JOINT CENTER FOR ENERGY RESEARCH
BIENNIAL REPORT

February 2012

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WWW.ENERGY.PSU.EDU/JCER
Almost a year after its official beginning, the Joint Center for Energy Research has facilitated several collaborations and has touched on many areas of energy-related research and technology. The Center, which was formally established with a ceremony in April 2011, stemmed from discussions about institutional cooperation between Penn State and Dalian University of Technology (DUT) in October 2008.

The Center is now part of a much larger global engagement effort that aims to enhance international work for faculty and students and strengthen collaborative research endeavors. With today’s political atmosphere and environmental concerns, international cooperation is critical to solving many of the world’s energy problems. In addition, student exposure to multiple cultures is important for nurturing future leaders.

As co-directors of the Joint Center, we would like to thank both institutions for their tremendous support. In addition to the participation of faculty from both Universities where several departments and institutes have provided administrative and financial support. At Penn State, the EMS Energy Institute, the College of Engineering, the College of Earth and Mineral Sciences, the Energy and Mineral Engineering Department, and the Penn State Institutes for Energy and the Environment have all been involved with the Center. At DUT, the Energy Research Center, the School of Chemical Engineering, and the School of Environmental and Biological Science and Technology have all been significant in the Center’s progress. In addition, we would like to thank the many government funding agencies whose support has allowed our faculty to build a strong foundation of energy and environmental research, which was vital to the development this center.

The Center has allowed the universities to enhance ongoing collaborations, formalize and expand on these partnerships as well as promote the exchange of faculty and students. It is our hope that bringing together experts from both countries will result in significant contributions to the world’s energy future. Already some collaborations have resulted in published research and additional papers are forthcoming in major research journals. This report will provide an overview of the Center’s activities, affiliated faculty expertise, research focus areas, joint publications as well as the Center’s history and annual workshops.

For more information on the Joint Center for Energy Research, affiliated faculty, research and news, visit www.energy.psu.edu/jcer.

Dr. Chunshan Song,
Co-Director, Penn State

Dr. Jieshan Qiu,
Co-Director,
Dalian University of Technology
TABLE OF CONTENTS

Letter from the Co-Directors ................................................................. 4
Vision and Mission .................................................................................. 6
Partner Universities................................................................................... 7
Messages from University Leaders......................................................... 8
Time Line of JCER Milestones............................................................... 10
Technical Research Areas .................................................................... 11
Affiliated Faculty .................................................................................... 12
  Co-Directors ....................................................................................... 12
  Penn State University ........................................................................... 13
  Dalian University of Technology ....................................................... 20
JCER Activities ..................................................................................... 26
List of Joint Publications ...................................................................... 31
Financial Support ................................................................................ 35
VISION AND MISSION

The Joint Center for Energy Research is an alliance between Penn State and the Dalian University of Technology, in China, to promote global cooperation in clean energy research and education. The center was established in April 2011, with the goal of facilitating collaborative and multi-disciplinary research in energy sciences and technology. In addition, the center will serve as a hub for innovative research and global education and provide an institutional umbrella for interacting with industry, the U.S. and Chinese governments, and local communities in the area of clean energy.
**About Dalian University Of Technology**

Dalian University of Technology (DUT) is located in the coastal city of Dalian, in northeastern China’s Liaoning Province. It is one of the key universities under the direct leadership of the State Ministry of Education. As one of China’s top science and technology universities, DUT has an excellent reputation in engineering with strengths in chemical engineering, mechanics, civil engineering, mechanical engineering, mathematics, and environmental engineering, and has produced strong research in the areas of energy and the environment.

DUT also offers programs in business, liberal arts, and management. DUT now has 14 colleges offering 38 bachelor’s degree programs. In addition, the University offers 147 master degree programs and 107 doctorate degree programs. DUT has about 30,000 full-time students including 18,950 undergraduates and 15,567 graduate students as well as over 7,000 students in its City Institute and 20,000 in the School of Continuing Education. There are over 3,000 faculty and staff including 1800 teaching faculty.

**About The Pennsylvania State University**

Founded in 1855, Penn State is a public research university with a threefold mission of teaching, research, and service. The University has 20 campuses and 6 special mission units throughout the state of Pennsylvania, with its administrative and research hub, the University Park campus, located in State College, Pennsylvania.

