2024 Consortium of Hybrid Resilient Energy Systems (CHRES) Technical Forum

July 22 & 23, 2024

National Energy Technology Laboratory
Morgantown, WV

https://netl.doe.gov/events/24CHRES

Welcome

Preparing a diversified workforce that can oversee and maintain the current energy infrastructure, manage the efficient use of energy, and discover new environmentally responsible ways to generate, store and distribute energy is critical to the future of our nation's security and economy. The CHRES consortium's research and development is focused on the integration of energy systems, including hybridization of power systems, renewable energy sources, energy storage, energy conversion, and modeling & simulation of power grids. The CHRES consortium is dedicated to building and supporting a sustainable STEM career pipeline and best preparing those specifically in the Hispanic community to meet the future energy needs of our society. During their appointments, participants gain access to world class researchers and scientists, use one-of-a-kind equipment and facilities, collaborate with subject matter experts, author/co-author papers, and attend/present at conferences. They receive hands-on experience, professional opportunities, and personal growth for a well-rounded experience. This event provides a forum for student and faculty participants to show what they are learning and the important contributions they are making at the national labs and universities to solve the nation's energy challenges. Students will give a 12-minute presentation with a 3-minute Q&A session. In addition, the NETL participants will provide a tour and demonstration of the Hybrid Performance Facility (HyPer).

How to join this Webex event:

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DAY 1

Monday, July 22, 2024

(All times shown are EST)

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10:05 am	**Opening Remark** – *Betsy Snell, Program Manager, MSIPP/NNSA/DOE*
10:10 am	**Opening Remark** – *NETL Manager*
10:15 am	Urine to Energy Using Proteus Mirabilis-Pt/Pt-Ni Systems for Urea to Ammonia Oxidation – *Galilea De La O/Andrea Hernandez, UTEP*
10:30 am	Enhancing Signal Performance of RFID in Industrial Environments for PRDs and Nuclear Inventory – *Giovanni Cartagena Marrero/Diego Merchan Rueda/ Armando Diaz De Jesus, LLNL*
10:45 am	Effect of Parametric Spectra on Annual Energy Estimation – *Rafael Baez Ramirez, SNL*
11:00 am	Engineering Tasks in Constructing World's First Automated SOFC-GT Hybrid Power Generating System – *Miguel Camarena, NETL*
11:15 am	Integrating Grid-Forming Inverters: A Necessity for Modern Power Systems– *Zeeshan Akhtar, UPRM*
11:30 am	Low-Cost Micro Wind Turbine Control System with Monitoring and Braking Capabilities – *Derek Vargas/Jorge Carde, UAGM*
11:45 am	Material Testing for Advanced Nuclear Reactor – *Aaron Holzer, UNM*
12:00 pm	**Picture/Lunch Break**
1:00 pm	2024 US DoEnergy Solar District Cup: Dallas Division – The UPRM Experience – *Amanda Calderon , UPRM*
1:15 pm	Offshore Wind Farm Development: Puerto Rico – *Luis A. Negron Torres, UPRM*
1:30 pm	Proyecto Luz Verde UPRM: Project-Based-Learning Education on Energy Using Off-Grid PV Systems – *Javier Moscoso, UPRM*
1:45 pm	Simulation Models for Extreme Environments: Estimating Thermal Performance and Structural Resistance on Turbines for Airplanes – *Brian Reyez , UPRM*

Monday, July 22, 2024 *(continued)*

(All times shown are EST)

2:00 pm	Mathematical Models of Hybrid DC Microgrids – *Dilcia Santos, UPRM*
2:15 pm	Airborne Wind Energy Systems – *Nico Galarza, SNL*
2:30 pm	Wave Energy Converter (WEC) Modeling in Julia – *Jaime Lopez-Molina Bendecu, SNL*
2:45 pm	Heliostats Wind Analysis – *Javier Martell, SNL*
3:00 pm	Evaluation of Damage Tolerance for Alternative Glass Fiber Formulations for Edgewise Reinforcement of Large Rotors – *Lucas Muller, SNL*
3:15 pm	Enhancing the User Experience for Hydrogen Extremely Low Probability of Rupture (HELPR) – *Liara Ortiz, SNL*
3:30 pm	Understanding Wind Energy Systems – *Joseliz Perez Rovira, SNL*
3:45 pm	Modeling Osmotic Coefficients, Vapor Pressures and Water Activities of Electrolyte Solutions Using EQ3/6 Version 8.0a – *David Reyes Soto, SNL*
4:00 pm	A Methodology To Incorporate Wave Energy Converter (WEC) Devices Into Microgrid Design Toolkit (MDT) – *Luis Rodriguez Rodriguez, SNL*
4:15 pm	IEEE 1547 Standards Applied to Wind Turbine Generators – *Edgardo Desarden Carrero, SNL*
4:30 pm	Optimization of the Portable Power Station with Several Sources of Energy for Emergencies – *Pedro Carrasco/Anthony Ortiz, UAGM*
4:45 pm	**Adjourn**

Agenda

DAY 2

Tuesday, July 23, 2024

(All times shown are EST)

