

PROJECT FACTS

UNIVERSITY OF KENTUCKY CENTER FOR APPLIED ENERGY RESEARCH

PARTICIPANTS

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Research

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SPONSORS

E-ON US

COST SHARING

\$1,500,000 E-ON US
\$0 UK

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POWER GENERATION & UTILITY FUELS

Carbon Management in Power Plants

The most obvious constraint on carbon emissions arises from climate change. Growing evidence clearly indicates the earth has become warmer than several hundred years ago due to the change of atmosphere constituents. The atmosphere contained 580 Gt of carbon in 1800 when the industrial revolution started; and today it is approaching 770 Gt. In order to stabilize the global carbon cycle, carbon emissions would have to be held constant between now and 2050, and then enter into a steep decline. In effect, the growth in energy consumption between now and 2050 would have to be carbon neutral. Stabilization of carbon cycle requires that the net per capita CO₂ emission at the end of the century drops to roughly 3% of what they are in the US today.

In the U.S., electricity generation accounts for about 2.5 billion tons of carbon dioxide emissions annually. U.S. emissions are projected to grow about 35% between now and 2020, as the economy and demand for electricity grows.

Coal is the least costly fuel for power generation. However, coal is the most carbon-intensive, placing coal at a disadvantage in a carbon-controlled world. As over half of the electricity generated in the US is from coal, it is imperative that we develop technical solutions to provide reductions in CO₂ emissions that are practical and affordable. It is also vital that we develop such technologies quickly if we are to maintain our current level of energy production without inflicting irreversible damage to the environment. Unfortunately, the estimated cost of CO₂ separation and purification of CO₂ in a coal-fired boiler with current technology is \$100–\$200 per ton of carbon. This equates to a 60-70% increase in the cost of electricity. Thus, cost reductions for CO₂ capture must be a major focus of our research.

Supported by E-ON US, CAER is undertaking three carbon management projects.

- I. Development and Heat Optimization in an Amine-based CO₂ Scrubber
- II. Development of an Integrated CO₂ Capture/Fertilizer By-product Process
- III. Development of Chemical Looping Combustion/Gasification for Solid Fuels