Penn State is ranked among the top thirteen public universities nationally and has many highly ranked academic programs. Combined enrollment among all Penn State campuses, including the World Campus is over 96,000 undergraduate and graduate students, making it one of the largest universities in the United States. In addition, Penn State has the world’s largest dues-paying alumni association. Penn State also has over 41,000 faculty and staff with about 6,000 teaching faculty.

With 17 colleges, Penn State offers a variety of academic programs in disciplines such as the natural and applied sciences, social sciences, arts, humanities, and the professions. As Pennsylvania’s land-grant university, Penn State also provides access and public service to support the citizens of the Commonwealth. The University engages in collaborations with industrial, educational, and agricultural partners locally and abroad to generate, disseminate, integrate, and apply knowledge that is valuable to society.
MESSAGES FROM UNIVERSITY LEADERS

**Penn State has a long tradition of global engagement and it is a great pleasure to continue this tradition through our partnership with Dalian University of Technology in China.** The U.S. and China share common energy portfolios based heavily on fossil energy. Therefore, clean energy research as well as the management of carbon dioxide emissions are important to both countries and the world. The Joint Center for Energy Research provides great opportunities to better address these critical issues through contemporary science and technology development, and help connect Penn State faculty and students to their counterparts at Dalian University of Technology.

Faculty members across the University are actively engaged in collaborations with Chinese universities and Dalian University of Technology is one of our global strategic partners in China. Thus, the Joint Center is truly a major step toward the continued globalization of Penn State’s research and education. With this institutional cooperation, we look forward to advancing important energy research as well as cultivating future leaders from both the U.S. and China.

*Penn State President Rodney Erickson*

**Dalian University of Technology, as one of the top universities in China, endeavors to develop itself into a world famous research university through talent education, innovative science and technology research, and outreach services.** Internationalization is one of the priority strategies for DUT. The partnership with Penn State greatly enhances DUT’s international collaborations in terms of student exchange, academic exchange, joint-effort research and cultural exchanges through the Confucius Institute.

The DUT-PSU Joint Center for Energy Research is engaged in addressing energy issues facing both China and the U.S., which will surely promote the development of science and technology in both countries and help to meet the increasing demand of clean energy both locally and internationally. I’m sure the collaboration devoted by the faculty from both sides will become the model for the collaboration and exchange between the institutions in our two countries.

*Dalian University of Technology President Jinping Ou*
Penn State has established a global engagement approach to enhance international work for faculty and students. The University Office of Global Programs supports and encourages all members of the Penn State community to pursue global perspectives in their work, studies, and activities. The cooperative relationship between Penn State and Dalian University of Technology is an important part of this larger initiative for Penn State’s global engagement.

The Joint Center for Energy Research is significant because it will provide an opportunity for faculty and students from both universities to work closely, sharing ideas and resources, to solve critical energy issues. When students graduate today, they will work with people from around the world, so this exposure to different cultures and ideas is absolutely critical. Establishing the Joint Center and formalizing a relationship with Dalian University of Technology speaks to our commitment to expand and diversify Penn State’s international partnerships.

Dalian University of Technology has always been taking efforts in enhancing international cooperation and exchange with world-class partners abroad. To explore mutual interest, to implement every potential collaboration and to push forward co-development is our goal to realize internationalization and to serve society.

Now globally, we are all faced with the critical energy issue, which is a great challenge and calls for an urgent action from the higher education institutions and researchers. The Joint Center for Energy Research provides a significant platform for both institutions for joint research and exchange of faculty and students. It greatly promotes collaborative research and education in the areas of clean energy and energy-related environmental protection and to further strengthen the cooperation between faculty, researchers, and students from both institutions. Penn State is one of our strategic international partners. We will work together and explore a more fruitful and substantial collaboration in future.

Michael Adewumi, Vice Provost, University Office of Global Programs, Penn State

Guiling Ning, Vice President, Dalian University of Technology
TIME LINE OF JCER MILESTONES

2008

In October 2008, Penn State Vice Provost of Global Programs Michael Adewumi and DUT President Jinping Ou first agreed to explore institutional cooperation after meeting at an event at Xiangtan University in Hunan, China. Dr. Chunshan Song was brought into discussions and later met with DUT President Jinping Ou, DUT Vice President Guiling Ning, and the dean of DUT’s School of Chemical Engineering Jingping Qu in Dalian during an invited lecture for the U.S.-China Energy Research Frontiers Symposium in November 2008. After the meetings, all parties felt a collaboration between Penn State and DUT was a win-win.

