



# MICKEY LELAND ENERGY FELLOWSHIP PROGRAM

Sponsored by the U.S. Department of Energy Office of Fossil Energy

# 2016 TECHNICAL FORUM



U.S. DEPARTMENT OF  
**ENERGY**

<http://energy.gov/fe/mickey-leland-energy-fellowship>



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## FE Leadership

- 56 Christopher A. Smith**  
 Assistant Secretary  
 Office of Fossil Energy  
 U.S. Department of Energy
- 57 Douglas Hollett**  
 Principal Deputy Assistant Secretary  
 Office of Fossil Energy  
 U.S. Department of Energy

## Program Coordinators

- 60 Alan F. Perry**  
 Supervisor  
 Office of Management and Field Operations  
 Office of Fossil Energy  
 U.S. Department of Energy
- Sandra Cortez**  
 Program Specialist  
 Office of Management and Field Operations  
 Office of Fossil Energy  
 U.S. Department of Energy
- 61 Barbara Dunkin**  
 Project Specialist, Science Education Programs  
 Oak Ridge Associated Universities
- Jennifer Casey**  
 Project Manager, Science Education Programs  
 Oak Ridge Associated Universities

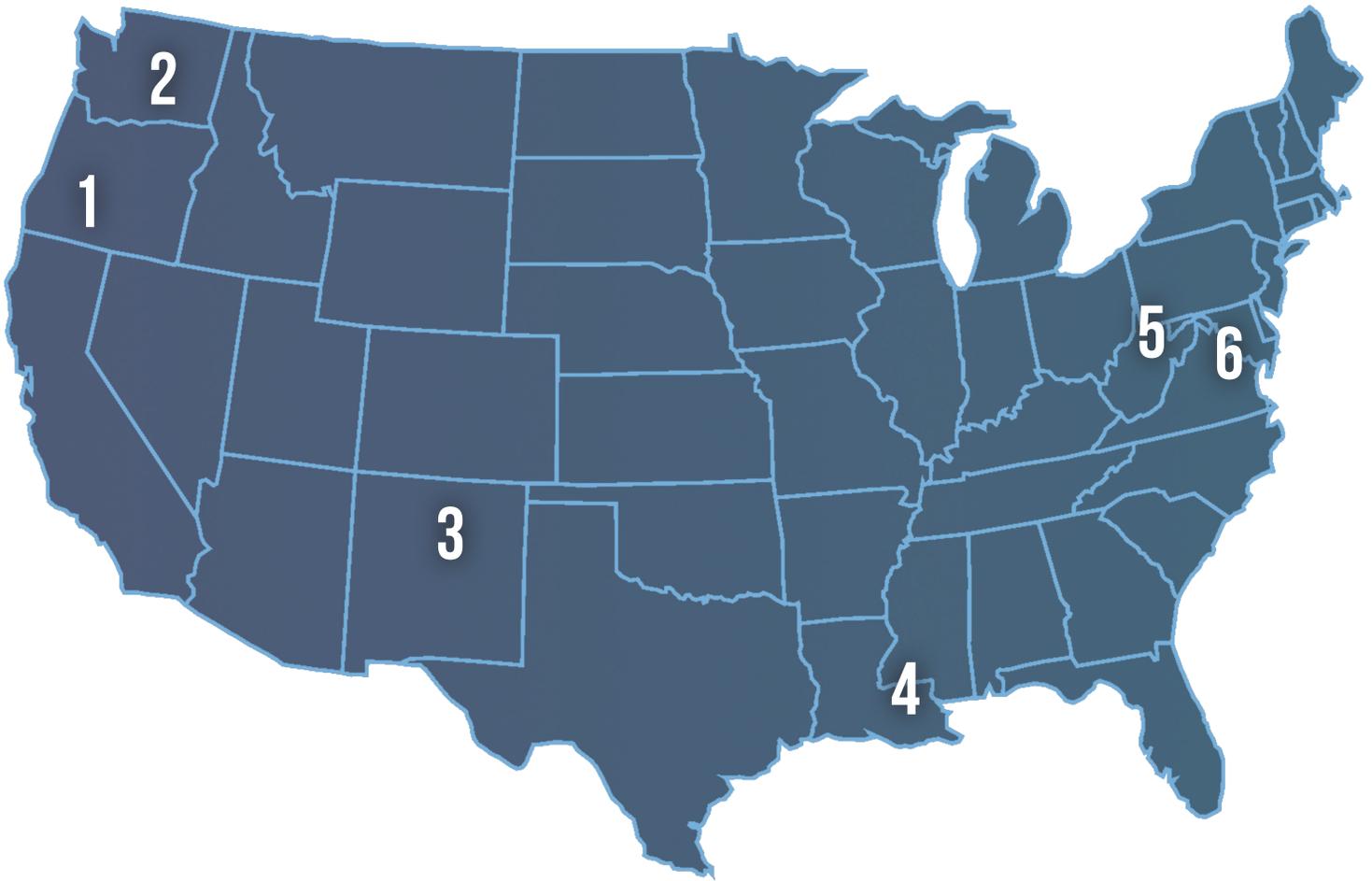
## Program Staff

- 64 Nancy Andres**  
 Site Coordinator  
 Program Analyst, ECO Team  
 National Energy Technology Laboratory  
 Office of Research & Development

**Scott A. Robbins**  
 Site Coordinator  
 Program Manager  
 Los Alamos National Laboratory

- 65 Wendy Chunn**  
 Site Coordinator  
 Office of Work Based Learning  
 Pacific Northwest National Laboratory

**Kelly Schwehm**  
 Site Coordinator  
 General Engineer  
 Strategic Petroleum Reserve



### 2016 Fellow Locations:

- 1 NATIONAL ENERGY TECHNOLOGY LABORATORY, ALBANY, OR
- 2 PACIFIC NORTHWEST NATIONAL LABORATORY, RICHLAND, WA
- 3 LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM
- 4 STRATEGIC PETROLEUM RESERVE, NEW ORLEANS, LA  
BAYOU CHOCTAW SITE, PLAQUEMINE, LA
- 5 NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA  
NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV
- 6 U.S. DEPARTMENT OF ENERGY HEADQUARTERS, WASHINGTON, DC  
GERMANTOWN, MD

## GEORGE THOMAS “MICKEY” LELAND



**Mickey Leland** was a six-term U.S. Congressman and Texas state representative who was best known for focusing much-needed attention on issues of health and hunger. He was an effective spokesman for the hungry and rallied support which resulted in both public and private action to reduce hunger in the U.S. and throughout the world.

Mr. Leland was born on November 27, 1944 in Lubbock, Texas to Alice and George Leland II. He moved to Houston's Fifth Ward at a young age with his mother and brother. In 1964 he graduated in the top ten percent of his class from Houston's Phyllis Wheatley High School. While attending Texas Southern University (TSU), he became a vocal leader of the local civil rights movement and brought national leaders of the movement to Houston. He graduated from TSU's School of Pharmacy in 1970 with a Bachelor of Science. From 1972 to 1977 he served in the Texas state legislature in Austin representing Houston's 88th District. As a state representative he became famous as a champion of health care rights for the poor.

In 1978, Mr. Leland was elected to the United States Congress from the 18th Congressional District in Houston. His ability to reach out to others with innovative ideas and to gain support from unlikely sources was key to his success in effectively addressing the problems of the poor and minorities.

Congressman Leland led an eight-member House of Representatives delegation

on a tour of famine stricken areas in Ethiopia. Increasingly active in international human rights and world hunger issues, he worked tirelessly to solve the problems of hunger and malnutrition around the world. On August 7, 1989 while leading a humanitarian mission to a United Nations refugee camp, his plane crashed in a mountainous region of Ethiopia. He was accompanied on this trip by members of his staff, State Department officials, and Ethiopian nationals. There were no survivors.

In 2000, then-Secretary of Energy Bill Richardson renamed the Office of Fossil Energy's Minority Education Initiative the Mickey Leland Energy Fellowship. The more than 100 members of the class of 2000 became the first Mickey Leland Energy Fellows. Mr. Richardson stated that the ceremony to honor the late Congressman would be a way to "remember a great American who dedicated his life to expanding human potential." He added that he "could find no better way to honor [Mr. Leland's] memory than to endow his name on a program that will elevate the opportunities for future generations of minority students."

## ABOUT THE MICKEY LELAND ENERGY FELLOWSHIP PROGRAM

### 10-Week Summer Internship Program

The Mickey Leland Energy Fellowship (MLEF) Program is headquartered in Washington, DC, and is sponsored by the Office of Fossil Energy (FE), U.S. Department of Energy. MLEF's mission is to encourage women and under-represented minority students majoring in Science, Technology, Engineering and Mathematics (STEM), to apply their academic achievements to actual research and gain hands-on experience as they prepare to enter the workforce. All eligible candidates can apply for this program.

The 10-week summer internship may place students at one of several possible FE sites including: the Strategic Petroleum Reserve site in Louisiana; the National Energy Technology Laboratory sites in Pittsburgh, Pa., Morgantown, W.V., and Albany, Ore.; and the Department of Energy Headquarters sites in Washington, D.C., and Germantown, Md. During the final week of the program, MLEF Fellows attend a Technical Forum and present their internship project to their peers, mentors, site representatives, and senior FE managers.

#### Selected MLEF Fellows will receive:

- A weekly stipend of \$600 for undergraduate students
- A weekly stipend of \$750 for Master's students
- A weekly stipend of \$850 for Doctoral and Postdoctoral students
- Approved temporary relocation costs to and from your host site
- Approved housing allowance based on appointment location
- Approved travel reimbursement to the Technical Forum

The Mickey Leland Energy Fellowship Program was awarded the Secretary of Energy's EEO/Diversity Best Practices Award in 2007.



## **CAPTAIN (RET) ERNEST R. HUNTER SR., P.E., ACP**

MLEF Program Co-Founder  
Former Deputy Assistant Secretary  
Department of Energy

Mr. Hunter served as the Director of Physical Plant/Facilities Services for The University of Texas at Austin for six years. In this position, he was responsible for a 1000-person workforce that providing facilities services including maintenance and operations, architect and engineering services, custodial services, landscape services, and general support services to two campuses of over 50,000 students, 20,000 faculty and staff, 16 million gross square feet of space and 800 acres of grounds with an annual budget of over \$50 Million. He implemented a significant strategic restructuring of the Physical Plant organization greatly improving service delivery and organizational management all work units. Under his leadership, the University of Texas at Austin Physical Plant/Facilities Services organization became a benchmark of excellence and gained national recognition for its Custodial Services program, Landscape Service program, Preventative Maintenance program, and its strategic change management activities. He hosted numerous benchmark visits from organizations seeking to learn from his efforts.

Prior serving as Directors, Mr. Hunter served as the Assistant Director of Support Services in the Physical Plant from 1999t-2001. In this position, he was responsible for the oversight of three Physical Plant divisions - Custodial Services, Landscape Services, and General Services He was also responsible for the university's vehicle fleet operations, automotive repair shop, refuse and recycling program, pest control, surplus property operations, and transportation support.

Before arriving at UT Austin, Mr. Hunter held a wide-variety of leadership, managerial and technical positions throughout a 26-year career in the United States Navy. His final assignment as a Navy Captain was as Commanding Officer, Engineering Field Activity West, in San Bruno, California where he was responsible for over \$200 million in construction activity per year and a wide variety of engineering and facilities services. His 550-person organization provided service to five major active military bases and numerous reserve centers throughout the California, Utah and Nevada areas as well as managed the closed military base conversion program for over a half dozen closed Navy bases in the San Francisco Bay area. He made Navy history by executing the first closed Navy base "Early Transfer" to the allowing the Port of Oakland to take responsibility for the environmental cleanup and place the base into civilian use many years ahead schedule.

Among his many other Navy assignments, Mr. Hunter also served as Deputy Assistant Secretary for the Department of Energy in Washington, DC responsible for the Naval Petroleum and Oil Shale reserve. During this assignment he greatly reduced operating cost and significantly increased revenue for the Elk Hill government oil and gas fields in Bakersfield, California. He also played a major role in the sale of the oil fields generating \$3.65 billion for the U.S. treasury. It was also during this assignment when Mr. Hunter cofounded the HBCU intern program which has blossomed into the Mickey Leland Energy Fellowship program.

Mr. Hunter received many awards including the Navy Legion of Merit; the Department of Energy Gold Award; Fort Valley University Platinum Achievement Award; The University of Texas Eyes of Texas Award; and The University of Texas Employees and Campus Services SLICE Award.

His educational background includes a Masters and Bachelors of Electrical Engineering from Texas A&M University and a Masters of Science in National Resource Strategy from the Industrial College of the Armed Forces. He is also a graduate of the APPA Facilities Institute. Mr. Hunter is a registered Associate Computer Professional with the Institute for the Certification of Computer Professionals and a Microsoft Certified Office Specialist at the Expert level.

He is married to Brenda Hunter (Newton) and they have one son, Ernest R. Hunter II, and one daughter, Britney Hunter.



## REGINAL "REG" SPILLER

MLEF Program Co-Founder  
Former Deputy Assistant Secretary  
Department of Energy

Mr. Spiller is currently the President and CEO of Azimuth Energy LLC, an international oil and gas company with projects in the USA, Africa and South America. He formerly served as the Honorary Consul General for Sierra Leone and has over 35 years of combined industry and government experience in over 80 countries. Previously he was COO for Allied Energy where he managed the company's deep water Nigeria production and development. He was also co-founder of Frontera Resources and Chief Scientist. Frontera was an AIM/London listed company that had as its focus, oil and gas field development in the country of Azerbaijan and the Republic of Georgia. Advisory Boards he served on include The National Academy of Science National Research Council, Penn State University College of Earth and Mineral Science, The University of Utah Energy Geoscience Institute, The University of Arkansas Department of Geoscience, The Palmer Drug Abuse Program, and the National Association of Black Geoscientist. From December of 1993 to March of 1996 Mr. Spiller was the Deputy Assistant Secretary for Gas and Petroleum Technologies, the highest ranking geologist in the Administration and

the first Petroleum geologist to hold the position. Mr. Spiller Holds an MS in Geology from Penn State University, is a recipient of the Distinguished Alumni Award, and a B.A.S.S in Geology from the State University of New York, Fredonia.

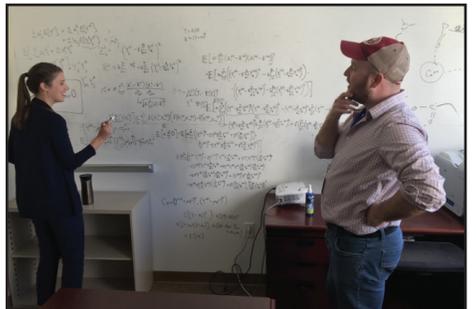
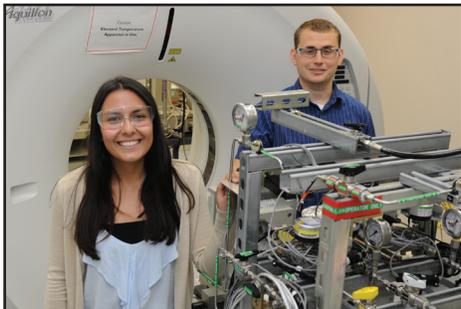
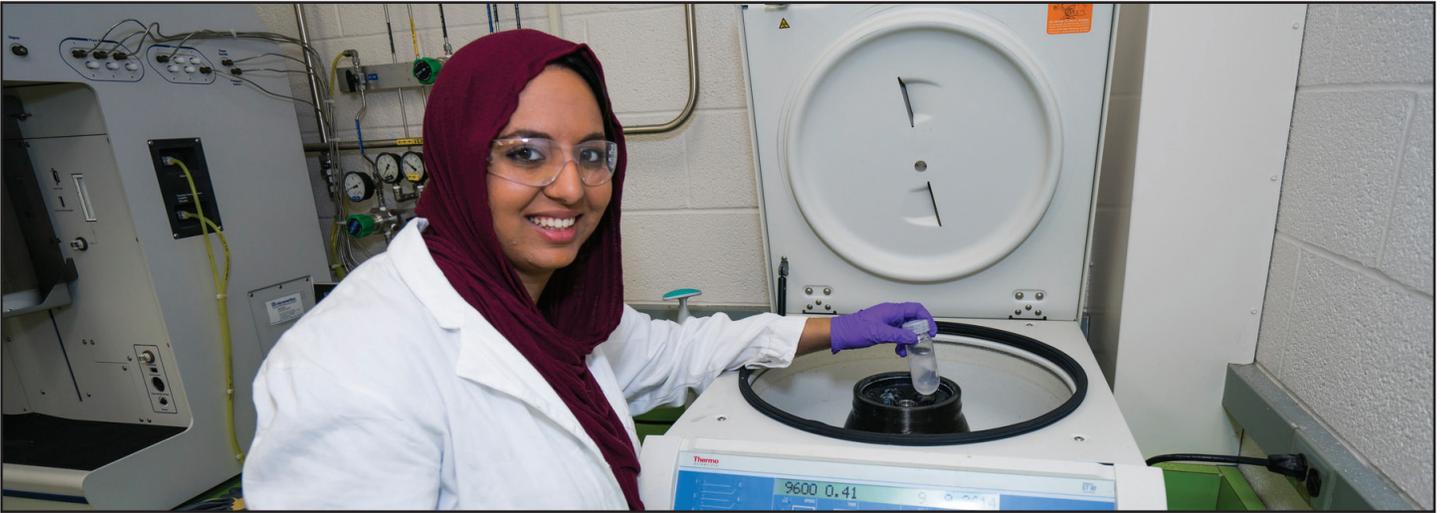


# 2016 FELLOWS

Adrian Salguero  
Alvin Li  
Amelia Mcilvenna  
Andre Gilchrist  
Austin Bushree  
Beverly J. Agtuca  
Brandon Mathis  
Brendan Hoover  
Bryan Moore  
Carl Otto  
Caroline Quanbeck  
Chelsea Bourgeois  
Chietha S. Moore  
Chyanne Nader  
Ciara Robertson

Emily Ghosh  
Emma Keegan  
Esin Schulz  
Evan Gragg  
Francesca Moloney  
Helena Ochoa  
Huda Ashfaq  
James Russ  
Jared Carpenter  
Jenna Sartucci  
Jeremy Ikeogu  
Jerome P Raque III  
Jisoo Kim  
Jordan Bordonaro  
Joree LaFrance

Kelsey Hunter  
Krista K. Bullard  
Maryssa A. Offlee  
Matthew Edgin  
Maziar Zarea  
Minh Bui  
Nicola Anastasia Peyko  
Oscar Francisco Pineda  
Rebecca Hirsch  
Vienna (Jing Hao) Liu  
Wei-Lee Wu  
Zaid Joya





## ADRIAN SALGUERO

Junior

Major: Computer Science

Minor: Mathematics

University of California, Santa Cruz

Mentor: Eilis Rosenbaum

### BIOGRAPHY

Adrian is a rising senior at the University of California, Santa Cruz pursuing a bachelor's degree in computer science and a minor in mathematics. Prior to this fellowship, Adrian has worked as a peer tutor and mentor to undergraduate STEM students at UCSC.

