staff members and all of my coworkers and students in EI/EGEE, especially Dr. Harold Schobert and Dr. Alan Scaroni for encouraging and supporting our earlier research in catalytic hydrocarbon conversion which helped building the base for the current research program in clean fuels and catalysis.”

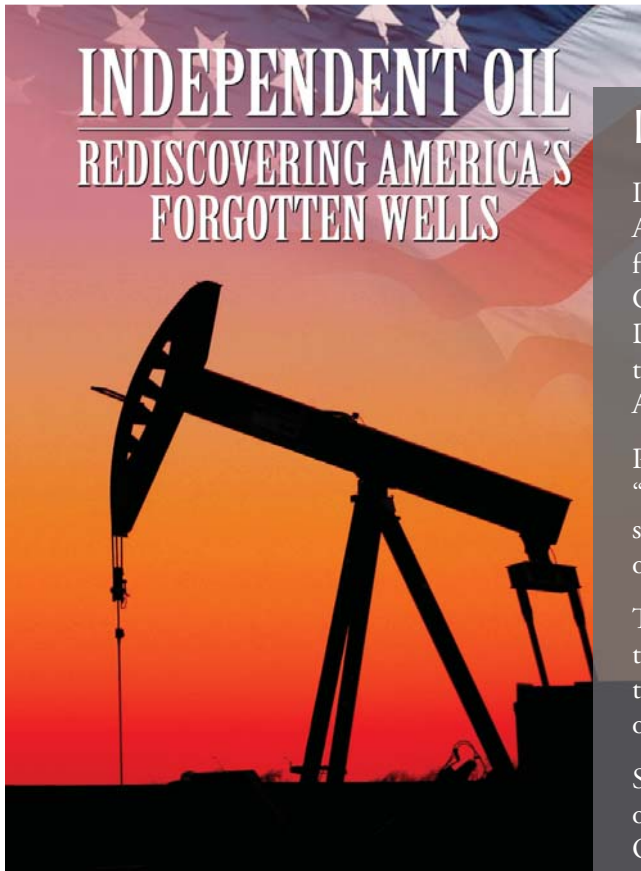
ASSE Recognizes Joel Haight for his Work on a Handbook for Safety Engineers

Joel Haight, associate professor of energy and mineral engineering, received two awards in recognition of his work in publishing a new two-volume reference book for Safety Engineers and health professionals, released in June 2008. Haight was editor-in-chief and one of 80 authors who contributed to the handbook, “The Safety Professionals Handbook.” The two volumes, Management Applications and Technical Applications, focus on how to develop, implement or improve safety, health and environmental programs.

“This is a valuable reference book. We enforced a rigorous peer review process in which each chapter was evaluated by three reviewers,” said Haight. “As we moved through the process of developing this book it became clear that it was going to be so thorough and cover the topic areas so well that it would be valuable to anyone in the safety profession at any level — students, new professionals, seasoned professionals and anyone needing to have access to additional information about safety and health.”

In addition, a percentage of the royalties from the book, which is already in its third printing, will go towards the American Society of Engineers (ASSE) and Joel M. Haight Scholarship for undergraduate safety engineering students. So far, the scholarship fund has received about \$2,500.

For his role in the creation of this handbook, Joel received the Charles Culbertson Award for Meritorious Service to the Council on Practices and Standards, and the Safety Professional of the Year – Engineering Practice Specialty from the ASSE. Both awards are given annually.



Independent Oil Wins Telly Award

Independent Oil DVD “Independent Oil: Rediscovering America’s Forgotten Wells,”—a documentary produced with funding from the Department of Energy, the Stripper Well Consortium (SWC) and New York Energy Research and Development Authority—has received a bronze award in the public relations category at the recent 28th Annual Telly Awards.

Produced by Penn State Public Broadcasting, the video “explores the often overlooked potential of the nation’s 500,000 small, independent oil and gas wells and their role in reducing our dependence on foreign supplies.”

The Telly Awards recognize the best local, regional and cable television, as well as film and video productions. According to the award’s Web site, the 28th Annual Telly Awards received over 14,000 entries from all 50 states and 5 continents.

Since the release of “Independent Oil” in the fall 2005, the SWC has distributed over 4,000 DVD copies. The video has also been the recipient of a Communicator Award in Excellence in the Documentary Video Category.