2009

In early February 2009, DUT Director of the International Office, Dr. Shengchuan Zhao, visited Penn State to meet with Dr. Adewumi, Dr. Song, Dr. Paul Jovanis, professor of civil engineering, and various other faculty, staff and students. These discussions resulted in a letter of intent for institutional cooperation between Penn State and DUT, which was signed in March 2009, by Dr. Adewumi and President Ou. At that time, President Ou suggested the establishment of a Joint Center for Energy Research and Penn State Leaders agreed. Then in April 2009, the Penn State Global Engagement Node's China committee selected DUT as one of the top recommended strategic partners for Penn State.

In May 2009, Dr. Adewumi and Dr. Song visited DUT to meet with President Ou, Vice President Ning, and Dr. Qu, and to visit the State Key Laboratory at the DUT School of Chemical Engineering. While in China, they also met with Madame Xiaoying Liu, the Head of the Bureau of Science and Technology for Dalian City. The Dalian City government was very supportive of a Joint Center for Energy Research.

On October 16, 2009, a delegation from DUT, led by President Ou, visited Penn State and the EMS Energy Institute to sign a Memorandum of Understanding and establish a formal collaborative relationship. By signing the Memorandum Penn State and DUT leaders agreed to develop a Joint Center for Energy Research.

2010

In October 2010, the Joint Center for Energy Research held its first workshop at DUT. Faculty from both universities were present to discuss possible collaborations and research directions.

2011

On April 12, 2011, the Joint Center for Energy Research held its second workshop at Penn State to discuss future activities. This date also marked the official establishment of the Center. Leaders from both Universities came together to attend a ribbon cutting ceremony and banquet to celebrate this institutional partnership.
TECHNICAL RESEARCH AREAS

Bio-energy and Water Treatment
PSU Faculty: Bruce Logan
DUT Faculty: Liping Huang

Catalysis for Chemicals, Clean Fuels and Biofuels
PSU: Chunshan Song, Michael Janik, Robert Rioux
DUT: Xinwen Guo, Anjie Wang, Min Liu, Xiang Li, Yao Wang

Carbon Materials
PSU: Semih Eser
DUT: Jieshan Qiu

Carbon Dioxide (CO₂) Capture
PSU: Xiaoxing Wang, Chunshan Song
DUT: Yongchun Zhang, Anhui Lu, Xinwen Guo

Characterization of Materials
PSU: Yongsheng Chen
DUT: Anhui Lu, Jieshan Qiu

Clean Coal Utilization
PSU: Sarma Pisupati, Jonathan Mathews, Bruce Miller, Yaw Yeboah
DUT: Haoquan Hu

CO₂ Conversion to Fuels
PSU: Chunshan Song
DUT: Xinwen Guo, Anfeng Zhang

Computational Energy and Catalysis Research
PSU: Michael Janik
DUT: Yi Luo, Xiaowa Nie, Xinwen Guo

Energy Economics
PSU: Andrew Kleit, Zhen Lei
DUT: Hailin Mu

Information Science Technology and Software
PSU: John Yen
DUT: He Guo
AFFILIATED FACULTY

JCER Co-Directors

Chunshan Song
Distinguished Professor, Energy and Mineral Engineering Professor, Chemical Engineering

Dr. Chunshan Song is internationally known for his contributions to clean fuels, catalysis, and CO₂ capture and utilization research. He is the Director of the EMS Energy Institute and the Associate Director of the Penn State Institutes for Energy and the Environment. Dr. Song has over 200 refereed publications in leading journals and books, 22 patents and patent applications and 6 published books. He has delivered 50 plenary or keynote lectures at international conferences and 220 invited lectures worldwide. He has received many major awards, and has held numerous leadership positions with professional societies and international conferences. Dr. Song’s current research interests include catalysis and adsorption for fuel processing, desulfurization of fuels and bio-gas, reforming of hydrocarbons and bio-fuels 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.