8:30 am	*On-site participant arrival and check-in*
9:00 am	**TOUR**
10:00 am	Measuring Stored Energy in Shape Memory Polymers – *Benjamin Estrada, UTEP*
10:15 am	Development of Porous Silica and Ionic Liquid-Based Deep Eutectic Solvent Composites for Energy-Relevant Chemical Separations – *Natalia Gonzalez, UTEP*
10:30 am	Electrode-Induced Nanostructures of Surface-Active Ionic Liquids (SAILs) on Planar Interfaces – *Silvestre Guillen, UTEP*
10:45 am	Nanocontainers Based on Surface Active Ionic Liquids for nanoparticle Synthesis – *Elisa Morales Figueras, UTEP*
11:00 am	The Development of the Processing Parameters for a Functional Graded Ultra-High Temperature Ceramic – *Joseph Munoz, UTEP*
11:15 am	Mineral Nucleation and Growth in Nanopores and Planar Interfaces – *Bryan Rodriguez Tirado, UTEP*
11:30 am	Fundamental Study of Role of Microwave Irradiation for Catalytic Reactions using Carbon Dioxide as a Probe Molecule – *Zachary Chanoi, NETL*
11:45 am	The Development of the Processing Parameters for a Functional Graded Ultra-High Temperature Ceramic– *Melvin Foster, NETL*
12:00 pm	**Lunch Break**
1:00 pm	UAS Guidance and Flight Restrictions – *Braian Diaz Aquino, LLNL*
1:15 pm	Modelling the Effect of Small Quantity of Explosives on Drywall Using FEA Models – *Jorge E. Jimenez Ortiz, LLNL*
1:30 pm	Neutron Flux Measurements using Foil Activation – *Kevin Donnelly, LLNL*

Tuesday, July 23, 2024 *(continued)*

(All times shown are EST)

1:45 pm	Leveraging Analytical Techniques for Environmental Health and Safety In-Field Observations of Qualitative and Quantitative Data – *Giovanni Cartagena, Armando Diaz, and Diego Merchan. LLNL*
2:00 pm	Implementation of a Control System for a Three-Phase Inverter – *Ricardo Acosta Rivera, UNM*
2:15 pm	Real-Time Monitoring of Wind Turbine Propellers for Advanced Structural Health Monitoring – *Christian Torres Ortiz, UNM*
2:30 pm	Real-Time Tracking of Wind Turbines – *Jahsyel Rojas Ortiz, UNM*
2:45 pm	Human-Robot Interfaces for Emergencies Planning and Control – *Fabiola Reyes-Rios, UNM*
3:00 pm	Increasing Bandwidth of Kinetic Meso-Scale Energy Harvesters using Parachute-Based Proof Mass – Charlie Vizcaya, *UNM*
3:15 pm	Implementation of a Control System for a 3-Phase Inverter through LabVIEW – *James Tapia, UNM*
3:30 pm	Acoustical Pyrometry Techniques for Harsh Environment Energy Systems – *Marielly Rodriguez-Gauthier, UNM*
3:45 pm	Utilization of Ferromagnetic Material to Boost RFID Signal in Situations with Metal Interference – *Nahomy Hernandez, LLNL*
4:00 pm	Optimization of the Hybrid Portable Power Station for Emergencies – *Daniel Mera, UAGM*
4:15 pm	Assessment of Energy Efficiency using pervious concrete – *Lissette Rubero/Orlando Colon, UAGM*
4:30 pm	**Closing Remarks** – *David Tucker, NETL*

Galilea Montserrat De La O

College/University: University of Texas at El Paso

Field of Study: Chemistry/Biological Sciences

Research Advisor: Dr. Cartos Cabrera

Research Location: University of Texas at El Paso

Project Title: Urine to Energy Using Proteus Mirabilis-Pt/Pt-Ni Systems for Urea to Ammonia Oxidation

Description of Your Summer Project:
Urine is a common waste that is produced by every living being in this world, urea is a byproduct that is converted to ammonia by using certain techniques. Ammonia can be used as a clean source of energy by using Ammonia Oxidation Reaction. In my project I am using a platinum/nickel electrode to convert urea to ammonia to energy using synthetic urine and Proteus Mirabilis bacteria which naturally produces urease. The bacteria will be cultured and then applied onto the surface of my electrode to run the Ammonia Oxidation Reaction to successfully remove the ammonia from the synthetic urine.

What You Like Best About the Summer Research Project/Experience:
I enjoy coming into the laboratory every day to work on my project, it's allowed me to learn new terms and new techniques to maintain a clean environment for my experiment. Being in lab is comforting and it lets me communicate with my lab colleagues about any issue I might be having. Everyone is understanding and it makes coming to school joyful and entertaining. Working with bacteria is also something I've never done before and it's truly an amazing experience.

Andrea Hernandez

College/University: The University of Texas at El Paso

Field of Study: Biochemistry

Research Advisor: Dr. Carlos Cabrera

Research Location: UTEP CCSB Building

Project Title: Urine to Energy Using Proteus Mirabilis - Pt/Pt -Ni Systems for Urea to Ammonia Oxidation Reaction (AOR)

Description of Your Summer Project:
Ammonia (NH3) is a colorless, toxic and corrosive gas with an unpleasant odor, emitted by both biogenic and anthropogenic sources. When present in a large amount of water, ammonia is highly detrimental to the aquatic life as it induces immoderate growth of algae, which it increases the biological oxygen demand and eventually lead to death. Therefore, the study of the electro-oxidation of ammonia is an important issue in the environmental field for the electrochemical removal of ammonia from wastewater. The use of Proteus Mirabilis can produce urease, an enzyme that catalyzes the conversion of urea to ammonia. At the same time, ammonia can be oxidized using platinum electrodes, to eliminate ammonia and produce an oxidation current that may be used for self-sustained systems. The final objective is to obtain a urea/ammonia- free recycled urine solution that can be later treated by reverse osmosis to eliminate the rest of the components of urine to obtain drinkable water.