Joel Morrison, Gary Covatch and John Martin show off the bronze Telly Award

Department of Energy and Mineral Engineering Awards Banquet

2008

Robert and Leslie Griffin Award

Jennifer L. Clemons
Michael R. Fitzgerald
Joshua M. Taron

Frank and Lucy Rusinko Graduate Fellowship

Michael R. Fitzgerald
Marielle R. Narkiewicz
Joshua M. Taron

Charles B. Darrow Award

Marielle R. Narkiewicz

Graduate Teaching Assistants of the Year

Michael R. Fitzgerald
Joshua M. Taron

2009

Outstanding Graduate Teaching Assistants

Igor Faoro
Yu Noda

Charles B. Darrow Award

Jean Denis Pone

C.C. Wright Award

Dirk T. van Essendelft
Daniel van Niekerk

Robert and Leslie Griffin Award

Meredith A. Hill Bembenic

Robert Stefanko Memorial Scholarship

William L. Dennis



From left to right, Jean Denis Pone, Yu Noda, Meredith A. Hill Bembenic, Dr. Chunshan Song, Dirk T. van Essendelft, Gregory K. Lilik.

Chevron Corp. Environmental Systems Scholarship
Laura C. Bradley

Frank and Lucy Rusinko Graduate Fellowship
Gregory K. Lilik
Meredith A. Hill Bembenic

Wilson Awards Banquet

2008

Faculty Mentoring Award

Derek Elsworth
Professor of Energy and Geo-Environmental Engineering
Energy and Mineral Engineering

Gladys Snyder Education Grants

Demian Saffer
Associate Professor of Geosciences
Geosciences
"Development of an On-Campus Wellfield to Improve Experimental Education in Hydrogeology"

Jay M. and Katherine Definis Award for Outstanding Student Leadership

Nicole J. Reed
Graduate Student
Energy and Mineral Engineering

2009

Wilson Award for Excellence in Research

André L. Boehman
Professor of Fuel Science
Energy and Mineral Engineering



André L. Boehman (left) and Williams E. Easterling, Dean, College of Earth and Mineral Sciences

Commission for Women Second Annual Awards Luncheon

Achieving Women Awards

Nicole Reed
Graduate Student
Energy and Mineral Engineering

EMS Energy Institute 2008 Celebration of Accomplishments

Student Achievement Award

Yi Yang
Meredith Bembenic
Dirk van Essendelft
Ramanathan Sundraramanan
Masoud Almarri

Student Service Award

Jiahua Guo
Laura Bradley

Administrative Staff Excellence Award

Erin Rogers
Sarah Haner

Dedicated Employee Award

Vince Zello
Ron Wincek
Dave Johnson
Elizabeth Wood
Xiaoxing Wang

Distinguished Service Award

Sharon Miller
Joel Morrison

Research Achievement Award

Angela Lueking
Serguei Lvov

EMS Energy Institute Researchers Among Most Cited in Elsevier Catalysis Journals

Director of the EMS Energy Institute Dr. Chunshan Song was recently honored as Elsevier's "Top-Cited Author 2002-2006" for the publisher's catalysis journals in a special ceremony held at the 20th North American Catalysis Society Meeting last month.

Four papers published by EMS Energy Institute researchers were also recognized among the "Top 50 Most-Cited Papers" published worldwide in Elsevier's catalysis journals. Elsevier is responsible for what many consider to be the most prestigious journals in the catalysis field. The following four articles were recognized:

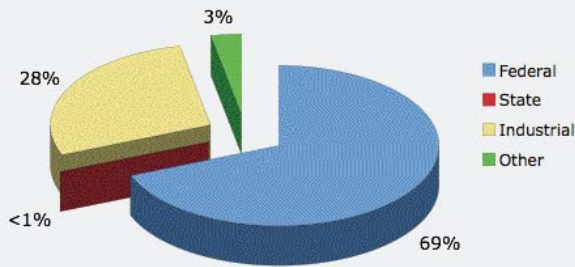
1. C. Song, and X. Ma. New Design Approaches to Ultra-Clean Diesel Fuels by Deep Desulfurization and Deep Dearomatization. *Applied Catalysis B: Environmental*, 2003, 41 (1-2), 207-238.
2. C.S. Song, An Overview of New Approaches to Deep Desulfurization for Ultra-Clean Gasoline, Diesel Fuel and Jet Fuel. *Catalysis Today*, 2003, 86 (1-4), 211-263.
3. C.S. Song, Fuel Processing for Low-Temperature and High-Temperature Fuel Cells. Challenges, and Opportunities for Sustainable Development in the 21st Century. *Catalysis Today*, 2002, 77, 17-50.
4. Ma, X., L. Sun and C.S. Song. A New Approach to Deep Desulfurization of Gasoline, Diesel Fuel and Jet Fuel by Selective Adsorption for Ultra-Clean Fuels and for Fuel Cell Applications. *Catalysis Today*, 2002, 77, 107-116.

