

Twenty-four FY2012 Phase I Fossil Energy Projects Chosen by DOE's Small Business Innovative Research (SBIR/STTR) Program

Washington, D.C. — The Department of Energy has selected twenty-four new projects under the Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Program.

Taken as a whole, the Department of Energy's (DOE) Fossil Energy (FE) Research and Development (R&D) activities help ensure that as the nation strives to reduce its reliance on imported energy sources, new technologies and methodologies will be in place to promote the efficient and environmentally sound use of America's abundant fossil fuels.

The selections will provide research grants in eight topic areas — advanced clean energy research, advanced crosscutting fossil energy research, climate control technologies for fossil energy applications, coal gasification technologies, advanced turbine technologies for IGCC power plants, fuel cell technologies for central power generation with coal, technologies for clean fuels and hydrogen from coal, and oil & gas technologies — and will be funded at a maximum of \$150,000 for 9 months. The projects are managed by the DOE's Office of Fossil Energy and its National Energy Technology Laboratory (NETL).

The selections mark the 33rd round of the Department's SBIR program. Over the 29 years of its existence, the DOE SBIR Program has evolved significantly. DOE has issued 33 Phase I solicitations in SBIR, reviewed approximately 43,216 proposals, and selected for funding 6,094 Phase I projects and 2,167 Phase II projects valued in excess of \$2.07 billion. A summary of the topic areas and the selected projects follow.

Advanced Clean Energy Research Carbon Dioxide (CO₂) Conversion to Fuels and Chemicals

Utilization of carbon dioxide (CO₂) has become an important global issue due to the significant and continuous rise in atmospheric CO₂ concentrations, accelerated growth in the consumption of carbon-based energy worldwide, depletion of carbon-based energy resources, and low efficiency in current energy systems. Projects under this topic will develop novel concepts, based on the use of advanced catalysts, for the conversion of CO₂ from energy production and utilization systems to value-added fuels and industrial chemicals.

- **Green Pacific Biologicals, Inc.**, San Francisco, CA — This project will develop novel bioengineering solutions that, if successful, will reduce production costs of renewable algae biofuels to around \$50/barrel. (DOE Share: \$150,000)
- **Phosphortech Corporation**, Lithia Springs, GA — In this phase 1 SBIR project, we propose to develop a new type of photo-catalyst nanowire structure for high yield CO₂ reforming into fuels and useful chemicals by sunlight energy. (DOE Share: \$150,000)

Advanced Clean Energy Research Solid Oxide Fuel Cell High-Temperature Sealing Systems Based on Viscous Glass

Research is sought to develop viscous glass-based sealing concepts for SOFCs. The ultimate objective is the development of an economically-viable, manufacturable seal

material followed by a composite system design that can provide sealing under all operating conditions for the life of planar SOFC stacks.

- **Sem-com Company, Inc.**, Toledo, OH — Over the years many applications have been abandoned because the mismatch between the sealing components was too great to be of practical consequence or because no high CTE glasses were available. A compliant seal technology will open up at least some of these applications to hermetic seal technology. The high CTE hexacelsian glass, especially with the addition of the nano-scale materials will allow a new family of high CTE sealing glasses to be developed that do not exist today. These high CTE glasses would be especially useful in glass-to-metal applications. (DOE Share: \$150,000)

Advanced Clean Energy Research Long-life Thermal Barrier Coatings (TBC) for High Temperature Gas Turbine Applications

Grant applications are sought to develop materials and methodologies that advance the state-of-the-art and address new ceramic top coat and metallic bond coat chemistries for long-life TBC systems capable of operating at temperatures greater than currently available YSZ TBC systems.

- **Hifunda, LLC.**, Salt Lake City, UT — The new coating technology developed through this STTR program can help to increase energy efficiency of gas turbines, reduce energy costs, maintain US leadership in gas turbine equipment, and reduce greenhouse emissions. (DOE Share: \$150,000)
- **Powdermet, Inc.**, Euclid, OH — This project improves turbine efficiency through the application of a strong, temperature-resistant ceramic film to the turbine blades. The increased turbine efficiency results in reduced energy usage, environmental impact, and costs. (DOE Share: \$150,000)

Climate Control Technologies for Fossil Energy Applications Advanced Solvents for CO₂ Capture from Existing Coal-fired Power Plants

Applications are sought to develop solvent based technologies that can substantially lower the cost of CO₂ capture from flue gas produced by existing coal-fired power plants.

- **Materials Modification, Inc.**, Fairfax, VA — Capture and storage of CO₂ is a key component of the President's vision for a cleaner, more secure energy future. This project will focus on ionic liquid based flue gas purification for CO₂ capture. (DOE Share: \$150,000)

Climate Control Technologies for Fossil Energy Applications CO₂ Utilization to Develop Valuable Products

Applications to develop novel technologies for the use of captured CO₂ as a feedstock for chemical synthesis into valuable products (excluding algae and fuels which are addressed elsewhere).

