DOE Project Selections for Reducing the Costs of Using Gasification for Coal Conversion

Aerojet Rocketdyne (Canoga Park, Calif.)—*Dry Solids Pump Coal Feed Technology*. Under this project, researchers at Aerojet Rocketdyne (AR) will gather data to prove superior performance of dry solids pump (DSP) technology for integrated gasification combined cycle plants. DSP technology is targeted to reduce feed system capital cost and operational costs. Through continued testing and upgrades to the existing DSP, the project will also mature the technology to an advanced stage of development on the path to commercialization. (DOE share: $5,428,067; Recipient share: $2,326,315; Duration: 36 months)

Air Products and Chemicals, Inc. (Allentown, Pa.)—*Development of ITM Oxygen Technology for Low-Cost and Low-Emission Gasification and Other Industrial Applications*. The objective of this project is to advance ion transport membrane (ITM) technology with the goal of executing an ITM oxygen development facility. This project focuses on improving, creating, and testing ceramic oxygen-producing modules, each expected to make 1 ton per day of oxygen from air. This ITM system operates at warm temperature, and capital costs are expected to be less than conventional cryogenic air separation units. Long-term, this project is expected to serve domestic and global applications for energy-intensive industrial and power plant applications. (DOE share: $11,188,366; Recipient share: $11,188,367; Duration: 36 months)

Air Products and Chemicals, Inc. (Allentown, Pa.)— *Advanced Acid Gas Separation Technology for Clean Power and Syngas Applications*. The project team will develop a proprietary alternative to acid gas removal systems that consists of two process blocks: sour pressure swing adsorption (PSA), which separates CO_2 and H_2S from the desired products, and a tailgas disposition block, which separates the sulfur-containing compounds and purifies the CO_2 to a sequestration-grade product. Replacing the acid-gas-removal process with downstream processes may reduce the cost of CO_2 capture in a high-hydrogen-containing syngas. (DOE share: $851,757; Recipient share: $212,939; Duration: 12 months)

Gas Technology Institute (Des Plaines, Ill.)—*Hybrid Molten Bed Gasifier for High H_2 Syngas Production.* The research team will evaluate and test a hybrid molten bed (HMB) gasification process for producing syngas from a coal/natural gas feed. The HMB gasification process potentially offers several benefits over conventional gasifiers including higher efficiency, higher yield of electricity or diesel, lower cost of electricity or diesel, lower costs for carbon capture, and lower capital costs due to simpler plant layout. The project team will conduct techno-economic analyses for plants based on conventional slagging gasification and HMB gasification producing both power and diesel and including carbon capture. (DOE share: $800,040; Recipient share: $200,133; Duration: 12 months)

Gas Technology Institute (Des Plaines, Ill.)—*Low-Cost High-Hydrogen Syngas Production for Power and Liquid Fuels.* The team will conduct laboratory studies to establish the proof-of-concept of a metal-polymeric membrane, obtain additional design data for an integrated multi-contaminant removal process, and perform techno-economic analyses to integrate these technologies with a PWR gasifier that is co-fed coal and natural gas. The research target is to determine the technical and economic feasibility of using these integrated systems to produce lower-cost high-hydrogen syngas from coal leading to significantly reduced cost of power,

hydrogen, or liquid transportation fuels with carbon capture, as well as reducing the environmental impact of gasification. (DOE Share: $800,000; Recipient share: $200,000; Duration: 12 months)

Massachusetts Institute of Technology (Cambridge, Mass.)— *Coal-CO_2 Slurry Feeding System for Pressurized Gasifiers*. This project will develop and assess a slurry feeding system based on a suspension of coal in liquid CO_2 that can be pumped into the high-pressure gasifier. The advantages of this solution are that CO_2 has a low heat capacity, a low heat of vaporization and low viscosity. Thus, the liquid CO_2 imposes a much smaller thermal load on the gasifier, relative to a water slurry, and has the potential to improve the efficiency and economics of Integrated Gasification Combined Cycle power plants with carbon capture and dramatically reduce the greenhouse gas emissions from power generation from coal. (DOE share: $500,000; Recipient share: $239,509; Duration: 12 months)

The Ohio State University (Columbus, Ohio)—*Chemical Looping Gasification for Hydrogen Enhanced Syngas Production with In-Situ CO_2 Capture.* The objective of this project is to further demonstrate the technical and economic advantages of chemical looping gasification (CLG) for power production and transportation fuel production from coal. Specifically, the research team aims to (1) improve oxygen carrier performance, (2) demonstrate at bench-scale that the CLG process can achieve greater than 98 percent coal conversion, (3) demonstrate the effects and fates of contaminants, (4) develop a sub-pilot-scale cold-flow model, and (5) provide a comparative techno-economic analysis that validates the feasibility and attractiveness of the CLG system. (DOE Share: $954,428; Recipient share: $249,321; Duration: 12 months)

Research Triangle Institute (Research Triangle Park, N.C.)—*Benefits of Integrating AR and RTI Advanced Gasification Technologies for Hydrogen-Rich Syngas Production.* A fundamental challenge for gasification is to achieve production costs for syngas that ensure the overall conversion process is cost-competitive with other technologies and alternative feedstocks, such as natural gas. In this project, the research team will assess the potential to substantially reduce the cost of producing syngas with near-zero emissions by incorporating multiple advanced technologies into the overall conversion process, thereby realizing cumulative, synergistic improvements. Technologies to be integrated include those already tested successfully at pilot-scale. (DOE share: $1,198,703; Recipient share: $299,676; Duration: 12 months)

Southern Research Institute (Durham, N.C.)—*High-Hydrogen, Low-Methane Syngas from Low-Rank Coals for Coal-to-Liquids Production.* The research team will design and analyze a modified advanced gasification system for converting low-rank coals to syngas for coal-to-liquids and integrated gasification combined cycle applications. The team will also develop, test, and optimize steam-reforming catalysts that will allow for high-temperature conversion of tars and other contaminants, improving hydrogen yield and reducing downstream cleanup requirements. The development and commercialization of such a process could significantly reduce the cost to gasify Western low-rank coals, leading to lower costs for producing power and transportation fuel. (DOE share: $931,825; Recipient share: $282,000; Duration: 12 months)

TDA Research, Inc. (Golden, Colo.)—*Advanced Reactor Design for Integrated WGS/Pre-combustion CO_2 Capture.* The objective of this project is to develop a new high-hydrogen syngas

production technology and demonstrate its techno-economic viability for use in integrated gasification combined cycle (IGCC) power plants and coal-to-chemical plants that process low-rank coals and woody biomass. The new system will use a warm gas CO_2 scrubber integrated with a water-gas-shift catalyst to capture greater than 90 percent of the carbon emissions while maintaining the cost of electricity increase to less than 10 percent compared to an IGCC plant without carbon capture. (DOE share: $1,000,000; Recipient share: $278,000; Duration: 12 months)