What You Like Best About the Summer Research Project/Experience:
The best part of this research summer experience is the immersive learning environment where hands-on projects foster deep understanding. Collaborating with mentors and laboratory partners sparks creativity and innovation. The opportunity to contribute to meaningful work, develop new skills and explore potential career paths makes it an invaluable and transformative experience.

Nahomy Hernández Pagán

College/University: University of Puerto Rico, Mayagüez

Field of Study: Chemical Engineering

Research Advisor: Raul Lara and Heather Ottaway

Research Location: LLNL

Project Title: Utilization of Ferromagnetic Material to Boost RFID Signal in Situations with Metal Interference

Description of Your Summer Project:
My research project is focused on implementing a mount on the current LLNL ChemTrack Radiofrequency Identification (RFID) tag used for tracking chemical equipment inventory. The goal is to increase the RFID tag's signal and make it capable of working on metallic surfaces and environments. The MnZn ferrite helps redirect these currents and thus boost the signal. It was selected as our ferromagnetic material.

I am also involved in a pilot project to use ChemTrack RFID tags to track pressure relief devices (PRD) and nuclear material containers. Boosting RFID tag's signals should help in these applications as well.

Additionally, I work in the Sustainability Office, assisting with Scoop 3 Emissions, Meter Mapping, and Site 300 Water Tanks Microsoft form. The goal of Scoop 3 was to accurately measure and report indirect greenhouse gas emissions associated with employee travel at LLNL. Meter mapping is involved in collecting and recording the geographical coordinates of electrical and water meters located at Site 200 to replace these current meters with cellular meters. Finally, for Site 300, a Microsoft form was created to collect and record the water used in the laboratory.

What You Like Best About the Summer Research Project/Experience:
It has been exciting to be able to implement my knowledge in an area that is not so focused on my concentration and challenge myself with the project.

Additionally, being able to expand my areas of interest by going on different tours and having the opportunity to speak with subject matter experts (SME's) about the different areas and professions that make up the laboratory has been great. Also, working on different projects at the same time and being able to interact with students from different concentrations but with a common goal. Without a doubt, my experience in the laboratory allowed me to explore areas within it as well as outside of Livermore.

Giovanni A. Cartagena Marrero

College/University: University of Puerto Rico at Mayagüez

Field of Study: Mechanical Engineering with a minor in Computer Science

Research Advisors: Bernd Werres and Raul Lara

Research Location: LLNL

Project Title: Enhancing Signal Performance of RFID in Industrial Environments for PRDs and Nuclear Inventory

Description of Your Summer Project:
My main summer project involves creating a pilot program at LLNL to track pressure relief devices (PRDs) and nuclear material containers using Radiofrequency Identification (RFID) technology. Implementing an efficient RFID tracking system saves time and effort, enhances safety planning, and training for inventory management. This system ensures easy tracking and accountability for PRDs and nuclear material containers, contributing to a secure workspace.

I'm also working on an exploratory analysis project using Natural Language Processing (NLP) to evaluate in-field ES&H observations. By extracting insights from inspections and forms required by safety guidelines, we aim to identify patterns and recommend changes or eliminations. Python's NLTK library helps us analyze the data and provide suggestions to subject matter experts. This analysis enhances safety, efficiency, and decision-making within the laboratory.

What You Like Best About the Summer Research Project/Experience:
One aspect I like about this summer research experience is the opportunity to meet and learn from subject matter experts at ES&H. Their guidance and briefings have been invaluable in expanding our knowledge of different projects. Working on the RFID project PRDs and nuclear material containers has had a profound impact on my Mechanical Engineering studies and minor in Computer Science. It has enhanced my technical skills and allowed me to apply my knowledge in developing efficient data management algorithms. Moreover, it has deepened my understanding of safety protocols in engineering projects involving nuclear materials. The chance to work on a side project alongside the main one has also been fantastic for exploring diverse research topics and expanding my skill set. Overall, this summer research experience has been rewarding and provided invaluable opportunities for learning and personal growth.

Diego H. Merchan Rueda

College/University: Ana G. Méndez University

Field of Study: Computer Engineering

Research Advisor: Raul Lara

Research Location: LLNL

Project Title: Leveraging Analytical Techniques for Environmental Heath and Safety In-Field Observations of Qualitative and Quantitative Data

Description of Your Summer Project:
LLNL would like to utilize the current RFID (Radio Frequency Identification) system used in ChemTrack for additional programs. These applications are in areas with metal interference. My research project is to test and determine if the Radiofrequency Identification (RFID) system performs well, with good performance and readability in environments with metal interference. Testing will be conducted in two instances: RFIDs working with Pressure Relief Devices (PRDs) and with nuclear material containers. The results obtained by the testing will determine if the system is suitable for the desired application.

At LLNL, there are currently systems in place to produce in-field observations of environmental health and safety risks. Therefore, I will be working on another project focused on Natural Language Processing (NLP) to analyze all the data from the employee's evaluation. The goal is to categorize collected data, enabling the laboratory to efficiently identify and prioritize areas requiring significant attention based on evaluation counts.

