This Week at NETL

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Analysis Takes In-Depth Look at Next-Generation CO_2 Enhanced Oil Recovery Technology

Timely application of next-generation CO_2 enhanced oil recovery (EOR) technologies can provide strategically significant benefits to the United States and is unlikely to come about from business-as-usual, according to a new NETL analysis. Building on a June 2011 resource assessment published by NETL, investigators analyzed five next-generation CO_2-EOR technologies: (1) improved conformance control, (2) advanced flood design, (3) enhanced mobility control, (4) increased volumes of efficiently injected CO_2, and (5) near-miscible behavior. The CO_2-PROPHET reservoir simulator was used to model each of the CO_2-EOR technologies, singularly and in combination, on 1,824 lower-48 onshore reservoirs that have potential for CO_2-EOR. Among the key results was that each of the next-generation technologies has a preferred regional setting. For example, California's oilfields benefit most from advanced CO_2 flood design (technology #2), while oilfields in the Permian Basin benefit most from increased volumes of efficiently used CO_2 (technology #4). A comprehensive slide deck about the analysis is available on the NETL website.

Southern Company Services Submits Techno-Economic Analysis for Carbon Capture and Storage Project

Southern Company Services (Birmingham, Ala.) submitted to NETL a report on a techno-economic analysis conducted for the company's carbon capture and storage (CCS) project entitled Development and Demonstration of Waste Heat Integration with Solvent Process for More Efficient CO_2 Removal from Coal-Fired Flue Gas. The report contains an evaluation of the effect of heat integration on the cost and performance of pulverized coal power plants operating with CCS. The heat-integration system evaluated consisted of two primary pieces of equipment: (1) a CO_2 cooler that used CO_2 gas from the CO_2-capture process to heat boiler condensate, and (2) a flue gas cooler that used air heater outlet flue gas to heat boiler condensate. The company also evaluated the addition of an auxiliary turbine to capture work from the steam used in the CO_2 solvent reboiler. All plants were evaluated for net output of 550 megawatts of electricty with 90% CO_2 capture. The addition of heat integration to a subcritical plant equipped with Mitsubishi Heavy Industries' Kansai Mitsubishi Carbon Dioxide Recovery Process (KM-CDR Process®) was found to improve energy efficiency, water use, environmental performance, total overnight cost, and cost of electricity. Although the goal of achieving 90% CO_2 capture with less than a 35% increase in cost of electricity was not achieved, the study indicated that heat integration can offer substantial progress toward this goal. The cost-of-electricity increase was reduced from 71% for the KM-CDR plant with no heat integration to 62% for the KM-CDR plant equipped with CO_2 cooler, flue gas cooler, and auxiliary turbine.

AVESTAR® Wins Regional Technology Transfer Award

The Federal Laboratory Consortium Mid-Atlantic Region has selected NETL's AVESTAR® 3D Virtual Energy Plant Simulator and Immersive Training System as a winner of its annual award for *Excellence in Technology Transfer*. NETL is transferring the augmented virtual reality–based software technology to the energy industry, academic institutions, and research organizations through its AVESTAR workforce training, engineering education, and research and development programs. Strategic agreements and mechanisms used by NETL to transfer technology to the worldwide marketplace, through partner Invensys Operations Management (Houston, Texas), include software copyright license agreements and cooperative research and development

agreements. The award will be presented at the Mid Atlantic Region's annual meeting on November 13–14, 2013, in Leesburg, Va.

Equation-of-State Models Capture Isomeric Structure on Density Predictions

An NETL Regional University Alliance research team has extended perturbed-chain, statistical associating theory (PC-SAFT) equation of state (EoS) modeling studies to address whether the PC-SAFT EoS can accurately model the effect of isomer structure on density. This is the first step in ascertaining fundamental information needed to predict other fluid properties at high temperatures and pressure, such as solution viscosity, which directly impacts the efficacy of operating ultra-deep petroleum reservoirs. The predictive approach used by the researchers elucidated the impact of structure on the densities of branched cyclohexane compounds. Details of the study were published in the July 25, 2013 issue of *The Journal of Physical Chemistry B*.

NETL Develops Non-Destructive Imaging Techniques for Supported Ionic Liquid Membranes

NETL researchers used x-ray computed tomography (CT) scanning to produce the first truly non-destructive, high-resolution, 3-dimensional images of a supported ionic liquid hollow-fiber membrane with an asymmetric pore structure. This is the first time that a CT scan has been used for this application. Supported ionic liquid membranes have been a topic of interest for many years because of their high permeability and selectivity for gas separation. Until now, however, there has not been a definitive technique for determining the location and migration of ionic liquid within the pore structure of the membrane. Using conventional imaging techniques, such as optical microscopy or scanning electron microscopy, requires cutting the membrane, causing a disturbance of the ionic liquid. The information gained from applying this new technique is important for forming thin, defect-free ionic liquid layers to maximize the gas transport properties of the membrane.

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