Penn State is one of the few groups to have more than one ranking article. The top 50 most-cited papers are within the top 1 percent of the over 8,600 papers published in catalysis journals by Elsevier during 2002-2006. The authors of the top 50 most-cited papers include many of the leading universities, research institutes and corporate R&D laboratories in America, Europe, and Asia.

"These awards are external recognitions of the high-quality research on clean fuels and catalysis at the Energy Institute in EMS College at Penn State," Dr. Song said.

According to the Elsevier, "the Catalysis journals are widely accessible by institutes worldwide. Over 5,250 institutes enjoy access to the Catalysis journals via ScienceDirect, and almost 3.4 million full-text articles were downloaded from the journals during the last 12 months."

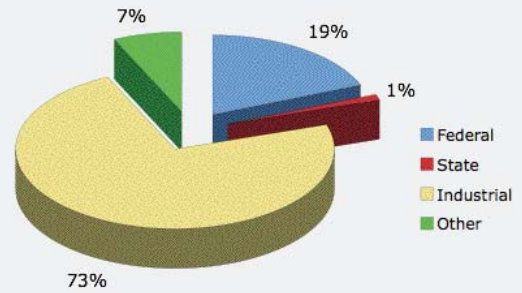
EMS Energy Institute funding by source
(fiscal year 07/08)



Total funding: \$8,946,206*

*This amount excludes \$2,984,739 in awards administered through PSIEE.

EMS Energy Institute awards by source
(fiscal year 07/08)



Total awards: 178

Summary of EMS Energy Institute projects for FY05 through FY08
(July 1, 2005 through June 30, 2008)

CATEGORY	NUMBER	% OF TOTAL	FUNDING	% OF TOTAL
Coal Projects				
Materials	12		\$2,231,196	
Advanced Characterization	12		\$575,822	
Utilization	16		\$9,599,147	
Pollution Control	1		\$44,069	
	41	18.2	\$12,450,234	39.0
Petroleum/Natural Gas Projects				
Exploration	13		\$564,293	
Production	6		\$4,130,000	
Storage	6		\$1,485,320	
Utilization	6		\$305,068	
	31	13.8	\$6,484,681	20.3
Renewable Energy Project				
Biomass	9		\$857,345	
Liquid Fuels	1		\$336,000	
Solar/Wind/Geothermal	1		\$15,109	
Multiple Technologies	3		\$376,288	
	14	6.2	\$1,584,742	5.0
Transportation Projects				
Combustion	3		\$284,741	
Fuels & Lubricant Char.	1		\$400,000	
Pollution Control	7		\$562,06	
	11	4.9	\$1,247,147	3.9
Clean Fuels and Catalysis Projects	14	6.2	\$1,678,905	5.3
Fuel Cell Projects	11	4.9	\$1,185,724	3.7
Hydrogen Projects	9	4.0	\$1,380,103	4.3
Sensors/Materials Projects	12	5.3	\$859,030	2.7
Geoscience Projects	22	9.8	\$2,815,166	8.8
Materials Characterization Projects	27	12.0	\$849,653	2.7
Industrial Safety Projects	5	2.2	\$376,444	1.2
Nuclear Projects	3	1.3	\$1,013,655	3.2
Total	225		\$31,925,484	

Contracts and Grants

The EMS Energy Institute receives contracts and grants from various government agencies, industries and universities. Below is a sample of the contracts awarded since January 2008.

Boehman, André

- Clean and Efficient Diesel Locomotive; *Industry*

Burgess-Clifford, Caroline

- Coker Runs, *Industry*
- Solvent Extraction of Coal to Produce Feedstock for a Laboratory Scale Delayed Coker; *Consortium for Premium Carbon Products from Coal*

Cannon, Fred

- Anthracite Fines for Foundries and Graphite Substitution; *Consortium for Premium Carbon Products from Coal*

Elsworth, Derek

- Role of Desorbing Gas on the Energetic of Failure Coal; *Centers for Disease Control and Prevention*

Flemings, Peter

- Geofluids Consortium Membership; ConocoPhillips; Exxon Mobil Corporation; BHP Billiton Corporation; Anadarko Petroleum Corporation; Shell International; BP Exploration Operating Company Limited; *Industry*

