# Introduction to Advanced Coal

The global coal resource is enormous and more widely distributed than other fossil fuels such as oil or natural gas. Since coal is abundant and inexpensive, it is used extensively for electric power generation in the US, China, and India. A growing demand for transportation fuels and an alternative to petroleum may escalate the practice of converting coal to liquid fuels. Such processes require large energy inputs and have a significant carbon footprint. As a result, the challenge of reducing greenhouse gas emissions associated with the use of coal is a significant one.

In recent decades, most of the attention on advanced coal combustion has shifted from university-based research to private sector development. Therefore GCEP is interested in advanced coal research that addresses conceptual approaches to coal conversion that go beyond incremental improvements towards systems and processes that emphasize $CO_2$ emission reductions.

GCEP currently supports a program on coal energy conversion with aquifer-based sequestration led by Professor Reginald Mitchell. The process involves $CO_2$ capture in inherently stable forms through supercritical oxidation of coal in aquifer-derived water. The products of reaction, including $CO_2$, are returned in the aqueous solvent to the aquifer. The project is divided into four research areas - Area 1: Systems Analysis, Area 2: Supercritical Coal Reforming, Area 3: Synthesis Fluid Oxidation and Heat Extraction, and Area 4: Aquifer Interactions. To date, Area 1 has been completed and work continues in parallel for the other areas. There was considerable effort towards the experimental set-up in Area 2 and 3. The reformer set-up required redesign to accommodate accurate measurements and flow control, and the combustor required extensive utility upgrades to adequately handle the experimental demands such as water flow rates. Experiments and tests of coal in supercritical environments and initial flame experiments are expected to be performed by the end of the summer 2009. Geochemical models have been completed in Area 4 and future work is expected to be performed in bench-scale testing of combustion products and representative aquifer materials.