NATIONAL ENERGY TECHNOLOGY LABORATORY

ACCOMPLISHMENTS

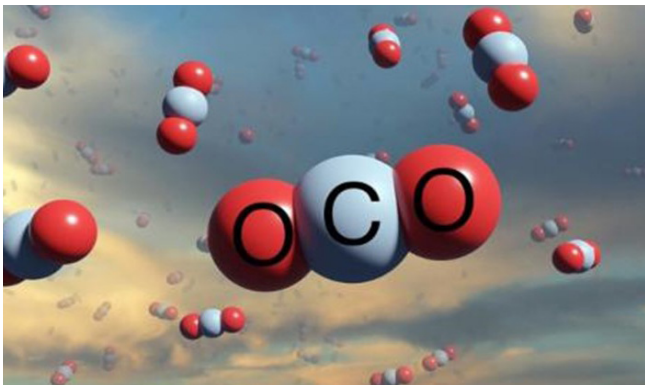
Q2 FY23

U.S. DEPARTMENT OF ENERGY

NETL ACCOMPLISHMENTS

Quarter 2 – Fiscal Year 2023

NETL Team Used Microwaves To Reduce Energy Required for Direct Air Capture



NETL researchers reported the successful use of microwaves to accelerate sorbent regeneration — results that can lead to substantial reduction of expensive water and energy requirements of some promising direct air capture (DAC) technologies. In a paper published in January 2023 in Materials Today Sustainability, NETL researcher Fan Shi and his team explained that the research shows that room temperature microwave-accelerated regeneration of sorbents for DAC can advance the science of carbon dioxide (CO_2) capture. Shi and co-author McMahan Gray also explained their work in a Spotify podcast.

NETL Demonstrated New Pipeline Sensor Technologies in a Pilot-scale Field Test

NETL's pipeline sensor team completed successful field tests of an extensive new collection of fiber optic sensor and surface acoustic wave sensor technologies for natural gas pipeline monitoring that can help ensure safer and more secure natural gas pipeline delivery and mitigate greenhouse gas methane emissions. To increase the technology readiness level, the pipeline sensor team has focused on packaging the sensors and conducting field test validations. The most recent testing of the new technologies occurred in mid-February 2023 at the Southwest Research Institute test facility.

NETL Patented Fiber Optic Sensor Technology for Hydrogen Leak Detection

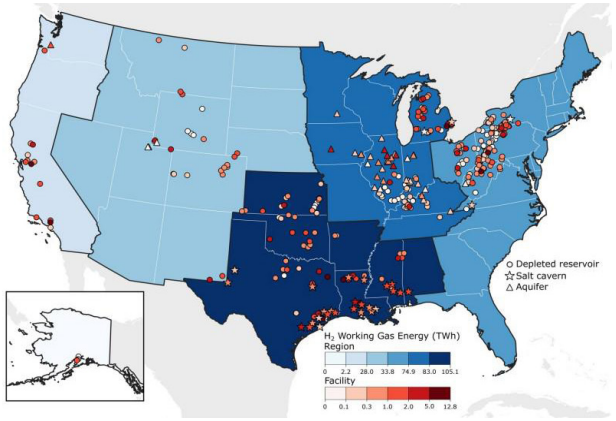
NETL researchers were awarded a patent for a new fiber optic sensor designed to detect hydrogen leaks at storage facilities that can save time and money compared to traditional methods — progress that can help accelerate the drive to put hydrogen to work as a dependable fuel to advance America's decarbonization efforts. The patented technology, titled "Low-Cost Fiber Optic Sensor Array for Simultaneous Detection of Multiple Parameters," enables hydrogen monitoring at the parts per million level. The hydrogen leak detection technology features multiple sensing layers along a single fiber for simultaneous hydrogen/gas and temperature sensing. It was originally developed for transformer oil monitoring operations as part of grid modernization efforts. The work was part of NETL's participation in the multi-national laboratory Subsurface Hydrogen Assessment, Storage and Technology Acceleration (SHASTA) effort.

