Novel Carbon Capture Solvent Begins Pilot-Scale Testing for Emissions Control

January 13, 2015 - 11:20am

Pilot-scale testing of an advanced **technology** for economically capturing carbon dioxide (CO2) from flue gas has begun at the National Carbon Capture Center (**NCCC**) in Wilsonville, Ala. Under a cooperative agreement with the Energy Department's National Energy Technology Laboratory (NETL), Linde LLC is operating a nominal 1-megawatt-electric (MWe) pilot plant expected to capture 30 tons of CO2 per day. Cost-effective carbon capture and storage from fossil-based power generation is a critical component of national efforts to mitigate climate change.

Testing at the pilot plant will validate performance of the Linde-BASF CO2-capture technology on actual coal-derived flue gas. The NCCC 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. Successful testing will be a major step toward achieving the overall Energy Department goal of 90 percent CO2 capture with 95 percent CO2 purity at a cost of $40 per metric ton of CO2 captured.

The technology being tested integrates BASF's advanced aqueous amine-based solvent (OASE® blue) and process technology with novel CO2-capture process and engineering innovations being developed by Linde. OASE® blue chemically absorbs CO2 from the flue gas at a relatively low temperature in the absorption column. The CO2-rich solvent is then transferred to a stripping column where steam is added to heat the solvent, reversing the chemical reaction and releasing high-purity CO2 for compression and pipeline transport. The CO2-lean solvent is recycled back to the absorption column for additional CO2 capture.

BASF's OASE® blue offers key benefits in comparison to monoethanolamine, a benchmark solvent employed in other applications. These benefits include increased CO2 loading, reduced regeneration steam requirements, and increased thermal and chemical stability. Process-related innovations incorporated into the pilot plant include:

• Gravity-driven interstage absorption column coolers.
• High-capacity structured packing.
• An advanced amine wash unit.
• Placement of a reduced-size flue gas blower downstream of the absorption column.
• High-pressure stripping of the captured CO2.

The planned 18-month test program consists of three phases: initial start-up and operation with flue gas and solvent recirculation, parametric testing, and long-duration testing for a minimum of 60 days. Parametric testing will evaluate the impact that key parameters—including flue gas flow rate, solvent circulation rate, and regeneration pressure—have on process performance criteria, such as the CO2 capture rate, solvent CO2 loading, solvent working capacity, pressure drop, steam demand, and outlet CO2 pressure. Long-duration testing at optimal operating conditions will evaluate steady-state performance with power plant cycling, pilot unit reliability, solvent stability, and the emissions profile.

Following pilot testing, Linde and BASF will jointly pursue opportunities for larger-scale testing, leading to full-scale commercialization in the 2025 timeframe.