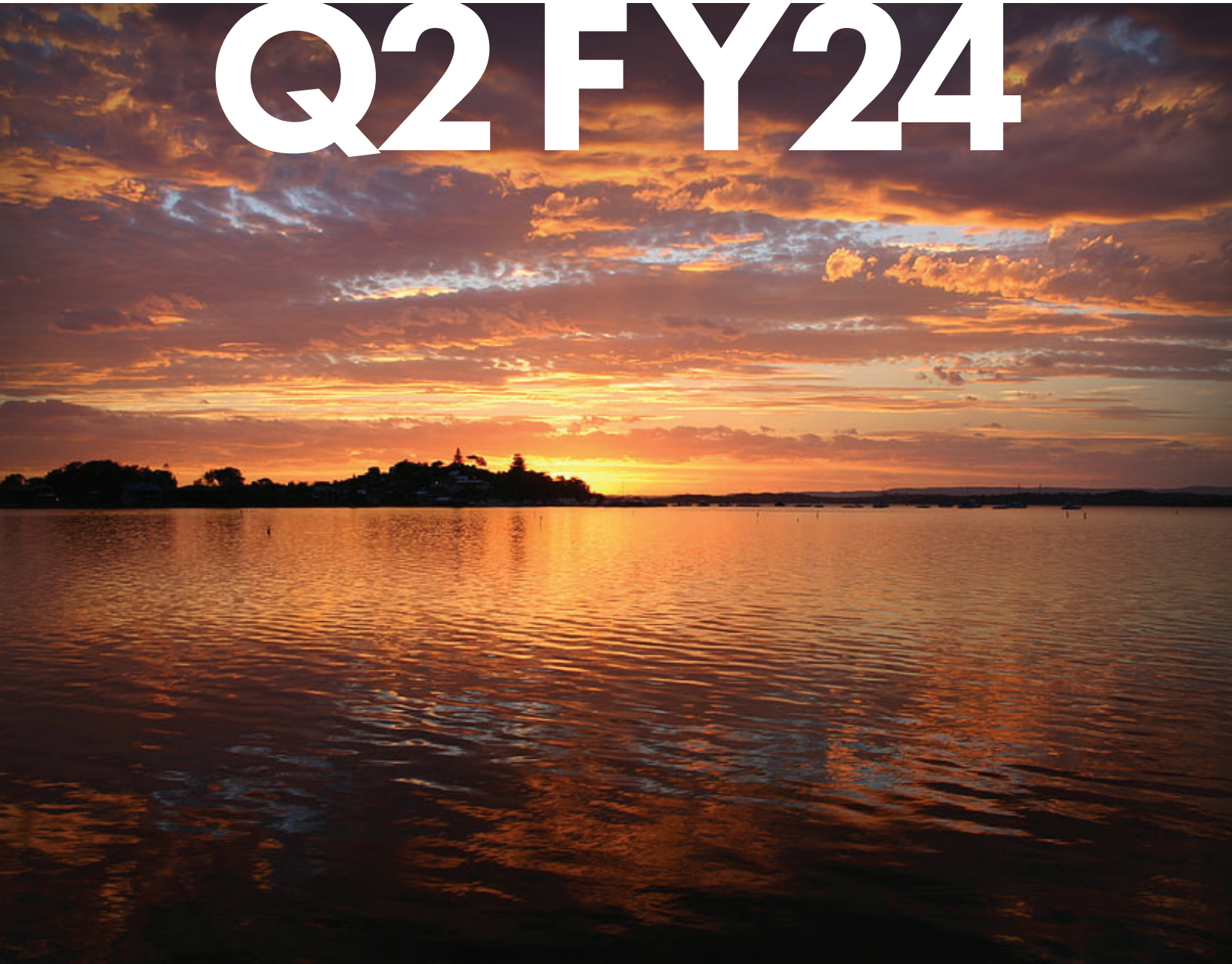




# ACCOMPLISHMENTS

# Q2 FY24



U.S. DEPARTMENT OF  
**ENERGY**

# NETL ACCOMPLISHMENTS

Quarter 2 – Fiscal Year 2024

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## NETL Software Tools Contributed to First of Its Kind Publication on Water Treatment

By using software tools developed at the Lab, NETL helped co-author “Modeling Framework for Cost Optimization of Process-Scale Desalination Systems with Mineral Scaling and Precipitation,” which was published in the journal ACS ES&T Engineering. The paper is the first publication to demonstrate the mathematical optimization of multiple key decision variables for a water treatment train while modeling detailed water chemistry phenomena like mineral scaling and precipitation. This work was the product of a collaboration between NETL researchers and OLI Systems, a water chemistry software company, which was funded by the National Alliance for Water Innovation.

## First-of-Its-Kind Combustion Research Provided Critical Data for Ammonia-Based Power Generation

NETL researchers completed some of the first in-situ measurements of ammonia-fueled flames. The foundational combustion research will be used to validate computer models needed to design next-generation energy systems using ammonia as a carbon-free fuel. Fuels that create zero carbon dioxide emissions such as ammonia, among other decarbonization strategies, will be critical for combatting the effects of climate change. However, to develop optimized ammonia combustion systems, validated modeling tools are needed that require real-world data.