Upon completing his undergraduate career, he plans on attending graduate school and entering research in computer science with the goal of becoming a university professor. Still unsure of what specifically he wants to research, Adrian definitely wants to use his skills and knowledge to help solve national and global issues. In his spare time, Adrian enjoys running, hiking, playing video games and watching films. One day, he wishes to travel across Europe with his family.

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### PROJECT

FOAM CEMENT ANALYSIS

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Foam cement can be applied as a substitute to standard cement in well cementing applications due to its material characteristics. Developed as a combination of foaming agents, a base cement slurry and gas (commonly nitrogen), foam cement obtains these beneficial properties. The ability of foam cement to maintain its structure and strength in high-pressure, high-temperature environments makes it a viable candidate for use in well cementing as the possibility of the cement breaking and requiring repair is significantly reduced. However, different production methods yield various forms of cement, some less stable than others. The stability depends on the amount and size of bubbles that are formed within the foam cement, as larger neighboring bubbles can lead the cement to fracture and break. In this project, we will analyze samples of foam cement generated in both a lab and through computer simulations. Comparing the two forms of samples we will analyze the distribution of the bubbles to determine the stability and efficiency of different methods for developing foam cement.

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### MENTOR



Eilis Rosenbaum is a research engineer in the Materials Characterization Division within the Office of Research and Development at NETL, Pittsburgh, PA. She is a current PhD candidate in the Civil Engineering Department at Carnegie Mellon University. She earned her Master of Science in Chemical Engineering at the University of Pittsburgh and her Bachelor of Science in engineering concentration in Mechanical Engineering and Bachelor of Science Degree in Chemical Engineering with a minor in Mathematics from Geneva College. Her research at NETL has included work in methane hydrates, thermal properties, computer tomography (CT) scanning, CT image analysis, and work in quality control and safety. Her current research and interest is with foamed cements and modeling its behavior under well bore conditions.



## ALVIN LI

Sophomore

Major: Materials Science and Engineering

University of Maryland, College Park

Mentor: Regis K. Conrad

### BIOGRAPHY

Alvin Li studies Materials Science and Engineering at the University of Maryland at College Park. He reads books on business, personal psychology, and organizational psychology in his free time. Alvin will receive his B.S. degree in the Spring of 2018 and plans to use it to pursue an engineering career in the private energy industry to obtain useful soft skills, technical skills, and engineering experience as groundwork for future endeavors.

Alvin eventually wants to start his own business selling engineering solutions of his own creation and development. He ultimately plans on looking at large problems and finding innovative solutions that solves a need for a myriad of customers. He enjoys meeting and understanding experienced and successful people as a way to interpret the world through their unique perspectives.

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### PROJECT

HIGH PERFORMANCE MATERIALS

### SITE

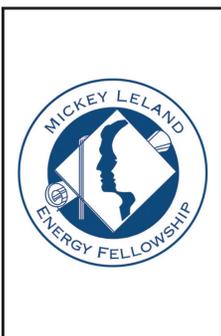
U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

Alvin worked on high performance materials for advanced ultra-supercritical carbon dioxide (AUSC) technologies in order to analyze and determine apt alloys for aggressive AUSC environments. Parts of his work include assessing costs, comparing material properties and compiling useful data. Alvin modified and enhanced a spreadsheet developed by a previous MLEF for simplicity, accessible information, and error correction. His work helps process designers select a suitable alloy for AUSC with economic and material technical implications in mind.

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### MENTOR

Regis Conrad has worked in electrochemistry and materials engineering since 1978. Currently Mr. Conrad manages the research on sensor and control, computational modeling and high temperature materials research. Prior to working for the Department of Energy he worked for the Department of Navy as a materials engineer. Mr. Conrad has a B.A. in Chemistry and Zoology from George Washington University.





# AMELIA MCILVENNA

PhD Student  
Industrial Engineering  
University of Tennessee, Knoxville, TN  
M.A. Mathematics 2015, Oakland University  
Mentor: David Tucker, PhD

## BIOGRAPHY

Amelia is pursuing a Ph.D. in Industrial Engineering at University of Tennessee. She is interested in sustainable energy including grid stability and hybrid energy systems. Last year she participated in the Research Alliance in Math and Science (RAMS) program at Oak Ridge National Lab.

She is an avid competitive gymnast participating in the club gymnastics team at UTK. In May, she qualified to finals at the national competition in Sacramento, California. Additionally, she is married to a gymnast and even did gymnastics in her wedding dress. Inconceivable!

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## PROJECT

INTEGRATING ANODE RECYCLE IN A GAS TURBINE/ FUEL CELL HYBRID SYSTEM

## SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Hybrid energy systems combine different types of generation sources that work together in order to increase efficiency and reduce waste in the system. Gas Turbine/Fuel Cell hybrids pose a particular challenge due to the slow ramp rates and fragility of fuel cells. The HYPER project at NETL Morgantown uses a cyber-physical system to simulate dynamics of a Solid Oxide Fuel Cell (SOFC) with a real turbine and generator. Amelia's project adds anode recycle to the SOFC cyber model. This allows for a portion of fuel cell off-gas to be sent back to the fuel manifold and reused. The recycle was tested offline (in the SOFC model) then integrated with the physical hardware of the HYPER facility.

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## MENTOR



Dr. David Tucker is the project leader for the Hybrid Performance project at the Morgantown campus of the National Energy Technology Laboratory. He has a diverse background in industry, academia, and government research, and he has explored the farthest reaches of the world. David firmly believes the creative process goes hand in hand with the scientific method and does his best to inspire unconventionality in his students.



## ANDRE GILCHRIST

Bachelor of Science

Major: Electrical Engineering

University of Pittsburgh, Pittsburgh PA

Mentor: Murphy Keller

### BIOGRAPHY

Andre is currently working towards his BS in Electrical Engineering at the University of Pittsburgh. After his under graduate studies, Andre plans to pursue his master's degree in Electrical Engineering in Electronics or Electric Power Engineering. In addition to his master's degree, Andre plans on earning his MBA to further his career.

Andre's career ambitions are to advance energy longevity and efficiency by providing industry and government sectors with new progressive techniques and technologies. With a strong desire to reduce greenhouse gas emissions, his ambition is to become involved with an organization that is committed to supporting sustainable development through responsible and progressive initiatives. Andre is motivated to be at the forefront of stopping global climate change and he aims to reform the scientific community through research that will benefit the production and efficiency of energy across the world.

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### PROJECT

EFFECTIVE EXTRACTION OF RARE EARTH MINERALS FROM COAL ASH

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Coal Ash contains trace amounts of Rare Earth Elements. Rare Earth Elements play an essential role to society and industry, and can be found in a spectrum of applications such as Capacitors, Power Generation, and Petroleum Refining. Due to the abundance of Coal Ash, there is an increasing interest from the scientific community to develop a renewable energy source. Formulated through his research at NETL, Andre will apply various grinding and leaching techniques to help create a strategic procedure to maximize the recovery of Rare Earth Elements from Coal Ash.

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### MENTOR



Murphy Keller is a Research Project Leader at the Department of Energy's National Energy Technology Laboratory (NETL). He received his Bachelor of Science degree with a minor in Biology from Rust College in Holly Springs, MS., and Post Baccalaureate credits from the University of Pittsburgh and University of Phoenix - Robinson Township (Pittsburgh, PA). He was awarded an Honorary Doctorate of Philosophy in Inorganic Chemistry from Canbourne University in the United Kingdom. His research has focused on Direct Coal Liquefaction, Direct Methane Conversion/Gas Hydrates, Amine Sorbents, Precombustion Carbon Dioxide Capture Solvents, and Development of Fiber Optic - Sensors for Downhole pH Measurements. He has either authored, coauthored or been acknowledged on more than 50 technical papers, and two patents pending. His research interests are in separation technologies; capture, storage, and utilization of carbon dioxide; and detection and recovery of rare earth elements from coal-derived materials.



# AUSTIN BUSHREE

Senior

Majors: Physics & Computer Science

University of San Francisco

Mentor: Nataliia Makedonska

## BIOGRAPHY

In Spring 2017 I will be graduating from the University of San Francisco with BS degrees in Physics and Computer Science. The first undergraduate research project I helped with was for USFGreenHomes, which aimed to give homeowners feedback on which appliances were consuming the most unused electricity in their home using a RaspberryPi and SmartSensors to gauge power usage. The second research project I participated in required learning a parallel programming language called Swift (not the IOS Swift) to analyze the spectra of supernovae. After graduation this spring, I intend to enroll in a graduate program studying sustainable energy or applied physics.

My career aspiration for the last 7 years has been to help improve the way that we generate electricity, and provide the world with an environmentally sustainable way to create and transport the energy that the majority of the world now depends on. In my spare time I make my way down to Ocean Beach, San Francisco and enjoy surfing amongst the many large fish and waves of Northern California. My biggest personal goal is to share renewable energy resources with the world and drastically reduce the cost that harvesting energy has on our planet.

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## PROJECT

MODELING TRANSPORT OF HYDROCARBONS FROM UNCONVENTIONAL RESOURCES

## SITE

LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM

Although hydraulic fracturing has been used for natural gas production for the past couple of decades, there are significant uncertainties about the underlying mechanisms behind the production curves that are seen in the field. Recently developed at LANL, the computational suite dfnWorks allows scientists to model a discrete fracture network-based reservoir-scale workflow, which is successfully used to identify the relative effect of gas flow in hydraulic and natural fractures on the production site. As an open source software package, dfnWorks currently has many users, both international and domestic. The main goal of the project is to develop a user interface that validates the dfnWorks input parameters, which represent a complex structure of fracture characteristics observed on a natural production sites, and verifies their dependencies on each other by checking the geometry, magnitude, and range of values. It will assure that input is both physically meaningful and computationally feasible, while providing users with clear error messages and warnings when corrections are necessary. Additionally, a visual statistical report will be implemented for dfnWorks output, which will give users immediate feedback on how well the generated model matched their target distributions and further specifics of the modeling process. By the end of the internship term, the reservoir-scale discrete fracture network will be generated with the following simulation of subsurface flow and transport through natural and hydraulic fractures.

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## MENTOR



- 07/2012 - present Postdoc and Scientist at Earth and Environmental Science Division, Los Alamos National Laboratory, Los Alamos, NM. Development and implementation of computational tools for transport simulation of transient and multiphase subsurface flow using 3D Discrete Fracture Network Model.
- 02/2011 PhD in Applied Mathematics, Department of Environmental Sciences & Energy Research at Weizmann Institute of Science, Israel.
- PhD Thesis "Interplay of structure and dynamics of out of equilibrium systems: Glass and Granular matter". 02/1999 B.Sc. and Specialist Degree in Computer Science and Engineering at Kharkiv State Polytechnical University, Ukraine. BSc Thesis "Methods and algorithms of medical diagnostic systems."

### Recent Relevant Publications:

- Evaluating the Effect of Internal Aperture Variability on Transport in Kilometer Scale Discrete Fracture Networks, N. Makedonska, J. D. Hyman, S. Karra, S. L. Painter, C. W. Gable and H. S. Viswanathan, *Advances in Water Resources*, 2016.
- Effect of advective flow in fractures and matrix diffusion on natural gas production, Karra, S., Makedonska, N., Viswanathan, H. S., Painter, S. L., and Hyman, J. D., *Water Resources Research*, 2015.
- Particle tracking approach for transport in three-dimensional discrete fracture networks, Makedonska, N., Painter, S. L., Bui, Q. M., Gable, C. W., and Karra, S., *Computational Geosciences*, 2015.



## BEVERLY J. AGTUCA

PhD 2nd Year Graduate Student  
Plant, Insect & Microbial Sciences  
University of Missouri, Columbia, MO  
Bachelor of Science, 2014  
Carlow University, Pittsburgh, PA  
Mentor: Dr. Christopher Anderton

### BIOGRAPHY

Beverly J. Agtuca went to State University of New York College of Environmental Science and Forestry in Syracuse for her bachelor's degree in biotechnology. She is currently a 2nd year graduate student pursuing a Ph.D. in Plant, Insect, and Microbial Sciences with a focus of Plant Breeding, Genetics, and Genomics at the University of Missouri-Columbia. Her research interest is on the symbiotic interaction of bacteria in legumes/non-legumes.

After graduating, Beverly plans to pursue a post-doctoral associate position that will broaden her expertise in plant-microbe interactions, with the overarching goal of solving environmental issues that are at the forefront of scientific inquiry. It is her goal that by being involved in active research, she will deliver new and useful understanding to the community, as well as advance diversity in science that can serve for the betterment of mankind. Additionally, Beverly's hobbies include; dancing, hanging out with friends, and traveling. In her bucket list, she wants to do bungee jumping.

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### PROJECT

DEVELOPMENT OF SPATIALLY RESOLVABLE MASS SPECTROMETRY ANALYSIS METHODS TO UNDERSTAND CARBON TRANSFORMATION RESULTING FROM THE SYMBIOSIS OF PLANTS AND BACTERIA

### SITE

PACIFIC NORTHWEST NATIONAL LABORATORY, RICHLAND, WA

Beverly worked on mass spectrometry techniques, such as LAESI-MS and MALDI-MSI, to investigate the metabolism of carbon cycles in a model plant-bacteria system, specifically soybean plants infected by rhizobium. She grew these plants and bacteria for three-dimensional mass spectrometry analysis, and then used advanced data processing and statistical analyses to compare metabolites between the roots and the bacteria within the nodule. This study gave basic knowledge of the plant-bacteria systems in metabolism that could potentially lead to a carbon capture technique, thus mitigating CO<sub>2</sub> output.

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### MENTOR



Christopher R. Anderton received his Bachelor of Science degree in Chemistry at the University of Colorado at Colorado Springs in 2005. He attained his Ph.D. in Chemistry at the University of Illinois at Urbana-Champaign in 2011, under Mary L. Kraft, where his graduate work focused on multi-technique correlative analysis (secondary ion mass spectrometry, atomic force microscopy, and scanning electron microscopy) of supported lipid membranes. Afterwards, he received a U.S. National Research Council Postdoctoral Associateship to work at the National Institute of Standards and Technology under Anne L. Plant, where he studied how eukaryotic cells respond to changes in the physicochemical properties of their extracellular environment. In 2013 he joined the Mass Spectrometry Group at the Environmental Molecular Sciences Laboratory, which is located on the Pacific Northwest National Laboratory campus. Currently, he focuses on developing new mass spectrometry imaging instrumentation and capabilities to elucidate chemical interactions occurring within microbial communities, soils, and the rhizosphere.



