NETL's Water-Energy RD&D Core Capabilities & Competencies

Table of Contents

Introduction

The National Energy Technology Laboratory (NETL) has long recognized the critical link between sustainable water and energy. This nexus is being continually stressed in the United States and throughout the world by growing populations in water deficient regions, shifting precipitation patterns, and competing demands for clean water. As such, it is a key component of the Laboratory's broad mandate to enable the discovery, development, and deployment of early stage technology solutions that enhance the Nation's energy foundation and protect the environment for future generations.

Since 2002, NETL has carried out an integrated research, development, and demonstration (RD&D) program to advance our understanding of energy exploration, extraction, development, and use on water availability and quality with the goal of improving the security and resiliency of our fossil-energy investments. Research on water is being conducted in a synergistic manner across the Laboratory's programs in thermoelectric power generation, oil and natural gas resource development, carbon capture and storage, value product recovery, coal combustion byproducts, life cycle analysis (LCA), and decision science and modeling.

Leveraging its core capabilities, competencies, skills, and authorities, NETL partners with industry, national laboratory, academia, and non-government stakeholders to conceive, develop, and bring to commercial readiness the technology to continue the environmentally sound and sustainable use of our domestic fossil energy resources.

As the only government-owned, government-operated (GOGO) laboratory in the U.S. Department of Energy (DOE) complex, NETL is well positioned to apply its diverse spectrum of in-house RD&D capabilities, facilities, and extramural program and project management competencies specific to the water-energy nexus to be able to work with both public- and private-sector organizations through partnership agreements and various other collaborative vehicles. Further, through such partnerships, the Laboratory can bring to the water-energy challenge a world class research and professional staff that includes scientists, engineers, economists, technical professionals, post-graduate, graduate, and undergraduate interns, research support staff, and technical project managers.

The purpose of this document is to provide a capsule summary and examples of the Laboratory's water-energy capabilities, competencies, facilities, laboratories, and expertise that can be leveraged through collaboration and partnership to solve current and emerging water-energy issues and challenges.

NETL's Current Water-Energy RD&D Thrusts

NETL has been carrying out a comprehensive, integrated intramural and extramural RD&D program directed at the nexus between water and energy for nearly two decades. Below is a brief description of the Laboratory's current water-related research thrusts that serve as the basis for the Laboratory's water-energy RD&D program.

Advanced Cooling and Transformative Power Generation Technology

Research focused on technology innovations that reduce evaporative loss and enhance overall performance associated with wet, dry, and hybrid cooling systems for thermoelectric power production and other industrial applications as well as water-saving innovations in carbon capture and condenser efficiency.

Non-Traditional Water Use

Research directed at the characterization and treatment of non-traditional sources of water, such as produced water and brines from geological carbon storage, for reuse in power generation, unconventional oil and natural gas production operations, and on other industrial, agricultural, and domestic water-use sectors.

Water Treatment and Detection Technology

Research focused on advanced sensors, wireless networks, novel sorbents, and innovative technologies for detecting and treating oil and natural gas flowback and produced water, coal mining discharge, geological carbon storage brines, and effluents from fossil-based power generation.

Value Product Recovery and Reuse

Research directed at treatment and recovery of value products such as rare earth elements (REE) from non-traditional sources of water such as acid mine drainage, flue gas desulfurization blowdown, and brines from high-saline wastewaters.

Decision Science and Modeling

Research focused on the development and application of a range of modeling, Artificial Intelligence/ Machine Learning, LCA, and decision-making tools to evaluate and predict the impact of fossil energy development on surface and sub-surface water resources.

Research and Innovation Center Laboratory Water-Related Facilities, Capabilities, and Current Projects

NETL's Research and Innovation Center (RIC) is charged with carrying out the Laboratory's internal water-related research programs. RIC possesses six core capabilities applicable to the water-energy nexus: Applied Materials Science and Engineering, Chemical Engineering, Computational Science, Decision Science and Analysis, Environmental Subsurface Science, and Systems Engineering and Integration.

Specific competencies housed within these six core capabilities that support the Laboratory's water-energy nexus research include:

- Predictive modeling of subsurface systems, management of geoscience data, remote and downhole sensing of subsurface systems, and statistical approaches to integrate multiple data streams.
- Geological physics-based machine learning.
- Reservoir engineering; technical, economic, and environmental systems modeling.
- Novel distributed sensing capabilities, processing data streams from distributed sensors.
- High-performance computing, machine learning, data analytics.
- Advanced computational tools (system-wide process optimization and uncertainty quantification; advanced technology design and cost estimation; grid, infrastructure, and energy reliability assessment; energy-economy modeling; and LCA).
- Functional and structural materials, which leverages the extreme environment materials initiative (eXtremeMAT); developing low-cost, high-temperature alloys and ultrahigh-temperature alloys and ceramics through integration of multiscale computational materials engineering, data science, targeted validation experiments, performance evaluation at conditions, and advanced manufacturing.

A description of the RIC facilities and laboratories with application to the water-energy challenge and a few examples of ongoing water-related research are provided below.