## Additive Manufacturing: A New Path to Durable Turbine Components, Lower Emissions

GE Vernova’s Gas Power business, under a cooperative agreement with NETL, successfully tested an advanced cooling architecture enabled by additive manufacturing to produce turbine components that can deliver improved performance under higher operating pressures and temperatures — crucial factors for increasing turbine efficiency and reducing greenhouse gas emissions from power plants. Improved turbine efficiency is necessary to achieve the administration’s goal of 100% clean electricity, or a net-zero power grid, in the United States by 2035.

## NETL’s Belarbi Received Award from World’s Largest Corrosion Control and Coatings Organization

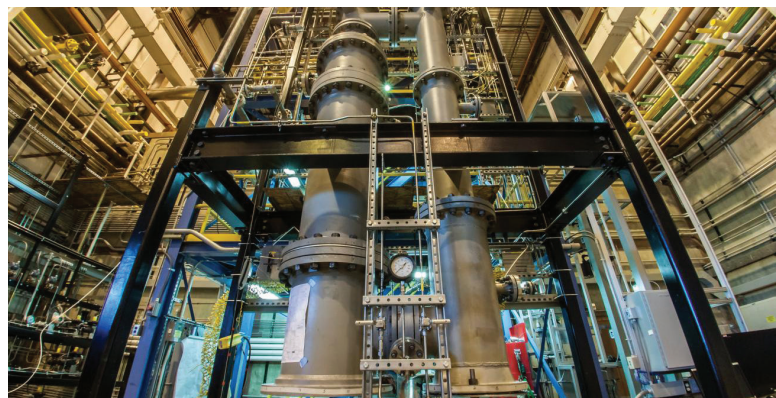
Zineb Belarbi, Ph.D., a leading corrosion and electrochemistry researcher at NETL’s Albany, Oregon, facility, was recognized by the Association for Materials Protection and Performance (AMPP) with the Joyce Wright Industry Impact Award in ceremonies held at the association’s annual conference March 6 in New Orleans. The award recognizes women who have contributed to creating a positive impact on the culture of the materials protection and performance industry, mentoring, and providing wisdom to others in the industry. Belarbi’s work focuses on overcoming corrosion challenges in the nation’s methane mitigation and carbon dioxide transport and storage efforts. She is a regular contributor to AMPP conferences and publications.

## NETL’s MUST Technology for Removing Heavy Metals from Water Netted Patent

A game-changing award-winning NETL technology that can effectively capture heavy metals from acid mine drainage and municipal water supplies and extract beneficial critical minerals such as aluminum, nickel and rare earth elements from water, has been granted a U.S. patent, bringing it a step closer to wide use throughout the nation. The patent for Multi-functional Basic Immobilized Amine Sorbents for Removal of Metal Contaminants from Wastewater was issued as U.S. patent number 11,850,571 B2 in December 2023. The technology is known as multi-functional sorbent technology (MUST).

## NETL Discovered Breakthrough Scaling Approach for Circulating Fluidized Bed Technology

NETL researchers developed a new scaling methodology for measuring and understanding the performance of key elements used in circulating fluidized bed (CFB) technologies that can speed their development for more widespread use. Advantages of CFB include fuel flexibility; capability for firing low-grade fuels like biomass; desulfurization during combustion; low nitrogen oxide emissions; intense heat transfer characteristics; use of crushed fuel with relatively large particles; and small installation capabilities.



### NETL Demonstrated New Electrode Fabrication Technology on Durable Solid Oxide Fuel Cells

NETL researchers successfully demonstrated how the Lab's patented electrode infiltration technology can be applied to electrode fabrication, marking a significant advancement in solid oxide fuel cell (SOFC) research that may have positive implications for emerging electric transportation technologies, such as vertical take-off and landing (eVTOL) aircraft. NETL experts applied its patented electrode infiltration technology to electrode fabrication on a porous electrolyte matrix, provided by industrial partner OxEon, and then subjected those cells to extensive long-term testing. A long-term test of one infiltration-made cell was carried out over 1,000 hours, achieving results that make the infiltration-based electrode fabrication strategy attractive for use in emerging SOFC technologies.

### Patent Issued for Laser Technology That More Efficiently Detects Leaks from Underground CO<sub>2</sub> Storage Sites

Two NETL researchers were awarded a patent for improvements to laser technology that can be used to detect carbon dioxide leaks more efficiently from underground carbon storage sites. The technology also holds potential for use as an online sensor in a range of other hostile environments that require environmental monitoring. NETL's Dustin McIntyre and Daniel Hartzler were recently awarded the fifth in a series of technology patents that cover aspects of a laser induced breakdown spectroscopy probe for underground storage site monitoring.