# BRANDON MATHIS

Senior

Major: : Computer Science, Computer Security, Mathematics

Fairmont State University, Fairmont, WV

Mentor: Eilis Rosenbaum

## BIOGRAPHY

Brandon Mathis attends Fairmont State University in Fairmont, WV, where he is earning his BS in Computer Science, Computer Security, and Mathematics. He has participated as a student peer mentor and tutor at his school for Mathematics and Computer Science. This is his second year participating as a Mickey Leland Energy Fellow working with foamed cement. Brandon will graduate in the spring of 2017 and plans on attending graduate school in the fall for Computer Science, focusing on Artificial Intelligence and Computer Vision. He is still unsure of where he would like to work and what kind of work he wants to do, but he aspires to do something that will help to better the lives of people around the world. Brandon would also like to one day get the opportunity to travel around the world.

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## PROJECT

FOAM CEMENT BUBBLE CHARACTERIZATION

## SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Foamed cement is used in numerous applications for its lower density, higher ductility, better zonal isolation, improved mud displacement, reduced overall cost, and most importantly lower environmental impact when compared to traditional, non-foamed cements. This makes looking at how clustering and structuring by the bubbles in the cement occurs significantly important because it plays a key role in the structural integrity of the hardened cement. The premise of this project is to examine the distribution and flow of the bubbles in the foam cement slurries prepared using the blender method, a foam cement generator, and industry cementing equipment for indications of clustering or structuring within the samples. CT images of these samples will be examined to determine the position and volume of the bubbles within the cement to allow us to work with data that is closer to a real sample and not randomly placed idealized data. The position and volume of the bubbles from the CT images will then be used as inputs for simulations to see how their final position is effected when flowing. By doing all of this, we hope to gain more insight into the patterns and reasoning for the clustering and structuring of bubbles that is occurring within the foam cement.

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## MENTOR



Eilis Rosenbaum is a research engineer in the Materials Characterization Division within the Office of Research and Development at NETL, Pittsburgh, PA. She is a current PhD candidate in the Civil Engineering Department at Carnegie Mellon University. She earned her Master of Science in Chemical Engineering at the University of Pittsburgh and her Bachelor of Science in engineering concentration in Mechanical Engineering and Bachelor of Science Degree in Chemical Engineering with a minor in Mathematics from Geneva College. Her research at NETL has included work in methane hydrates, thermal properties, computer tomography (CT) scanning, CT image analysis, and work in quality control and safety. Her current research and interest is with foamed cements and modeling its behavior under well bore conditions.



## BRENDAN HOOVER

Doctoral Student  
Geography and the Environment  
The University of Texas, Austin  
M.S. - 2013, The University of Montana  
B.S.- 2010, Northern Illinois University  
Mentor: Dr. Richard Middleton

### BIOGRAPHY

Brendan A. Hoover is a doctoral student the University of Texas, Austin (UT) in the Department of Geography and the Environment. At UT Brendan has worked as a graduate research assistant with Dr. Jennifer Miller to develop novel approaches for analyzing dynamic interactions within movement data. Brendan has also worked with Dr. Miller to explore privacy issues associated with smartphone location data using a computational movement analysis framework. Brendan’s research has focused on analyzing scientific questions using Geographic Information Systems (GIS), remote sensing, and spatial statistics. Before pursuing his Ph.D. Brendan was a Spatial Modeler in the Wildlife Biology Department at the University of Montana’s Avian Science Center. Previously Brendan was also employed at Textron Systems Geospatial in Missoula, Montana where he gained a comprehensive knowledge of image processing, remote sensing, scripting languages, and LIDAR processing. At Textron Brendan worked with the engineer and customer support teams to develop, test, and maintain Textron Systems’ software products. Brendan’s career aspiration is to continue using the spatial, scripting, and statistical tools he has learned to address real world scientific problems. In his spare time Brendan worries about the Chicago Bulls, likes to rock climb, plays several instruments, and loves his wife Karla, his dog Duncan, and his cat Leo.

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### PROJECT

INVESTIGATING THE EFFICACY OF CO<sub>2</sub> CAPTURE AND STORAGE USING INDUSTRIAL CO<sub>2</sub> SOURCES

### SITE

LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM

Current CCUS research has primarily focused on capturing CO<sub>2</sub> emissions from coal-fired power plants, but recent research at Los Alamos National Laboratory (LANL) suggests focusing CCUS CO<sub>2</sub> capture research upon industrial sources could offer a better approach for CCUS deployment. The objective of this project is to build off the current research at LANL to examine the effectiveness of capturing CO<sub>2</sub> from industrial sources by integrating a regional system of transport to inject CO<sub>2</sub> into sedimentary basins. To achieve this project’s objective the following tasks will be performed:

1. Collect data from US EPA and US DOE EIA databases and estimate the costs of CO<sub>2</sub> capture from industrial sources.
2. Determine the optimal geospatial arrangement of an industrial CCUS infrastructure by incorporating industrial source and sink locations within SimCCS, which is a software tool that estimates potential CO<sub>2</sub> pathways within a landscape. New tools within SimCCS will also be developed during this project.

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### MENTOR



Dr. Richard Middleton is a Senior Scientist and Team Leader (Applied Terrestrial, Energy, and Atmospheric Modeling; ATEAM) in the Earth and Environmental Sciences (EES) division at Los Alamos National Laboratory (LANL). He has a Ph.D. in Geography and Operations Research from the University of California, Santa Barbara, and Geography degrees from the University of Leicester (M.Sc.) and Lancaster University (B.Sc.). Dr. Middleton’s research focuses on climate impacts and energy development. He has published and led major energy projects for applications including CO<sub>2</sub> capture and storage (CCS), geothermal energy, shale gas and hydraulic fracturing, wind power optimization, and biofuels development. Dr. Middleton is currently one of LANL’s energy-water nexus (EWN) representatives and leading a large project examining the impacts of climate-driven disturbances—drought, wildfire, and pathogens—on ecosystems and hydrology/water supply for the EWN.



## BRYAN MOORE

Graduate Student (2nd year)

Chemical and Materials Engineering

University of Southern California, Los Angeles, California

B.S. in Chemical and Biological Engineering, 2015

University at Buffalo

Mentor: Dr. Velimir Vesselinov

### BIOGRAPHY

Bryan Moore currently attends the University of Southern California in Los Angeles, California. He had received his B.S. in Chemical and Biological Engineering at the University at Buffalo in 2015, where he had been a part of a Computational Chemistry lab under Dr. Hachmann. Bryan continued his research at U.S.C. in the lab of Dr. Nakano, studying applied machine learning algorithms to various Quantum Chemical problems.

Mr. Moore plans on continuing with his education and obtaining his Ph.D. in either Chemical Engineering or Materials Science. Ultimately, Bryan would want to use his knowledge to aid in the development of future material technologies working with NASA or in a National Laboratory setting.

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### PROJECT

A NEURAL NETWORKS APPROACH TO SUBSURFACE FLOW MODELS

### SITE

LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM

While working for Los Alamos National Laboratory, Mr. Moore worked on applying machine learning approaches and search heuristics, like Artificial Neural Networks and Genetic Algorithms, to optimize subsurface and contamination flow problems. The application can vastly speed up previous methods that solved these types of problems, while also dropping other computational expenses. In addition, the pre-loaded Neural Network will be available for future scientists to utilize on similar subsurface flow problems.

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### MENTOR



Velimir V Vesselinov completed PhD degree at the University of Arizona, Tucson. Presently, he is technical staff member of Earth and Environmental Sciences Division, Los Alamos National Laboratory, NM, USA. His research interests include uncertainty quantification, risk and performance assessments, optimal experimental design, and decision support. He is a PI of several projects targeting model development, model analyses and decision support related groundwater flow and transport in the vadose zone and the regional aquifer at the LANL site. He is also Task Leader of the Decision Support team within the ASCEM (Advanced Simulation Capability for Environmental Management; DOE Environmental Management), and the LANL PI of the DiaMonD project (An Integrated Approach to Mathematics at the Interfaces of Data, Models, and Decisions; DOE Office of Science). He is also a co-developer of an open-source computational framework for Model Analysis & Decision Support (MADS; <http://mads.lanl.gov>; <http://mads.readthedocs.org>).



## CARL OTTO

Senior

Major: Ecosystem Science & Sustainability

Colorado State University, Fort Collins, CO

Mentor: Sarah Forbes

### BIOGRAPHY

Carl is a rising senior at Colorado State University, living in Fort Collins, Colorado and pursuing a degree in Ecosystem Science and Sustainability. In his time at CSU, he has completed courses in environmental policy, sustainable ecosystem ecology, and human dimensions of natural resources. In addition to his academic pursuits, he has been involved at the Natural Resource Ecology Laboratory at CSU on two different projects involving soil microbial adaptation to climate change, and carbon cycling in potential future Arctic ecosystems. Carl will graduate in the spring of 2017 and hopes to gain some experience working before eventually attending graduate school.

His career goal is to work in interpreting environmental and climate data along with studying social issues related to climate change for political and legislative consultation nationally and internationally. Carl enjoys hiking, backpacking, skiing, and travel, and eventually would like to travel to all seven continents and summit Mt. Kilimanjaro.

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### PROJECT

CARBON DIOXIDE REMOVAL STRATEGIES FOR MAJOR CITIES NATIONALLY AND INTERNATIONALLY

### SITE

U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

This summer at the DOE, Carl completed a project analyzing best fit carbon dioxide removal (CDR) strategies for major cities around the world, to help the international community reach emissions targets set in the COP21 agreements. Cities are some of the largest carbon sources on the planet, and therefore will be key players in the decarbonisation efforts of the next century. CDR options exist in a large variety, and each city will likely have its own unique combination of capture and sequestration that works best. Carl studied the current state of small scale CDR technology, and the viability of CDR implementation from an economic and policy perspective for cities around the world.

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### MENTOR



Sarah M. Forbes is a scientist in the Office of Fossil Energy. Sarah applies her ecological perspective to the regulatory, political and engineering challenges associated with demonstrating and deploying carbon capture and storage (CCS). Sarah's work is aimed at developing tools and analyses that inform policy/regulatory developments and standards, with a focus on environmental and social integrity. Prior to joining the Office of Fossil Energy, Sarah led initiatives on CCS and shale gas at the World Resources Institute (WRI). Sarah began working on joint US-China issues in 2008 and partnered with Tsinghua University to lead a bilateral stakeholder process which led to the publication of Guidelines for Carbon Dioxide Capture Transport and Storage in China. This work followed the successful effort Sarah led to develop the Guidelines for Carbon Dioxide Capture, Transport and Storage, a robust set of technical guidelines for how to responsibly proceed with safe CCS projects which have informed the global development of environmental regulations for CCS. Sarah also worked at the National Energy Technology Laboratory (NETL) where she led analyses on environmental aspects of CCS, the energy-water nexus, and climate change. Sarah has a BS in Biology from Wheaton College in Illinois and a MS in Biological Sciences from Mississippi State University. Sarah lives in the West Virginia Highlands with her husband, son, and a dog named Moose.



# CAROLINE QUANBECK

Senior

Major: Geology and Ecosystem Science/Policy

University of Miami, Miami, Florida

Mentor: Regis Conrad

## BIOGRAPHY

Caroline Quanbeck is a senior at the University of Miami, where she is earning a B.S. in Geology and Ecosystem Science and Policy. At school she is a research assistant in the Sedimentology lab and currently works on a project that studies paleo-sea level in the Dominican Republic. She is also looking forward to studying abroad in Prague this fall.

After college, Caroline plans to attend graduate school to earn a Ph.D. in Geology. She especially enjoys fieldwork, and wants to do research that will allow humans to prepare for the future by broadening our understanding of Earth's past. Caroline loves to travel and wants to visit all seven continents.

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## PROJECT

IDENTIFYING CLAY DEPOSITS ENRICHED IN RARE EARTH ELEMENTS NEAR COAL SEAMS

## SITE

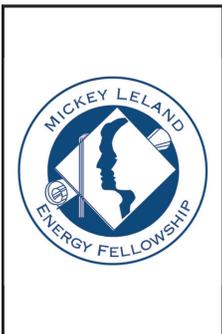
U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

The goal of Caroline's project is to identify clay deposits enriched in REE (Rare Earth Elements) that are associated with coal seams in Appalachia. REE are found in technology that people use every day ranging from cell phones to vehicles. China currently supplies 95% of the world's REE which is why it is essential to find a domestic source. Caroline is analyzing data from well logs to find layers of clay that are likely to have minable concentrations of REE. She is also creating a financial model of a coal mine that co-produces REE.

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## MENTOR

Regis Conrad has worked in electrochemistry and materials engineering since 1978. Currently Mr. Conrad manages the research on sensor and control, computational modeling and high temperature materials research. Prior to working for the Department of Energy he worked for the Department of Navy as a materials engineer. Mr. Conrad has a B.A. in Chemistry and Zoology from George Washington University





# CHELSEA BOURGEOIS

Graduate Student

Environmental and Occupational Safety and Health

Louisiana State University Health Sciences Center, New Orleans

Bachelor of Science, Tulane University 2015

Mentor: James DePaoli

## BIOGRAPHY

Chelsea Bourgeois attends Louisiana State University Health Sciences Center in New Orleans, where she is earning her MPH in Environmental and Occupational Health and Safety. She earned her BS at Tulane University, where she studied Public Health. While at Tulane University, she studied abroad in Denmark at the Danish Institute for Study Abroad and then again in Suriname, where she learned about public health policy, health economics, food systems, environmental issues, biodiversity and worker exposures. Chelsea will graduate in the spring of 2017 and plans on gaining further work experience prior to graduation.

Ms. Bourgeois's career aspirations include working in occupational safety and health as she is passionate about protecting the environment and worker safety. She enjoys traveling and hopes to travel more with her future career to help her gain more local and foreign knowledge to be able to continue to learn and improve on environmental and worker safety.

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<b>PROJECT</b>	COMPARISON BETWEEN BLANKET HEAT STRESS MITIGATION PROGRAM AND POINT-SPECIFIC HEAT STRESS MITIGATION PROGRAM
<b>SITE</b>	STRATEGIC PETROLEUM RESERVE, NEW ORLEANS, LA

Ms. Bourgeois evaluated whether the Blanket Heat Stress Mitigation program, which uses the Accuweather RealFeel® Temperature is less, more than, or equally as effective in protecting workers as the ACGIH's Screening Criteria for Heat Stress Exposure. Measurements from all four Strategic Petroleum Reserve sites were collected and analyzed. Workers' core body temperatures were taken before and after each task, as well as the WetBulb Globe Temperature readings and Accuweather RealFeel® Temperature at the same time to evaluate any differences between the measurements. The work/rest regimens, personal protective equipment and other factors that affect heat stress were also measured for this evaluation of controls. All relevant heat data was collected in order to compare accuracy and work/rest regimens to find which is most effective in controlling heat stress.

## MENTOR



James De Paoli holds the position of Industrial Hygiene Manager for Fluor Federal Petroleum Operations LLC, a prime contractor for the Department of Energy's Strategic Petroleum Reserve, and is located in New Orleans, LA. James has served as a mentor with the Mickey Leland Energy Fellowship Program for 10 years.



## CHIETHA S. MOORE

Senior

Major: Chemistry

Chicago State University, Chicago, IL

Mentor: Megan Macala

### BIOGRAPHY

Chietha Moore attends Chicago State University in Chicago, Illinois, where she is earning her BS in Chemistry. She conducts research at the university under Dr. Robert LeSuer, analyzing the constituents of alcoholic beverages using nuclear magnetic resonance (NMR). Chietha will graduate in the fall of 2016 and plans on attaining her PhD in Analytical Chemistry or pursuing a Pharm.D.

Ms. Moore's career goals include conducting research in industry or at a government institution and she hopes to lead research in a lab of her own one day. Chietha enjoys cooking and crocheting in her spare time and she plans on traveling to all the continents. Her life's goal is to be successful in the scientific community doing what she loves and also helping others along the way.

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### PROJECT

SYNTHESIS AND CHARACTERIZATION OF IONIC LIQUIDS FOR ION GEL MEMBRANES FOR CARBON CAPTURE APPLICATIONS

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Moore's project involved the synthesis and characterization of ionic liquids for incorporation into polymer ion gel membranes for post-combustion CO<sub>2</sub> capture. The ionic liquids were synthesized via a two-step procedure in high purity and good yield. A variety of analytical techniques were employed to confirm the structure and purity of the ionic liquids Ms. Moore was able to further her NMR experience using 13C NMR to confirm the synthesis of the ionic liquids. Several ionic liquids were successfully incorporated into free standing polymer ion gel membranes and tested for their gas separation performance.