What You Like Best About the Summer Research Project/Experience:
What I like most about this experience with LLNL is the multiple projects of diverse areas where I can work, irrespective of one's field of study. This provides the opportunity to increase my work experience in different areas of expertise. Moreover, the employees here that have been involved in different projects are open to talking about their projects and discuss it, which is truly remarkable.

Armando R. Diaz De Jesus

College/University: University of Puerto Rico Mayaguez

Field of Study: Mechanical Engineering

Research Advisors: Bernd Werres and Raul Lara

Research Location: LLNL

Project Title: Enhancing Signal Performance of RFID in Industrial Environments for PRDs and Nuclear Inventory

Description of Your Summer Project:
The focus of my research project is utilizing Radiofrequency Identification (RFID) to quickly and efficiently take inventory of the various pressure relief devices (PRDs) and nuclear material containers throughout LLNL. Since these devices and containers are comprised of and/or are surrounded by metal, and RFIDs tend to lose efficiency when there is metal present, the project seeks to find ideal orientations and proper distances that would allow for successful scanning of such metallic objects. I proposed a series of tests utilizing different arrangements, scanning the objects in those arrangements, and comparing the ratio of successful to failed scans between all the tests to find a desirable orientation of metallic objects for scanning purposes that can be used actively in storage at LLNL. As low as reasonably achievable (ALARA) is a key safety concept for work in the proximity of radioactive materials. Time, distance, and shielding are key ALARA concepts to protect workers. Faster and more accurate scans using RFIDs can reduce dose and lower exposure of personnel.

What You Like Best About the Summer Research Project/Experience:
I've thoroughly enjoyed the abundance of interesting subjects inside LLNL. It really helps to broaden my sights on what can be done, and in some sense what I can eventually get to do in the future. The size of the lab has also been somewhat enjoyable, and I also enjoy the plethora of enjoyable public events from LLESA as they have been a nice change of pace from being in an office.

Rafael Baez Ramirez

College/University: University of Texas at El Paso

Field of Study: Computer Science

Research Advisor: Carlos A. Michelen Strofer

Research Location: Sandia National Laboratories

Project Title: Effect of Parametric Spectra on Annual Energy Estimation

Description of Your Summer Project:
When we record the energy of ocean waves in spectral density form, they can be converted into two parameters that are also used to reconstruct another spectra with the same characteristics. These parameters are used to get the distribution of similar spectra and help calculate/estimate the power output of wave energy convertors. This compact form loses the information needed to completely reconstruct the original spectra.

Last year, autoencoders were successful in better preserving the original spectra when reconstructing them from learned parameters. Building on that, further constraining the model using a custom activation function we can enforce specific spectra characteristics. These constraints allow the autoencoder to solely focus on the "shape" of the spectra and describe them as two learned parameters in our experiments. We learned that the autoencoder has an interesting tradeoff between preserving the reconstructed values and distribution; sacrificing the latter, resulting in inaccurate energy estimations but overall better spectra reconstruction.

What You Like Best About the Summer Research Project/Experience:
I continued working with my mentor year-round during my school semesters after the summer and I can confidently say that it is more interesting to work in-person than virtually. Once my access was up to date, many of the issues I faced the last summer were easily resolved this time around. I am still grateful for all the faculty and staff that I have encountered, everyone helps each other out when they can and are patient enough to face issues that are sometimes unique to me and haven't been encountered for some time, if at all. I didn't require any new theory this time around so I was able to quickly get to work on the project and like last year, my mentor was always offering to help if I got stuck.

Miguel J. Camarena

College/University: University of Texas at El Paso

Field of Study: Mechanical Engineering

Research Advisors: David Tucker and Nana Zhou

Research Location: NETL – Morgantown, WV

Project Title: Engineering Tasks in Constructing World's First Automated SOFC-GT Hybrid Power Generating System

Description of Your Summer Project:
My summer project entails supporting the mechanical and process engineering design team by addressing challenges during the construction of the world's first automated Solid Oxide Fuel Cell–Gas Turbine (SOFC-GT) hybrid system. This includes redesigning system components as fabrication progresses while minimizing expensive rework and fabricator delays. For example, calculating and selecting safety rupture disks for bottled gases to prevent the dangerous buildup of pressure in the case a gas regulator fails, designing a steam condensate line with special attention to protect equipment, and redesigning the inlet/outlet connections for a solid oxide fuel cell after the vendor-provided fuel cell was revealed to have a wholly modified design.

What You Like Best About the Summer Research Project/Experience:
Participating in summer research has been transformative by allowing for an opportunity in self-reflection, meeting, and collaboration with new people, and being challenged to learn about a new field in a short period of time. Specifically, past and present research experiences have helped broaden my understanding about topics in mechanical engineering, chemistry, and material science which have helped to influence my career choice.

Derek Vargas Figueroa

College/University: Universidad Ana G. Méndez

Field of Study: Engineering

Research Advisor: Dr. Diego A. Aponte-Roa

Research Location: Gurabo, PR

Project Title: Low-Cost Micro Wind Turbine Control System with Monitoring and Braking Capabilities

Description of Your Summer Project:
This summer project consists of an integrated control system for micro wind turbines with monitoring and electronic capabilities. This project promotes using off-the-shelf components for low costs. Our control system consists of an electronic braking circuit implemented to prevent undesired situations like overvoltage or to facilitate manual intervention when needed. A microcontroller is used to activate the braking system automatically or manually. For manually braking, an emergency button is added to send the desired signal to the microcontroller. Our monitoring system use sensors for measurements on RPM, input and output currents, input and out voltages, power, and emergency button state.