- **United Environment & Energy, LLC**, Horseheads, NY — This project will develop a high performance, low cost, and environmentally friendly bioasphalt technology for

building applications, which will bring significant energy and cost savings to the end-users, protect the environment and improve human health, and reduce the use of petroleum based fuel. (DOE Share: \$149,821)

Climate Control Technologies for Fossil Energy Applications Advanced Monitoring Technologies for Geologic CO₂ Storage

Grant applications are sought for technologies involving field-based Monitoring Verification and Accounting (MVA) hardware that quantify CO₂ emissions in the unlikely event that CO₂ migrates out of the injection zone, detect leakage pathways through existing faults, fractures, and/or wellbores, monitor and image the CO₂ plume, and/or monitor the pressure front for carbon storage projects.

- **Groundmetrics, Inc.**, San Diego, CA — This project will develop and build a system for long term monitoring of CO₂ reservoirs to confirm the integrity of the seal. The purpose of storing CO₂ is to mitigate its effect on the atmosphere and climate. (DOE Share: \$149,991)
- **Innosense, LLC**, Torrance, CA — This project will support the DOE program objectives of lowering the cost of CO₂ capture and ensure that this greenhouse gas can be stored in geologic formations safely and permanently. (DOE Share: \$150,000 STTR)

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- **Ion Engineering, LLC**, Boulder, CO — The use of advanced polymer membranes for CO₂ capture at power plants can provide an economical and energy efficient means of drastically reducing emissions while continuing to utilize conventional fuel sources for electric power generation. This project will develop materials that can achieve this goal and accelerate the utilization of inexpensive, clean energy. (DOE Share: \$150,000 STTR)

Coal Gasification Technologies Novel Multi-contaminant Control Technologies for IGCC

Applications are sought for development of novel multi-contaminant control technologies to remove trace metals and non-sulfur contaminants from IGCC syngas.

- **TDA Research, Inc.**, Wheat Ridge, CO — The use of environmentally responsible coal-based processes is hindered by the presence of a wide spectrum of contaminants present in coal. This project will develop a clean-up technology to remove these contaminants in a cost-effective way to support the widespread utilization of coal in environmentally responsible power generation and production of transportation fuels. (DOE Share: \$150,000)

Coal Gasification Technologies Novel Energy Storage Concepts Integrated with IGCC that Include CCS

Applications are sought for novel concepts to enable load-shifting of the parasitic energy requirements for carbon capture and storage (CCS) to non-peak periods, thereby increasing the net power that can be delivered to the grid during peak demand periods while still

maintaining a high average carbon capture percentage (>90%).

- **Creare Incorporated**, Hanover, New Hampshire — This project will develop a low-cost, combined thermal and CO₂ storage system to enable power plants to increase electrical output during peak demand periods without increasing CO₂ emission. (DOE Share: \$149,961)

Coal Gasification Technologies

Hybrid Integrated Concepts for IGCC (with CCS) and Non-Biomass Renewable Energy (e.g. Solar, Wind)

Applications are sought for novel design concepts for integrating new IGCC plants with a non-biomass renewable energy resource (e.g. wind and solar).

- **Advanced Cooling Technologies, Inc.**, Lancaster, PA — This hybrid solar gasifier will provide coal-derived syngas for liquid fuels produced with a new catalyst for FT synthesis. (DOE Share: \$149,988)

Coal Gasification Technologies

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Technologies for Clean Fuels and Hydrogen from Coal

Concepts for Advanced Catalysts for Water-Gas-Shift (WGS) and Fischer-Tropsch (FT) Processes for Gases from Co-Mingled Coal and Biomass Gasification

Grant applications are sought for novel WGS and/or FT catalyst-related improvements that will result in improved Coal-Biomass-to-Liquids (CBTL) plant efficiency and/or cost.

- **Emerging Measurements (emco)**, Knoxville, TN — This project will develop high temperature optical based thermographic phosphor sensors for fossil fuel fired power plants. (DOE Share: \$150,000 STTR)

Crosscutting Fossil Energy Research

Distributed Low Cost Sensing for Power and Energy Systems

Grant applications are sought for the design and rapid prototyping of highly distributed low cost sensing concepts for power and energy systems. Measurements of interest include temperature, pressure, stress/strain, vibration, and key indicators of process condition and system status.

- **Habsonic, LLC**, Rolla, MO — One of a kind, low-cost sensors and associated

instrumentation will be developed for advanced control and optimization of various energy systems to achieve greater efficiency and reduced emissions. (DOE Share: \$149,886)

Crosscutting Fossil Energy Research

Novel Approaches for Monitoring the Condition of Advanced Power Plants

Grant applications are sought for condition monitoring sensors capable of function in high temperature (800oC-1200oC) harsh environment that will directly contribute to improving system control, protect capital equipment investment, and promote safety through prevention of catastrophic equipment failure. Non-destructive and embedded

- **Emerging Measurements (emco)**, Knoxville, TN — This project will develop high temperature optical based thermographic phosphor sensors for fossil fuel fired power plants. (DOE Share: \$150,000 STTR)
- **Sporian Microsystems, Inc.**, Lafayette, CO — This project will develop a novel technology, based on advanced high temperature materials, to support the implementation of new sensor technologies that can increase the fuel efficiency of fossil energy generation systems. (DOE Share: \$149,990)

Crosscutting Fossil Energy Research

Advanced Process Control Techniques using Distributed Intelligence

Grant applications are sought for the development of novel process control techniques that distribute intelligence to the actuation and sensing level within a system. Viable concepts which include self organization, adaptive control, model based techniques, and data mining capability that can be distributed with a realistic sensing and actuation network to enable distributed intelligent control are encouraged.