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### MENTOR



Megan is currently designing and synthesizing ionic liquids for carbon capture applications. She also manages the Polymer Synthesis Lab's day-to-day activities and collaborates with numerous teams to provide the resources that enable her colleagues to work effectively. Prior to joining NETL, Megan worked in the pharmaceutical industry as a medicinal chemist for seven years where she was responsible for planning, synthesis, purification and characterization of drug candidates on milligram to multi-gram scales. Megan obtained a B.S. in Chemistry from John Carroll University in Cleveland, Ohio and an M.S. in Chemistry from the University of Pittsburgh.



# CHYANNE NADER

Junior  
Major: Civil/Environmental Engineering  
Minor: Sustainability  
University of Maryland, College Park  
Mentor: Regis Conrad

## BIOGRAPHY

Chyanne Nader attends University of Maryland, College Park where she is earning her BS in Civil/Environmental Engineering with a minor in Sustainability. She is pursuing the water resources/environmental engineering track within Civil/Environmental Engineering, as she aspires to work on water management projects in the future. Chyanne is the president of her sorority, Kappa Lambda Xi Multicultural Sorority Inc., and will be working as a Teacher’s Assistant in the fall as well as a SEEDS Mentor Coordinator. One item on Chyanne’s bucket list is to go skydiving.

In the future, Chyanne would like to pursue a Professional Engineering license through working with the government or industry and possibly a Master’s degree in some kind of topic outside of Civil Engineering. She wants to find a job where she can help improve people’s daily lives and happiness levels.

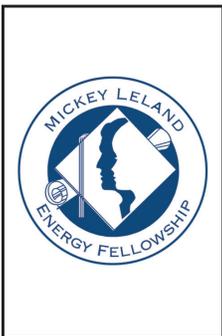
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<b>PROJECT</b>	IMPROVING SUPERCRITICAL CO <sub>2</sub> POWER CYCLE RECUPERATORS
<b>SITE</b>	U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

Supercritical CO<sub>2</sub> cycles allow for a greater efficiency, while reducing greenhouse gas emissions, plant size, and water consumption. Ms. Nader worked on Supercritical CO<sub>2</sub> power cycles, with a focus on making the recuperators more efficient and cost effective. She has been using Pro-II to perform data analysis and modeling of the Brayton Cycle with supercritical CO<sub>2</sub> as the working fluid. She collaborated with another MLEF fellow, James Russ, Nate Weiland from NETL, and Darren Molloy from HQ to help revise a supercritical CO<sub>2</sub> spreadsheet that models different cycles such as partial cooling, indirect-fired and direct fired to find which is most efficient and practical for commercialization.

## MENTOR

Regis Conrad has worked in electrochemistry and materials engineering since 1978. Currently Mr. Conrad serves as the Director of the Division of Advanced Energy Systems in the Office of Advanced Fossil Technology Systems. Prior to working for the Department of Energy he worked for the Department of Navy as a materials engineer. Mr. Conrad has a B.A. in Chemistry and Zoology from George Washington University.





## CIARA ROBERTSON

Sophomore

Major: Petroleum Engineering

University of Wyoming, Laramie

Mentor: Neal Sams

### BIOGRAPHY

Ciara is currently a student at the University of Wyoming in Laramie where she is working on a B.S. in Petroleum Engineering with a concentration in Unconventional and Tight Sand Drilling. While at UW, she participates in the Society of Petroleum Engineers, National Society of Collegiate Scholars, Golden Key, as well as being on the President’s Honor roll each year. Ciara is expected to graduate in May of 2018 from the College of Engineering and Applied Sciences at UW.

Once graduated, Ms. Robertson plans to join the work-force where she hopes to work on drilling projects in Texas and maybe even go off-shore. Ciara plans on entering the work-force first to gain experience in the industry but keeps an open-mind about graduate school.

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### PROJECT

GEOHERMAL MODELING

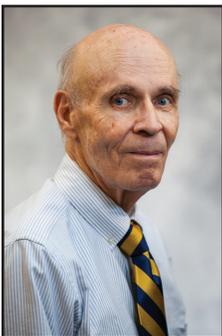
### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

This summer, Ms. Robertson worked on a geothermal modeling project that computed heat loss in the well-bore. The model simulates the pumping of water into a downward flowing well where it then flows through a hot-rock reservoir and is pumped up a second well to be used for hydronic heating purposes. In the 2-D model, the water will gain heat energy as it passes through the hot reservoir rock to increase temperature. The program then calculates the amount of heat lost from the water as it travels through the well-bore depending on variable flow-rates dictated by the amount of hot water needed. Ms. Robertson also worked on a 3-D project examining water flow through a fracture network which is then pumped back to the surface also for heating purposes.

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### MENTOR



Dr. W. Neal Sams is a fellow scientist physics with AECOM at the National Energy Technology Laboratory in Morgantown, WV. He has a PhD in physics from the University of Houston. Dr. Sams research interests are petroleum reservoir engineering and simulation. Dr. Sams is the author of NFFLOW a discrete fracture reservoir simulator meant to simulate production and storage in naturally fractured tight sand and shale reservoirs. Prior to work at NETL Dr. Sams was a senior reservoir engineer with H. J. Gruy and Associates in Houston, Texas.



## EMILY GHOSH

Senior

Major: Physics (Graduate Track, Honors)

Minor: Astronomy

Boston University, Boston, MA

North Carolina A&T State University

Mentor: Paul Ohodnicki, Miaolei Yan

### BIOGRAPHY

Emily Ghosh recently graduated from Boston University in Boston, MA, where she earned a BA in Physics with a minor in Astronomy. She participated in undergraduate research at BU under Dr. Karl Ludwig studying stress evolution during thin film growth for MEMS devices and acoustic emission sensors, at CERN in Geneva, Switzerland under Dr. Haraldur Pall Gunnlaugsson studying radioactive element implantation effects on magnetic properties of materials, and at BU under Dr. Manher Jariwala studying the effects of her physics undergraduate mentorship program on the quality of students' first year experience in the BU Physics Department. Emily plans to work in materials and condensed matter research in Boston in the fall and attend graduate school for Physics or Materials Science in Fall 2017.

Ms. Ghosh's career aspirations are to work in sustainable and clean energy research, particularly in research to best utilize solar energy. She enjoys performance arts for music and classical Indian dance. She would like to go back to go Switzerland and other European nations to continue her materials science research and contribute to the scientific community.

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### PROJECT

OPTICAL AND STRUCTURAL ANALYSIS OF DOUBLE PEROVSKITE THIN FILMS FOR SOLID OXIDE FUEL CELL APPLICATIONS

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Ghosh's project is on synthesizing and studying thin film materials as candidates for use in solid oxide fuel cells. She specifically worked in depositing double perovskite  $\text{Sr}_2\text{FeMoO}_6$  and  $\text{PrBaMn}_2\text{O}_5$  materials via sol gel synthesis and sputter deposition, as well as characterizations of optical and structural properties of the films. Once perfected for highest quality and found to be single phase structures, these films can be used for various applications to study and operate solid oxide fuel cells.

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### MENTOR



Paul Ohodnicki is a material scientist working on high temperature sensor materials for gas sensing applications in advanced fossil energy applications. Paul received a dual bachelor's degree in engineering physics and economics from the University of Pittsburgh. He then moved on to Carnegie Mellon University where he received his Ph.D. in materials science and engineering. Paul spent several years in new product development working on large area sputtered thin film coats for energy efficient window applications. He joined NETL in early 2010 and spent a short time as a project manager for the Solid State Energy Conversion Alliance program prior to taking his current position.



## EMMA KEEGAN

Sophomore

Major: Chemical Engineering

Minor: Sustainability

University of Michigan, Ann Arbor

Mentors: Dr. Evan Granite and Dr. Elliot Roth

### BIOGRAPHY

Emma Keegan attends University of Michigan in Ann Arbor, where she is earning her BSE in Chemical Engineering, with a minor in Sustainability. Emma plans to pursue her Master's degree with a focus in sustainable energy after she graduates in 2018, and also plans to obtain her MBA.

Emma's career aspirations include working to provide clean drinking water to various areas of the world, and helping to develop clean energy advancements. Emma enjoys running, and is currently working her way up to a marathon. Emma's greatest hope is that she can use the skills and knowledge she gains from engineering to make the world a more livable place.

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### PROJECT

USING PORTABLE XRF TO DETECT RARE EARTHS

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Keegan worked with a portable XRF device to analyze coal and coal by-product samples for the presence of rare earth elements. The portable XRF device, while useful because of its ability to analyze samples quickly and in the field, has questionable accuracy and poor detection limits for most rare earths. Ms. Keegan tested several samples in order to study the optimal settings, including mode, time, and sample preparation, for the device while analyzing coal byproducts. She also examined marker elements, such as thorium and yttrium, which the portable XRF can easily detect and that often exist in nature with rare earths. The overall goal of her project was to determine whether the portable XRF device can provide accurate data about the existence and concentration of rare earth elements in materials associated with a coal deposit, and if so, to determine the optimal settings.

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### MENTOR



Evan J. Granite is the Technical Portfolio Leader for the Department of Energy's National Energy Technology Laboratory (NETL) RIC research program on Rare Earth Detection and Recovery, and an Adjunct Professor of Chemical and Petroleum Engineering at the University of Pittsburgh. Dr. Granite did postdoctoral research at the Department of Energy, received a PhD in Chemical Engineering from the University of Rochester, and BS and MS degrees in Chemical Engineering from The Cooper Union. Dr. Granite is the principal or co-investigator for projects on the capture of mercury, arsenic, selenium and phosphorus from coal-derived flue and fuel gases; oxygen and carbon dioxide separations from flue gas and air; and extraction and detection of rare earth elements from coal byproducts.

Evan is the coauthor of forty one peer-reviewed journal articles, eight patents/patents pending, two hundred thirty conference papers and presentations, three DOE Topical Reports, fifty two DOE reports of invention, and co-editor (and co-author, with Henry Pennline and Connie Senior) of the book "Mercury Control for Coal-Derived Gas Streams" published by Wiley-VCH in 2015.



## ESIN SCHULZ

PhD

Materials Science and Engineering

Master of Science, Materials Science and Engineering

UCF, Orlando FL

Mentors: Dr. Evan Granite and Dr. Elliot Roth

### BIOGRAPHY

Esin Schulz is a doctoral research assistant at University of Central Florida in Orlando, where she is currently investigating diffusional interactions and phase development in metallic alloys critical for energy production and efficiency. One of her current projects is measuring diffusion coefficients and solid solution strengthening in Mg alloyed with rare earth metals. The data she generates will help develop new and improved Mg-alloys particularly in the framework of Materials Genome where materials data will play a critical role from development to processes.

Esin is an active member of ASM International (American Society of Metals) and the treasurer for Central Florida chapter of the organization. Her goal is to complete a PhD in engineering and gain research employment in government or industry.

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### PROJECT

OXYGEN SORBENTS FOR AIR SEPARATION

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Schulz worked on development of a new re-generable chemical sorbent to selectively remove oxygen (O<sub>2</sub>) from air. Development of a novel oxygen sorbent is the key step in the development of alternative air separation processes that will reduce energy and capital costs involved with current cryogenic distillation technology. Nonstoichiometric oxides have been nominated as potential sorbents due to their high selectivity for oxygen over nitrogen and high oxygen adsorption rates. In this work, Esin synthesized various sorbents utilizing solid state reaction method and characterized their storage and release capabilities as oxygen sorbents.

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### MENTOR



Evan J. Granite is the Technical Portfolio Leader for the Department of Energy's National Energy Technology Laboratory (NETL) RIC research program on Rare Earth Detection and Recovery, and an Adjunct Professor of Chemical and Petroleum Engineering at the University of Pittsburgh. Dr. Granite did postdoctoral research at the Department of Energy, received a PhD in Chemical Engineering from the University of Rochester, and BS and MS degrees in Chemical Engineering from The Cooper Union. Dr. Granite is the principal or co-investigator for projects on the capture of mercury, arsenic, selenium and phosphorus from coal-derived flue and fuel gases; oxygen and carbon dioxide separations from flue gas and air; and extraction and detection of rare earth elements from coal byproducts.

Evan is the coauthor of forty one peer-reviewed journal articles, eight patents/patents pending, two hundred thirty conference papers and presentations, three DOE Topical Reports, fifty two DOE reports of invention, and co-editor (and co-author, with Henry Pennline and Connie Senior) of the book "Mercury Control for Coal-Derived Gas Streams" published by Wiley-VCH in 2015.



## EVAN GRAGG

Ph.D. Geology Candidate

New Mexico Tech, Socorro, NM

M.S. in Geology, New Mexico Tech 2016

B.S. in Environmental Geology, University of Illinois at Urbana, Champaign 2014

Mentor: Dr. Ernest Linder

### BIOGRAPHY

Evan Gragg is a passionate geoscientist who began his career at the Illinois State Geologic Survey working in Clay Mineral science while earning his BS at the University of Illinois at Urbana-Champaign. During this time, he spent a semester abroad studying earth science at Uppsala University, Sweden. Additionally, he conducted senior thesis research looking at clay mineral effects on porosity and permeability in the Illinois Basin. Mr. Gragg then moved to New Mexico Tech to conduct research for the Southwest Regional Partnership on Carbon Sequestration, where he focused on constructing and simulating basin models using seismic, well log and core data for current and potential future carbon storage sites. Mr. Gragg received his MS Geology and is continuing on in the PhD program at NMT with the Petroleum Recovery Research Center diving into new fronts within carbon storage science.

Mr. Gragg strives to make a beneficial impact on society using interdisciplinary approaches to understand earth systems. His career aspirations include working collaboratively beyond conventional cross-disciplinary approaches in government, academia and industry.

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### PROJECT

UNCERTAINTIES IN FLUID FLOW AND FRACTURE MODELING

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

To identify a set of simple relationships to describe the various processes that will affect fracture permeability (fracture aperture) related to CO<sub>2</sub> flow over a period of time. A critical set of parameters will be identified for each and a simple block model will be constructed. The effect of parameter variation will be examined. Simple models will be developed for each process, and the critical parameters controlling the process will be identified. A basic model of the combined processes will be constructed using the GoldSim code. Variation in parameters will be utilized to examine process inter-relationships and effect on computed flow along a fracture.

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### MENTOR



Ernest Lindner is a senior researcher for AECOM working under the NETL Research and Engineering Services Support Contract located in Morgantown, West Virginia. He has a PHD from the University of Minnesota at Minneapolis, and also has a Master of Science from the Massachusetts Institute of Technology in Cambridge, MA and a Bachelor of Engineering from the Cooper Union for the Advancement of Science and Art in New York, NY. Dr. Lindner's focus is on geomechanics, fracture flow and seismic risk analyses, and has worked on various government-related projects including the Yucca Mountain Nuclear Waste Repository, the Salt Nuclear Waste Program and the Second Repository Program for the Department of Energy. His experience includes working with AECOM and (AECOM-related firms such as Woodward-Clyde Consultants and Dame and Moore, Inc.) for over 15 years, and has worked in engineering and management for other organizations including Parsons Brinckerhoff and Battelle Memorial Institute. He is a licensed Professional Engineer in New Mexico and a member of the American Society of Civil Engineers and the International Society of Rock Mechanics.



## FRANCESCA MOLONEY

PhD Student

Mechanical Engineering

University of South Florida, Tampa, FL

B.S. in Civil Engineering, 2014, Florida Gulf Coast University

Mentor: David Tucker, PhD

### BIOGRAPHY

Francesca Moloney currently attends the University of South Florida in Tampa. She is pursuing a doctorate in mechanical engineering. Her thesis focuses on numerically modeling the integration of a geothermal and solar thermal energy hybrid system, focusing on power conversion.

Francesca aspires to pursue research in the energy field after obtaining a doctorate. For fun, she wrestles poisonous snakes and snorkels with FOUS (fish of unusual size).

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### PROJECT

NUMERICAL APPLICATION OF THERMAL ENERGY STORAGE TO A SOLID OXIDE FUEL CELL GAS TURBINE HYBRID SYSTEM

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Francesca is working on the Hybrid Performance (HyPer) Project. This project focuses on the dynamics of combining a solid oxide fuel cell (SOFC) with a gas turbine. This hybrid system is highly efficient, however, SOFCs are very fragile and have a slow ramp rate. In order to overcome these challenges, the HyPer Project combines the real hardware of a gas turbine with a solid oxide fuel cell modeled in real-time. Her study focuses on the integration of thermal energy storage to the system.

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### MENTOR



Dr. David Tucker is the project leader for the Hybrid Performance project at the Morgantown campus of the National Energy Technology Laboratory. He has a diverse background in industry, academia, and government research, and he has explored the farthest reaches of the world. David firmly believes the creative process goes hand in hand with the scientific method and does his best to inspire unconventionality in his students.