Dr. Jieshan Qiu
Cheung Kong Distinguished Professor, Chemical, Environmental and Biological Science and Technology

Dr. Jieshan Qiu is the executive director of the Institute of Energy Science and Technology and the dean for Research and International Collaboration as well as the associate dean for the DUT faculty of chemical and environmental technology. Dr. Qiu teaches in materials science and chemical engineering and his research interests focus on carbon materials and conversion of coal to advanced carbon materials. Dr. Qiu’s current research includes preparation and application of high performance carbon adsorbents; adsorption separation technology and surface science; functional carbon materials for energy storage; preparation, characterization and application of carbon nano- and micro-materials; carbon-based novel catalysts and catalysis reactions; plasma chemistry and chemical engineering; novel nanomaterials from biomaterials.
Penn State Faculty

Yongsheng Chen
Assistant Professor, Energy and Mineral Engineering

Dr. Yongsheng Chen came to Penn State as an assistant professor in 2007. Since then, he has been active in research and teaching in the areas of catalysis and materials characterization. Dr. Chen's current research interests include materials characterization using XANES and EXAFS; heterogeneous catalysis, sulfur poisoning of catalyst; steam reforming of hydrocarbons for hydrogen production and tar removal; structure and deactivation mechanism of carbon-supported multimetallic electrocatalysts; trace element speciation and quantification; quantification of surface functional groups and total oxygen content in carbon materials; and bioenergy, catalytic conversion of biomass, and nanomaterials for energy production.

Semih Eser
Professor, Energy and Mineral Engineering

Dr. Semih Eser is a professor of energy and geo-environmental engineering. He is also the director for the Carbon Materials Program in the EMS Energy Institute. Dr. Eser actively contributes on many committees within Penn State as well for professional organizations. He serves on the editorial board for a number of research publications. Dr. Eser’s research revolves around carbon and carbon materials. His current research interests are chemistry of carbonization and mesophase development for controlling the structure and properties of carbon materials, including needle coke production for graphite electrodes, and sponge coke production for carbon anodes; mechanisms of undesirable carbon deposition in engine fuel systems and in industrial process units, including coke deposition on ICE fuel injectors and in tube heaters or reactors; and solid carbons materials from pyrolysis of waste polyethylene for Li-ion battery applications.
**Michael Janik**  
Assistant Professor, Chemical Engineering

Dr. Michael Janik is the John J. and Jean M. Brennan Clean Energy Early Career Professor in the College of Engineering. Dr. Janik uses atomistic modeling techniques to study systems of relevance for advanced energy conversion technology. The majority of ongoing projects examine electrocatalytic systems, and applying first principles modeling techniques to determine reaction mechanism and advance the design of electrode materials for fuel cells. Specific emphasis is placed on catalytic processes relevant to alternative energy conversion technologies, such as the development of polymer electrolytes for lithium ion batteries, fossil fuel reforming and desulfurization, and biomass conversion to liquid fuels, and current research concentrates on electro-catalytic systems such as fuel cell electrodes.

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**Andy N. Kleit**  
Professor, Energy and Mineral Engineering  
Professor, Meteorology

Dr. Kleit is professor of energy and environmental economics and directs the College of Earth and Mineral Sciences’ program in energy business and finance. He holds a joint appointment in the departments of Energy and Mineral Engineering and Meteorology. In addition, he directs the Energy Economics Program in the EMS Energy Institute. Dr. Kleit’s interests center on weather risk management and electricity markets and his teaching emphases the interaction of weather and electricity markets, specifically the economic implications of weather. His current research involves restructured electricity markets, including designing competitive markets, consumer demand for competitive electricity suppliers, implementing demand response programs, integrating renewable energy sources into the electricity grid, and advances in the efficiency of nuclear power plants as well as competition policy and antitrust, and supply of and demand for rare earth elements.
**Zhen Lei**  
Assistant Professor, Energy and Mineral Engineering

Dr. Zhen Lei has expertise in both economics and science, holding a Ph.D. in Economics and Chemistry. He teaches in energy and environmental economics and his diverse research interests include economics of innovation, intellectual property, science and technology policy, energy and environmental economics, and applied econometrics. Dr. Lei’s current work includes studying the roles of technology innovation and diffusion in addressing energy and environmental issues including climate change, economics of electricity markets, and patent evaluation in the context of international patenting and patent litigation.