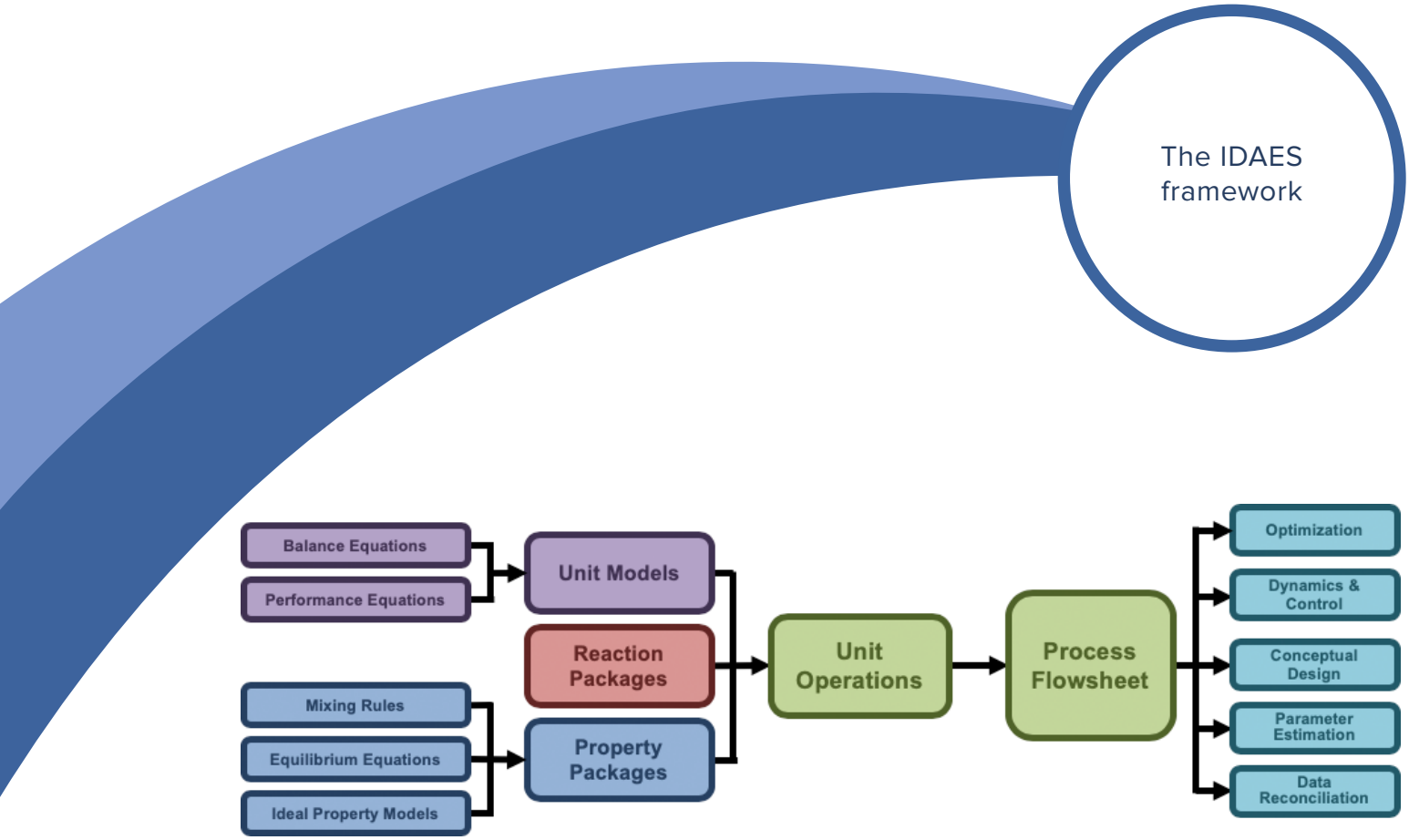
For more information on NETL's Water Energy Research Portfolio visit https://netl.doe.gov/water-energy-research

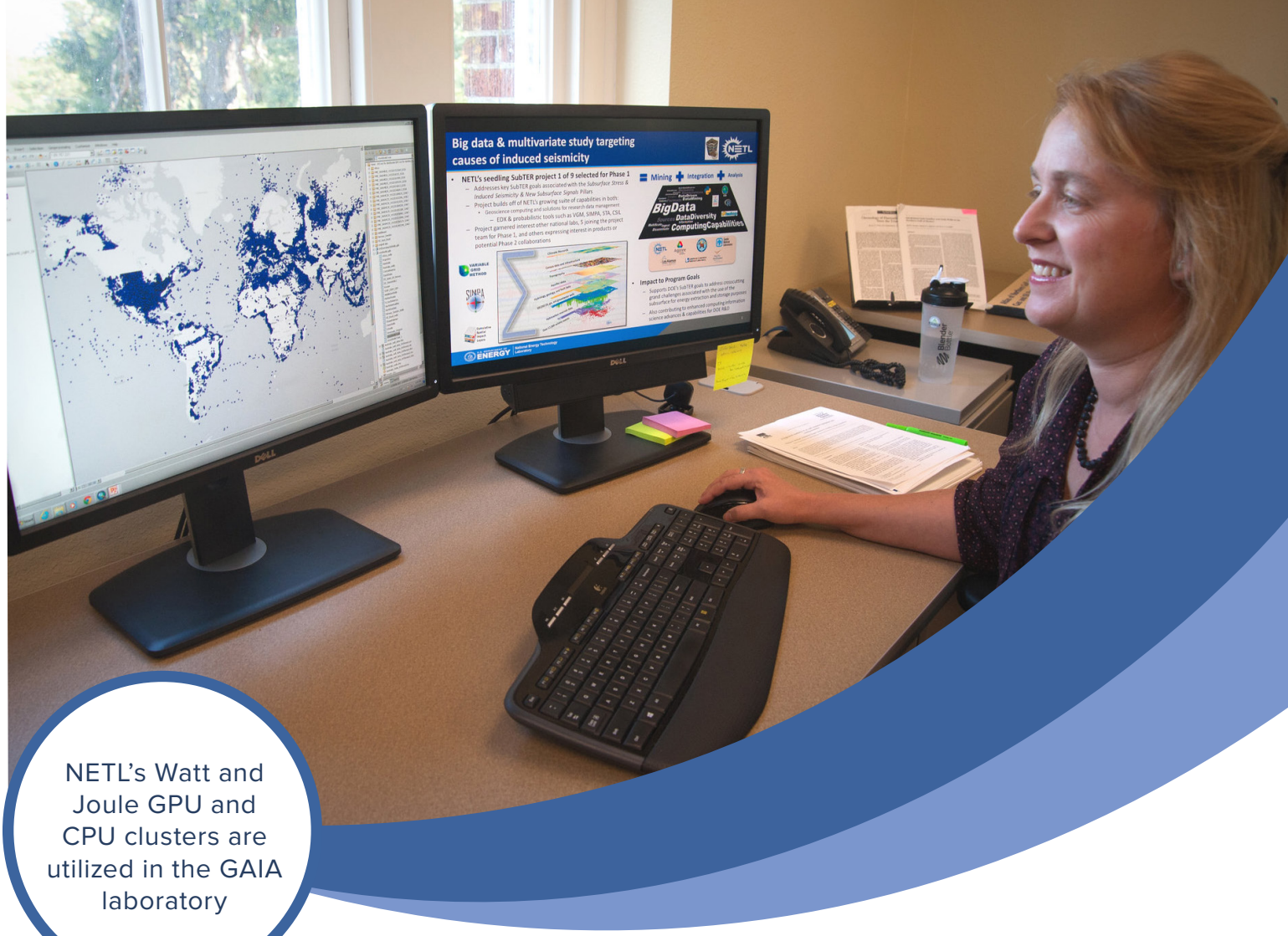
Institute for the Design of Advanced Energy Systems (IDAES)