# HELENA OCHOA

Graduate Student

Public Health

Environmental And Occupational Health

Louisiana State University Health Sciences Center, New Orleans, LA

B.S. Coastal Environmental Sciences, 2014, Louisiana State University

Mentor: James Depaoli

## BIOGRAPHY

Helena Ochoa attends Louisiana State University Health Sciences Center in New Orleans, LA where she has completed her first year of a MPH in environmental and occupational health. She was born in the New Orleans area and grew up in Baton Rouge, LA, but recently moved back from Orlando, FL after a Spring risk management internship at SeaWorld. She plans to graduate with her MPH in May 2017 and enter the workforce immediately after.

Ms. Ochoa hopes to enter the workforce in a role that involves safety, industrial hygiene, or water quality. She plans to get her certification in public health and eventually her certification in industrial hygiene depending on her career path. Helena enjoys playing soccer, running, spin class and circuits, and loves trying new food at different restaurants throughout New Orleans. She hopes to return to the central Florida area permanently. Her career goal is to create a safety protocol that will be implemented and have significant results on worker safety and/or environmental health.

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## PROJECT

INDUSTRIAL HYGIENE ON THE SPR

## SITE

STRATEGIC PETROLEUM RESERVE, NEW ORLEANS, LA

Ms. Ochoa worked on applied industrial hygiene practices at the DOE's strategic petroleum reserve (SPR) sites. Throughout the summer she traveled to each site and collected air samples for volatile organic compounds, dust, and metals while workers completed tasks in maintenance such as welding, grass cutting, and oil sampling. These samples were sent out for lab analysis and then evaluated to verify that workers were not being exposed to concentrations above set exposure limits. She also collected noise measurements to ensure hearing conservation program in place was sufficient. Helena assisted in collecting data for the heat stress protocol project and observed workers from an ergonomic perspective. This project allowed Helena to become familiar with multiple industrial hygiene instruments and proficient in exposure limits for worker safety on the SPR.

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## MENTOR



James De Paoli holds the position of Industrial Hygiene Manager for Fluor Federal Petroleum Operations LLC, a prime contractor for the Department of Energy's Strategic Petroleum Reserve, and is located in New Orleans, LA. James has served as a mentor with the Mickey Leland Energy Fellowship Program for 10 years.



## HUDA ASHFAQ

Rising Junior

Majors: Chemical Engineering (BS) and Chinese (BA)

Minor: Nanosystems

Virginia University, Morgantown, WV

Mentor: Todd Gardener

### BIOGRAPHY

Huda Ashfaq attends West Virginia University in Morgantown, where she is pursuing a B.S. in Chemical Engineering and a B.A. in Chinese. She is also earning her minor in Nanosystems. She will be the President of the American Institute of Chemical Engineers at West Virginia University this upcoming year. She will also be the Chinese club's Activity Committee Officer for three consecutive years. Huda will graduate in the spring of 2017.

Ms. Ashfaq's aspirations include combining her two fields of study by working as a chemical engineer on international relations between U.S. and China. She is very passionate about her majors, but is also applying her Nanosystems Minor to her future career. Her biggest goal is giving back to the community, and our nation. Her hobby is learning different languages. She also wants to travel the world to learn more cultures.

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### PROJECT

NANOCATALYSTS FOR THE DIRECT CONVERSION OF NATURAL GAS

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Ms. Huda Ashfaq is working on the development of bimetallic alloy nanocatalysts that efficiently reform natural gas into syngas – a feedstock for chemical and fuel manufacturing. As part of her project, she is characterizing the bimetallic catalyst materials and is performing kinetic measurements on reforming reactions as part of the functional material performance assessment. The novel catalysts under investigation are for use in highly compact, millisecond contact time reactors. Kinetic measurements are critical to the development and techno-economic evaluation of next generation microgrid manufacturing technology.

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### MENTOR



Dr. Todd Gardner is a Research Chemical Engineer with extensive experience in catalyst materials engineering and chemicals and fuels manufacturing. His recent research focuses on the development of heterogeneous catalysts and nanomaterials for natural gas utilization and their application to microgrid manufacturing. The co-production of energy and fuels using microgrid platforms will efficiently convert natural gas into energy, through natural gas combined cycles (NGCC), and drop-in fuel products through Fischer-Tropsch synthesis. He has chaired a number of committees including the ACS George A. Olah Award Committee in Hydrocarbon or Petroleum Chemistry, the Pittsburgh Section of AIChE and the Northern West Virginia Section of the ACS. He has authored/co-authored numerous technical publications including three book chapters. Dr. Gardner conceived, developed, and commissioned NETL Morgantown's Nano-Particle Technology Laboratory.



# JAMES RUSS

Junior

Major: Mechanical Engineering

Minor: Spanish, Math

The University of Houston, Houston, TX

Mentor: Regis Conrad

## BIOGRAPHY

James Russ attends the Honors College at the University of Houston, where he is earning his Bachelor of Science in Mechanical Engineering. He participates in undergraduate research at the engineering school under Dr. Hadi Ghasemi, studying how ferrofluid interfaces alter surface energy, and can prevent freezing at low temperatures and corrosion on turbine blades. James will graduate in May, 2018 and plans to pursue a master's degree in either Aerospace Engineering or Alternate Energy.

James is passionate about Thermodynamics and aims to pursue a career in a related field. His career aspirations include either working for a private company like SpaceX or for the Department of Energy. In his free time James loves to play instruments and sports, and plays on basketball and dodgeball intramurals teams in college.

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## PROJECT

MODULAR GASIFICATION COAL TO FLUIDS SYSTEMS

## SITE

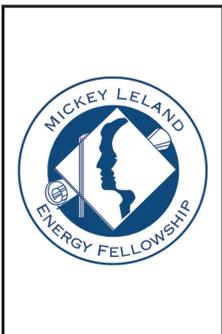
U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

When energy companies design power plants, they often begin with a demonstration plant to test their technology, and then scale to larger plant sizes after each subsequent success to generate more power. However, researchers have only just begun to look into the vast benefits that result from reducing the sizes of power plants. Over the summer, James conducted research on the limitations and applications of designing small modular power plants, particularly in coal gasification. He used what he learned to design a modular coal to liquids power plant that can both generate electricity and produce diesel fuel, and built a financial model for the costs of implementation and maintenance. Modular power plants show significant potential in decreasing plant construction times and reducing the cost of transportation by directly providing energy resources to small towns and cities. They are also beneficial in that they can decrease carbon footprint, as well as increase energy security.

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## MENTOR

Regis Conrad has worked in electrochemistry and materials engineering since 1978. Currently Mr. Conrad manages the research on sensor and control, computational modeling and high temperature materials research. Prior to working for the Department of Energy he worked for the Department of Navy as a materials engineer. Mr. Conrad has a B.A. in Chemistry and Zoology from George Washington University





## JARED CARPENTER

First year Master's Student  
Mechanical Engineering  
University of Tennessee, Knoxville  
Mentor: Dr. Benjamin Chorpening

### BIOGRAPHY

Jared Carpenter attends the University of Tennessee in Knoxville, where he has just earned his BS in Mechanical Engineering. He has participated in the Mickey Leland Energy Fellowship Program the previous two years where his research has been on chemical looping. Jared will be returning to Knoxville in August to begin working toward his Masters in Mechanical Engineering.

Jared's career aspirations include working for NETL while working on his Doctorate. He is very concerned about the future of energy in the world, and would like to work toward making the future a better place.

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### PROJECT

HEAD GAS MEASUREMENT VESSEL DESIGN

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Jared Carpenter developed a design for a head gas measurement vessel in Autodesk Inventor for an experiment being constructed to study production of methane by microorganisms in coal seams. This vessel will be used to investigate ways to enhance coal bed methane production, especially for coal pockets that are deemed unmineable. To better simulate underground conditions, the vessel will operate at temperatures and pressures that are commonly found underground (max of 60 °C and 1000 psi). These conditions were simulated in an FEA software. A very slow water flow will circulate through the coal sample and carry produced methane to a head gas separation vessel, where a laser measurement of the methane will be performed, without extracting gas from the system.

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### MENTOR



Ben Chorpening is a Research Mechanical Engineer in the Energy Conversion Engineering Directorate of the Research and Innovation Center at the National Energy Technology Laboratory, in Morgantown, West Virginia. He earned his PhD from the University of Illinois at Urbana-Champaign in Mechanical Engineering. He has performed research in combustion and sensors for fossil energy applications in the Office of Research and Development at NETL since 2002, with a recent emphasis on sensors and diagnostics for chemical looping. He also serves as Task Technical Coordinator for Sensors & Controls under the Innovative Process Technologies FWP.



## JENNA SARTUCCI

1st year Graduate Student

Chemistry

Georgetown University, Washington, DC

B.S. in Chemistry from The George Washington University, 2016

Mentors: Anne Marti and Surendar Venna

### BIOGRAPHY

Jenna graduated from the George Washington University in 2016 with a BS in Chemistry. She participated in undergraduate research under Dr. Adelina Voutchkova-Kostal, studying heterogeneous catalysis and CO<sub>2</sub> transformation. In the fall, Jenna will begin her PhD in Chemistry at Georgetown University.

Jenna's career aspirations include working as a research chemist to help advance technologies that will provide future generations with cleaner, renewable energy sources and a healthier environment. She is passionate about solving today's major challenges through science and collaboration and is very excited to be a part of the Mickey Leland program for 2016.

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### PROJECT

METAL ORGANIC FRAMEWORKS FOR CARBON CAPTURE

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

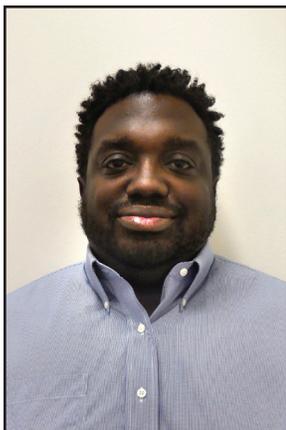
Mixed Matrix Membranes (MMMs) are hybrid systems that combine polymer membranes with inorganic filler particles. MMMs are materials of interest because they offer low cost and high transport performance. The MMMs studied for post combustion CO<sub>2</sub> capture must possess high gas permeance and selectivity at low CO<sub>2</sub> concentrations. To achieve this, Metal Organic Frameworks (MOFs) have been used as the inorganic filler in the polymer matrix. The MOF filler gives the advantage of high surface area and porosity as well as post-synthetic functionalization capabilities. In this study, we are investigating what the optimum affinity for CO<sub>2</sub> is for a membrane material by tuning the heat of adsorption of the filler particle. NU-1000, a Zr based MOF can be post functionalized with various groups to tune the heat of adsorption, and characterized using IR, BET, SEM and NMR. NU-1000 with different affinities for CO<sub>2</sub> will be studied for comparative gas separation performance in order to determine the optimum trait of the filler to be used.

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### MENTOR



Surendar is developing membranes for post-combustion CO<sub>2</sub> capture from coal power plants. He received his Bachelor's and Master's from Osmania University, India. Surendar later moved to the U.S. in 2007 to work on his PhD and completed his Ph.D. in Chemical Engineering at University of Louisville, KY in 2010. He performed research with Dr. William Koros for two years in developing hollow fiber sorbent technology for Exxon Mobil. In August 2012, Surendar accepted a position at the National Energy Technology Laboratory to work on CO<sub>2</sub> capture projects. He is the author of 13 peer-reviewed papers in reputable journals and presented at several scientific conferences. Surendar received several scholarships and fellowships for his innovative research work. Most importantly, Surendar received the Young Research Scholar Award from Indian Institute of Chemical Engineers for his outstanding graduate research work.



## JEREMY IKEOGU

Graduate Student  
PhD Chemical Engineering  
Texas A&M University, College Station  
BS Mechanical Engineering, Texas Tech University  
Minor in Mathematics  
Louisiana State University  
Mentor: Joe Giove

### BIOGRAPHY

Jeremy Ikeogu attends Texas A&M University, where he is pursuing a PhD in Chemical Engineering. He obtained his undergraduate degree in mechanical Engineering from Texas Tech University and then went to work for ExxonMobil Chemicals in their major project department. Jeremy anticipates graduating in the spring of 2020 and plans on returning to industry of pursuing opportunities within the Department of Energy.

Mr. Ikeogu's career aspirations include leading a large company's research or major project department so he can shape the future of the company and world through proper project selection. Jeremy enjoys travelling and has been to 10+ countries on 3 continents. His biggest goal is to help the world produce current high demand products from renewable sources.

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### PROJECT

ETHANOL TO BUTADIENE ECONOMIC MODEL

### SITE

U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

Mr. Ikeogu worked on the conversion of ethanol, a renewable feedstock to butadiene a chemical used in the production of tires and pharmaceutical applications. Ethane and other long chain alkanes are essential building blocks of the petrochemical industry and the diversion from coal to natural gas, which contains alkanes, seems to be leading to a decline in the availability of building blocks for butadiene production. In order to address this decline, the project focused on using ethanol to produce butadiene. A simulation with Pro/II was developed and an economic model was developed to test the viability. In addition to butadiene, ethylene, hydrogen, and butanol were tested as production sensitivities. This type of an integrated approach may help with understanding how to maximize profits from renewable feedstocks.

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### MENTOR



Joseph Giove currently serves as the Director of Coal Business Operations for the United States Department of Energy's Office of Fossil Energy. In this capacity, Mr. Giove provides financial oversight for all Coal Procurements, Coal Budget Execution, and also leads Coal State Outreach efforts. Mr. Giove was previously the Director of the Division of Large Carbon Management Projects which was responsible for the management and oversight of the \$3.4 billion dollar program to build the next generation of carbon capture and storage (CCS) power and industrial facilities as part of the 2009 ARRA Stimulus law. Mr. Giove has represented the United States Government at over 20 bilateral/multilateral meetings and has spoken at over 30 international conferences in 18 countries, and countless domestic meetings and conferences throughout the United States. Mr. Giove was the United States' Technical Delegate to the Carbon Sequestration Leadership Forum (CSLF) from 2006-2012, representing the United States at meetings in: China, Norway, Canada, Poland, France, United Kingdom, Saudi Arabia, India, and the United States. In addition, Mr. Giove represents DOE as an official member of the National Association of Regulatory Utility Commissioners' (NARUC) Staff Sub-Committee on Clean Coal and Carbon Management (2010-present.) Mr. Giove holds a Bachelor of Science degree from Lee University (cum laude), and a Master of Science in Computer Systems Management from the University of Maryland University College. Mr. Giove holds 5 certifications (PMP, COR Level III, TPO Level II, PMCDP, and Lean Six Sigma Blackbelt) and has over 15 years of project management experience.



## JEROME P RAQUE III

Senior

Major: Mechanical Engineering

University of Louisville, Louisville, KY

Mentor: Ronald Breault

### BIOGRAPHY

Jerome Raque graduated this past May with a Bachelor of Science from the University of Louisville’s Mechanical Engineering department. He will be returning to the University of Louisville in the fall to pursue his Master’s degree in mechanical engineering.

Jerome wishes to travel to all fifty United States. Eventually he would like to work as a design engineer in some industry to be determined. He would like to make a lasting impact through his designs and maybe invent a new product.

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<b>PROJECT</b>	FINDING THE VOLUME FRACTION OF SOLIDS THROUGHOUT DIFFERENT LOCATIONS OF A FAST FLUIDIZED BED
<b>SITE</b>	NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Mr. Raque worked on an experimental set up to assess the solids volume fraction in various fluidized bed systems. In this work, Mr. Raque documented the measurement volume of the probe and calibrated the probe using a series of fixed solids fraction bricks made with the 3D printer. The calibrated probe was then used in a 2D spouting bed to define the central spout geometry. Throughout his researched he used an electrical capacitance probe to measure the solids volume fraction and different locations throughout the experimental set up. The information was then used to project the extent of mixing throughout the bed.

### MENTOR



Dr. Breault has over thirty years of experience in the energy and transport fields and is presently the Reactor and Process Development Team Lead within the Energy Process Innovation Division of the Office of Research and Development at a the US DOE’s National Energy Technology Laboratory. Presently, he leads a team focused on the development of chemical looping combustion. He received his Ph. D. and M.S. in Chemical Engineering from the University of New Hampshire and a B.S. in Chemical Engineering from Clarkson University. Prior to joining the department of energy, he was Director of Environmental Technologies Division within a subsidiary of Thermo Electron. At Thermo he managed programs on the development of the copper oxide process, a corona based NOx control process, hydrogen production and storage programs as well as programs on gasification, combustion, emissions control and heat recovery. Prior to his tenure at Thermo he was a senior engineer at Riley Stoker Corporation and technical leader of fluidized bed technology development. Dr. Breault is has been the US DOEs representative and chair to the IEA Mutiphase Flow Implementing Agreement. He has numerous publications on multiphase flow dating back to 1985



## JISOO KIM

Junior

Major: Earth Science

Minor: Hispanic Studies

University of Pennsylvania, Philadelphia, PA

Mentor: Maggie Gill

### BIOGRAPHY

Jisoo Kim attends the University of Pennsylvania, where she is earning her BA in Earth Science with a minor in Hispanic Studies. Jisoo will graduate in the spring of 2018 and plans on attaining her master's in the geosciences. Her career aspirations are largely based in public service, whether continuing to conduct research in a government-affiliated facility or advising environmental policy. She enjoys the arts and the outdoors.

