NATIONAL ENERGY TECHNOLOGY LABORATORY

ACCOMPLISHMENTS

Q1 FY21

U.S. DEPARTMENT OF ENERGY

NETL ACCOMPLISHMENTS

Quarter 1 – Fiscal Year 2021

NETL Co-Developed Open Source Model to Quantify Electricity Consumption

NETL, in collaboration with the U.S. Environmental Protection Agency and the National Renewable Energy Laboratory, developed a new, open-source computer model to quantify baseline life cycle impacts of electricity consumption in the United States, allowing for more robust and consistent analyses to inform decision makers and stakeholders. The publicly available model enables a range of users–from small communities to major industrial developers–to conduct in-depth analyses on domestic electricity use and its effects, providing stakeholders the means to assess environmental impacts and facilitating informed and responsible use of the nation's energy resources.

NETL Technologies Earned R&D 100 Awards

Two NETL technologies were awarded prestigious 2020 R&D 100 awards: NETL's Institute for the Design of Advanced Energy Systems (IDAES), a center of excellence for the identification, synthesis, optimization and analysis of innovations to meet the nation's growing energy needs; and NETL's Low-Cost Coal-to-Graphene Manufacturing Process, which converts feedstocks of domestic coal into a material that can be used to build stronger roads and bridges and manufacture various high-tech products. R&D 100 awards recognize the developers of the 100 most technologically significant products introduced into the marketplace in the last year.

Multi-Lab Computational Approach Employed by Oil & Natural Gas Operators

A team of national laboratories led by Lawrence Berkeley National Laboratory and Lawrence Livermore National Laboratory, with support from the National Energy Technology Laboratory (NETL) and Stanford Linear Accelerator Laboratory, collaborated in a multi-scale modeling project that resulted in an approach that significantly improves the prediction of hydraulic fracture propagation. The results and modeling approach from the multi-lab project, titled "A New Framework for Microscopic to Reservoir-Scale Simulation of Hydraulic Fracturing and Production: Testing with Comprehensive Data from Hydraulic Fracturing Test Site (HFTS) and Other Hydraulic Fracturing Field Test Sites," were subsequently adopted by numerous oil and natural gas operators following publication by the Society of Petroleum Engineers.

NETL Hosted DOE InnovationXlab CarbonX Summit

NETL hosted members of the nation's energy and manufacturing industries Oct. 21-22 to share ideas and pitch novel solutions to new challenges facing the power generation sector and economy at the DOE InnovationXLab CarbonX Summit. The entirely virtual CarbonX Summit showcased DOE technologies and the national laboratories' capabilities at the heart of the domestic energy economy, from production to utilization to reuse. Panels included representatives from industry and government, and topics ranged from artificial intelligence and machine learning to commercialization pathways for new innovations and projections of the future for the natural gas industry.

NETL-Supported Virginia Tech Project Won AES 2020 Energy Award

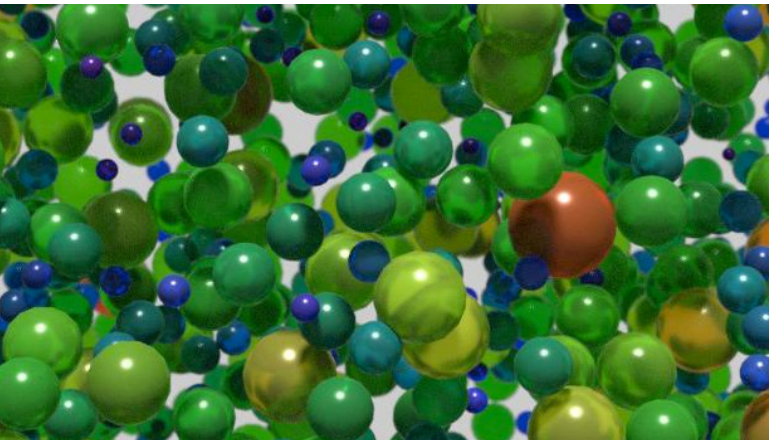
The American Energy Society (AES) recognized NETL-supported research at Virginia Tech as one of the top energy and technology developments of the year for its game-changing economic potential to supply the United States with a steady domestic source of vitally important rare earth elements. The project, titled "Development of a Cost-Effective Extraction Process for the Recovery of Heavy and Critical Rare Earth Elements from the Clays and Shales Associated with Coal," was recognized as one of the three "most interesting energy-tech developments of 2020," with respect to the projected fastest-to-market and long-term impact.

NETL Advanced New Oil Extraction Strategies for Utah's Paradox Basin

An NETL-supported field laboratory in Grand County, Utah, is generating strategies to efficiently extract oil from the region's unconventional shales. Drilling of a nearly 10,000-foot-deep characterization well in the Paradox Basin began in December 2020. The Utah Geological Survey estimates undiscovered recoverable oil reserves from the Cane Creek shale play and other shales in the Paradox Basin of at least 471 million barrels, making the development of these sizable resources an important step to maintain U.S. energy independence. NETL and its project partners, including the University of Utah and Zephyr Energy, will use the well to study and characterize the regional geology, stress regime and natural fracture networks.

