



ACCOMPLISHMENTS

Q4 FY22



U.S. DEPARTMENT OF
ENERGY

NETL ACCOMPLISHMENTS

Quarter 4 – Fiscal Year 2022

[NETL's Christina Lopano Received an Award from the Association for Women Geoscientists](#)

An NETL researcher who led the development of a groundbreaking process to extract rare earth elements and critical minerals (REEs-CMs) from coal and coal byproducts received the Professional Excellence Award from the Association for Women Geoscientists. Lopano drove development of NETL's Targeted Rare Earth Extraction (TREE) process to extract REEs-CMs from a broad range of coal and coal-processing materials and waste streams, including acid mine drainage and various ashes. The association presented the award to Lopano for outstanding contributions in the government/regulatory category at its awards breakfast on Monday, Oct. 10, 2022, in Denver.



[Research Found Some Rock Formations Could Self-Seal Fractures in the Presence of CO₂](#)

NETL researchers used unique laboratory equipment, including specialized CT scanners, to determine that certain rock formations could self-seal fractures in the presence of stored CO₂ — a finding that means igneous rock intrusions in the eastern U.S. could effectively keep CO₂ sequestered and sealed underground, opening the potential for CO₂ storage locations in the mid-Atlantic region where many CO₂ point source emitters exist. The new study highlighted the ability of igneous rock intrusions to geochemically self-seal fractures when CO₂ is present. The research results were published in an NETL report and in an article in the Geological Society of London. The project also allowed NETL to help train a West Virginia University student in clean energy research, and this training has already led to a significant career move.

[NETL Released Updated Map Highlighting Pittsburgh's Energy Districts](#)

In 2015, NETL and Pittsburgh leaders signed a memorandum of understanding (MOU) to transform the city's energy system and aging infrastructure by implementing a "grid of microgrids" concept that spanned nine energy districts. Many of the advancements made under the MOU are highlighted in an updated City of Pittsburgh Energy Districts Map that includes information about today's 10 districts across Pittsburgh that are operating, planned or under development to supply local residents, businesses and institutions with clean, reliable and affordable power. This unique partnership between NETL and the City of Pittsburgh supports the development of energy districts designed to meet the energy needs of individual neighborhoods using highly efficient and cost-effective technologies.

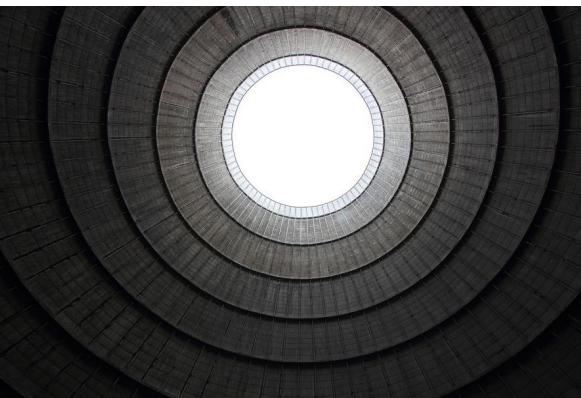
[NETL Patented Technology to Obtain Key Data from Ultra-Deep Subsurface Locations](#)

NETL researchers developed a cutting-edge fiber-optic sensor to monitor conditions in extreme environments thousands of feet below the Earth's surface and obtain essential data needed to safely sequester greenhouse gas in underground reservoirs. The breakthrough invention by NETL researchers can be used to obtain accurate pH measurements from formation fluids in harsh subsurface conditions where temperatures range up to 300 degrees Celsius (572 degrees Fahrenheit) and pressures range up to 30,000 pounds per square inch. Obtaining pH levels from these extreme environments is critical to ensure the safe sequestration of CO₂ in the subsurface, a major component of the administration's goal to achieve a net-zero carbon emissions economy by 2050.