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### PROJECT

INDUCED SEISMICITY AND EXPERIMENTAL SHEARING OF CAPROCK FRACTURES: EVALUATION OF IMAGE PROCESSING METHODS AND FRACTURE MORPHOLOGY

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Fractures in rock may be created by natural or anthropogenic processes. There are many scenarios in which fractures must be well-monitored, such as the integrity of caprock used to seal off carbon sequestered under the surface. However, the effects of shear stresses on fractures in the subsurface are not yet well-understood. Jisoo evaluated the data from an experimental setup in which shales were incrementally sheared under variable pressure. The analysis began with X-ray computed tomography (CT) scans taken during the experiment. Jisoo evaluated the accuracy of different modes of image processing on these scans. The programs ImageJ and Ilastik were compared in their ability to execute image classification on sometimes fine, ambiguous fractures present in the scan data. ImageJ was developed by the National Institutes of Health to assist in biomedical research, while Ilastik was developed at the University of Heidelberg in Germany as an open source software for segmentation. Flow data for these fractures allowed for permeability calculations to augment the analysis of the accuracy of each mode of image processing.

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### MENTOR



Maggie Gill is a geologist working on imaging geological materials in the X-ray computed tomography (CT) lab, with a primary focus on developing and utilizing image, numerical and statistical data processing techniques for increasing understanding of flow in fractured and porous media. Projects include non-destructive analysis of fracture morphology changes under different types of stress, associated changes in permeability, and core to reservoir scale characterization of target formations for carbon capture and storage.



## JOREE LAFRANCE

Senior

Major: Earth Sciences and Native American Studies

Minor: Anthropology

Dartmouth College, Hanover, NH

Mentor: Ann Satsangi

### BIOGRAPHY

JoRee LaFrance is a member of the Crow Nation of Montana. She attends Dartmouth College in Hanover, New Hampshire, where she will earn a B.S. in earth sciences and a B.A. in Native American studies with a minor in Anthropology in the spring of 2017. She had the opportunity to work as an undergraduate researcher in a collaboration project that encompasses three different Indigenous communities: Grand Traverse Tribe, Walpole Island First Nation, and Waikato Tainui of New Zealand with plans and strategies on river restoration. JoRee’s academic interests include understanding the intersection of energy and tribal affairs at the tribal, state, and federal levels.

JoRee loves going home to Montana to be with family and enjoy the big sky, rolling hills, and mountains. She also takes pleasure in going to new places and learning from Indigenous people because of the unique perspective you can gain about the respective area. Ms. LaFrance hopes to come back to the Department of Energy to continue her work for Native American people in the energy sector. Ultimately, JoRee’s goal is to contribute to the perennial efforts to strengthen the tribal-federal relationship regarding tribal natural resources, energy, and sovereignty.

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### PROJECT

TRIBAL ENGAGEMENT ON CARBON CAPTURE TECHNOLOGIES

### SITE

U.S. DEPARTMENT OF ENERGY HEADQUARTERS, WASHINGTON, D.C.

JoRee is interning in the Office of Clean Coal and Carbon Management under government affairs and analysis with Ann Satsangi. The scope of her project is to identify opportunities for tribal collaboration in Carbon Capture and Storage (CCS) and explore a case study of CCS with the Crow tribe. This outreach will establish the basis for an FE-20 tribal outreach strategy and initiate a productive partnership between the Office of Clean Coal and Carbon Management and Office of Indian Energy Policy and Programs. The case study will analyze a potential CCS deployment research and development project with the Crow Nation.

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### MENTOR



Ms. Ann Satsangi is an energy analyst at the U.S. Department of Energy in the Office of Fossil Energy’s Clean Coal and Carbon Management program. Ann has a background in physics and nuclear engineering and extensive experience in government policy and program management. She has worked with a wide variety of interagency programs and interdepartmental cross cutting activities including nuclear stockpile stewardship, fundamental plasma science, and clean electric power technologies. Her current focus is on technologies and policies to decrease environmental impacts of fossil fuels. Approaches include minimizing greenhouse gas emissions through the capture and permanent storage of CO<sub>2</sub>, improving plant efficiency, increasing plant availability, reducing water consumption, and achieving ultra-low emissions of traditional pollutants. Ann also enjoys being outdoors with her husband and three children, pursuing activities such as camping, running, hiking and skiing.



## JORDAN BORDONARO

Senior

Major: Mathematics, Chemical Engineering

University of Pittsburgh, Pittsburgh, PA

Saint Vincent College, Latrobe, PA

Mentors: James Hoffman, Ali K. Sekizkardes

### BIOGRAPHY

Jordan Bordonaro attends the University of Pittsburgh where she is earning her BS in Chemical Engineering through a 3-2 program. She just finished her third year and mathematics degree at Saint Vincent College and will begin at the University of Pittsburgh this fall where she will complete her engineering degree. Jordan is interested in pursuing her Ph. D in chemical engineering or material science after she finishes her undergraduate degrees.

Ms. Bordonaro has a range of career aspirations including working as an engineer in the public sector. Jordan is a musician and also enjoys traveling. She would like to spend some time in Thailand after her undergraduate education. Her ultimate goal is to become a business owner, and a philanthropist so that she can give back to the community that she grew up in.

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### PROJECT

DEVELOPMENT OF THE EDX SFIRE PORTFOLIO

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Bordonaro worked to improve the previously synthesized porous organic polymer (POP), BILP-101 which shows promise for use as a carbon capture sorbent. She completed a five parameter study to optimize the material's surface area. She then scaled up the synthesis of the material using her optimized procedure in an attempt to prove scalability without losing the desired surface area, CO<sub>2</sub> uptake, and CO<sub>2</sub>/N<sub>2</sub> selectivity of the material.

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### MENTOR



James Hoffman is a research engineer with 25 years of experience within the Research & Innovation Center of the U.S. Department of Energy, National Energy Technology Laboratory. His primary areas of research have centered on environmental controls for the use of fossil fuels in electric generation. He currently serves as Task Technical Coordinator for post combustion CO<sub>2</sub> capture using solid sorbents. He has a BS in Chemical Engineering, MS & PhD in Mechanical Engineering, all from Penn State University.



## KELSEY HUNTER

Master's Student

Civil and Environmental Engineering

The Ohio State University, Columbus

B.S. Environmental & Ecological Engineering 2013

Purdue University

Mentor: Richard Middleton

### BIOGRAPHY

Kelsey Hunter attends The Ohio State University where she is earning her MS in Civil and Environmental Engineering and conducting research at the Energy Sustainability Laboratory with Professor Jeffrey Bielicki. She previously earned her B.S. in Environmental and Ecological Engineering from Purdue University and participated in undergraduate research through the Office of Science, Science Undergraduate Laboratory Internship (SULI) at both Los Alamos National Laboratory (LANL) and the National Renewable Energy Laboratory (NREL). She studied the impacts of permafrost and sediment on riverbank erosion in Alaska and life cycle assessments (LCAs) of downstream natural gas operations. Before pursuing her Masters, Kelsey worked at Hull and Associates Inc., a project development and consulting firm, where she gained valuable experience in the environmental, shale oil and gas, and waste management markets. Kelsey will graduate from The Ohio State in the spring of 2017. Kelsey aspires to promote sustainable change in the energy sector of the United States through the adoption of life cycle research into energy fuels and technologies as well as the promotion of renewable energy forms that can be integrated into the grid. Kelsey enjoys traveling, hiking, and spending time with friends and family.

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<b>PROJECT</b>	OFFSETTING WATER REQUIREMENTS AND STRESS WITH ENHANCED WATER RECOVERY FROM CO <sub>2</sub> STORAGE
<b>SITE</b>	LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM

Ms. Hunter worked on a cost minimizing optimization approach for carbon dioxide (CO<sub>2</sub>) Capture, Utilization, and Storage (CCUS) with enhanced water recovery (EWR). She used the Finite Element Heat and Mass Transfer Code (FEHM), developed by LANL, to model CO<sub>2</sub> injection with brine production and the corresponding pressure trade-offs within the Rock Springs Uplift reservoir in Wyoming. The resulting pressure trade-offs were coupled with well bore drilling and CO<sub>2</sub> injection cost estimates to model the cost per ton of CO<sub>2</sub> injected in the reservoir and the subsurface brine production pumping costs. The pressure and quantity of the produced brine was integrated into the CO<sub>2</sub>-Predicting Engineered Natural Systems (CO<sub>2</sub>-PENS) Water Treatment Model (WTM) to determine potential desalination technologies that could be used to treat the produced brine and provide a source of fresh water, which could then be used for the water requirement for CCUS, thermoelectric power operations, or some other societal need without consuming current fresh water supplies in a region.

### MENTOR



Dr. Richard Middleton is a Senior Scientist and Team Leader (Applied Terrestrial, Energy, and Atmospheric Modeling; ATEAM) in the Earth and Environmental Sciences (EES) division at Los Alamos National Laboratory (LANL). He has a Ph.D. in Geography and Operations Research from the University of California, Santa Barbara, and Geography degrees from the University of Leicester (M.Sc.) and Lancaster University (B.Sc.). Dr. Middleton's research focuses on climate impacts and energy development. He has published and led major energy projects for applications including CO<sub>2</sub> capture and storage (CCS), geothermal energy, shale gas and hydraulic fracturing, wind power optimization, and biofuels development. Dr. Middleton is currently one of LANL's energy-water nexus (EWN) representatives and leading a large project examining the impacts of climate-driven disturbances—drought, wildfire, and pathogens—on ecosystems and hydrology/water supply for the EWN.



## KRISTA K. BULLARD

Senior

Major: Chemistry

Minor: Computer Science

University of Pittsburgh, Pittsburgh, PA

Mentor: Dominic Alfonso

### BIOGRAPHY

Lucy Tang is a rising junior at Princeton University, where she is completing a bachelor's degree in Mechanical and Aerospace Engineering. She has completed summer programs in UK at Cambridge University and the University of Leicester. She has also conducted undergraduate research in robotics programming, and is highly involved in her school's Engineers Without Borders student chapter.

Lucy's post-graduation plans include graduate study. She aspires to develop infrastructure to deliver clean energy solutions to communities with energy shortages in a sustainable and environmentally friendly manner. In her spare time, Lucy enjoys reading, traveling, playing guitar and spending time with friends.

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### PROJECT

CO<sub>2</sub> ELECTROREDUCTION ON AU<sub>13</sub> CLUSTER: A DENSITY FUNCTIONAL THEORY BASED COMPUTATIONAL ELECTROCHEMISTRY STUDY

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

The electrochemical conversion of the green-house gas CO<sub>2</sub> on a model gold nanoparticle theory will be studied. Quantum mechanics in combination with computational electrochemistry techniques will be used to obtain the difficult-to-measure atomic level picture of the CO<sub>2</sub> conversion under applied voltage. The first step will be to identify and generate a practical and realistic model of the target Au nanoparticle. The chemistry of the CO<sub>2</sub> conversion on the model will then be investigated with the widely used density functional theory implemented in the software QCHEM. The data obtained at the ab initio level will be subsequently used to investigate the process under electrochemical environment. This project will provide the foundational skill and appreciation on how theory can be used to look into aspects of electrochemistry that are hard to study experimentally. It also helps the Department of Energy in its mission to promote the use complementary computational tools among aspiring scientists to look into research efforts that would help enhance the US environmental quality.

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### MENTOR



Dominic Alfonso obtained his B.S Chemistry from the University of the Philippines and a Ph.D in Chemistry from the Ohio University. Before he joined NETL, he had done postdoctoral work at the International Center for Theoretical Physics, University of Louisville, Pacific Northwest National Laboratory and the University of Pittsburgh. His research focus is the implementation and deployment of multiscale simulation methods to examine chemical reactions with energy applications. The methods he uses help him to look at processes at the atomic level and at laboratory conditions. The resulting simulations assist experimentalists in the interpretation of their data and direct them toward promising new materials. They also provide "feedback loops" that improve the computer modeling itself. Outside of NETL, he serves as the Head Elder of the East Suburban Seventh-day Adventist Church in North Versailles, PA. He and his wife Renea coordinate the church's health based programs for confined senior citizens.



## MARYSSA A. OFFLEE

Graduate

Bachelor of Science in Petroleum Engineering

Louisiana State University, Baton Rouge, LA

Brookshire Engineering Scholarship 2015

Mentor: Ashley Thomas

### BIOGRAPHY

Maryssa is a recent graduate of Louisiana State University. She majored in Petroleum Engineering and graduated in May 2016. She was devoted to her studies while juggling extracurricular activities, friends and a part-time job during most of her college career. She was a resident assistant in the engineering residential hall at LSU for three years and worked as an office intern at Bloch, Briggs and Associates, Inc. during her last year in college. She is actively seeking a full-time position in her field of study.

During her free time, Maryssa enjoys travelling and participating in outdoor activities, as well as, painting and playing musical instruments. As she progresses in her career she ultimately hopes to create processes and technologies that advance the oil and gas industry to become environmentally cleaner.

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### PROJECT

ANALYSIS OF THE PIG WASTE MANAGEMENT PLAN

### SITE

STRATEGIC PETROLEUM RESERVE, WEST HACKBERRY, LA

The US Department of Energy’s Strategic Petroleum Reserve in Hackberry, LA is the second largest storage site at the SPR containing 22 caverns, totaling 213.2 MMB of crude oil. There are two mainline pipelines leading to the site: the Sun Marine Terminal in Nederland, TX and the Lake Charles Meter Station in Carlyss, LA. These pipeline are used for distributing and receiving crude oil to/from tankers, refineries and ultimately to areas around the United States.

The purpose of this project is to review the pig waste management system currently in use for the mainline pipeline pigging operations and to analyze the alternatives of utilizing a recycler versus utilizing a disposer for the waste. This project will ultimately determine the optimal solution of waste management, given the compliance and regulation requirements for the State of Louisiana as well as Federal regulations.

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### MENTOR



Ashley L. Thomas has been a DOE General Engineer at the SPR West Hackberry Storage Site located in Hackberry, LA since August 2011. She received her Bachelors of Science in Mechanical Engineering from Southern University Baton Rouge in 2007. During college, Ashley was a Mentor with the Boys and Girls Club of Baton Rouge as well as the Big Buddy Program. Ashley is the Black History/African American Program Manager for the SPR Employee Management Advisory Committee. This is her second year as a Mickey Leland Energy Fellowship mentor.



## MATTHEW EDGIN

M.S. Student  
Geology and Geophysics  
University of Wyoming, Laramie  
Mentor: Dr. Circe Verba

### BIOGRAPHY

Matt Edgin graduated this past May from Ohio State University, where he earned his BS in Geology with Research Distinction. He participated in undergraduate research at the School of Earth Sciences under Dr. Dave Cole, studying strontium and barium sources in the Point Pleasant shale formation. Mr. Edgin will attend University of Wyoming this fall under Dr. John Kaszuba where he plans on attaining his masters in geology and geophysics.

Mr. Edgin's career aspirations include research and development or energy exploration for an energy company, university or a national lab. His biggest goal is to understand the mineralogical and geochemical relationships that take place in the geologic subsurface and contribute to the scientific community. He enjoys the outdoors and can be found hiking, mountain biking, camping, or fly fishing.

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### PROJECT

POROSITY IN UNCONVENTIONAL SHALE RESERVOIRS

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, ALBANY, OR

Mr. Edgin research focuses on advanced image analysis of shale petrophysics for unconventional reservoirs; the project utilizes scanning electron microscopy (SEM). Mr. Edgin's role is characterizing porosity types (intraparticle, interparticle, and organic hosted) and quantifying porosity by generating 3-D images of the sample matrix and total porosity. His research goals are to better understand the pore connectivity and hydrocarbon content in unconventional shale reservoirs to evaluate the supercritical CO<sub>2</sub> storage capacity and economic feasibility for hydrocarbon extraction. Ultimately, his research will contribute to a larger dataset to provide statistical significance for each shale formation's properties.

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### MENTOR



Dr. Verba's research bridges together geochemistry and civil engineering; she specializes in microanalysis, respectively petrography and electron microscopy. Dr. Verba studies well integrity in carbon sequestration settings, petrophysics in unconventional systems, and advanced characterization of rare earth elements. Her primary research utilizes high pressure and temperature to replicate downhole conditions to better understand geochemical and microstructural impacts in both the reservoir and wells.