What You Like Best About the Summer Research Project/Experience:
Working on this summer research project has positively impacted me. I particularly enjoy assignments that challenge my experience as an electrical engineer. These tasks require me to research and acquire new skills, fostering my professional growth as an engineer. In addition, I am improving my hands-on skills through experiments that include Hardware and Software, and the manipulation of different measuring instruments.

Jorge J. Cardé Santiago

College/University: Universidad Ana G. Méndez, Gurabo

Field of Study: Computer Science & Engineering

Research Advisor: Dr. Diego A. Aponte Roa

Research Location: Gurabo, Puerto Rico

Project Title: Low-Cost Micro Wind Turbine Control System with Monitoring and Braking Capabilities

Description of Your Summer Project:
This summer project focuses on creating an integrated control system for micro wind turbines with robust monitoring and electronic capabilities. Emphasizing cost-effectiveness, we utilize off-the-shelf components. Central to the project is an electronic braking circuit, designed to prevent overgeneration and enable manual intervention when necessary. This circuit works together with a microcontroller, which autonomously or manually activates the braking system. For manual control, an emergency button sends a direct signal to the microcontroller.

Our monitoring system, driven by advanced programming, employs sensors to measure RPM, input and output currents, voltages, power, and button status. These sensors provide real-time data to the microcontroller, which processes and analyzes the information to ensure optimal performance and safety.

What You Like Best About the Summer Research Project/Experience:
Participating in a summer research project has greatly benefited me. I especially enjoy assignments that challenge my skills as a computer engineer. These projects push me to delve into new areas and acquire additional expertise, enhancing my professional growth and development. The opportunity to continuously learn and apply new knowledge has been invaluable in advancing my career.

Aaron Holzer

College/University: University of New Mexico

Field of Study: Nuclear Engineering

Research Advisor: Dr. Osman Anderoglu

Research Location: University of New Mexico, Extreme Materials lab, Albuquerque, New Mexico

Project Title: Materials Testing for Advanced Nuclear Reactors

Description of Your Summer Project:
I work in a few of Dr. Anderoglu's labs at UNM. In his extreme materials lab I have been helping design and install components for an inert atmosphere annealing/high heat quartz tube set-up. I've also gotten to work in the Nuclear lab at the cryogenic tensile strength testing set-up that they have. Here we use a cryogenic mixture to cool samples down to extreme temperatures, from there we use a large machine, that is really just two mechanical arms that pull on the sample until it breaks. I will also be using an SEM/EBSD to look at the crystal structure of the samples we test.

What You Like Best About the Summer Research Project/Experience:
I really just like doing the lab work, for example, figuring out all the problems and solutions while setting up the annealing equipment was like a puzzle, I would do hours of research and checking dozens of different valves and components just to make sure it followed all the rules and would also function. I feel like I have a much better understanding of what an engineer really does through being part of this program.

Amanda M. Calderón Cotto

College/University: University of Puerto Rico Mayagüez

Field of Study: Industrial Engineering

Research Advisor: Dr. Eduardo Ortiz

Research Location: University of Puerto Rico Mayagüez

Project Title: 2024 US DoEnergy Solar District Cup: Dallas Division – The UPRM Experience

Description of Your Summer Project:
The U.S. Department of Energy Solar District Cup challenges multidisciplinary students to create, develop, and model solar energy distribution systems. In this research, I worked on analyzing how we developed a project plan for the solar energy system at the University of Dallas and what our experience was like. I focused on the financial aspect of the project and the methods and resources used. Also, other resources that, although not used, could be of great help in future projects.

What You Like Best About the Summer Research Project/Experience:
I enjoyed the experience of learning the process of designing a system that, in its implementation, would benefit many people. In addition, I learned the importance of the financial aspect in projects and all the resources and stuff to consider when carrying out a robust analysis. Thus, making this a realistic one to know the project's viability and if it will obtain a return and financial benefits.

Luis A. Negrón Torres

College/University: University of Puerto Rico Mayagüez

Field of Study: Mechanical Engineering

Research Advisor: Dr. Eduardo I. Ortiz Rivera

Research Location: Mayagüez, Puerto Rico

Project Title: Offshore Wind Farm Development: Puerto Rico

Description of Your Summer Project:
Aeropower's Wind Farm Development Division has worked on researching and developing an offshore wind farm project on Puerto Rico's eastern coast which incorporates a hydrogen electrolysis and fuel cell plant. The project encompassed an interdisciplinary effort to research, locate, and design an offshore wind farm that can help power Puerto Rico with clean, sustainable energy. The project involved choosing a favorable turbine, creating an interconnection plan that caters our needs, and design infrastructure to support our wind farm plan. All while avoiding critical marine habitat, protecting natural resources , and maintaining a positive outlook towards renewables.

What You Like Best About the Summer Research Project/Experience:
What I liked best about this project is that it made me work on an important, yet untouched topic. Having to figure out which decisions to make and which assumptions to infer was a real challenge, but it helped us understand just how important this topic really is. Having to consult with professors in the industry allowed us to know that we have made a great effort on our work, and that this will positively impact our energetic future.

