

- Potential Tour Stops for EPSCoR Conference Attendees -
NETL Onsite Research Facilities, Morgantown, WV
Thursday, June 16, 2005

Simulation / Computational Energy Sciences

- **Advanced Process Engineering Co-Simulator (APECS) Software** – winner of the prestigious 2004 R&D 100 award, the APECS is an integrated software suite that combines the power of process simulation with high-fidelity computational fluid dynamics for improved design, analysis, and optimization of process engineering systems.
- **Transport Reactor Developmental Unit Gasifier Simulation** – the NETL MFIX (Multiphase Flow with Interphase eXchanges) simulation code is being used for simulation of scaled-up designs of the KBR (Kellogg Brown & Root) Transport Gasifier. The application of this software for transport gasifier modeling will be demonstrated. MFIX is a general-purpose computer code, developed at NETL, for describing the hydrodynamics, heat transfer, and chemical reactions that occur in heavily loaded fluid-solid or gas-particle systems. The KBR reactor is being operated at the Power Systems Development Facility in Wilsonville, AL.
- **Visualization Laboratory and Capabilities** – NETL has developed capabilities for visualizing detailed model output for components of advanced power generation systems. These visualization capabilities will be demonstrated using a proposed FutureGen power plant configuration.

Fuel Cells

- **Hybrid turbine fuel cell test facility** – developing methods to control the flow of power and energy in a combined fuel cell/turbine power plant.
- **Fuel cell test facility, and small fuel cell test stands** – conducting long-term fuel cell and stack testing. In April 2005, NETL completed construction of a Fuel Cell Test Facility designed to support the Office of Fossil Energy's Solid State Energy Conversion Alliance (SECA) program. The facility is configured with both ac- and dc-load banks and can accommodate fuel cells up to 10 kilowatts in size. The facility can be used to provide independent verification of the performance and efficiency of prototype fuel cells developed by SECA Industrial Teams.

Combustion

- **High-Pressure Combustion Lab** – developing methods to use hydrogen in turbines without collateral NO_x emissions, and advanced oxy-fuel systems.
- **Reciprocating Engine Lab** – testing the performance of engines using hydrogen and mixtures of H₂/natural gas, and developing advanced technology, such as laser ignitions. During March 2005, the reciprocating engine operated on 100% hydrogen fuel for the first time. NETL is investigating end-use applications for hydrogen fuel in reciprocating engines as well as gas turbines and fuel cell technologies in support of DOE's goal to develop strategies for reduced carbon emissions. The test engine operated smoothly with no problems over a range of oxygen-to-hydrogen ratios. The use of hydrogen in reciprocating engines offers the potential for substantial reductions in NO_x emissions as well as providing a platform for power generation from future coal-derived hydrogen fuels.

If time permits, the following areas will be included on the tour:

- **Fluidization Lab** – developing technology to handle advanced multi-phase reactors that will be used to circulate sorbents that absorb CO₂ from power production, or circulate oxygen in new energy system concepts. The research team's activities center on the operation of the Cold Flow Circulating Fluid Bed facility.
- **Scanning Electron Microscope Lab** – analyzing thin film coatings that are needed to allow fuel cells to operate with low-cost metal interconnects.
- **Surface Science Lab** – developing a sorbent capable of absorbing CO₂ from coal plant flue gases.