NETL Received Patent for Process To Produce Game-Changing Carbon Nanosheets

NETL researchers who asked the question — "How can we use coal without burning it and generating greenhouse gas?" — have been awarded a U.S. patent for an invention that transforms coal into a game-changing material to manufacture valuable products and generate jobs in coal communities as the nation transitions to clean energy. The recently patented NETL invention, 19N-01.NP1USPN 11,535,518, "Production of Graphene-Structured Products from Coal Using Thermal Molten Salt Process," is now available for licensing. This low-cost NETL process uses domestically sourced coal and coal wastes as the feedstock to produce carbon nanosheets that can be instrumental to manufacture safer, fuel-efficient vehicles, durable roads and bridges and much more while finding new uses for coal resources.

NETL Released Study on Hydrogen Storage Potential in Existing Underground Gas Facilities

A new study by NETL researchers, in collaboration with Pacific Northwest National Laboratory and Lawrence Livermore National Laboratory researchers, demonstrated that existing U.S. underground gas storage facilities can viably store hydrogen-methane blends, reducing the need to build new hydrogen infrastructure while meeting a range of the hydrogen demand projected for 2050 and helping to support the transition to a clean hydrogen economy.



NETL Project Partner Demonstrated More Than 2.8 Million Tonnes of CO_2 Capture From Ethanol Production and Its Deep Geologic Storage in Mount Simon Sandstone

Food processing company Archer Daniels Midland (ADM), with support from NETL, demonstrated an integrated system of processing CO_2 and transporting it from an ethanol plant to the Mt. Simon Sandstone saline reservoir for permanent geologic storage. This is the largest demonstration of its kind in the United States and marks a crucial step forward in efforts to decarbonize the U.S. economy and power sector by 2050. The system demonstrated by ADM at the company's Agricultural Processing and Biofuels Plant, located in Decatur, Illinois, collected CO_2 produced as a byproduct of processing corn into fuel-grade ethanol. Widespread deployment of large-scale carbon capture and storagetechnologies at sites like ADM's ethanol plant could offer insight into reducing CO_2 emissions at industrial operations throughout the country.

NETL Contractor Received Rookie of the Year Award from Federal Laboratory Consortium

An NETL specialist whose work significantly reduced the complexity of transferring the Lab's technologies to the private sector and increased the number of agreements executed by 27% was recognized as the "Rookie of the Year" by a prestigious national organization of more than 300 federal laboratories, agencies and research centers dedicated to increasing the impact of technology transfer for the benefit of the U.S. economy, society and national security. Chris Bond, a technology transfer agreement specialist with Leidos, a support contractor to NETL, received the honor from the Federal Laboratory Consortium at an awards ceremony Wednesday, March 29 at the FLC national Meeting in Cleveland, Ohio. According to NETL officials, "Bond quickly established himself as an innovator, communicator, educator, and issue resolver whose skills, ingenuity and critical thinking eliminated technology transfer barriers, corrected process inefficiencies, created new streamlined procedures, and helped elevate and expedite the technology transfer process, moving new innovations to market that help meet the nation's energy needs and accelerate initiatives for attaining the goal of net-zero carbon emissions."

Two NETL Employees Named Oppenheimer Fellows for 2023

NETL employees Alexandra "Ale" Hakala, Ph.D., and Joseph Stoffa, Ph.D., were named fellows in the 2023 cohort of the Oppenheimer Science and Energy Leadership Program (OSELP), the premier, yearlong leadership development initiative of the National Laboratory Directors' Council. Hakala and Stoffa will join 32 other individuals from 15 DOE national labs to explore the complexities, challenges and opportunities facing the national lab system and DOE. Through a series of site visits to national labs, OSELP immerses its fellows in the singular breadth, diversity and complexity of the national labs, DOE and their partners, and provides them with a unique opportunity to engage deeply with senior lab leadership and explore innovative ways to improve the DOE and national lab collective enterprise.

NETL-Developed Online Database Brought Energy-Related Wastewater Stream Data to Public's Fingertips

Community leaders and water researchers can now access publicly available online datasets curated and processed by NETL to better understand the composition of energy-related wastewater streams. The data will help mitigate environmental risks and identify possible sources of valuable critical minerals. The National Energy Water Treatment and Speciation (NEWTS) Database provides information at no cost about the levels of toxins, concentrations of metals and other hazardous materials found in energy-related wastewater streams, which include power plant leachate, acid mine drainage, brackish water and oil and gas produced water. Researchers can input the data into computer software to develop appropriate remediation steps. The NEWTS team released the first series of data Sept. 30, 2022, on the Energy Data eXchange, which included three large datasets with flue gas desulfurization power plant effluent, brackish water and produced water compositions in formats that are easy to enter into commercial software such as OLI Studio and Geochemist Workbench. Future releases will include additional large datasets of energy-related water samples with accompanying compositions.