**Bruce Logan**  
Professor, Civil and Environmental Engineering

Dr. Bruce Logan is the Kappe Professor of Environmental Engineering. He is also the director of the Engineering Energy and Environment Institute and the Hydrogen Energy Center. Dr. Logan’s main research interest is in the sustainability of the water infrastructure. Current research falls into the areas of bioenergy production, specifically electricity generation using microbial fuel cells, hydrogen production by microbial electrolysis cells and fermentation, water desalination with a zero-electrical energy input using microbial desalination cells, and the study of electro-active bacteria (electromicrobiology); Particle dynamics, including filtration, coagulation, and bioadhesion; and bioremediation.
Jonathan Mathews  
Assistant Professor, Energy and Mineral Engineering

Dr. Jonathan Mathews is a coal scientist active in teaching, research, and various service activities. He is the co-director of the Coal Science and Technology Program at the EMS Energy Institute and is involved with many aspects of coal research including traditional and emerging areas. Dr. Mathews’ research interests are focused on many aspects of coal structure and its influence on coal behavior. Specific topics include CO₂ sequestration in coal, molecular modeling of coal/char, coal to liquids research, and structural representation of complex behavior.

Bruce Miller  
Senior Scientist, EMS Energy Institute

Mr. Bruce Miller is the associate director of the EMS Energy Institute and has 30 years experience in energy research and development, combustion systems, fuels characterization, preparation and handling, hardware development and testing, and emissions characterization and control. Mr. Miller’s current research includes stationary combustion systems (fixed-bed, pulverized, and fluidized-bed) utilizing coal and biomass; advanced fuels evaluation and characterization; air emissions (sulfur dioxide, nitrogen oxides, trace metals, organic compounds) characterization and control; coal and biomass conversion (pyrolysis, gasification, and liquefaction); material handling, hardware development, and component evaluation; behavior of inorganic constituents in fuel utilization systems.
**Sarma Pisupati**  
Associate Professor, Energy and Mineral Engineering

Dr. Sarma Pisupati is a John T. Ryan Jr. Faculty Fellow in the College of Earth and Mineral Sciences as well as a program officer for the Energy Engineering program, and co-director of the Coal Science and Technology Program in the EMS Energy Institute. Dr. Pisupati’s current research includes identifying coals that are more suitable for oxy-coal; studying the effect of rank during oxy-coal combustion; modifying the existing char-oxidation kinetics sub-model in a commercially available CFD tool FLUENT, and using a more appropriate intrinsic rate parameter to accurately account for the contribution from char-CO₂ reaction for the prediction of char burnout and CO emissions; and fundamentally understanding carbon conversion and the mineral matter transformations in entrained flow gasifiers, which includes chemical kinetics of thermal decomposition, gasification, and combustion of coal, biomass, and coal/biomass blends as well as mechanism(s) by which biomass mineral matter catalyses or inhibits thermal decomposition of coal/biomass blends under high temperature and high pressure conditions and catalytic effects during gasification.

**Thomas Richard**  
Professor, Agricultural and Biological Engineering

Dr. Thomas Richard is the director of the Penn State Institutes for Energy and the Environment as well as the director of the Biomass Energy Center. Dr. Richard’s research group applies fundamental engineering science to microbial ecosystems, developing innovative strategies for a more sustainable agriculture and the emerging bio-based economy. Current research falls in three areas: lignocellulosic biomass conversion, including pretreatment strategy, silage, cellulose loading, white-rot fungi, and silage inoculants; manure conversion, including advanced compost engineering, and anaerobic digestion; and sustainable crop and livestock systems.
**Robert Rioux**  
Friedrich G. Helfferich Assistant Professor, Chemical Engineering

Dr. Robert Rioux is a chemical engineer active in teaching and research. He has co-authored numerous research publications. Dr. Rioux’s current research interests include heterogeneous catalysis, catalyst design and synthesis, time-resolved FTIR spectroscopy of condensed systems, x-ray absorption spectroscopy (EXAFS, XANES), reaction mechanisms in nanoscale systems, and photocatalysis.

