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Develop a credible technical path for achieving DOE's 2015 goal of an industrial-scale demonstration of carbon capture and sequestration (10MT/yr)

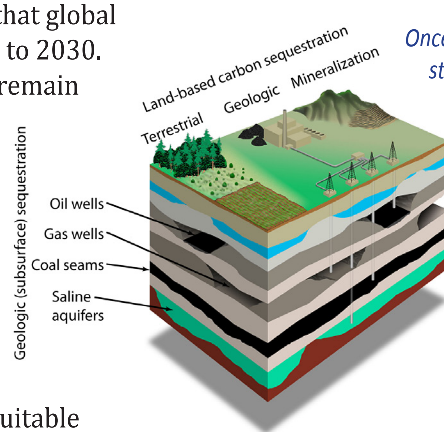
A growing consensus exists among climate scientists, economists, and policy makers that the link between man-made emissions of greenhouse gasses (GHGs) and climate instability is sufficiently likely to motivate global actions. Energy use and energy generation are at the heart of the problem, with the International Energy Agency (IEA) forecasting that global electricity generation will nearly double from 2005 to 2030. The Agency's statistics predict that fossil fuels will remain a significant part of the energy mix up to 2030, comprising roughly 70% of global and 50% of U.S. electricity generation.

One of the solutions being discussed to reduce GHG emissions from fossil fuel energy generation is carbon dioxide (CO_2) capture and storage (CCS). CCS is a group of technologies for capturing the CO_2 emitted from power plants and industrial sites; compressing this CO_2; and transporting it to suitable permanent storage sites, such as deep underground. CCS is in the relatively early phase of development, with several key questions remaining unanswered, including about its costs, timing, and relative attractiveness vs other carbon-lowering opportunities.

Fossil fuels are forecasted to continue to play a major part of the energy mix out to at least 2050, and CCS provides the main abatement lever for stationary fossil-fuel consumers like coal-burning power plants. CCS could also provide the main means of curbing GHG emissions from heavy industrial sectors such as the steel and cement makers and petroleum refineries, which together, account for ~15% of the nation's CO_2 emissions.

A 1 GW coal-fired power plant such as the San Juan Power Station in northwestern New Mexico will emit approximately 10 MT of CO_2 per year. An effective demonstration of CCS at this scale is a crucial step toward mitigating the climate impact of these emissions. Carbon sequestration could play a major role in the reduction of GHGs through increased use of clean coal, natural gas, and hydrogen.

Sandia has resources and capabilities such as geosciences, the Combustion Research Facility, material science, advanced simulation, probabilistic risk assessment, and dynamic simulation that, while developed for other purposes such as underground repositories, the nuclear weapons program, and automobile efficiency research, can be applied to this CCS problem facing the nation and the world.



Once CO_2 is captured from the plant's waste stream, it must be stored. Current schemes involve injecting it into pockets formed in the earth. Many options are available. A study from MIT (Herzog) estimates that

- *deep saline aquifers can store 100s to 1000s of gigatons of CO_2,*
- *depleted oil and gas reservoirs can store 100s of Gt,*
- *coal seams can store 10s–100s of Gt, and*
- *terrestrial resources (e.g., trees & soils) can store 10s of Gt.*

Sandia's geologists and modelers are investigating the geological strata near the plant for use as storage sites for carbon sequestration. They are geomodeling the fate (flow rates and direction) of injected CO_2 in the San Juan lithologies. They seek to understand the volumes of CO_2 that can be stored in these underground pockets and how many years the carbon sink may last.

Our ECIS scientists will partner with DOE's National Energy Technology Laboratory (NETL) to ensure success of the regional partnership and the success of NETL's internal research program through collaborative science and technology and partner with regional universities and industry to incorporate new capture and sequestration technology.

Our partnership efforts are working toward completing a multi-scale, multi-physics CO_2 sequestration geophysical model and leveraging our unique capabilities into a sustainable R&D program with federal agencies, universities, and industry partners to enable an industrial-scale CCS demonstration (10 MT/yr) by 2015.

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