Brian L. Reyes Santiago

College/University: University of Puerto Rico Mayagüez

Field of Study: Computer Science & Engineering

Research Advisor: Dr. Eduardo Ortiz

Research Location: University of Puerto Rico Mayagüez

Project Title: Simulation Models for Extreme Environments: Estimating Thermal Performance and Structural Resistance on Turbines for Airplanes

Description of Your Summer Project:
I researched the thermal performance and structural resistance of airplane turbines in extreme conditions, particularly through simulations for the design of more efficient turbofans.

What You Like Best About the Summer Research Project/Experience:
I enjoy the opportunity to learn new subjects and the interactions with my team. Because of our varied research group, there are many opportunities to get unique feedback based on everyone's perspectives. These interactions help in the decision-making process and the fluidity of the work.

Dilcia D. Santos

College/University: University of Puerto Rico Mayagüez

Field of Study: Electrical Engineering

Research Advisor: Dr. Eduardo Ortiz

Research Location: University of Puerto Rico Mayagüez

Project Title: Mathematical Models of Hybrid DC Microgrids

Description of Your Summer Project:
Development of a mathematical model of hybrid DC microgrids using MATLAB/Simulink; carry out a study of the behavior of the microgrid, including elements such as capacitors, DC-DC converters, inverters, transmission lines and loads, also considering transmission losses and using solar energy systems, thermoelectric generators and battery banks as sources of energy generation.

What You Like Best About the Summer Research Project/Experience:
The summer research project allows us to have the opportunity to have a support group and share knowledge and experiences with the research group in which we are working, acquire new experiences and/or knowledge in other areas of study or of particular interest and that contribute to our path in science and engineering, also delving into the use of tools and software that allow us to achieve our future research objectives.

Nico E. Galarza Morales

College/University: University Ana G. Mendez

Field of Study: Electrical Engineering

Research Advisor: Brent Houchens

Research Location: Sandia National Laboratories

Project Title: Airborne Wind Energy Systems

Description of Your Summer Project:
Airborne Wind Energy systems (AWES) allow for harnessing of winds at high altitudes through the replacement of a conventional wind turbine tower with tethers and a lifting body such as a kite, wing, or lighter than air gas envelope. However, these systems are still in prototype stages and require suitable locations for testing and development. This research focuses on exploring locations that could provide a test range for AWES. The analysis incorporates data from the Global Wind Atlas to evaluate mean wind speeds and power densities, while also utilizing GIS data to consider protected habitats for endangered species, electrical grid infrastructure, airport locations, and any additional resources that could benefit AWES.

What You Like Best About the Summer Research Project/Experience:
Participating in my summer research project at Sandia National Laboratories has been an enriching and exciting experience. One of my favorite moments was visiting the solar tower, where the team members were very knowledgeable and friendly. Additionally, collaborating with Sandia's wind team has been a great experience. I had the privilege of working with my mentor, Brent Houchens, who possesses extensive knowledge in the field. His guidance and support have greatly contributed to my growth throughout this summer research.

Jaime Lopez-Molina Bendecu

College/University: University of Puerto Rico-Mayaguez

Field of Study: Electrical Engineering

Research Advisor: Jeff Grasberger

Research Location: Sandia National Laboratories

Project Title: Wave Energy Converter (WEC) Modeling in Julia

Description of Your Summer Project:
Wave Energy Converters (WECs) are devices designed to capture and convert the kinetic and potential energy of ocean waves into usable electrical power These contribute to the diversification of renewable energy sources and are being applied for achieving climate goals. My work is on the development of the previously MATLAB-made WEC-Sim app onto Julia programming language to test the capabilities of Julia for generating body to body interactions simulations and visualizations for Wave Energy Converter (WEC) technologies.

What You Like Best About the Summer Research Project/Experience:
This summer research has brought me new opportunities to challenge and expose myself professionally, allowing me to explore various areas and engage in different activities throughout the New Mexico area. I also loved getting to know more about Sandia National Laboratories through their informative tours and by working closely with my team on my project. These experiences have enriched my understanding of the field of Wave Energy Converters and provided me with valuable insights into the practical applications of my academic area. I am really grateful to have had this internship opportunity.

Javier Martell

College/University: University of Texas at El Paso

Field of Study: M.S. Mechanical Engineering

Research Advisor: Dr. Kenneth Armijo

Research Location: Sandia National Laboratories

Project Title: Heliostats Wind Analysis

Description of Your Summer Project:
Heliostats experience wind loads that influence the efficiency and material selection that they are built with. Traditionally, Heliostats are built with steel to ensure structural safety when operating at high wind velocities. By creating a digital wind tunnel model, the heliostat structure can be studied under different wind speeds and configurations. By extracting these pressure loads on the heliostat, and performing a FEA harmonic analysis response, different materials can be studied to assess better vibration response and structural integrity.

What You Like Best About the Summer Research Project/Experience:
The thing that I liked the most is the opportunity that I got to work on impactful research projects and really get hands on experience. I don't think that I would have gotten this much trust as an intern to work and solve engineering problems anywhere else.