Facility Description: The IDAES is a next generation modeling and optimization platform used to develop multiscale, simulation-based computational tools and models in support of the Laboratory's efforts in advanced technologies like chemical looping, carbon capture, and advanced combustion systems. The IDAES is a very valuable tool in supporting NETL's water-energy research. Models are currently being developed to track the partitioning of contaminants in various power plant wastewater streams. In addition, the IDAES can be used to optimize water use within an entire power plant.

Project Title: Energy-Water Desalination Hub

Project Description: NETL supports the National Alliance for Water Innovation (NAWI) on water treatment systems using the IDAES framework. The outcome of this partnership with NAWI will be an open-source, predictive suite of models for steady-state and dynamic optimization of integrated water systems and treatment trains called Proteus. The initial implementation of Proteus focuses on building the steady-state unit and property models and system level capabilities to provide an initial version of a water desalination system simulator that can track ions, mass, and energy flows throughout the system. To find out more about the IDAES visit https://idaes.org/.





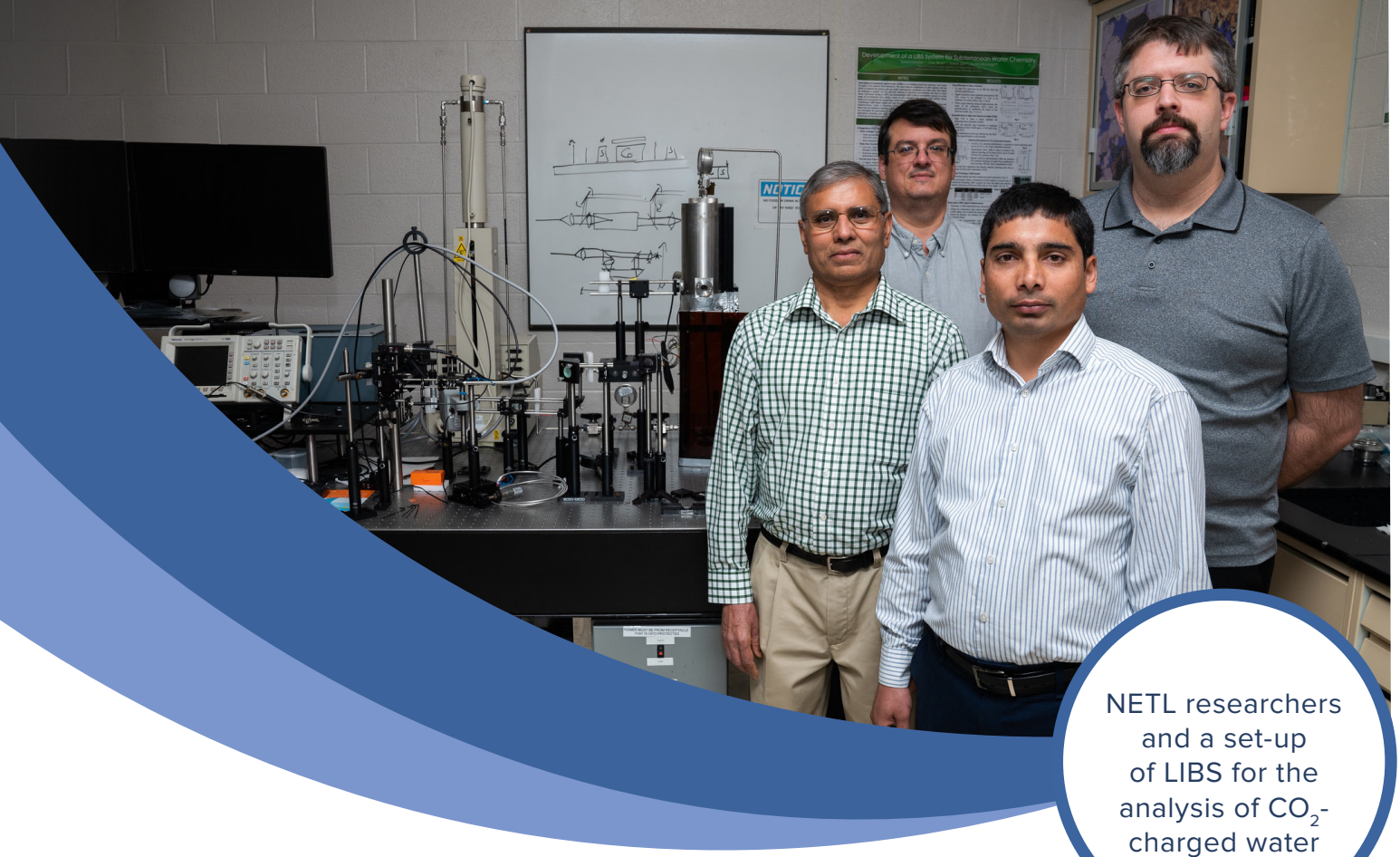
NETL's Watt and Joule GPU and CPU clusters are utilized in the GAIA laboratory

Geoscience Analysis, Interpretation, and Assessments (GAIA) Laboratory

Facility Description: The GAIA computational facility enables real-time research collaboration and analysis with the use of high-performance computers, robust software capabilities, and access to expansive collections of geologic, spatio-temporal, socio-economic, and environmental data. The facility provides innovative solutions for subsurface to surface energy challenges associated with energy materials, infrastructure, conventional and unconventional hydrocarbon systems, geothermal resources, carbon storage onshore and offshore, induced seismicity, water, and climate.