NETL's Microwave Ammonia Synthesis Won IChemE Global Awards

NETL's pioneering Microwave Ammonia Synthesis (MAS) took home the 2020 IChemE Global Awards for its potential to aid in agriculture, energy production and other applications while also lowering costs and overall energy use. The MAS process, developed by NETL in partnership with West Virginia University, is highly efficient and can run off renewable power sources such as those found on many farms. Because the process does not need a constant supply of power, it can function using intermittent power supplies during times of low wind and limited sun exposure, allowing for increased flexibility for ammonia producers.



MFiX 20.3 Released with Improved Modeling Capabilities

NETL released version 20.3 of its world-renowned Multiphase Flow with Interphase eXchanges (MFiX) software suite, which included an improved modeling capability that allows for more accurate descriptions of real particle-size distributions, offering an important new tool for designing next-generation energy systems to power the nation. The new version adds great value to the Lab's modeling work, especially for modeling larger-scale, complex reactor systems of mixed feedstocks such as coal, biomass and plastics, where high fidelity is critical.

NETL Researchers Named Among Top 2% of World Scientists

The journal PLOS Biology named several NETL researchers as among the top 2% of scientists in the world, based on their career-long citation impact up until the end of 2019. The data included all scientists who, according to a composite index, are among the top 2% of scientists within their main subfield discipline (considering those who have published at least five papers), leading to a total of 6,880,389 scientists being assessed. NETL researchers identified in the PLOS Biology article are current employees David E. Alman, Sofiane Benyahia, Ray Boswell, Yuhua Duan, Michael Gao, Randall S. Gemmen, Angela L. Goodman, Evan Granite, Mehrdad Massoudi, Ranjani V. Siriwardane, Dan Sorescu and Phuoc X. Tran, along with former employees David Maurice, Paul Ohodnicki, James Rawers, D.H. Smith and C.M. White.

Major Computational Milestone Demonstrated in NETL Collaboration

An NETL collaboration with Cerebras Systems demonstrated that the company's acclaimed CS-1 system could perform a key computational fluid dynamics workload more than 200 times faster and at a fraction of the power consumption compared to the same workload on an optimized number of cores of the Lab's supercomputer JOULE 2.0. Further development of this unique computational architecture could lead to a paradigm shift in NETL's high-performance computing efforts and help overcome challenges facing researchers as they design and model next-generation energy systems.

NETL-Funded Project Advanced 'Green' Process to Make Concrete Blocks

NETL and the University of California, Los Angeles, completed more than 1,200 hours of field testing at the Wyoming Integrated Test Center to successfully demonstrate a process to create concrete masonry units (CMUs, or concrete blocks) using carbon dioxide from power plant flue gas without the need for a carbon capture step. This demonstration illustrated the potential of a utilization technology to supply a large market with low-carbon concrete products while simultaneously reducing power plant carbon dioxide emissions.

AIChE Honored Two NETL Researchers

Two NETL researchers were recognized for achievements and contributions in their fields during the 2020 annual meeting of the American Institute of Chemical Engineers (AIChE), held virtually Nov. 16-20. Madhava Syamlal, Ph.D., senior fellow, Computational Sciences and Engineering, received the Elsevier Particle Technology Forum Award for Lifetime Achievements. Isaac Gamwo, Ph.D., a research chemical engineer on NETL's Reaction Engineering Team, received the AIChE Minority Affairs Committee's Eminent Chemical Engineers Award.

NETL Recognized for Innovation in Oil and Gas Exploration

An NETL-sponsored project that could unlock access to large reservoirs of natural gas in Central Appalachia and extract those resources with technology designed to leave a light environmental footprint has earned accolades from state and industry officials. The Virginia Department of Mines, Minerals and Energy's Division of Gas and Oil, in partnership with the Virginia Oil and Gas Association (VOGA), presented NETL and its project partners with the Excellence in Exploration Innovation Award for the development of the Emerging Stacked Unconventional Plays (ESUP) field laboratory and characterization well in southwestern Virginia.

NETL Inventions Take Home Wins at 2020 TechConnect Innovation Awards

NETL inventions to separate carbon dioxide from post-combustion flue gases and remove contaminants from water sources won at the 2020 TechConnect Innovation Awards for their ability to contribute to a more sustainable environment while providing potential economic benefits. Researchers David Hopkinson, Victor Kusuma and Surendar Venna earned an award for their development of "Crosslinked Polymer Blend Membranes for Carbon Dioxide Separation," which builds upon previous work to capture greenhouse gases from the nation's power plant fleet. The TechConnect Innovation Awards also recognized Brian Kail, McMahan Gray, Walter Wilfong and Qiuming Wang for their invention "Immobilized Amine Sorbents for the Removal of Organic Contaminants from Environmental and Industrial Water Sources," which can remediate the effects of industries such as dye and textiles on local water supplies.

NETL Developed Non-Spherical Modeling Technique

NETL researchers added a valuable new capability to the Lab's world-renowned Multiphase Flow with Interphase eXchanges (MFiX) modeling software suite that could accelerate design and deployment of advanced energy systems. Rather than modeling particles as spheres, as is the case with most discrete element modeling (DEM) techniques, NETL researchers developed and validated an algorithm to simulate non-spherical shapes that better approximates real-world particles, significantly increasing modeling accuracy. The newly developed non-spherical modeling technique in MFiX-DEM, called the superquadric discrete element method (SuperDEM), is an entirely different way of constructing and simulating particles using superquadrics — a family of geometric shapes — and offers a high degree of modeling fidelity.