DOE Commits $67M to 10 Carbon Capture Projects

WASHINGTON, D.C. — The US Department of Energy announced today the selection of ten projects aimed at developing advanced technologies for capturing carbon dioxide (CO_2) from coal combustion. The projects, valued at up to $67 million over three years, focus on reducing the energy and efficiency penalties associated with applying currently available carbon capture and storage (CCS) technologies to existing and new power plants.

The selections announced today will focus on improving efficiency and reducing the added costs to electricity at power plants with carbon capture systems to less than 30 percent for a new pulverized coal plant and 10 percent for a new advanced gasification plant. The Obama Administration has made a goal of developing cost-effective deployment of CCS technologies within 10 years, with an objective of bringing 5 to 10 commercial demonstration projects online by 2016.

Charting a path toward clean coal is essential to achieving our goals of providing clean energy, creating American jobs, and reducing greenhouse gas emissions. It will also help position the United States as a leader in the global clean energy race, said Secretary Steven Chu.

Carbon dioxide power plant capture systems currently require large amounts of energy for their operation, resulting in decreased efficiency and reduced net power output when compared to plants without CCS technology. The goal of this research is to reduce the energy penalty with carbon capture and sequestration technologies, thereby reducing costs and helping to move the technology closer to widespread use.

Post-combustion CO_2 capture technology offers great near-term potential for reducing power sector CO_2 emissions because it can be retrofited to existing plants. Today's selections will focus on bench-scale and slipstream-scale development (0.5 to 5 MWe) and testing of advanced post- combustion CO_2 capture technologies that include membranes, solvents, and solid sorbents.

Post-combustion CO_2 Selections include:

Bench-Scale Development and Testing of Post-combustion CO_2 Capture

Membranes

American Air Liquide, Inc. (Newark, DE)-This two-year project will develop a cost-effective system for CO_2 capture based on the performance achieved by the sub-ambient temperature operation of the Air Liquide hollow fiber membrane. The

membrane will be coupled with cryogenic processing technology in a closed-loop test system that will verify the effect of possible contaminants, such as SOx, NOx and water, on membrane performance at levels relevant to coal-fired power plants. Experimental results will be used to refine the integrated process simulation and to design a slipstream facility. (DOE share: $1,266,249)

Gas Technology Institute (Des Plaines, IL)-Partnering with PoroGen Corporation and Aker Process Systems, Gas Technology Institute proposes a three-year effort to develop cost-effective hybrid separation technology for CO2 capture from flue gases based on a combination of absorption and hollow fiber membrane technologies. The technology could also apply to removal of numerous other gas pollutants such as NOx and SOx, separation of CO2 from hydrogen in refinery streams, and separation of CO2 from natural gas (natural gas sweetening). (DOE share: $2,986,063)

Solvents

3H Company, LLC (Lexington, KY)-3H Company and partners will confirm experimentally and analytically the feasibility of 3H Company patented

Self-Concentrating Absorbent CO2 Capture Process. The process is based on amines in a non-aqueous solvent, which upon reaction with CO2, will separate into two distinct phases: a CO2-rich liquid phase and a dilute lean phase. Preliminary experimental data show that the process has the potential of reducing the total regeneration energy by as much as 70 percent. During the three-year project, the team will also develop an engineering design, supported by laboratory data and economic justification, to construct and operate a slipstream demonstration facility at an E-ON power plant in the United States as a next stage of commercialization development. (DOE share: $2,740,033)

Akermin, Inc. (St. Louis, MO)-Akermin proposes to demonstrate the ability to capture up to 90 percent of CO2 from a simulated flue gas using a solvent with significantly lower regeneration energy at rates comparable to those of conventional monoethanolamine. Over the course of the two-year project, Akermin will optimize solvent formulation and demonstrate process efficacy for treating up to 2,000 standard liters of gas per hour. (DOE share: $2,608,759)

ION Engineering, LLC (Boulder,CO)-In a 15-month project, ION Engineering and partners will fabricate, install, and operate a bench-scale carbon capture unit to process flue gas at an operating power plant using amine- based solvents, which are highly effective for CO2 capture. ION's innovative approach to solvent formulation employs an ionic liquid instead of water as the physical solvent, greatly reducing the energy required to regenerate the amines and significantly lowering process water usage. In addition to a 60 percent reduction in energy requirement, ionic liquid- amine solvent mixtures offer higher CO2 capacities, reduced corrosion, reduced solvent losses, and other benefits when compared to traditional aqueous amine technologies. (DOE share: $2,999,614)

University of Illinois (Champaign, IL)-Collaborators at the University of Illinois at Urbana-Champaign and Parsons Corporation will investigate the use of a carbonate

salt (potassium or sodium carbonate) as a solvent for absorption-based, post-combustion CO_2 capture. A preliminary techno- economic evaluation shows that energy use with the Hot Carbonate Absorption Process (CAP) is about half that of a conventional monoethanolamine process. The research team will perform a proof-of-concept study aimed at generating process engineering and scale-up data to help advance Hot-CAP technology to the pilot-scale demonstration level within three years. (DOE share: $1,261,459)

URS Group (Austin, TX)-URS Group, Inc. and partners will investigate the use of concentrated piperazine (PZ) as a solvent for absorbing CO_2 from coal-fired power plant flue gas. PZ coupled with two-stage flash regeneration at 150oC offers several advantages over other solvents, including: faster CO_2 absorption rate, higher CO_2 capacity, lower volatility, negligible thermal degradation, negligible oxidative degradation when used with an inhibitor, and production of CO_2 at elevated pressure (resulting in lower compression costs). The three-year project will be conducted initially at a 0.1 MW scale and ultimately with a 0.5 MW unit designed and constructed for a final test campaign with the absorber at DOE's National Carbon Capture Center. (DOE share: $3,000,000)

Slipstream Development and Testing of Post-combustion CO_2 Capture

Membranes

Membrane Technology and Research, Inc. (Joseph City, AZ))-Membrane Technology and Research (MTR) and partners will construct a 1 MW membrane skid capable of 90 percent CO_2 capture from a slipstream flow of 20 tons-of- CO_2/day in coal-fired flue gas during a six-month field test at the Arizona Public Service Cholla Power Plant. Field test data and membrane performance data obtained at the National Carbon Capture Center will allow a thorough techno-economic evaluation of the membrane capture process over the three-year project, and will clarify the relative potential of the approach. (DOE share: $14,756,199)

Solvents

Siemens Energy, Inc. (Pittsburgh, PA)-Siemens Energy will design, install, and operate a pilot plant for treating a slipstream (1 MW equivalent) at the TECO Energy Big Bend Station to demonstrate POSTCAP technology for post- combustion CO_2 gas capture. Siemens' POSTCAP technology utilizes an amino acid salt formulation as a solvent for CO_2 absorption. (DOE share: $8,960,000)

Solid Sorbents

ADA-ES, Inc. (Littleton, CO)-ADA-ES and partners will refine the conceptual design of a commercial solid sorbent-based, post-combustion CO_2 capture technology through slipstream pilot testing and process modeling. A pilot unit (1 MW) will be designed and constructed for operation at one of the cost-share participant's power plant sites to demonstrate solid sorbent- based CO_2 capture on actual flue gas for at least two continuous months. The pilot tests and process modeling during the 39-month project will provide the information necessary to complete a techno-

economic analysis of the technology. (DOE share: $11,133,706)

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