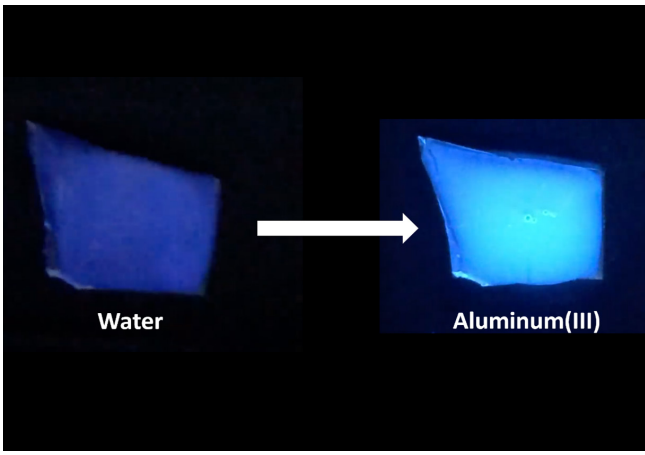
NETL-Supported Large Pilot Carbon Capture Project Broke Ground in Illinois

NETL representatives attended a groundbreaking ceremony at the City Water, Light and Power (CWLP) plant in Springfield, Illinois, to celebrate the advancement of a large pilot CO_2 capture project made possible with funding and project management support from the Lab. The large pilot testing will evaluate a 10-megawatt-electric (MWe) capture system, based on the Linde-BASF advanced amine-based post-combustion capture technology, designed to capture 200 tonnes of CO_2 per day. The project represents an important step toward realizing the administration's goal of a net-zero carbon emission electricity sector by 2035. The capture system will be installed in the Dallman 4 unit at CWLP, which is a nominal 200-MWe pulverized coal-fired unit that became operational in 2009 and is one of the cleanest coal-fired generating units in the nation according to the CWLP website.

Produced Water Recycling Approach Attracted International Attention

NETL-funded research on an approach to recycle hydraulic fracturing water using natural filtration and biogenic activity in specific layers of rock attracted international attention with a "highly commended" recognition in a global competition sponsored by an acclaimed engineering organization. The University of North Dakota's Energy & Environmental Research Center's Produced Water Management Through Geologic Homogenization, Conditioning, and Reuse project, developed in partnership with the North Dakota Industrial Commission Oil and Gas Research Program and Nuverra Environmental Solutions, was a finalist in the Oil and Gas category of the 2022 IChemE Global Awards. The project was funded by NETL and DOE's Office of Fossil Energy and Carbon Management.

NETL Researchers Created Technology To Detect Aluminum Impurities in Rare Earth Element Sources



Aluminum is a critical element used in thousands of important products, but it can often interfere with quick and effective extraction of valuable rare earth elements (REEs) from coal waste byproducts. Because aluminum interferes with the recovery of REEs from some sources, NETL researchers developed an effective, renewable technology that can detect aluminum in liquids for removal, clearing the way for effective recovery of REEs. REEs are a set of 17 metallic elements that are used in many high-tech devices, including clean energy components like generators in wind turbines and electric vehicle motors, in addition to defense systems, electronics and a large range of other consumer goods. Currently, most REEs are produced and refined in other countries. The creation of a reliable domestic supply of REEs is needed for U.S. economic, energy and national security.

NETL Demonstrated Fuel Cell Stack Cost, Performance and Durability

NETL demonstrated how solid oxide fuel cell (SOFC) stacks are uniquely suited to address environmental concerns associated with electric power generation while meeting clean energy goals with the installation of four 1.5 KW SOFC stacks at its Morgantown site to supply 5.6 KW of power to the facility's grid. SOFCs produce electricity through electrochemical reactions, rather than through combustion like conventional coal and natural gas power plants, which makes fuel cells much more efficient. Those benefits make the technology well-suited to helping meet clean energy goals that call for a net-zero carbon emission electricity sector by 2035 and economy-wide net-zero emissions by 2050.