[NETL's Richard Dennis Recognized for Advancing Turbine Technology](#)

The accomplishments of NETL's Richard Dennis to advance the development of high-efficiency turbines for low-cost power generation were recognized at Turbo Expo 2022, a conference held in Rotterdam, Netherlands, for world leaders in the fields of turbomachinery and propulsion engineering. The American Society of Mechanical Engineers (ASME) Electric Power Technical Committee and the Turbo Expo 2022 Organizing Committee approved and endorsed a special panel session held June 15 to highlight the accomplishments of DOE's turbine program over the last two decades, with a special focus on the programs led by Dennis.



[NETL Supported Start-up's Technology to Produce Clean Water From Cooling Tower Plumes](#)

NETL is supporting award-winning startup company Infinite Cooling (Somerville, Massachusetts) to help develop a novel power plant technology that can produce clean water from cooling tower plumes. The technology could significantly reduce water consumption in evaporative cooling tower systems by capturing water from cooling tower plumes, which are formed when water vapor generated in cooling towers mixes with colder ambient air as it leaves the tower and condenses. The novel technology produces clean water from cooling tower recirculating water by using the evaporation/condensation cycle that naturally takes place in cooling towers. The technology could potentially lead to significant water savings and improve water quality with minimal energy cost.

[NETL Research Paper Was One of the Most Popular Articles in Materials Advances](#)

Materials Advances, an international research publication dedicated to materials science breakthroughs, reported that a paper authored by three NETL researchers was one of the most popular articles published in its journal over the past year. Their work is advancing research on sensing materials for use in a wide range of fields beyond the energy sector. They collaborated on a manuscript titled "Metal-Organic Framework Thin Films as Versatile Chemical Sensing Materials," which discusses the importance of metal organic framework thin films, analyzes and compares different fabrication methods, and discusses optical fiber, electrochemical, quartz crystal microbalances and other platforms. The work also provides an overview of current barriers and potential future innovations, providing a foundation for other researchers to design high-performance sensors for a range of energy-relevant applications.

[NETL Work to Detect Abandoned Oil and Gas Wells Netted National Geographic Magazine Recognition](#)

NETL researchers' detective work to locate abandoned and undocumented oil and gas wells using drone flights, electromagnetic field detectors, light detecting and ranging (LiDAR) technology and even operation of a user-friendly tip line were detailed in an article in National Geographic Magazine, one of the most widely read magazines of all time. The magazine article details how NETL researchers Natalie Pekney and Jim Sams work with old photos and drawings combined with data gathered by remote sensing to detect undocumented oil and gas wells hidden by overgrown foliage throughout the Appalachian Region. Uncapped wells often emit methane and pollute groundwater.



[NETL's PARETO Wins 2022 Meritorious Award for Engineering Innovation](#)

DOE's produced water optimization program, PARETO, developed by NETL and Lawrence Berkeley National Laboratory, was named a winner in Hart Energy's 2022 Special Meritorious Awards for Engineering Innovation for its water management capabilities. PARETO, a free and open-source software tool, is an optimization framework for onshore produced water management that is meant to empower practitioners, researchers and policymakers to identify cost-effective and environmentally sustainable ways to manage, treat and beneficially reuse, when possible, produced water from oil and gas operations.

[NETL's Tool for Estimating Geological Environments for CO₂ Storage Attracted International Attention](#)

The ability to accurately predict the CO₂ storage capabilities in geologic formations is critical for leaders around the world to make high-level, energy-related government policy and business decisions. NETL's CO₂-SCREEN provides a robust, user-friendly tool to estimate CO₂ storage efficiency in a variety of geological environments, including saline formations, shale formations and residual oil zones. The importance of this publicly available resource is evident in both the number and prominence of the organizations that have downloaded the tool. Since its creation in 2017, it has been downloaded more than 500 times by organizations in nearly 90 countries around the world including Norway, Spain, France, South Korea, India, Australia, Mexico and the United Kingdom to estimate the effective CO₂ geological storage potential of almost 800 onshore basins. A wide range of U.S. researchers, including those at Battelle Institute, the University of Texas at Austin, Carnegie Mellon University, Indiana Geological and Water Survey and others are also using the tool to make planning decisions on underground storage.