### NETL-Sponsored National Carbon Capture Center Hit 150,000 Hours of Technology Testing and Demonstration

The National Carbon Capture Center (NCCC), a cornerstone of U.S. innovation for testing and demonstration of carbon management technologies established by DOE and NETL in 2009, achieved the milestone of performing 150,000 hours of technology testing. Southern Company operates NCCC in Wilsonville, Alabama, through a cooperative agreement with DOE's Office of Fossil Energy and Carbon Management and NETL.



### New NETL AI Tool Unlocked Vast Energy Data Opportunity

NETL researchers harnessed the power of artificial intelligence (AI) to develop a tool that can ingest enormous amounts of unstructured geological data such as publications, maps, websites and presentations and then accurately label the visual data — work that could lead to a better understanding of the subsurface for safer energy production and carbon dioxide storage. The tool is part of a software suite that emerged from the Lab's Subsurface Trend Analysis (STA) workflow, which was developed to assist subsurface research by bringing greater contextual knowledge to measured data such as cores, well logs and seismic surveys.

### NETL Launched EDX Spatial To Bring Energy Research Data and Interactive Maps to Decision Makers

To help commercial, regulatory and energy research professionals more effectively explore and interact with complex and evolving data, and glean insights through interactive maps, NETL developed EDX Spatial — a game-changing platform that empowers users to visualize data through online mapping. EDX Spatial is the official geospatial visualization, exploration, and discovery tool of the [Energy Data Exchange](#) (EDX), DOE/FECM's virtual library and data laboratory built to find, connect, curate, use and re-use data to advance energy and environmental research.



### NETL-Led Team Developed High-Performing Catalyst for Carbon Conversion

A team of NETL and University of Pittsburgh researchers developed a record-setting catalyst that electrochemically converts carbon dioxide and water into formic acid, which can be used as a hydrogen carrier in the clean energy economy. Researchers carefully optimized the catalyst formulation to maximize performance, and the demonstrated activity and product selectivity are among the highest reported in the literature. The research was detailed in a freely available [open access article](#) in the high-impact-factor journal, Applied Catalysis B: Environmental. Increasing catalyst selectivity is crucial in chemical reactions because higher selectivity means that the catalyst will enable maximized yield of the converted material — in this case, formic acid.

### NETL Study Investigated Long Duration Energy Storage Options

NETL researchers investigated long-duration energy storage options that can better accommodate deficits of variable renewable energy (VRE) sources over multi-day and seasonal timescales. The work calls for additional long-term research and development investments to reduce costs and help enable an improved electrical grid that features increasing amounts of VRE. Transitioning the grid to rely primarily on VRE sources while achieving the same degree of reliability currently afforded by fossil fuels will require dramatic changes. The study found that an increase in storage capacity of at least two orders of magnitude will be needed to enable an electricity grid with high amounts of VRE, which will require a significant increase as VRE sources increase.



### NETL Research Provided New Insight Into Catalysts for Carbon Conversion

NETL researchers developing carbon dioxide conversion technologies recently demonstrated that the material on which a catalyst is affixed, called a support, can have a dramatic impact on its performance. The discovery could lead to improved energy efficiency, boosted catalyst performance and a reduction the amount of expensive metallic catalyst materials needed for these systems, which will be crucial for meeting the nation's decarbonization goals.

### NETL's Yuhua Duan Named Fellow of the Royal Society of Chemistry

Yuhua Duan, Ph.D., a research physical scientist at NETL, has been named a fellow of the Royal Society of Chemistry (RSC), a professional society based in the United Kingdom with more than 54,000 members worldwide. RSC awards the designation of fellow to individuals who have made outstanding contributions to the chemical sciences. RSC, founded in the UK in 1841, is an internationally renowned not-for-profit publishing and knowledge organization that advances excellence in the chemical sciences.



### Two NETL Researchers Named Oppenheimer Fellows for 2024

NETL's Christina Wildfire, Ph.D., and Don Ferguson, Ph.D., were selected to serve as fellows in the 2024 Cohort of the Oppenheimer Science and Energy Leadership Program (OSELP). Wildfire served as technical lead for NETL's Center of Microwave Chemistry and has led projects spanning energy storage, hydrogen generation from waste and rare earth mineral recovery. Ferguson is a research engineer on the NETL Thermal Science Team and is a leading authority on gas and liquid fuel combustion, fluid dynamics and thermal sciences for advanced processes and energy applications, and a recognized expert in the fields of pressure gain combustion and thermoacoustic instabilities in gas turbines.



### NETL-Supported University of Oklahoma Project To Retrofit Natural Gas Engines for Methane Mitigation

The University of Oklahoma, in cooperation with NETL and industry partners, developed an advanced retrofit kit for natural gas engines used in the gas production, gathering, transmission and processing sectors that cut emissions while enhancing performance. The retrofit kit includes an advanced air management system that optimizes engine operation by manipulating key parameters while integrated sensors provide real-time data on engine performance. Virtual sensors enhance the precision of monitoring and control.



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