New Membrane Technology for Post-Combustion Carbon Capture Begins Pilot-Scale Test

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A promising new technology sponsored by the U.S. Department of Energy (DOE) for economically capturing 90 percent of the carbon dioxide (CO2) emitted from a coal-burning power plant has begun pilot-scale testing.

The technology is the PolarisTM membrane system, developed by Membrane Technology and Research Inc. (MTR). The system uses a specially designed CO2-selective membrane—a micro-porous film that acts as a semi-permeable barrier—to separate CO2 from other gases, such as nitrogen, in a coal-burning plant's flue gas.

The project, managed by the DOE Office of Fossil Energy's National Energy Technology Laboratory (NETL) is the largest-scale CO2 membrane technology in the Department's research portfolio and has the potential to support the reduction of greenhouse gas emissions from coal-fired power plants while minimizing the increase in electricity price. Cost-effective carbon capture and storage from fossil-based power generation has been cited by some national and international experts as a critical component for arresting the rise in atmospheric CO2 concentrations.

The PolarisTM system is 10 times more permeable to CO2 than conventional gas-separation membranes. That means the membrane area can be reduced, cutting down the cost and size of the system. In addition, the membrane system does not use hazardous chemicals, so there are no emissions or disposal issues; it uses less water than other capture technologies; and the membrane has no moving parts.

"Post-combustion carbon capture has presented unique challenges for researchers," said the NETL federal manager for the project, José Figueroa. "Membrane Technology and Research's CO2-separation technology has been designed to address risks associated with carbon capture, at a lower cost and footprint than other conventional systems."

The MTR membrane separation process has already completed 7,500 hours of small-scale (0.05 megawatt-electric) testing using actual flue gas. Successful testing at pilot scale (1 megawatt-electric) will be a major step toward meeting the Department program's goal of capturing more

than 90 percent of CO2 from flue gas at a cost of $40 per metric ton of CO2 captured and compressed to 2,200 psig (pounds per square inch gauge).

Pilot-scale testing of the technology, using actual flue gas, is underway at DOE's National Carbon Capture Center (NCCC) in Wilsonville, Ala., and will continue for 2–3 months. The NCCC, operated by Southern Company Services, includes a post-combustion carbon-capture facility that allows testing and integration of advanced CO2-capture technologies using flue gas from Alabama Power's Gaston power plant Unit 5—an 880 megawatt pulverized coal unit.

Data from this pilot test will provide the Department, MTR, and their project partners with insights into the next steps required for further scale-up and field tests. The project is being performed in cooperation with the Electric Power Research Institute, Helios-NRG, WorleyParsons, and Babcock & Wilcox. Other collaborators are the University of Illinois at Urbana-Champaign, the Prairie Research Institute's Illinois Sustainable Technology Center and Illinois State Geological Survey, Affiliated Engineers Inc., and City Water, Light and Power.

The technology is part of NETL's CO2-control technology R&D program, which also includes projects directed at the use of solvents and solid sorbents, as well as other novel approaches for CO2 capture specially designed for power plant applications.