Gul, Omer

- Production of Graphite from Coke Obtained from Delayed Coking of Decant Oil-Coal Blends; *Consortium for Premium Carbon Products from Coal*

Haight, Joel

- Intervention Effectiveness Research; *NIOSH - Pittsburgh Research Center*
- Performance Measurement Research; *Industry*

Lvov, Serguei

- *U.S. Department of Energy*

Ma, Xiaoliang

- Preparation of Novel Adsorbent from Coal for Adsorptive Removal of Nitrogen from Liquid Fuels;

Consortium for Premium Carbon Products from Coal

Marone, Chris

- The Role of Vibration in Stick Slip Behavior; *Los Alamos National Laboratory*

Mathews, Johnathan

- Enhancing Appalachian Coalbed Methane Extraction by Microwave-Induced Fractures; *Industry*

Mathews, Jonathan; Mitchell, Gary

- Coal Characterization; *Industry*

Mathews, Jonathan; Painter, Paul;

Schobert, Harold

- Coal Model Representation Creation & Use; *Industry*

Mathews, Jonathan; Halleck, Phil

- Coal Drying; *Industry*

Miller, Bruce; Mitchell, Gary; Falcone

Miller, Sharon

- Direct Coal Liquefaction Material Handling Research Proposal; *Industry*

Miller, Bruce

- NO_x/SO₂ Study and Anhydrous coal fines test; *Industry*
- Research Boiler Testing; *Industry*
- TGA Char Oxidation Kinetics; *Industry*
- DTR Pyrolysis Kinetics; *Industry*
- Power Plant Sample Preparation and Analysis; *Industry*
- Combustion Testing; *Industry*

Painter, Paul

- Metallurgical Coke and Other Premium Carbon Products from Coal; *Consortium for Premium Carbon Products from Coal*

Morrison, Joel

- *West Penn Power Sustainable Energy Fund, Inc.*
- *Gas Storage Technology Consortium*

Rajagopalan, Ram

- Preparation and Characterization of Boron Containing Carbons Derived from Coal Tar Pitch; *Consortium for Premium Carbon Products from Coal*

Ryan, Tim

- CT Scanning of Foot Bones; *University*
- CT Scanning of a Fossil Mammal; *Industry*
- CT Scanning of Partial Fossil Skull; *Industry*
- CT Scanning of Fossil Skulls from China; *Industry*
- CT Scanning of Fossil Teeth; *Industry*
- CT Scanning of Primitive Marsupial Skulls; *Royal Belgian Institute of Natural Sciences*

Saffer, Demian; Marone, Chris

- Laboratory Study of the Mechanics and Physical Properties of the Active San Andreas Fault Zone From Phase II SAFOD Cores; *National Science Foundation*
- Laboratory Investigations of Fault Zone Mechanical Behavior and Fluid Overpressure; *National Science Foundation*

Song, Chunshan

- CORE 10 kWe Reformer for TACOM Applications; *Industry*

Song, Chunshan; Ma, Xiaoliang

- Nanoporous Molecular-Basket Sorbents for Removing Hydrogen Sulfide in Syngas from Alternative Logistic Fuels Synthesis; *U.S. Navy*

Song, Chunshan; Lvov, Serguei

- Alternative Fuel Processing for Solid Oxide Fuel Cells; *Industry*

Partnerships and Affiliations

This list includes some of the many companies and agencies that have worked with the EMS Energy Institute since 2005.

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Argonne National Laboratory, Department of Agriculture, Department of Defense, Department of Energy, Department of Labor, Department of Health and Human Services, Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, National Science Foundation, NASA, Oak Ridge National Laboratory, Sandia National Laboratories, U.S. Environmental Protection Agency

State

Pennsylvania

Department of Agriculture, Pennsylvania Energy Development Authority, Pennsylvania Oil & Gas Association

California

California Energy Commission

Colorado

Colorado Engineering Experiment Station, Inc.

New York

New York State Department of Environmental Conservation

Ohio

Cincinnati Waterworks

Oklahoma

Oklahoma Commission on Marginally Producing Oil and Gas Wells

Academia

U.S. Universities

Clemson University, Colorado School of Mines, Delaware State University, Duquesne University, George Washington University, Kent State University, New York Institute of Technology, Oregon State University, Purdue University, State University of New York – Stony Brook, Taylor University, Texas A&M University, University of Arizona, University of Kansas, University of Kentucky, University of Missouri – Rolla, University of Pittsburgh, West Virginia University, Yale University

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Industrial

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