## MAZIAR ZAREA

Junior

Major: Petroleum Engineering

Minor: Energy & Sustainability

University of Houston, Houston, TX

Mentor: Amy Sweeny

### BIOGRAPHY

Maziar Zarea attends University of Houston in Houston, TX, where he is earning his B.S. in Petroleum Engineering with a minor in Energy & Sustainability. At UH, he is the Vice-President of Internal Affairs for the Society of Petroleum Engineers (SPE), and is quite active in the Houston Energy Community. Maziar, who also goes by the nickname, “Maz”, has also had experience interning at Shell, TimkenSteel, and Bechtel Corporation. In his free time, he enjoys playing and watching soccer, cooking, learning new things at the Houston Technology Center (HTC) and volunteering with the Society of Petroleum Engineers Gulf-Coast Section.

Maziar’s career aspirations include working in the upstream and midstream energy sector to pursue technical interests in emerging digital/startup technologies, data science, and enhanced oil recovery (EOR). He eventually wants to return to school to pursue a graduate degree in either petroleum or industrial engineering, as well as a graduate degree in business.

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### PROJECT

NATURAL GAS PIPELINE INFRASTRUCTURE IN CANADA AND MEXICO

### SITE

U.S. DEPARTMENT OF ENERGY HEADQUARTERS, WASHINGTON, D.C.

This summer, Maz is working with the Natural Gas Regulation group to create an interactive database of natural gas pipelines and LNG import/export terminals that cross the Canadian and Mexican borders. There is a lack of any sufficient data of planned and current pipeline infrastructure that is accessible by DOE to understand the capacity of natural gas that moves through the country’s borders and he strives to address this issue.

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### MENTOR



Amy joined Fossil Energy in late 2015 after nearly 14 years with the Energy Information Administration (EIA) where she led a team that produced the official U.S. natural gas statistics. Prior to her time at EIA, Amy also worked at the Census Bureau and Bureau of Economic Analysis. In FE, Amy’s role is to lead a multidisciplinary team charged with regulating the import and export of natural gas, including liquefied natural gas (LNG), under the Natural Gas Act. The team reviews applications and issues orders to companies that apply to import and/or export and also tracks the movements of the imports and exports pursuant to the orders. Amy enjoys working with the talented individuals on her team and throughout FE and the Department on natural gas issues. She is married to a fellow federal employee and has two daughters in elementary school.



## MINH BUI

Junior

B.S. Petroleum Engineering

The University of Texas, Austin, TX

Mentor: Dr. Nicolas Huerta

### BIOGRAPHY

I'm a rising junior pursuing a B.S. in Petroleum Engineering at the University of Texas at Austin. My career aspiration is to join an oil and gas company with a global presence and travel to many places to meet the world's energy needs. Aside from my technical goals, I'm pretty interested in making pastries and hope to be a pastry chef in the near future (on the side). Other hobbies of mine include gaming and casual cycling. An item from my bucket list is to venture through the Hang Son Doong Cave in Vietnam, which is the largest cave in the world. Only a few hundred people get the opportunity to tour it every year, but it's definitely something I want to see before I die!

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### PROJECT

REACTIVE TRANSPORT MODELING IN FRACTURED MEDIA

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, ALBANY, OR

This summer, I'm interning at the Albany NETL site under Dr. Nicolas Huerta to better our understanding of coupled reactive transport processes in fractured media. I'm using PFLOTRAN, a parallel reactive flow and transport model, to simulate the evolution of permeability, porosity, and flow patterns controlled by simultaneous precipitation and dissolution in fractured rocks. By developing these models, I hope to explore the effects of various factors, such as fracture geometry or fluid composition, on geochemical conditions that lead to self-sealing or self-enhancing flow.

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### MENTOR



Dr. Huerta is a physical scientist in the Predictive Geosciences Division in the Office of Research and Development within the Department of Energy's National Energy Technology Laboratory. He holds a B.S. and M.S. in Geology from The University of California at Davis, a M.S.E. in Petroleum Engineering and Ph.D. in Geological Sciences from The University of Texas at Austin. His research interest include characterizing the long-term fate of leaky wells in carbon storage environments and developing novel materials to improve well integrity in extreme environments.



# NICOLA ANASTASIA PEYKO

Senior

Major: Physics

Sonoma State University, Rohnert Park, CA

Mentor: Johnathan Moore

## BIOGRAPHY

Nicola Peyko attends Sonoma State University in Rohnert Park California, where she is earning her B.S. in Applied Physics. She has participated in undergraduate research under Dr. Hongtao Shi - fabricating and characterizing ZnO thin films doped with Mg and In. Nicola will graduate in the fall of 2016 and plans to join the work force and eventually attend graduate school.

Ms. Peyko's career aspirations include working for the US Department of Energy or General Atomics to continue research. After exposure to the energy sector, Ms. Peyko wishes eventually to transition to secondary education in physics. Nicola enjoys traveling and would like to visit the Bahamas and Central America after graduation. While Nicola wishes to pursue understanding of the energy issues and ways to address them, she ultimately wants to enrich the lives of her fellow denizens of earth through her work and outreach.

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<b>PROJECT</b>	CO <sub>2</sub> INDUCED SWELLING OF BLACK SHALES LOCATION: NATIONAL ENERGY TECHNOLOGY LABORATORY
<b>SITE</b>	NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Ms. Peyko is working to analyze the effects of CO<sub>2</sub> exposure on fractured samples of Marcellus shale. The intent of this study is to help understand the fundamental effects that CO<sub>2</sub> has on black shales and how that will play into future work. Involving sequestration or enhance resource recovery. Ms. Peyko uses CT scans, flow data, and X-ray direction data to analyze how the Marcellus shale responded under reservoir like conditions when exposed to CO<sub>2</sub>. A variety of image processing techniques were evaluated to determine their efficacy in extracting fracture data from the CT scans and relating that to the hydraulic results. It was found that the Marcellus likely does not respond drastically to exposure with CO<sub>2</sub> and that is likely a function of both the clay minerals and lack of high organic content when compared to other black shales.

## MENTOR



Johnathan is a research scientist working with the computed tomography group at the National Energy Technology Laboratory (NETL) in Morgantown, West Virginia. He graduated from West Virginia University with a B.S. and M.S. in Geology with an emphasis on geochemistry and natural CO<sub>2</sub> rich systems. Since graduation, Johnathan has been working at NETL to determine some of the fundamental properties of reservoir rocks and well bore materials. These studies are part of a larger initiative to better understand geological sequestration of carbon dioxide, enhanced resource recovery, and the stability of wellbores during production.



# OSCAR FRANCISCO PINEDA

Senior

Major: Mechanical Engineering

California State University, Long Beach

Mentor: Nathan Weiland

## BIOGRAPHY

Oscar Pineda is a student at California State University, Long Beach (CSULB), where he is earning his BS in Mechanical Engineering. He came to the United States at the age of 13 to advance beyond what was possible for him at his home country El Salvador. After graduating with honors from Saugus High School, he attended CSULB, where he has been working with student organizations like the Society of Hispanic Professional Engineers (SHPE) and the Hispanic Serving Institute in Science Technology Engineering and Math (HSI-STEM), in different projects that involve professional development, leadership, mentoring and tutoring of math, science, and engineering, and community service. His latest project was the design and manufacturing of an Ovality Removal Clamp System for Southern California Gas Company. Oscar will be graduating in December of 2016, and in the future he plans on pursuing his master's degree after gaining some real life experience in the engineering industry. Oscar's career aspirations include becoming a high level engineer recognized for his hard work and dedication. He wants to go far in the improvement of engineering applications and research of many engineering problems nowadays, but at the same time he wants to enjoy life and adventure. Oscar enjoys outdoor adventures, and he plans on visiting as many natural attractions in the world as he can during his lifetime.

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## PROJECT

MODELING OF RECUPERATORS FOR SUPERCRITICAL CO<sub>2</sub> POWER CYCLES

## SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Oscar Pineda worked on creating models of heat exchangers for supercritical carbon dioxide power cycles. He did extensive research on factors that affect the design of heat exchangers, as well as the different types of heat exchangers that exist today. The models that were created were for the high temperature and low temperature recuperators. The models use input factors that include hydraulic diameter, temperature approach, and pressure drop, and calculates the recuperator's approximate effectiveness, size, weight, and cost, among other factors. These models will assist in the analysis of the entire supercritical CO<sub>2</sub> power cycle by screening how the input factors affect the recuperator's effectiveness, size, and cost, and consequently, how the recuperator affects the overall cycle efficiency and cost.

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## MENTOR



Nathan Weiland received his B.S. in Mechanical Engineering from Purdue University in 1997, and his M.S. and Ph.D. in Mechanical Engineering from Georgia Tech in 2000 and 2004, respectively. His doctoral work culminated in two U.S. patents on novel pulse-combustion fired thermoacoustic engines. He began his work at the U.S. Department of Energy's National Energy Technology Laboratory (NETL) with 3 years of post-doctoral research in low-NO<sub>x</sub> hydrogen combustion. In 2008, he joined the Mechanical & Aerospace Engineering faculty at West Virginia University as a Research Assistant Professor, where he continued to work closely with NETL through their Regional University Alliance. He has specialized in combustion, gasification, pyrolysis, and advanced energy systems, including specific studies on coal/biomass co-pyrolysis and co-gasification, ash deposition processes specific to gasification systems, thermal plasmas in oxy-fuel combustion for magnetohydrodynamics (MHD) applications, and chemical looping combustion kinetics. Nathan joined NETL in 2014, where he currently works in the Systems Engineering and Analysis Directorate, designing and performing techno-economic analyses of oxy-fuel MHD power plants and supercritical CO<sub>2</sub> power cycles.



## REBECCA HIRSCH

Junior

Major: Chemistry and Mathematics

Physics

Warren Wilson College, North Carolina

Mentor: Dr. Victor Kusuma

### BIOGRAPHY

Rebecca Hirsch attends Warren Wilson College in North Carolina, pursuing her BS in Chemistry and Mathematics with a minor in Physics. Originally from California, Rebecca has travelled around the country and enjoys adventuring to new places. When she returns to her college in the fall, she will be participating in undergraduate research on organic photovoltaic cells under the advising of Dr. David Coffey. She plans to graduate in the spring of 2018 and hopes to obtain her PhD in Chemical Engineering or Material Science.

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### PROJECT

POLYMER IONIC LIQUID MEMBRANES FOR CARBON CAPTURE

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Hirsch worked with Dr. Victor Kusuma to characterize the thermal, mechanical, and gas transport properties of a promising series of polymer-based ionic liquid membranes in the hopes that they will be used for post-combustion carbon capture from coal power plants. She also addressed issues of incompatibility among the ionic liquids and the two co-polymers in the membranes.

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### MENTOR



Victor Kusuma is a research engineer and principal investigator with AECOM specializing in gas separation membrane technology, having had broad experience with new materials development, membrane fabrication, testing equipment design and operation. He obtained his PhD in Chemical Engineering from the University of Texas at Austin under Prof. Benny Freeman, who runs an active membrane separations research group. He also had postdoc experiences at Los Alamos National Laboratory and at NETL before becoming a staff engineer. In addition, he is an active member of the North American Membrane Society. Dr. Kusuma has followed his passion on developing innovative, practical solutions for carbon dioxide capture for the past five years. He spearheaded NETL's successful effort in constructing and operating a small-scale membrane testing skid at the DOE's National Carbon Capture Center in Central Alabama, allowing the facility to test laboratory scale membranes' CO<sub>2</sub> separation performance using real post-combustion flue gas. His materials development efforts have been documented in many peer-reviewed journals in the past 10 years. Going forward, he hopes to continue the membrane development effort and disseminate CO<sub>2</sub> capture solutions to meet the global need for CO<sub>2</sub> atmospheric emissions reduction.



## VIENNA (JING HAO) LIU

Masters

Statistics Co-Mentor: Brunello, Giuseppe F

Baruch College, New York City

Mentor: Romanov, Vyacheslav

Co-Mentor: Brunello, Giuseppe F

### BIOGRAPHY

Vienna (Jing Hao) Liu attended Baruch College in New York City. She participated in graduate research at the school in a study abroad program at Vienna University of Technology in collaboration with Dr. Peter Filzmoser and Dr. Alexander Mehlmann to develop efficient models in Robust Statistics and to apply research techniques in Mathematical Seriation to data. After graduation in 2016 from Baruch, Vienna plans on attaining her PhD in Statistics.

Ms. Liu's career aspirations include staying in the academia and becoming a professor of Statistics or becoming a researcher for federal or private agencies. Vienna enjoys traveling and would like to visit and live in many places around the world including Egypt and North Africa. Her biggest goal is to help progress the scientific community with her research and to discover technology that will help the lives of many people all over the world.

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### PROJECT

A BAYESIAN APPROACH TO FUEL CELL MODELING REFINEMENT

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, PITTSBURGH, PA

Ms. Liu worked on a Bayesian analysis to estimate a mathematical model's parameter values using available experimental/synthetic data. This work is done as a technical approach demonstration project for development of a larger, 1-D finite volume model of a symmetric Solid Oxide Fuel Cell (SOFC). The developed R algorithm will simulate the equilibrium physics-based equations and obtain a posterior distribution of the parameter values, with better estimates for the unknown values in the constitutive equations. As a result, the predictive model will be refined to facilitate the NETL SOFC projects.

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### MENTOR



Dr. Romanov has a Ph.D. in Physics and Mathematics from Moscow Tech, Ph.D. in Chemistry from the University of Pittsburgh, and MBA from Waynesburg College (University). He is an author of four inventions and over 50 publications. Prior to joining the Department of Energy, Dr. Romanov worked on Energy and Ecology research projects in support of the Russian space program and on development of glass-ceramic coatings with applications for automotive business, laser marking and electronics at Ferro Corporation in Washington, Pennsylvania.



## WEI-LEE WU

Junior

Major: Chemical and Biomolecular Engineering

Minor: Sustainability Studies

University of Maryland College Park, Maryland

Mentor: Dr. Sastri

### BIOGRAPHY

Wei-Lee Wu is a rising junior at the University of Maryland College Park studying chemical and biomolecular engineering with a minor in sustainability studies. He currently works as a peer mentor for Dr. German in an undergraduate molecular biology lab studying environmental pathogens. He is also an active board member in U. of Maryland's AIChE chapter and serves as the secretary of U. of Maryland's  $\Omega$ XE chemical engineering honor society. As Wei-Lee finishes his undergraduate degree, he would like to extend his academic interests and pursue a graduate degree as well as continue to explore career paths for chemical engineers. Outside of school and research, Wei-Lee loves to play indoor and grass volleyball. He also enjoys giving back to his community by participating in community service events.

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### PROJECT

MFiX COMPUTATIONAL FLUID DYNAMICS MODELING OF SPOUTED FLUIDIZED BED

### SITE

U.S. DEPARTMENT OF ENERGY HEADQUARTERS, GERMANTOWN, MD

Wei-Lee spent the summer learning about NETL's MFiX program to model computational fluid dynamics of fluidized beds. Wei-Lee examined the design and operation of spouted fluidized bed. He worked on trying to introduce modifications to the conventional system to improve efficiency and reduce carbon in ash due to better control of residence time.

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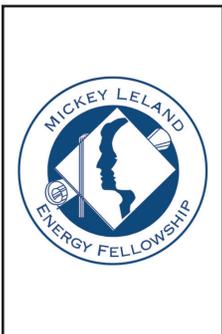
### MENTOR

Dr. Sastri

Program Manager of Advanced Combustion & Fuel Cells

Office of Fossil Energy

Germantown Headquarters





## ZAID JOYA

Senior

Major: Petroleum Engineering

Minor: Geology

University of Houston, Houston, TX

Mentor: Andrea McNemar

### BIOGRAPHY

Zaid Joya is a rising senior at the University of Houston, where he is pursuing a Bachelor of Science in Petroleum Engineering and a minor in Geology. He will graduate in the spring of 2017 and plans on working in the Oil and Gas industry upon graduation.

Zaid’s career aspirations include working for a multi-national oil company, such as ExxonMobil or Shell. In his career, he wants to help develop techniques to safely produce oil and gas with minimal harm to the environment. Zaid enjoys to travel and wants to visit Italy and Greece at some point in his life.

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### PROJECT

CARBON STORAGE FOCUSED ON PRESSURE MANAGEMENT

### SITE

NATIONAL ENERGY TECHNOLOGY LABORATORY, MORGANTOWN, WV

Zaid contributed to a carbon storage project to help develop a brine extraction and storage test (BEST) in the North Dakota portion of the Williston Basin. The test will focus on validating approaches for active reservoir management and extracted water treatment. Ultimately, the test will provide valuable information on how to monitor and measure the movement of differential pressure and CO<sub>2</sub> plumes in the subsurface for future saline CO<sub>2</sub> storage projects. Zaid contributed to the successful implementation of this project by evaluating the Statement of Project Objectives, Project Management Plan, and Budget Justification for the test.