[NETL Recognized for Efforts to Evolve Advanced Vehicle Technologies](#)

NETL's work to evolve advanced vehicle technologies, including electric vehicles, and expand their use on American highways has been recognized for excellence by the DOE Office of Energy Efficiency & Renewable Energy's Vehicle Technologies Office (VTO). Each year, VTO presents awards to individuals and teams from partner institutions for contributions to overall program efforts and to recognize research, development, demonstration and deployment achievements in specific areas. The Lab's Brett Aristegui, Dan Nardozi, Trev Hall, David Kirschner, Neil Kirschner, Erin Russell-Story and Darren Stevenson received a 2022 Team Award at the recent VTO Annual Merit Review Plenary Session.



[NETL, Partners Released Resource on Computational Tools to Complete CO₂ Storage Permit Applications](#)

NETL researchers collaborated with the U.S. Environmental Protection Agency, other contributing national laboratories and DOE's Regional Initiative to Accelerate Carbon Capture, Utilization and Storage Deployment to release the report "Rules and Tools Crosswalk: A Compendium of Computational Tools to Support Geologic Carbon Storage Environmentally Protective UIC Class VI Permitting." This report summarizes computational tools and methods that may be used to address specific requirements of the Underground Injection Control Class VI (Geologic Sequestration) permit application process. Deployment of carbon capture and storage technology at a scale that will impact global carbon levels will require efficient and effective siting, permitting, construction and operation of numerous commercial-scale geologic carbon storage operations.

[NETL Researcher Won R&D 100 Award](#)

A cutting-edge optical fiber sensor technology developed by the University of Pittsburgh (Pitt) and NETL that provides unprecedented measurement capabilities in environments previously thought impossible to probe earned a 2022 R&D 100 Award: NuSense Technology — High Spatial Resolutions Optical Sensors for Harsh Environments. The innovation, developed by a Pitt research group together with NETL as the co-developer, can function in extreme environments found in nuclear reactor cores and can be used to monitor the structural health in critical energy production systems such as gas turbines, boiler tubes, reactor coolant pipes or core containment vessels. These measurements can provide valuable early warnings before accidents or breakdowns occur. NETL researcher Michael Buric, serves on the project team. Pitt and NETL researchers co-developed four patents to support the technology. Besides Buric, NETL's Kirk Gerdes, deputy director for Research & Innovation, contributed to the efforts to develop the patents.

[NETL Explored CO₂ Capture Retrofit Costs for Industrial Sources](#)

NETL published "Cost of Capturing CO₂ From Industrial Sources," an update to an original 2014 study that examines the costs of retrofitting a variety of industrial processes with state-of-the-art CO₂ capture systems. The NETL study examined the cost of capture for facilities in nine industries — ammonia, ethylene oxide, ethanol, natural gas processing, coal-to-liquids, gas-to-liquids, cement, hydrogen refining and iron and steel production. The report is accompanied by NETL's Industrial Sources Carbon Capture Retrofit Database (CCRD), a tool that allows users to estimate the cost of capture for a given industrial plant or an entire industrial sector, using either study assumptions or user inputs. The study and the CCRD tool provide a resource for industry to identify and better understand project opportunities in the context of the various incentives, such as the 45Q CO₂ sequestration credits, as they pursue decarbonization.

[Transformational Carbon Capture Technologies Matured in NETL Collaboration](#)

Through a series of projects made possible with NETL funding and oversight, ION Clean Energy Inc. (ION) matured transformational carbon capture systems from early-stage research to pilot-scale testing — work that will help DOE cut costs for crucial decarbonization technologies. In ION's Project Apollo, which was completed in the summer of 2022, ION scaled up its water-lean, amine-based, third-generation capture solvent from bench scale to pilot scale using real flue gas at the National Carbon Capture Center in Wilsonville, Alabama. The successful test campaign further validated the technology's transformational performance that could lower capital and operating costs for carbon capture and facilitated progression to larger-scale pilot testing.



U.S. DEPARTMENT OF
ENERGY



NATIONAL
ENERGY
TECHNOLOGY
LABORATORY

