University Coalition for Fossil Energy Research

Penn State is leading a University Coalition for Fossil Energy Research (UCFER) that will advance basic and applied research for clean and low-carbon energy based on fossil fuels in support of the U.S. Department of Energy’s mission. UCFER is focusing on research that will improve the efficiency of production and use of fossil energy resources, while minimizing the environmental impacts and reducing greenhouse gas emissions.

Through a nationwide open competition, the six-year, $20 million dollar project was awarded by the Department of Energy’s National Energy Technology Laboratory. Penn State, along with the Massachusetts Institute of Technology, Princeton University, Texas A&M University, University of Kentucky, University of Southern California, University of Tulsa, University of Wyoming and Virginia Polytechnic and State University, are the founding members of the coalition. Dr. Chunjian Song, director of Penn State’s Energy Institute in the College of Earth and Mineral Sciences and distinguished professor of fuel science and chemical engineering, is the principal investigator and director of UCFER.

The University Coalition for Fossil Energy Research has been established to advance basic and applied fossil energy research through mechanisms that promote collaboration among the Department of Energy and the universities that are members of the Coalition by the coordination of research and the sharing of data. Its collaborative research focuses on coal, natural gas, and oil and the research involves one or more of the following five core competencies:

- Geological and Environmental Systems, consisting of research on geomatics, fluid flow in geologic media, and geospatial and strategic field monitoring.
- Materials Engineering and Manufacturing, consisting of research on the design, development, and deployment of advanced functional and structural materials for use in extreme service environments.
- Energy Conversion Engineering, consisting of the evaluation, integration, control and performance modeling of processes and components for developing innovative energy conversion processes and transformational technologies.
- Systems Engineering and Analysis, consisting of analysis and design of advanced energy systems such as power plants, energy markets, and energy-environment interactions.
- Computational Science and Engineering, consisting of research involving high-performance computing and data analytics that enable the generation of information and insights through the integration of experimental data and engineering analyses.

www.energy.psu.edu/ucfer

Universities interested in becoming members go to: www.energy.psu.edu/ucfer/becomemember.html

Projects were selected for funding:

- Converting CO₂ and Methane to Fuels by Enhanced Plasmonic Effects in a Nanotemplated Catalyst Plasma Project Reactor
- Efficient Reduction of CO₂ in a Bipolar Electrochemical Cell
- A Low-Cost Technique for In-Situ Stresses and Geomechanical Properties Measurement Based on Leak-Off Tests and Caliper Logs
- A Novel Point Process Filtering Paradigm for Modeling and Inversion of Microseismic Monitoring Data During CO₂ Storage
- Integration of Geophysical and Geomechanical Modeling to Monitor Integrity of Carbon Storage
- Grid Independence and Uncertainty Quantification in Gas-Solid Flow Simulations
- Designing Polymer/2D MOF Composite Membranes with Enhanced CO₂ Transport for CO₂/N₂ Separation
- Layer-by-Layer Functional Thin Film Coatings for Enhanced Light Gas Separations
- Validation of CFD Models for Turbulent, Supercritical CO₂ Combustion
- Fundamental studies on the reaction mechanisms of oxygen carriers for CO/CO₂ or CO/CO₂/Li2O reactions
- Evaluation of Agglomeration Potential of Oxygen Carriers for Chemical Looping Combustion (CLC) and Chemical Looping with Oxygen Uncoating (CLOU)
- Methane Emissions Quantification (MEQ) of Compressor Stations