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**Xiaoxing Wang**  
Research Associate, EMS Energy Institute

Dr. Xiaoxing joined Penn State as a postdoctoral researcher in 2005. He specializes in catalytic conversion of energy resources including petroleum, natural gas and biomass, and the synthesis, characterization and evaluation of materials such as microporous and mesoporous materials for energy related applications. His current research interests include catalysis and adsorption for fuel processing; desulfurization/purification of bio-gas, natural gas and other fuel gases; reforming of hydrocarbons and bio-fuels for hydrogen production and CO₂ capture and utilization; novel material synthesis and development for catalysis; and characterization of catalysts and sorbents using various techniques such as XRD, BET, TEM/SEM, TPR, TPD, TGA, FT-IR, Raman, UV-Vis, and XPS.
**John Yen**  
Professor, Information Sciences and Technology  
Affiliate Professor, Computer Science and Engineering

Dr. John Yen is the director for Strategic Research Initiatives in the College of Information Sciences and Technology. Dr. Yen's long-term research interest is the capturing and modeling of human knowledge in software agents for supporting decision making, for improving the productivity and adaptability of global enterprises, and for supporting individual/team learning in the digital information age. His current research activities include developing agent-based teamwork model and self-adaptive personalization technologies. Yen is also interested in the mining/learning of large-scale fuzzy knowledge (i.e., knowledge with imprecisions), predicting the influence of online social interactions to people (e.g., energy consumption behaviors and health behaviors), and modeling and facilitating the diffusion of innovation and energy technology through heterogeneous networks.

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**Yaw Yeboah**  
Professor, Energy and Mineral Engineering

Dr. Yaw Yeboah, department head, Energy and Mineral Engineering, has over 30 years of research, teaching, and project management experience. His research expertise covers such areas as catalysis, bioenergy, fuel cells, combustion and emission control, oil field scale formation, and flow visualization. Some of his recent research projects include electrocatalysis in PEM fuel cells, co-gasification of coal and biomass, catalytic gasification with eutectic salts, hydrogen from biomass, fire spread behavior in liquid pools, and use of non-thermal plasma discharge for emission (NOx) control.
He Guo
Professor, Software

He Guo is the vice dean in the DUT Software School. Dr. Guo’s current research interests include distributed and parallel computing, computer vision and software architecture.

Xinwen Guo
Professor, Catalysis Chemistry and Engineering

Dr. Xinwen Guo is dean of the School of Chemical Engineering, and vice director of the State Key Lab of Fine Chemicals, and director of the Department of Catalysis Chemistry and Engineering. He was a visiting scholar at Penn State in 2001 and 2004. Dr. Guo’s research and teaching revolve around catalysis and his current research interests include synthesis and application of nanoscale ZSM-5, Ti-containing zeolite, and SO\textsubscript{3}H-functionalized ionic liquids as well as catalytic conversion of biomass, and synthesis and characterization of novel catalytic materials.
**Haoquan Hu**  
Professor, Chemical Engineering

Dr. Haoquan Hu is vice dean of the School of Chemical Engineering, head of the department of Chemical Technology, and director of the Institute of Coal Chemical Engineering. He is a professor of chemical engineering with research interests in coal conversion to liquid fuels, and catalysis for fuels and chemicals. His current research focuses on the application of supercritical fluid in extraction and chemical reactions, the preparation and application of carbon and other porous materials, such as mesoporous materials for catalyst and adsorbent, carbon membranes, and carbon aerogels as well as the pyrolysis of coal, oil shale and biomass, including the integrated process of coal pyrolysis with methane partial catalytic oxidation for high liquid product, the characterization of weak covalent bonds in low and medium rank coal and free radicals during coal pyrolysis, coal and biomass to chemicals by hydroliquefaction, and kinetic study on coal direct liquefaction.

**Liping Huang**  
Professor, Environmental Engineering

Dr. Liping Huang’s research and teaching interests at Dalian University of Technology fall into two main areas: bioenergy and biomaterials. In bioenergy, Dr. Huang’s research interests include electricity generation with simultaneous wastes and wastewaters treatment using microbial fuel cells, electricity generation with simultaneous value-added chemicals production from microbial fuel cells, hydrogen production from microbial electrolysis cells, and microbial fuel cells coupling technologies for wastes treatment and in situ remediation. In biomaterials Dr. Huang’s current research includes lactic acid production from wastes and wastewaters by fermentation, and bioflocculant production from wastewaters.
Dr. Min Liu is an associate professor at Dalian University of Technology. His research interests include catalytic conversion of biomass, Ti-containing zeolite and shape selective catalysis for chemicals.