Project Title: Assessing Current and Future Infrastructure Hazards

Project Description: This project uses data and models from NETL's Offshore Risk Modeling platform in the GAIA laboratory to perform advanced analyses on data pertinent to existing offshore infrastructure (e.g., oil and gas platforms, wells, etc.). This includes the role seawater and subsurface saline water play in impacting the integrity of oil and gas platforms, well casings, etc. The findings of this study aim to provide new machine learning tools and analytical insights to improve forecasting of infrastructure lifespan, integrity, and identification of hazards, including those from water-based systems, to extend the life of existing infrastructure. To find out more about the GAIA laboratory visit https://www.netl.doe.gov/sites/default/files/rdfactsheet/R-D194_3.pdf



NETL researchers and a set-up of LIBS for the analysis of CO_2-charged water

Laser Nanoparticles Laboratory

Facility Description: NETL's Laser Nanoparticles Laboratory is outfitted to perform optical measurements of solids, liquids, and gases. Laser systems are used to perform atomic emission measurements of elemental concentrations in samples. The laboratory can also perform Raman shift molecular measurements of solids, liquids, and gases. The laboratory is capable of performing two dimensional elemental maps of solids with micron level resolution. Technologies in the Laser Nanoparticles laboratory is setup to fabricate, test, and validate novel optical sensors.

Project Title: Quantification of Dissolved Metals in High-Pressure CO_2-Water Solutions by Underwater Laser-Induced Breakdown Spectroscopy (LIBS)

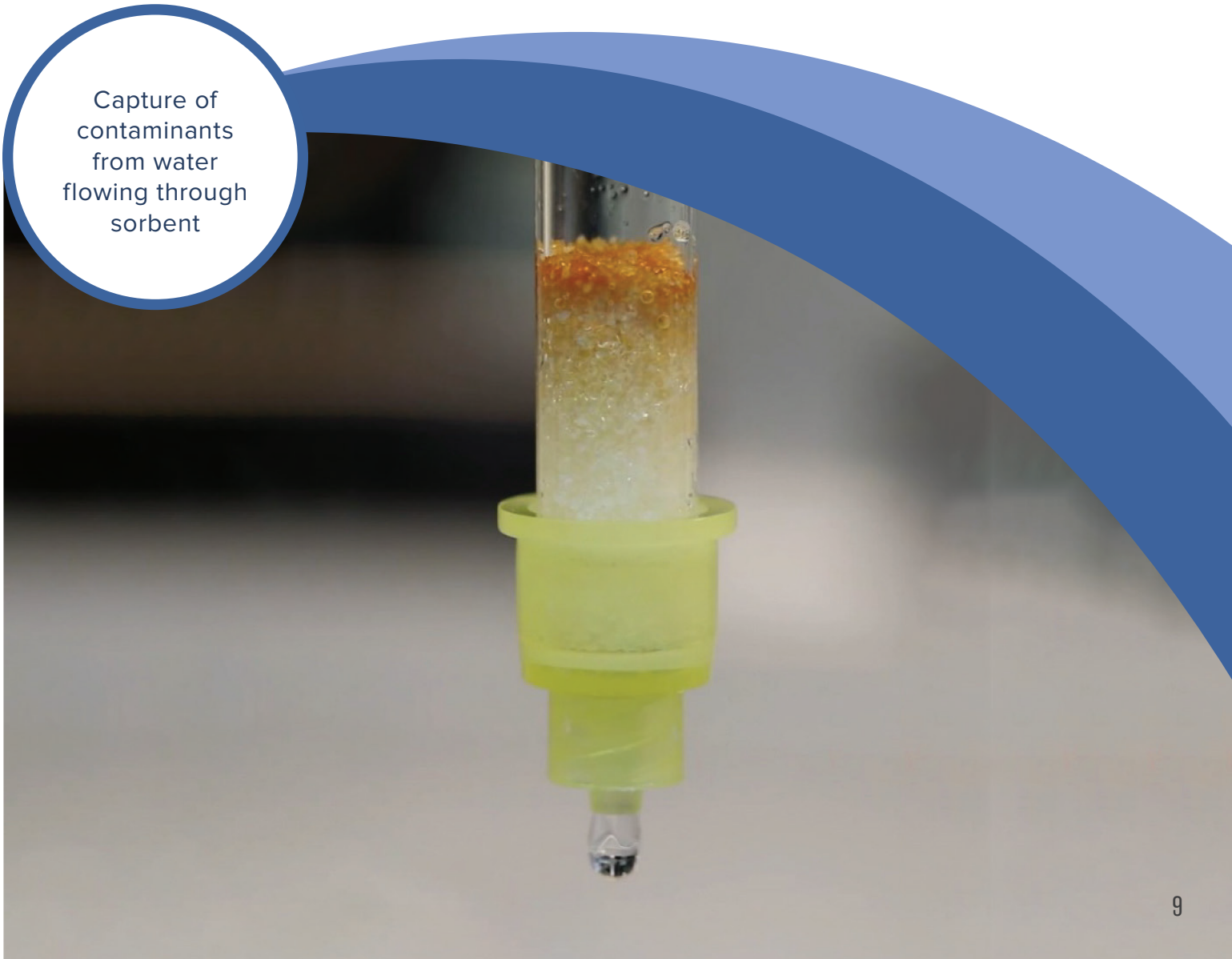
Project Description: Underwater LIBS has been employed in the Laser Nanoparticles laboratory for the measurement of dissolved metals in high-pressure CO_2-water solutions. LIBS can be applied to in situ measurements of gases, liquids and solids, making it amenable to the monitoring of air, water, and soil. The results demonstrate that low-ppm range concentrations of Mg, Ca, Sr, Ba, and Mn can be precisely measured in CO_2-charged water at varied pressure conditions by using underwater LIBS.

