the ENERGY lab

PROJECT FACTS

Carbon Sequestration

Near-Surface Leakage Monitoring for the Verification and Accounting of Geologic Carbon Sequestration Using a Field-Ready ^{14}C Isotopic Analyzer

Description

Through its core research and development (R&D) program administered by the National Energy Technology Laboratory (NETL), the U.S. Department of Energy (DOE) emphasizes monitoring, verification, and accounting (MVA), as well as computer simulation, of possible carbon dioxide (CO_2) leakage at CO_2 sequestration sites, along with risk assessment of those sites. MVA efforts focus on the development and deployment of technologies that can provide an accurate account of stored CO_2, with a high level of confidence that the CO_2 will remain permanently sequestered. Effective application of these MVA technologies will ensure the safety of sequestration projects with respect to both human health and the environment, and provide the basis for establishing carbon credit trading markets for sequestered CO_2. Risk assessment research focuses on identifying and quantifying potential risks to humans and the environment associated with CO_2 sequestration, and helping to ensure that these risks remain low.

This four-year project—performed by Planetary Emissions Management, Inc. (PEM) in partnership with AXYS Technologies, Inc.; DOE's Kansas City Plant (a national secure manufacturing R&D facility); Lawrence Berkeley National Laboratory (LBNL); LI-COR, Inc.; and Rutgers University—will commercialize a carbon-14 (^{14}C) field-ready analyzer having a sensitivity of approximately 1 ppm of fossil fuel CO_2 in ambient air. The analyzer will be based on PEM's already completed multi-isotopic Global Monitor Platform (GMP) and deployed for testing and validation at two reference sites: one where CO_2 leaks from natural geologic reservoirs and the other a pilot CO_2 injection site. Ideally, these test deployments will be followed by long-term deployment at large-scale operating sequestration projects.

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PARTNERS

AXYS Technologies, Inc.

Kansas City Plant

Lawrence Berkeley National Laboratory

LI-COR, Inc.

Rutgers University

National Oceanic and Atmospheric Administration/Global Monitoring Division

COST

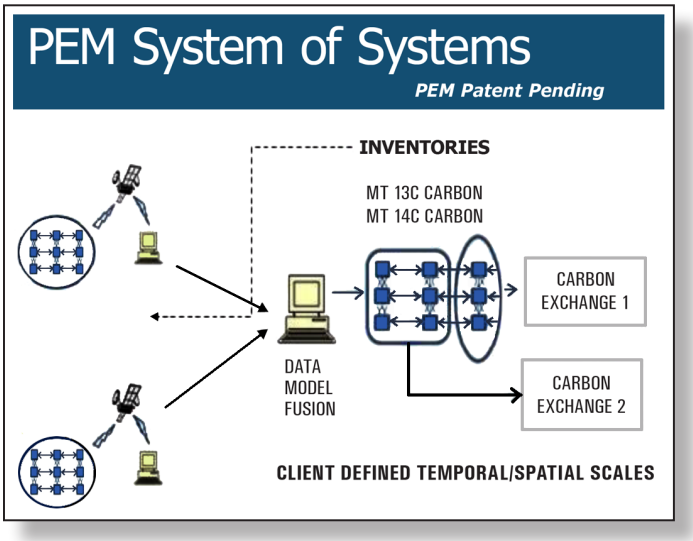
Total Project Value
$3,042,805

DOE/Non-DOE Share
$1,995,575 / $1,047,230

Primary Project Goal

The overall project goal is to field a high-resolution, low-cost, spatial and temporal data analyzer for direct tracking of fossil fuel CO_2—namely, the ^{14}C content of CO_2—as a means to detect leakage of geologic sequestered CO_2 (GSC). The primary focus of the application is within the near-surface environment covering the project area; however, a gas stream from any component of a GSC project or location may be analyzed. Further objectives are to

- Deploy the ^{14}C analyzer as a spatial array of devices across the project location to monitor and verify leakage of GSC at project-relevant scales.
- Co-deploy an already developed ^{13}C radiocarbon analyzer in a common instrument platform offering simultaneous ^{13}C and ^{14}C isotope ratios.



A system of systems utilizing data acquisition across landscapes at differing locations resulting in comparable carbon trading units for fossil carbon and biogenic carbon flux suitable for carbon trading platforms. PEM has applied for a patent covering proprietary hardware and software.

Accomplishments

This project was awarded on January 15, 2010. Anticipated accomplishments for each of the four project phases lie within the following scope of work.

- **Phase I:** Place one PEM GMP (^{13}C, ^{14}C) in the field at the first reference site and fabricate/install one new instrument platform. Thus, instrumentation work and field preparation will be key to this phase.
- **Phase II:** Fabricate and deploy two upgraded Technology Readiness Level (TRL)-enhanced instrument platforms (^{13}C and ^{14}C) within a second reference site. Improvements will be based on operational and performance data for the two GMPs deployed in Phase I, which also will be upgraded as needed. Instrumentation work and project management at the field site level and in verifying and addressing issues in data transmission, archiving, quality control, and model applications will be critical in this phase to demonstrate readiness for deployment within the active GSC site.
- **Phase III:** Transition the four reference site-tested instrument platforms to an active GSC project site, placing the instruments in strategic locations to monitor for potential point- and landscape-scale leakage. Project management at the site level, involving authorization and access for placement of the instruments, will be critical in this phase and will be arranged and managed on site by LBNL.
- **Phase IV:** Optimize the system-level architecture and function for all four devices; collect, analyze, and archive data; and derive spatial and temporal quantitative results for leakage from GSC and/or impacts on the natural environment of the project. Use the collected data to derive meaningful flux data in a format suitable for evaluation by carbon trading platforms.

Benefits

This technology represents a breakthrough in the capability to directly track fossil fuel CO_2 with high precision and lower costs than existing Accelerator Mass Spectrometry (AMS) approaches. The realization of increased data rates for ^{14}C analysis at lowered cost will benefit end users in MVA programs as well as policymakers and the public. Furthermore, an increased data rate for a number of locations offers the opportunity to create spatial baselines for ^{14}C of atmospheric CO_2, as well as from a variety of environments in the near-surface zones of the geologic reservoir holding sequestered CO_2.