Lucas J. Muller

College/University: University of New Mexico

Field of Study: Mechanical Engineering

Research Advisor: Ryan Clarke

Research Location: Sandia National Laboratories

Project Title: Evaluation of Damage Tolerance for Alternative Glass Fiber Formulations for Edgewise Reinforcement of Large Rotors

Description of Your Summer Project:
The purpose of this incubator project is io investigate the viability of the use Beryllium Oxide glass for edgewise reinforcement of wind turbine blades. The primary design consideration is the economic viability given the decreased usage of glass in the design. The secondary design consideration is the ability for said turbine blades to resist damage in the trailing edge bond line. One way of measuring this ability to resist damage is to determine how quickly a crack will grow, which governed by Paris' Law.

The rate of crack growth can be found using the Strain Energy Release Rate (SERR), along with two material properties found experimentally. The SERR for a trailing edge crack can be approximated using a 2nd order solution for a cracked elastic beam undergoing an axial load. This SERR can then be compared between the designs to determine how likely a design/material is resist damage to the trailing edge bond line.

What You Like Best About the Summer Research Project/Experience:
So far, This investigation into the edgewise reinforcement of large rotors has allowed me to gain more knowledge of both composite structures, along with fracture and fatigue mechanics of those composites. Along with this, I have gotten some experience with how ANSYS, FAST, and MATLAB programs are used in the simulation of wind turbine blades. I did not know a lot about wind turbine blade, nor the forces that they experience. Along with this, I have greatly enjoyed the tours that FORCEE and CHRES have set up for us.

Liara Ortiz

College/University: University of Puerto Rico - Mayaguez

Field of Study: Chemical Engineering

Research Advisor: Benjamin Schroeder

Research Location: Sandia National Laboratories

Project Title: Enhancing the User Experience for Hydrogen Extremely Low Probability of Rupture (HELPR)

Description of Your Summer Project:
Hydrogen Extremely Low Probability of Rupture (HELPR) is a modeling platform that utilizes engineering and probabilistic models to assess the structural integrity of pipeline infrastructure for the transmission and distribution of hydrogen natural gas blends. This program tool uses deterministic and probabilistic methods to analyze user-specified inputs and form predictions on the effect of hydrogen on pipeline infrastructure. With growing interest in using hydrogen as an energy source, HELPR can help predict fatigue and fracture risks in blending hydrogen into natural gas pipelines and ensure a safer process. My part in this project requires writing and organizing the user manual for HELPR to assist users in navigating the platform, understanding its features, and completing the desired studies effectively.

What You Like Best About the Summer Research Project/Experience:
Sandia National Laboratories has been a great place to learn and grow as a person and professional. My mentor has been amazingly helpful through this whole process, making the production of the HELPR user manual a wonderful experience. Working on HELPR has given me the opportunity to learn about hydrogen as a healthier source of energy than carbon. Taking part in something that could impact the world in such a significant, positive way feels incredibly rewarding, and it inspires me to look for similar projects in the future.

Joseliz Perez Rovira

College/University: University of Puerto Rico

Field of Study: Mechanical Engineering

Research Advisor: Jon Berg

Research Location: Sandia National Laboratories

Project Title: Understanding Wind Energy Systems

Description of Your Summer Project:
The objective of this project is to enhance the representation of Wind Energy Systems through the development of 3D visualizations for Wind Turbines and other renewable systems. This is achieved by leveraging 3D visualization tools such as MATLAB and Blender to process real-time data obtained from the laboratory. The project aims not only to benefit Sandia Employees but also to create an outreach version adapted for students from kindergarten to twelfth grade.

What You Like Best About the Summer Research Project/Experience:
What I like best about the summer research internships are the opportunities that are available both, within and beyond Sandia. I also think the experience that I have earned during my internship will play a vital role in shaping my future career. For example, I have always been interested in 3D rendered models and animation. My internship this year is related to Empowering Renewable Energy Through High Performance 3D Visualization. This represents a great opportunity to explore my interests and hopefully increasing renewable energy acceptance through enhanced visualization.

David José Reyes Soto

College/University: University of Puerto Rico Mayaguez Campus

Field of Study: Theoretical Physics

Research Advisor: Xiong Yongliang

Research Location: Sandia National Laboratories

Project Title: Modeling Osmotic Coefficients, Vapor Pressures and Water Activities of Electrolyte Solutions Using EQ3/6 Version 8.0a

Description of Your Summer Project:
A problem that hinders the further development of nuclear energy is the concerning doubts related to final disposal of nuclear waste. Although there are existing places where nuclear waste has been stored, like the Waste Isolation Pilot Plant at Carlsbad New Mexico, understanding the effects of nuclear waste disposal can further support the advancements of nuclear energies. To understand the effects of disposal of High-Level Nuclear Waste (NLW), it is important to understand the effects it causes to its surrounding environment. One of the aspects that must be investigated further is the geochemical interactions of groundwaters with such waste. In this project, we focus on implementing existing models to predict thermodynamic properties of high ionic strength solutions, EQ3/6 version 8.0a is a thermodynamic equilibrium code that can model solid-liquid-vapor equilibrium, and has been approved for use in nuclear waste disposal programs. This project additionally aims to further extend the applicability of this code, in coupling with python scripts, to model other thermodynamic properties such as osmotic coefficients, vapor pressures and water activities of electrolyte solutions.

What You Like Best About the Summer Research Project/Experience:
I have enjoyed many things about my summer research project. As a Theoretical Physicist, having to learn about aqueous geochemistry was certainly out of my comfort zone. However, I embraced the opportunity as much as I could, taking advantage of all the knowledge I could acquire. Additionally, spending time in an actual lab, where actual experiments get done was a surreal experience. Having the opportunity to contribute in the advancement of science, specially in the field of Nuclear Energy is something I will never forget. All said and done, by far what I have most enjoyed has been being able to apply past computational knowledge to develop models in fields I am not familiar with. As well as learn more computational skills and methods is definitely what I have most enjoyed of this summer research project.