Functional Materials Synthesis Laboratory

Facility Description: The Functional Materials Synthesis laboratory focuses on the analysis, synthesis, and purification of chemical compounds to identify novel materials for carbon capture with potential application to water treatment and value products recovery. The basic immobilized amine sorbents (BIAS) particle and pellet technology have demonstrated superior stability in both gas and liquid environments for the capture of carbon dioxide, REE, and heavy metals in various physical and chemical medias. The DOE-NETL BIAS technology represents a scalable, cost-effective, and regenerable series of sorbents that are competitive in both price and performance, relative to state-of-the art sorbent-based gas and water treatment processes.

Project Title: Metal-Loaded Basic Immobilized Amine Sorbents for the Removal of Metal Contaminants from Wastewater

Project Description: Heavy metals are common in industrial wastewater streams such as those associated with flue gas desulfurization, acid mine drainage, hydraulic fracturing, and nuclear fission. NETL researchers have discovered a method for using a metal-chelated polyamine that is chemically tethered to a solid silica support via a crosslinker. These sorbents can be used to capture heavy metals from aqueous sources. The invention can also be applied to the removal of heavy metal contaminants from flowing or stagnant aqueous systems, including industrial effluent, ponds, rivers, lakes, seawater, and groundwater.



Capture of contaminants from water flowing through sorbent

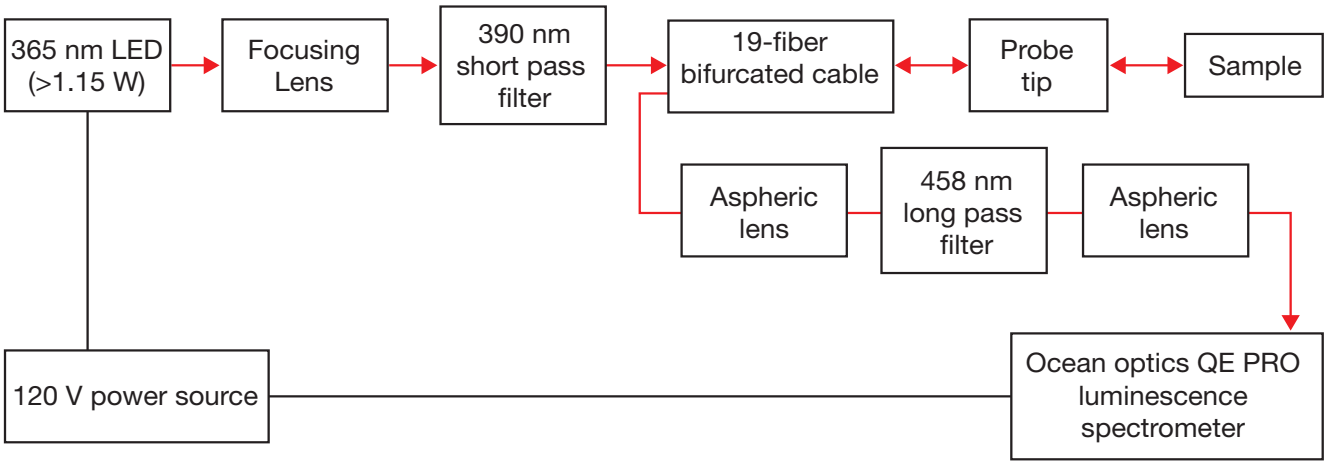
High Salinity Brine Treatment Laboratory

Facility Description: The High Salinity Brine Treatment laboratory has been built to examine water and salt transport rates in membrane-based processes. The laboratory has the capability of testing reverse osmosis (RO), Pressure Retarded Osmosis, Osmotically Assisted Reverse Osmosis (OARO), Forward Osmosis, Membrane Distillation, and Nanofiltration membranes at both high pressure and variable salinity on both the feed and swept side of the membrane. The laboratory is capable of testing both flat sheet and hollow fiber membranes.

Project Title: Osmotically Assisted Reverse Osmosis for High Salinity Brine Treatment

Project Description: This work evaluates a novel OARO process for dewatering high salinity brines using readily available membranes and equipment in NETL's High Salinity Brine Treatment laboratory. NETL develops an OARO model to identify feasible operating conditions for the process and to estimate the water recovery and energy consumption across a range of brine feed concentrations. The results suggest that an OARO dewatering process improves upon the recovery of RO for high salinity brines and has a comparable or lower energy consumption than mechanical vapor compression.

Experimental setup for testing 2" by 3" flatsheet membranes



Schematic diagram of a portable REE sensor

Advanced Sensors Development Laboratory

Facility Description: The Advanced Sensors Development laboratory places an emphasis on new sensor material technologies integrated with advanced sensing device platforms to allow for operation under harsh environments and enhanced sensor device functionality. Embedded sensors are under development for applications such as monitoring of CO_2 migration and groundwater impacts for CO_2 sequestration, corrosion monitoring in wellbores and natural gas pipelines, and in situ process control in high-temperature power generation systems such as Solid Oxide Fuel Cells, gas turbines, and combustion systems.

Project Title: Real-Time and Portable Characterization Systems: Fiber Optic Luminescent Probe for REE

Project Description: The project conducted in the Advanced Sensors Development laboratory focuses on the development of portable spectroscopic probe systems for detecting and measuring the quantities of REE in coal, coal byproducts, acid mine drainage, and REE separation process streams. These systems are important for determining whether these materials and streams contain sufficient REE and to evaluate REE separation processes. Real-time determination of REE in coal and coal byproduct materials is critical for efficient prospecting of the enormous quantities of available materials to identify which ones to target for processing. By using optical filtering, researchers can identify materials with higher quantities of REE.

Systems Engineering and Analysis

A key complimentary skill set within RIC focused on the water-energy nexus is the Systems Engineering and Analysis (SEA) Directorate. The capabilities of SEA allow comprehensive evaluation complex energy systems from the sub-process to the global scale and their related technical, economic, resource, policy, environmental and market risks along their entire value chain and throughout their life cycle, and the identification of effective research and development (R&D) investment choices.