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### MENTOR



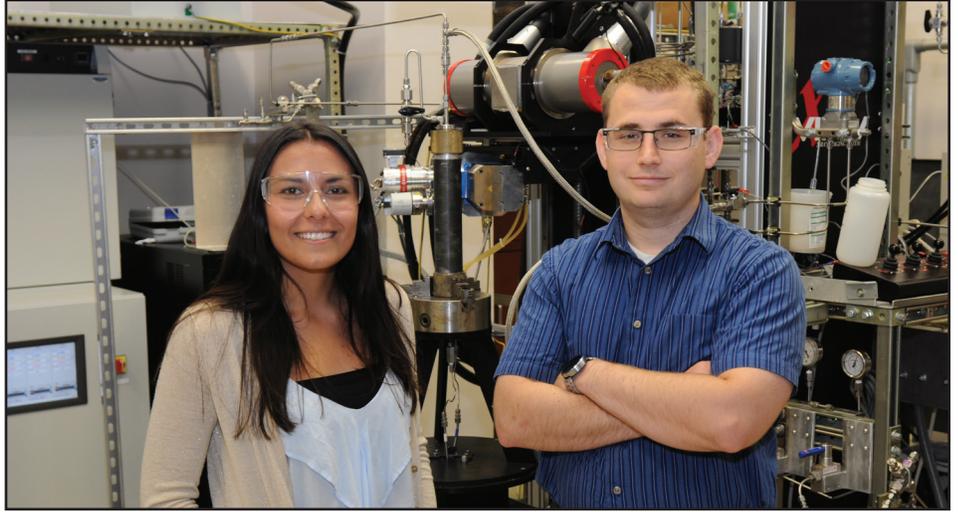
Andrea is a Project Manager for the Carbon Storage Team with the Department of Energy’s / Office of Fossil Energy’s / National Energy Technology Laboratory. Andrea manages a variety of projects within the Carbon Storage Program, and has been with NETL for 9 years. Prior to working for NETL she worked for SAIC providing technical support to NETL’s Innovations for Existing Plants Team. Andrea received her B.S and M.S. in Civil and Environmental Engineering, both from West Virginia University.

# FE LEADERSHIP



Christopher A. Smith

Douglas Hollett



# OFFICE OF FOSSIL ENERGY

## FE LEADERSHIP

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## CHRISTOPHER A. SMITH

**Assistant Secretary**

**Office of Fossil Energy**

**U.S. Department of Energy**

Christopher Smith serves as Assistant Secretary for Fossil Energy at the U. S. Department of Energy. President Obama nominated Smith for the position in November 2013. He was confirmed by the U. S. Senate and sworn into office in December 2014.

As Assistant Secretary, Smith leads the Department of Energy's Office of Fossil Energy, including scientists and engineers working at eleven sites across the United States. In this capacity, he oversees the Department's fossil energy's research and development program (coal, oil and natural gas) and the National Energy Technology Laboratory. He is also responsible for the U.S. Petroleum Reserves, the largest strategic petroleum stockpile in the world.

Prior to his Senate confirmation, Smith served as Principal Deputy Assistant Secretary for Fossil Energy and as Deputy Assistant Secretary for Oil and Natural Gas. During that tenure, he served as the Designated Federal Official for the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, established by President Obama to investigate the root causes of the Gulf oil spill.

Before his appointment in October 2009, Smith served in managerial and analytical positions of increasing responsibility in the private sector. Most recently he spent eleven years with two major international oil companies focused primarily on upstream business development and LNG trading, including three years negotiating production and transportation agreements in Bogotá, Colombia.

Smith began his career as an officer in the U. S. Army and served tours in Korea and Hawaii. He subsequently worked for Citibank and JPMorgan in New York City and London in the area of emerging markets and currency derivatives. Smith holds a bachelor's degree in Engineering Management from the United States Military Academy at West Point and an MBA from Cambridge University.

# OFFICE OF FOSSIL ENERGY

## FE LEADERSHIP

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## DOUGLAS HOLLETT

**Principal Deputy Assistant Secretary**

**Office of Fossil Energy**

**U.S. Department of Energy**

Douglas Hollett is Principal Deputy Assistant Secretary (PDAS) in the Office of Fossil Energy (FE). His portfolio includes R&D and programs in Clean Coal and Carbon Management, Oil and Natural Gas systems, international engagements in clean fossil energy, and inter-agency engagements within the US government.

Prior to being named PDAS in FE, he served as Deputy Assistant Secretary for Renewable Power in the Office of Energy Efficiency and Renewable Energy, where he oversaw research, development, and demonstration for a diverse clean energy portfolio.

Mr. Hollett came to the Department of Energy in 2011 with more than 32 years of experience in the oil and gas industry. Most recently, he was Manager and Director for Unconventional New Ventures at Marathon Oil. In that role, his responsibilities included capturing and initiating new domestic and international opportunities in shale gas and tight oil reservoirs. He also served as Manager, International New Ventures, which included identifying and growing new global energy projects, and as VP and General Manager of Atlantic Canada, where he led the first modern deep-water drilling campaign in Canada. While in Canada, Mr. Hollett was concurrently the Chairman of Petroleum Research Atlantic Canada (PRAC) from 2001–2004, a unique multi-stakeholder research organization designed to rapidly fund and advance prioritized research in a variety of technical, environmental, and safety and operational disciplines. Other positions at Marathon included Business Development, North America and International Exploration, and Rocky Mountain Production Operations. In addition to experience throughout North America, he has led projects in Southeast Asia, Latin America, Canada, Europe, North and East Africa, Australia, and Russia. Prior to Marathon, he worked for Unocal conducting frontier field studies, the U.S. Geological Survey mapping in California and Colorado, and the Massachusetts Audubon Society doing integrated land use planning.

Mr. Hollett holds a Bachelor of Arts in Geology from Williams College and a Master of Science in Geology from the University of Utah.

# PROGRAM COORDINATORS

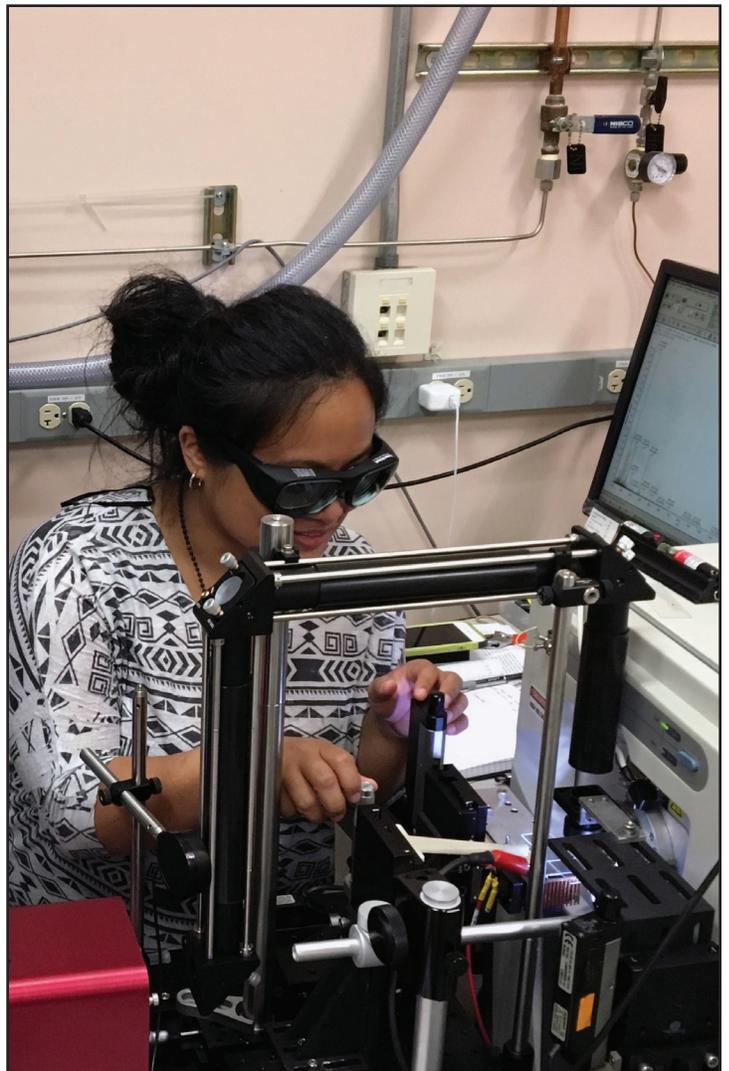


Alan F. Perry

Sandra Cortez

Barbara Dunkin

Jennifer Casey



# OFFICE OF FOSSIL ENERGY

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## ALAN F. PERRY

Supervisor

Office of Management and Field Operations

Office of Fossil Energy

U.S. Department of Energy

Alan Perry is a Supervisory Administrative Officer and the MLEF Program Manager in the Office of Management & Field Operations in the Office of Fossil Energy. In this capacity, Mr. Perry serves as a principal advisor to the Office Director, Assistant Secretary, Principal Deputy Assistant Secretary, and Deputy Assistant Secretaries on management, policy and organizational issues, human resources management, workforce development, succession planning, and other operational issues. This is his fourth year overseeing the Mickey Leland Energy Fellowship Program. Alan has over 23 years of experience in Federal HR and business operations with an emphasis on implementing business process reforms to improve customer service and organizational performance. Alan started his career as an intern while earning a Master's degree in Business Administration. He attended the University of Maryland for both undergraduate and post graduate studies. Alan grew up in the Washington, DC area but still roots for his hometown Red Sox. Last year, he completed his second marathon - the Boston Marathon. Alan currently lives in Rockville with his two daughters (one an Indiana Hoosier and the other a high schooler) and dog Watson.

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## SANDRA CORTEZ

Program Specialist

Office of Management and Field Operations

Office of Fossil Energy

U.S. Department of Energy

Sandra Cortez serves as a Program Specialist in the Office of Management and Field Operations in the Office of Fossil Energy. This is her second year managing the Mickey Leland Energy Fellowship Program. Her previous experience includes serving as a Program Analyst and Education/Outreach Program Specialist with the U.S. Department of Agriculture and serving as the Director of the HACU National Internship Program. She has over 15 years of experience in program management and advising students on careers in the federal sector. Ms. Cortez earned her B.A from the University of Maryland College Park and her M.A. in Education and Human Development from The George Washington University. She enjoys watching football and spending time outdoors with her family.

# OAK RIDGE ASSOCIATED UNIVERSITIES

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## BARBARA DUNKIN

Project Specialist, Science Education Programs

Oak Ridge Associated Universities

Barbara holds the position of program specialist at ORAU located in Oak Ridge, TN. For over ten years, she has assisted with the administration of a wide variety of Department of Energy programs throughout the United States, including the Mickey Leland Energy Fellowship (MLEF) Program. Barbara specializes in client service and, when not assisting interns, she enjoys spending time with her children and grandchildren.



## JENNIFER CASEY

Project Manager, ORISE

Oak Ridge Associated Universities

Jennifer is a project manager for ORAU located in Oak Ridge, TN. Previous to her Project Management career, she was a chemistry teacher and a NASA STEM teacher liaison for the State of TN. Jennifer has a background in Anthropology, Administration, Science education development, group travel planning, and recruitment. As an ORAU project manager, she administers appointments for various Department of Energy programs for the National Energy Technology Laboratory (NETL), the Oak Ridge Environmental Management Agency, and the Mickey Leland Energy Fellowship (MLEF) Program.

# PROGRAM STAFF

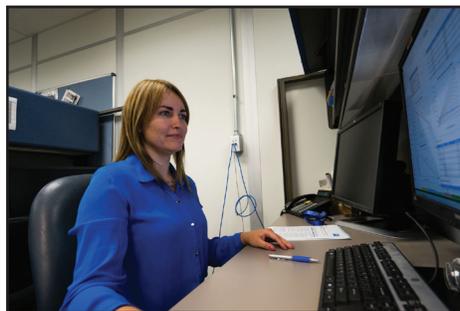
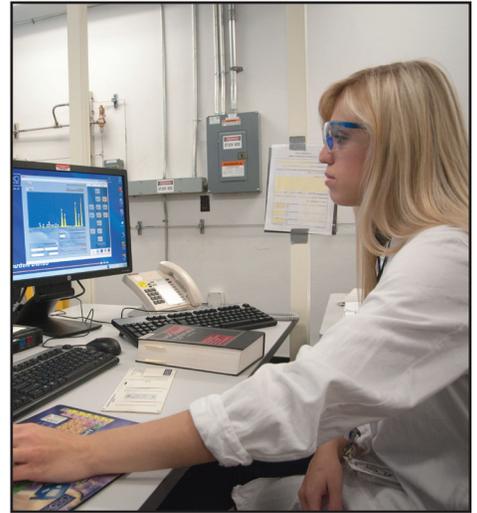
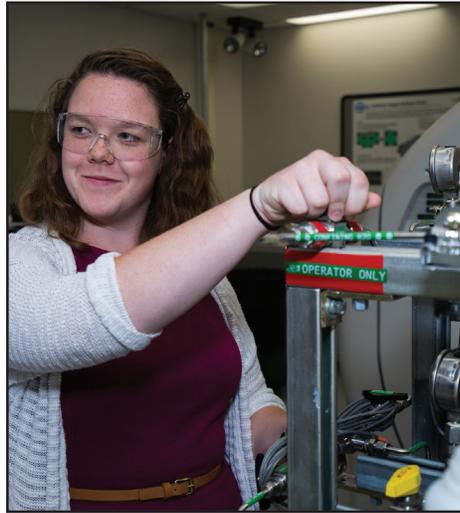


Nancy Andres

Wendy Chunn

Scott A. Robbins

Kelly Schwehm



# NANCY ANDRES



Site Coordinator

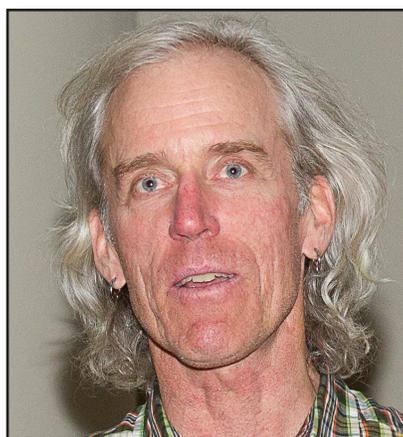
Program Analyst

Office of S&T Career Management

National Energy Technology Laboratory, Pittsburgh, PA

Nancy Andres is a member of NETL's Laboratory Operations Center, Office of Science & Technology Career Management. She manages post-secondary education and outreach programs for NETL. She serves as the site coordinator for the Albany, Oregon; Morgantown, WV; and Pittsburgh, PA sites. This is her sixth year of involvement with the Mickey Leland Energy Fellowship Program.

# SCOTT A. ROBBINS



Site Coordinator

Program Manager for the Student Programs Office

Los Alamos National Laboratory

Since 2007 Scott has been serving as the Program Manager for the Student Programs Office at Los Alamos National Laboratory (LANL). In this capacity he supports students, mentors, and management to ensure the best outcomes for all stakeholders. Prior to this Scott worked at LANL and at Intel as a training and program evaluation specialist. As a Senior Training Specialist at LANL Scott provided specialized support in the areas of job analysis, training staff development, and training program evaluation. For over fifteen years Scott worked as a Nuclear Facility Training Coordinator, training program designer, and Team Leader in the realm of environment, safety and health training. He has taught college courses on training & human performance at both the undergraduate and graduate level. He has also provided training and evaluation consultant support for corporations and non-profit enterprises in Northern New Mexico. He earned his B.A. in Education from University of Montana, an M.S. in Instructional Technology from University of Oregon, and his Ph.D. in Program Evaluation from the University of New Mexico.

# WENDY CHUNN



Site Coordinator

Office of Work Based Learning

Pacific Northwest National Laboratory

# KELLY SCHWEHM



Site Coordinator

General Engineer

Strategic Petroleum Reserve, New Orleans, LA

6th Year Site Coordinator

Kelly Schwehm is a General Engineer serving as the New Orleans Senior Site Representative in the Site Operations & Maintenance Division of the Department of Energy's Strategic Petroleum Reserve (SPR). She received both her Bachelor of Science in Mechanical Engineering (2002) and Master of Business Administration (2007) from the University of New Orleans. She has been with the SPR's New Orleans office for 10 years (4 years in Quality Assurance and 6 years in Site Operations and Maintenance). This is her sixth year serving as a Mickey Leland Energy Fellowship Program site coordinator. She also holds the position of Lesbian, Gay, Bisexual & Transgender (LGBT) Program Manager on the SPR's Employee Management Advisory Committee.

# NOTES

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## Mickey Leland Energy Fellowship Program

For more information please contact:

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Office of Fossil Energy

National Energy Technology Laboratory

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Pacific Northwest National Laboratory

Strategic Petroleum Reserve



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