- **General Cybernation Group**, Rancho Cordova, CA — This project will result in a novel advanced process control architecture with Self-Organizing Sensing (SOS) and Self-Organizing Actuation (SOA) methods, technologies, and products. They can make a big impact on the industry and help the U.S. strengthen its energy security economic health and movement towards a cleaner environment. (DOE Share: \$149,990)

Advanced Turbine Technology for IGCC Power Plants

High-Yield Manufacturing of Single Crystal Gas Turbine Components

Research and development is sought to explore innovative approaches to increase the yield rates of single crystal castings for high-temperature gas turbine applications. This could be through compositional adjustments and/or casting process improvements relative to the state of the art. Development of models correlating casting defects to composition and process variables is encouraged.

- **Mikro Systems, Inc.**, Charlottesville, VA — This project will develop ceramic filters that will optimize filtration performance while enabling directional flow of molten alloy during the SX casting process. These performance advantages will be enabled through the geometric design of the filter. Another anticipated benefit is the ability to design part-specific filtration schemes for advanced airfoil castings. (DOE Share: \$150,000)

Advanced Turbine Technology for IGCC Power Plants Advanced Gas Turbine Sealing and Leakage Control Strategies

Grant applications are sought for research and development to explore specific sealing improvements in the areas of the unshrouded blade tips and/or shaft sealing. Grant applications should address the technology of the proposed concept(s) relative to the current state of the art, substantiate the costs and benefits, and evaluate a validation strategy with existing gas turbine equipment.

- **Florida Turbine Technologies, Inc.**, Jupiter, FL — This project will develop an innovative design approach to provide a highly durable “contactless” air riding rotating-to-static seal. Rotating-to-static seals are critical components of all gas turbine engines. The seals can significantly affect the efficiency, operability, and durability of a gas turbine engine. (DOE Share: \$150,000)

Fuel Cell Technologies for Central Power Generation with Coal Aluminized Coatings for Solid Oxide Fuel Cell (SOFC) Applications

Grant applications are sought to identify, test and select candidate iron and nickel based alloys and aluminized coatings for applications in air and thermal management units of advanced SOFC systems.

- **Nnextech Materials, LTD**, Lewis Center, OH — This project will develop a commercially viable aluminization process that is amenable to high volume SOFC manufacturing. (DOE Share: \$150,000)
- **Ngimat Co.**, Norcross, GA — SOFCs represent a clean and efficient power generation method; however, current technology is cost prohibitive. This project proposes the use of novel nano-coatings that will enable decreased manufacturing and operating cost, increased reliability, and increased lifetimes for SOFCs.(DOE Share: \$150,000)

Fuel Cell Technologies for Central Power Generation with Coal Low-Cost Alloys for high-Temperature SOFC System Components

Applications are sought to identify and/or develop low-cost alloys amenable to the high-temperature requirements of an SOFC system. Specific technical requirements will be dependent on the design of the SOFC system with which it is associated; however, the following general requirements must be addressed: low chrome volatility for piping carrying air to the SOFC cathode inlet. Weldability, and flexibility relative to high-temperature bellows. Applicants are encouraged to consult with the SECA Industry Teams with respect to their detailed specifications.

- **Questek Innovations, LLC**, Evanston, IL — This project will apply a computational alloy design methodology and experience with high-Cr stainless ferritic alloy for SOFC with low Cr volatility and high oxidation resistance that is also weldable, to resolve a major technical challenge in SOFC commercialization. (DOE Share: \$149,768)

Oil and Gas Technologies

Enhanced Recovery of Petroleum Resources

Grant applications are sought to develop innovative tools or methods to reduce geophysical, environmental impact reduction or mitigation, oil processing, or field development costs – and/or improve recovery efficiency – related to the development and production of oil from residual oil, heavy oil, and fractured oil-bearing shale resources.

- **Optiphase, Inc**, Van Nuys, CA — High-resolution fiber optic based distributed acoustic sensing is applied to the enhancement of oil and gas reservoir imaging with the prospect to increase the recovery rate of performing wells. Increases in the oil recovery rate will have a considerable positive effect on the environment, as the remaining oil from marginal fields can be extracted with the existing infrastructure. (DOE Share: \$149,374)

- **Frac Biologics, Inc.**, Pittsburgh, OH — Researchers at Frac Biologics and Allegheny Singer Research Institute are testing an exciting new biotechnology to cost effectively remove hazardous contaminants from frac water. (DOE Share: \$100,000)