RIC SEA staff have conducted numerous LCA studies directly applicable to the link between water and energy that have focused on the impact and consequences of energy policy and technologies on water use and water quality. These LCA studies can be found at https://www.netl.doe.gov/LCA.

SEA also possesses strong capabilities in Energy Markets Analyses to evaluate the potential role of advanced technologies in the future U.S. energy landscape under varying factors including market forces, macroeconomic trends, or government regulations. Scenario analyses use platforms such as the National Energy Modeling System (NEMS), Market Allocation (MARKAL), and MarketBuilder.

SEA has recently developed a prototype water-energy model called the NETL Water-Energy Model that couples a data on water supply, water availability, and power plant water use with NEMS to forecast the impacts of power generation choices of water supply and demand on a watershed level.

Extramural Program and Project Development, Implementation, and Management

As a GOGO Laboratory, NETL possesses a competency unique among all DOE national laboratories in providing extramural program implementation functions powered by professional project managers who are also effective technical managers, technology communicators, and quality-assurance experts. A successful extramural technology RD&D portfolio is built on a thorough understanding of the economic, environmental, technological, regulatory, and political landscape; science-based strategic planning for programs and activities; collaboration with strategic partners to develop and test technology over a variety of maturity levels; and effective project management. Through integrated project teams, NETL defines, solicits, negotiates, awards, manages, and delivers federally sponsored research, development, and demonstration benefits to the Nation.

Since the inception of the program in 2002, NETL has collaborated with industry, academia, non-government organization, federal and agencies, national laboratories, and other key stakeholders in successfully carrying out almost $100 million in extramural water-energy RD&D. This has included research in advanced cooling technologies, produced water treatment, geological carbon storage brine management, value products recover from mine water, trace metal detection, and non-traditional water treatment and reuse. In FY19/FY20 the Laboratory awarded over $20 million in new cost-shared projects including research to develop technologies to detect arsenic and selenium in coal ash ponds, to pretreat and reuse produced water from unconventional oil and gas developments, and to further advanced dry cooling for coal- and natural-gas fired power plants.

Below are several examples of successful partnerships NETL has engaged in through its extramural RD&D water-energy program over the past several years and a brief description of two recently awarded research projects directed at the treatment and reuse of produced water from unconventional (shale) gas.

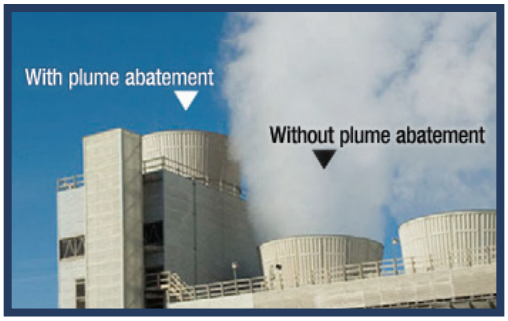
Recent NETL Extramural RD&D Success Stories

Brine Extraction and Storage Test (BEST) Facilities

BEST Facility in North Dakota

To address formation pressure and stress management through brine extraction, the carbon storage program initiated the BEST project in 2018. The BEST facilities are located in the oil and gas fields of western North Dakota and at the Gulf Power's Plant Smith in Florida and are managed by the Energy and Environmental Research Center (EERC) and Electric Power Research Institute (EPRI) respectively. This project will focus on managing formation pressure through brine management. The facilities are available for pilot-scale testing and validation of third party technologies and processes for treating and reusing brines and other high total dissolved salt waters. Additional information on EERC's BEST facility can be found at https://undeerc.org/_files/docs/best-wb-water-treatment.pdf.

SPX ClearSky™ Plume-Abatement System



Comparison between a power plant with and without a plume abatement

The ClearSky™ Plume-Abatement System was developed by SPX Cooling Technologies in partnership with NETL to minimize cooling plumes and reduce evaporative water loss. The ClearSky™ moisture capture technology recovers an average of 18 percent of the water evaporated from a cooling tower, offering an economical and environmentally friendly solution for reducing the amount of water used by fossil fuel-fired power plants. The technology is being marketed worldwide with a recent order placed for the system on a coal liquefaction facility in China.

Water-Lean Solvent Process

Technology Center Mongstad in Norway

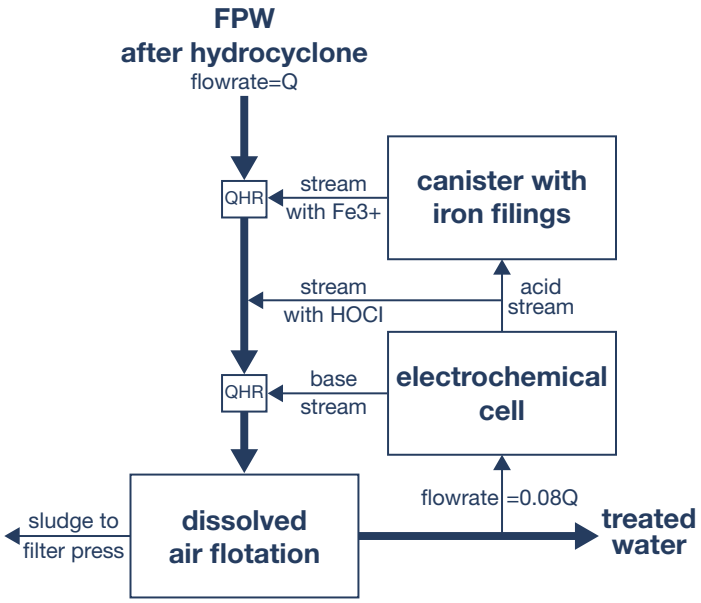
This project highlights Research Triangle Institute's (RTI) Water-Lean Solvent-based CO_2 Capture Process with reduced capital and operating costs. Water usage in the solvent mixture is reduced by substituting water with a hydrophobic non-aqueous solvent. The water-lean process substantially reduces energy consumption, thereby reducing operating costs, and enhances solvent performance with a lower-cost regenerator design, allowing for reduced capital cost. The project stated with a bench-scale development and later a large-scale testing was initiated at Technology Centre Mongstad in Norway.