Dr. Xiang Li is an associate professor and part of the State Key Laboratory of Fine Chemicals at Dalian University of Technology. His research interests include deep hydrodesulfurization catalyst supported by mesoporous materials as well as the kinetics of the HDS of 4,6-dimethyl dibenzothiophene.
**An-hui Lu**  
Professor, Chemical Engineering

Dr. An-hui Lu is part of the State Key Laboratory of Fine Chemicals at Dalian University of Technology. Dr. Lu’s current research interests involve carbon nanostructure, including synthetic porous carbon, functionalization of porous carbon, and porous carbon catalysts/adsorbent as well as magnetically separable catalysts, including magnetic porous carbon, encapsulation of nanoparticles by polymer/silica, and multifunctional magnetic catalyst.

**Yi Luo**  
Professor, Chemical Engineering

Dr. Yi Luo is part of the Key Laboratory for Micro/Nano Technology and System, in Liaoning Province, China. His research focuses on computational catalysis and lubrication. In computational catalysis, his current research includes the calculation of organometallic complexes as catalysts with the purpose of interpreting reaction mechanism and hence providing a rational guide to experiments. In the area of lubrication, Dr. Luo is using computer simulation and lab experiments to research the development of green lubricants.
Dr. Anjie Wang is a professor of catalysis and part of the State Key Laboratory of Fine Chemicals. His research interests focus on catalysis in hydrodesulfurization and hydrodenitrogenation (metal sulfides and phosphides), synthesis of mesoporous and micro-mesoporous materials, oxidative desulfurization of petroleum fractions, non-thermal plasma assisted catalysis, selective hydrogenation of acetylene, and micro-channel reactors. Dr. Wang’s current projects include deep desulfurization and denitrogenation of engine fuel and the application of microchannel reactors in fine chemical synthesis.

Dr. Hailin Mu teaches in the area of energy and the environment. His current research interests include energy, economy and environment development strategy; energy-saving and environmental emission control technologies, policies and countermeasures; circular and low-carbon economy; new energy and re-generation energy technologies as well as development countermeasures; assessment of environmental pollutant lost; and energy plan, energy auditing, energy efficiency assessment and energy monitoring.
**Yao Wang**  
Associate Professor, Chemical Engineering

Dr. Yao Wang received her Ph.D. degree in Chemical Engineering from DUT in 2004. She has been a faculty of Dalian University of Technology since 1991. She has published over 50 quality papers in peer-reviewed journals, and is one of the recipients of the Third Prize of Natural Sciences of Liaoning Province. She specializes in heterogeneous catalysis, bio-oil upgrading, and process system engineering. Her current research interests include catalytic hydrotreating of engine fuel, hydrodeoxygenation of bio-oil derived from cellulose-based biomass, and synthesis of transition metal phosphides via hydrogen plasma reduction and their applications in hydrotreating process. Dr. Wang’s current research interests include hydrodeoxygenation of bio-fuels, deep hydrodesulfurization and hydrodenitrogenation catalysis, synthesis of catalytic materials by non-thermal plasma enhancement, and total process energy integration.

**Yongchun Zhang**  
Professor, Chemical Engineering of Catalysis  
School of Chemical Engineering

Dr. Yongchun Zhang is a teacher and researcher in the area of catalysis. His current research interests focus on gas adsorption and separation, CO$_2$ capture and purification, and CO$_2$ activation and conversion to methanol or dimethyl ether by hydrogenation.
JCER Activities

Since 2009, the Joint Center for Energy Research has been actively working to find mutual areas of interest and facilitate research collaborations. The group has met at DUT and Penn State to hold workshops with faculty and meetings with university leaders as well as participate in laboratory tours.

Memorandum Signing
Penn State

On Friday October 16, 2009, a delegation from Dalian University of Technology visited Penn State and the EMS Energy Institute to discuss the establishment of the Joint Energy Research Center and sign a Memorandum of Understanding. During the visit, the DUT delegation visited laboratories at the EMS Energy Institute, and discussed potential collaboration topics and a future workshop on joint clean energy research with Penn State faculty members.

The delegation from DUT included DUT President Jinping Ou; Shengchuan Zhao, director of the DUT International Office; Xinwen Guo, associate dean of the School of Chemical Engineering; Min Han, associate director of the personnel department; and Xiaoli Hui, associate dean of School of Software Engineering.