Recently Awarded Projects Directed at Produced Water Treatment and Reuse

NETL recently awarded four projects to develop advanced pre-treatment technologies that would help to significantly reduce the volume of produced water from unconventional oil and natural gas development that is injected into disposal wells while increasing water supplies for reuse. A description of two of the selected project is presented below.

Non-Fouling, Low Cost Electrolytic Coagulation & Disinfection for Treating Flowback and Produced Water for Reuse – The Arizona Board of Regents, The University of Arizona

The project's primary goal is to develop a pilot scale test for delivering a ferric ion coagulant and disinfectant for treating flowback and produced water. The water will be treated to be beneficially re-used in future hydraulic fracturing and water flooding operations and potentially reduce operational water costs by up to 50 percent. The treatment system will remove suspended solids, dispersed oil, H_2S, microorganisms and scale forming cations.



Proposed treatment system

Fouling-Resistant, Chlorine-Tolerant Zwitterionic Membranes for Treatment of Produced Water in the Permian Basin – ZwitterCo, Inc.

Prototype membrane module

This project aims to advance the development of a novel membrane technology using zwitterionic copolymers that can reject impurities from produced water, specifically from the Permian Basin, while maintaining immunity to detrimental and irreversible membrane fouling. The membrane will remove nanoscale oils, greases, colloidal material, heavy metals, and dissolved organic molecules without removing salts and dissolved solids thereby making the filtration of highly saline waste streams practical and more cost-effective than traditional membrane filters. This technology focuses on the economically favorable removal of impurities that would otherwise reduce the efficiency of further treatment methods such as ion exchange, electrocoagulation, and desalination.

Available NETL Technologies and Patents

At NETL, researchers work every day to develop technology solutions to difficult energy and environmental issues. NETL works with entrepreneurs, companies, universities, and others to make laboratory-developed technologies available to assist organizations for further development, implementation, and practical use. Below is a list of NETL inventions available for further research and development and/or licensing that are applicable to addressing water-energy challenges and opportunities.

Technology	Description	USPN	Link
Metal-Loaded Basic Immobilized Amine Sorbents for the Removal of Metal Contaminants from Wastewater Multi-Functionalized Basic Immobilized Amine Sorbents for Removal of Metal Contaminants from Wastewater	These sorbents can be used for the capture of heavy metals from a variety of aqueous sources.	Patent Pending	https://netl.doe.gov/node/9223 and https://netl.doe.gov/node/9224
Laser Induced Breakdown Spectroscopy Probe for Simplified Light Collection and Laser Operation	This tool can be useful as an optical sensor for environmental water and air research or in laser range finding.	10,145,737	https://netl.doe.gov/node/348
Stable Immobilized Amine Sorbents for the De-Coloration of Waste Waters	The innovation has the potential to remove organic-based colorants and pollutants from different water sources.	Patent Pending	https://netl.doe.gov/node/350
Simplified, Cost Effective Process for Extracting Lithium from Natural Brines	This process extracts lithium from natural brines such as seawater.	10,315,926	https://netl.doe.gov/node/372
Sensors for Corrosion Monitoring in Harsh Environments	These sensors provide corrosion monitoring for a wide range of critical infrastructure including oil and natural gas wells and wellbores, water pipelines, bridges, and buildings.	Patent Pending	https://netl.doe.gov/node/382
Thin Ionic Liquid Film Deposition within Porous Substrates	This membrane makes many classes of supported liquid membranes, including supported ionic liquid membranes, practical for gas separations and wastewater treatment.	9,186,854	https://netl.doe.gov/node/429
Distributed Optical Sensor for CO_2 Leak Detection	Sensors can be distributed widely either above ground or down hole to monitor for the presence of CO_2 or to detect characteristic changes in the ground water contents that may indicate leakage from a CO_2 injection site.	8,786,840	https://netl.doe.gov/node/446
A Unique Split Laser System for Environmental Monitoring	The technology can be used to monitor and analyze groundwater and municipal water systems.	7,421,166; 8,786,840; 8,934,511; 9,297,696; 9,548,585	https://netl.doe.gov/node/458

NETL's Water-Energy Researchers and Professional Staff

NETL's research and professional staff includes a broad spectrum of scientists, engineers, economists, and technical professionals, as well as accountants, attorneys, post-graduate, graduate, and undergraduate interns, research support staff, and technical project managers. Over the past 25 years, NETL's scientists have earned 51 prestigious R&D 100 awards and 49 regional and national awards from the Federal Laboratory Consortium. NETL researchers have also garnered national recognition for their work, securing Presidential Early Career Awards for Scientists and Engineers and Arthur S. Flemming Awards, as well as being inducted as fellows into professional societies such as the American Institute of Chemical Engineers.

Below are brief biographies for several of the Laboratory's key researchers and professional staff currently engaged in developing, conducting, implementing, and managing NETL's water-energy research activities.

Briggs White | Technology Manager

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Dr. Briggs White is a Technology Manager for the Crosscutting Research Program that includes R&D directed at the development of technologies to reduce the impact of thermoelectric power generation on water availability and quality. He completed his Ph.D. in Materials Science from the University of Florida and the University of Rome Tor Vergata. He received his B.S. degree in Materials Science from Alfred University, Alfred, NY.

Alexandra Hakala | Environmental Geochemist

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Dr. Alexandra Hakala is an Environmental Geochemist on the Geochemistry Team with research interests focusing on how chemical reactions can increase the efficiency of producing energy while minimizing environmental impacts and how to monitor the sources of fluids and gases in natural systems. She earned her doctorate in the School of Earth Sciences at Ohio State University and bachelor's in Geosciences with a certificate in Environmental Studies from Princeton University.

Nicholas Siefert | Mechanical Engineer

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Dr. Nicholas Siefert is a Mechanical Engineer on the Innovative Energy & Water Processes Team. His research interests include waste-to-energy, coal gasification with carbon capture, plasma physics, solid oxide fuel cells, and nuclear fusion. Dr. Siefert earned his Ph.D. in Mechanical Engineering from Carnegie Mellon University, master's in Applied Physics from Air Force Institute of Technology, and bachelor's in Mechanical and Aerospace Engineering from Princeton University.