DUT delegates met with Penn State President Graham Spanier; Eva Pell, senior vice president for research and dean of the Graduate School; Alan Scaroni, associate dean for graduate education and research, College of Earth and Mineral Sciences; Renata Engel, associate dean for academic programs, College of Engineering; Tom Richard, Director of Penn State Institutes of Energy and the Environment; Janet Murphy, director of general administration and planning, University Office of Global Programs; Yaw Yeboah, department head, Energy and Mineral Engineering; Chunshan Song, director of EMS Energy Institute; and Denis Simon, School of International Affairs; along with faculty members from the College of Earth and Mineral Sciences and the College of Engineering.
First Workshop
Dalian University of Technology

On October 11, 2010 Penn State and Dalian University of Technology held the first official workshop to discuss research opportunities and possible collaborations. During this visit Penn State faculty heard about Dalian University of Technology’s research capabilities, facilities, and areas of expertise. The workshop also included tours of some various laboratory spaces on the DUT campus.
Opening Ceremony and Second Workshop
Penn State

On April 12, Penn State and Dalian University of Technology celebrated the establishment of the Penn State–Dalian Joint Center for Energy Research with a ceremony, musical performance and banquet.

Ceremony attendees included Penn State President Graham Spanier, Penn State Vice President for Research Henry Foley, Penn State Vice Provost Michael Adewumi, State College Mayor Elizabeth Goreham, DUT President Jinping Ou, DUT Vice President Guiling Ning and many other faculty and staff members from both universities.

This visit also served as the second Penn State – DUT Joint Energy Workshop, which was held at the EMS Energy Institute. Faculty from both institutions came together to talk about their expertise with the goal of finding areas of mutual interest for collaborations. The discussed key issues and action items for the JCER. After presentations and discussions, guests from DUT participated in a tour of the EMS Energy Institute laboratories.
Opening Ceremony
Dalian University of Technology

On May 17, 2011 members from the Penn State community traveled to Dalian University of Technology to hold a second ceremony for the opening of the Joint Center for Energy Research. During this small ceremony, a plaque commemorating the Center was presented to Dalian University of Technology. Penn State has a matching plaque, which hangs in the EMS Energy Institute.
Hosting Faculty and Students

Penn State has hosted faculty and students from Dalian University of Technology, including visiting scholar Yao Wang, associate professor, visiting PhD student Xiaowa Nie, and PhD students Xiao Jiang and Wenying Quan.

Dalian University of Technology has hosted several Penn State faculty visits, including Tom Richard and Chunshan Song in May 2011 as well as Semih Eser in July 2011.

Upcoming Workshop
Dalian University of Technology

On March 22-23, 2012 Dalian University of Technology will be hosting the third Joint Center for Energy Research Workshop. Participants from Penn State will include President Rodney Erickson; Vice Provost Michael Adewumi; Tom Richard, director, Penn State Institute of Energy and the Environment; Yaw Yeboah, department head, Energy and Mineral Engineering; Bruce Logan, professor, Civil and Environmental Engineering; Michael Janik, assistant professor, Chemical Engineering; Sarma Pisupati, associate professor, Energy and Mineral Engineering; Yongsheng Chen, assistant professor, Energy and Mineral Engineering; Zhen Lei, assistant professor, Energy and Mineral Engineering; Jonathan Mathews, assistant professor, Energy and Mineral Engineering; and Chunshan Song, director of the EMS Energy Institute. In addition to the Penn State attendees, Dalian University of Technology leaders and faculty members from multiple schools will participate in the two-day workshop.
LIST OF JOINT PUBLICATIONS

Peer Reviewed Journals Articles


2012 Submitted

2011


2010


2010 cont.


2009


Conference Papers

2011

2010


2009

Both Penn State and Dalian University of Technology have provided initial financial support to the Joint Center for Energy Research. Penn State’s initial support includes $80,000 for five years, which is contributed by the EMS Energy Institute, the Department of Energy and Mineral Engineering, the College of Earth and Mineral Sciences, the College of Engineering, the Penn State Institutes of Energy and the Environment, and the central administration as well as the time of faculty contributing to the PSU-DUT collaborations. Dalian University of Technology has committed 800,000 RMB in support of the Joint Center and the collaborative research activities in Dalian. In addition, Dr. Chunshan Song, Penn State, as a distinguished visiting professor at DUT, received the QianRen award from the Chinese government (type B award). This award is used in part to support the collaborative research between DUT and Penn State in clean energy and catalysis.