Djuna Gulliver | Environmental Engineering Researcher

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Dr. Djuna Gulliver is an Environmental Engineering Researcher on the Biochemistry & Water Team. She is currently analyzing the microbial communities in various energy systems such as acid mine drainage, shale gas reservoirs, and microbial electro-synthesis reactors to characterize the microbial taxonomy and metabolic capacity of these environments. Dr. Gulliver completed her Ph.D. in Environmental Engineering from Carnegie Mellon University, master's in Environmental Engineering from Johns Hopkins University, and bachelor's in Chemical Engineering, Geology, and Geophysics from the University of Minnesota.

Eric Grol | Senior Energy Analyst

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Eric Grol is the Senior Energy Analyst for the Systems Engineering and Analysis Team. His current research areas are split between water-related issues in fossil power generation for both water used for cooling, as well as treatment and tracking federal regulations that apply to coal-fired power plants.

McMahan Gray | Physical Scientist

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McMahan Gray is a Physical Scientist for the Functional Materials Team. He most recently led the development of BIAS technology, which was originally designed to capture carbon dioxide from fossil fuel-based power plants and further resulted in the development of technology that could be applied to treat municipal and industrial wastewater on a large scale. He holds a bachelor's degree in Chemical Engineering from the University of Pittsburgh.

Jared Ciferno | Technology Manager

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Jared Ciferno is the Technology Manager for the Onshore Unconventional Oil and Natural Gas and Natural Gas Infrastructure Programs. In this role, he interfaces with executive-level government officials to establish near- and long-term R&D program objectives, oversee project development, and ensure technology integration. He received his B.S. and M.S. degrees in Chemical Engineering from the University of Pittsburgh.

Andrea McNemar | Project Manager

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Andrea McNemar serves as the Project Manager on the Carbon Storage Team. She manages research and development projects with a focus carbon storage and water issues. Her research interests include water and mercury capture at power plants, for which she is a published co-author. She earned her M.S. in Civil and Environmental Engineering from West Virginia University.

Mark McKoy | Technology Manager

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Mark McKoy is the Acting Technology Manager for the Carbon Storage Program. His current research focus includes low-temperature geothermal energy from sedimentary rock resources in the eastern U.S., naturally fractured sedimentary rock reservoirs, and associated oil & gas production R&D. In addition, he focuses on the environmental impacts associated with coal-fueled power plants. He received his M.S. and B.S. in Geology.

Partnering with NETL

NETL's partnership activities are central to DOE's core mission. NETL utilizes a complete suite of contractual vehicles, as well as its inherent authority as a GOGO laboratory, to pursue technology development and eventual transfer of technology to the marketplace. NETL's success in developing technology solutions that can be applied to the intersection of water and energy depends upon strong relationships with both public and private entities. From targeted competitive announcements to cooperative research and development agreements, NETL offers a variety of cost-shared funding and partnership arrangements to help move technology and intellectual property (IP) through the maturation cycle into the marketplace. Partnership and licensing mechanisms NETL utilizes to enable collaboration and technology transfer include the following:

Cooperative Research and Development Agreements (CRADAs) allow for joint research and development performed by NETL and other organizations. Background IP protection is included for the parties, and CRADA-developed IP is addressed. A CRADA offers participants the option for an exclusive license in a specific field of use for IP developed by NETL.

Contributed Funds Agreements (CFAs) allow a participant to provide funds to NETL for a specific scope of work to be completed. At the end of the project, NETL will report research findings back to the participant.

Memorandums of Understanding (MOUs) or Memorandums of Agreement (MOAs) are written agreements between NETL and other entities that outline collaboration between the parties. An MOU or MOA is not considered a binding contract. It cannot be used to obligate or commit funds or be used as the basis for the transfer of funds between the parties. Actual implementation of the understandings established by the MOU or MOA must be accomplished through a legally binding agreement, such as an Interagency Agreement, CRADA, or other appropriate agreement between the parties.

Non-Disclosure Agreements (NDAs) are sometimes referred to as confidentiality agreements and are used when NETL and/or another party wish to exchange information that is either considered potentially patentable by NETL or proprietary by the other party. NETL is bound to maintain information received in the course of business confidential by the Trade Secrets Act (18 USC Sec. 1905). Therefore, an NDA is not required for Federal employees to receive proprietary information from other organizations. However, NETL will enter into an NDA that encompasses the Trade Secrets Act. NDAs may be unilateral or bilateral, depending on the circumstances. NETL only executes its own NDAs.

Non-Analysis Agreements (NAAs) allow for a party to share its patented technology with another party for a pre-negotiated purpose, such as testing or further research. The receiving party agrees not to analyze the technology to determine composition, use the technology for commercial purposes, or transfer the technology to a third party.

Licenses transfer NETL-owned IP from the government to the private sector. NETL looks for licensing partners with a plan for technology development and marketing, with a high probability for technology commercialization and sharing IP benefits with the public.

Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) Programs are U.S. government programs in which federal agencies with funding for small businesses only. Small businesses that win awards in these programs keep the rights to any technology developed and are encouraged to commercialize the technology.

Funding Opportunity Announcements (FOA) & Financial Assistance Awards (FA) are two different opportunities. An FOA is a notice of a federal grant funding opportunity. NETL uses FedConnect and/or Grants.gov and FedBizOpps to post solicitations FOAs and amendments related to the energy sector receive proposals and applications, and disseminate award information. Proposals accepted only as indicated in the solicitation document. FAs support specific research activities conducted outside of NETL, resulting in cooperative agreements or grants. FAs may be unsolicited or the result of the competitive FOA process.

Unsolicited Proposals (USP) are applications for support of an idea, method, or approach is submitted by an individual, business, or organization, based solely on the proposer's initiative rather than in response to a DOE solicitation. Funding of unsolicited proposals is considered a noncompetitive action.

For more information on opportunities to partner with NETL on water-energy topics contact:

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