Luis E. Rodriguez, E.I.T.

College/University: University of Puerto Rico at Mayaguez

Field of Study: Electrical Engineering (M.S.)

Research Advisor: Jorge Leon

Research Location: Sandia National Laboratories

Project Title: A Methodology To Incorporate Wave Energy Converter (WEC) Devices Into Microgrid Design Toolkit (MDT)

Description of Your Summer Project:
The summer project aims to develop a methodology to incorporate Wave Energy Converter (WEC) generation data into the Microgrid Design Toolkit (MDT). The wave resource for a potential location is characterized, and a resource profile is created and integrated into MDT. MDT (Microgrid Design Toolkit) is a software that can be used to design microgrids subject to different constraints. Using a model that includes wavebot, generator, rectifier, battery, inverter, and grid, a control system is designed to optimize power injection to the grid. The projects evaluates the wave resource and how it influences the sizing of solar microgrid with storage. This methodology aims to integrate wave resource into MDT to increase the integration of renewable sources in microgrid.

What You Like Best About the Summer Research Project/Experience:
What I have enjoyed most this summer has been the experience of being in a research and development environment. It is my first experience in this environment, and it has been challenging and gratifying. I have learned a lot and put a lot of prior knowledge into practice. I have had excellent mentors who have been with me in every step of the way, providing me with suggestions and feedback to continue learning. Also, what I like about working specifically on this project is that it is aligned with my interest and skills. Developing a methodology to incorporate wave resources into design of microgrids has improved my technical skills and has allowed me to contribute to the integration of renewable energy.

Edgardo Desarden Carrero

College/University: University of Puerto Rico Mayagüez

Field of Study: Electrical Engineering

Research Advisor: Rachid Darbali-Zamora

Research Location: Sandia National Laboratories

Project Title: IEEE 1547 Standards Applied to Wind Turbine Generators

Description of Your Summer Project:
Applied the IEEE 1547 standards to wind turbine generators to test their performance in supporting the grid through grid support functions (GSF), voltage (VRT), and frequency (FRT) right-throughs. When applied the 1547 standard to wind turbine generators, the Frequency-Watt control ensures that wind turbines can adjust their power output based on grid frequency variations, helping to maintain system stability. Volt-Var control allows wind turbines to manage reactive power, supporting voltage regulation and improving power quality. VRT ensures that turbines remain connected during voltage dips, while FRT requires turbines to stay online during frequency deviations. Complying with this standard guarantees the reliability, efficiency, and stability of wind power integration into the electrical grid, looking for a more robust and resilient energy system.

What You Like Best About the Summer Research Project/Experience:
What I value most about my summer research experience is the opportunity to utilize advanced technological equipment to simulate various challenging scenarios to test the performance of the wind turbine generator, which has been particularly valuable. Additionally, engaging with experts from diverse fields provides a comprehensive perspective on addressing research objectives. The collaborative and supportive environment at Sandia National Laboratories has made it an ideal place for research and a potential future workplace.

Benjamin R. Estrada

College/University: University of Texas at El Paso

Field of Study: Metallurgical And Materials Engineering

Research Advisor: Dr. David Roberson

Research Location: M302 Polymer Extrusion Lab

Project Title: Measuring Stored Energy in Shape Memory Polymers

Description of Your Summer Project:
The focus of this research project is to calculate the energy released during the recovery of shape memory polymers and relating this to their ability to revert to their original shape using Digital Image Correlation (DIC) and Dynamic Mechanical Analysis (DMA). This study aims to explore the potential application of 4-D manufacturing as energy storage devices by evaluating the energy dynamics and recovery efficiency of shape memory polymers contributing to the advancement of innovative energy storage solutions.

What You Like Best About the Summer Research Project/Experience:
This is my first time conducting research, making this experience both nerve wrenching and exciting. The aspect of this summer research project that I like best the most is its hands-on approach, which necessitates learning each component of the research process. This approach has enabled me to gain a deeper understanding of the results and the material as a whole. Additionally, it has afforded me the opportunity to explore various techniques not covered in our class curriculum.

Natalia Gonzalez

College/University: University of Texas at El Paso

Field of Study: Biological Sciences

Research Advisor: Dr. José L. Bañuelos

Research Location: Nanomaterials, Interfaces, and Confinement for Energy & the Environment (NICE^2) Laboratory, Department of Physics

Project Title: Development of Porous Silica and Ionic Liquid-Based Deep Eutectic Solvent Composites for Energy-Relevant Chemical Separations

Description of Your Summer Project:
In this research we will be making a mixture of Hydrophobic Deep Eutectic Solvents (HDESs) with Ethanol or acetone which have lower densities than the HDESs. The HDESs behavior is due to containing hydrogen donor and acceptor components allowing them to have low vapor pressure, be non-flammable, have high thermal stability, and an excellently low melting point allowing the HDESs to be a new target of interest for nano-lubrication and energy storage. We will observe the behavior of a mixture containing HDESs mixed with Ethanol or acetone with added Controlled Pore Glass (CPG 75), CPG 75 of 8 nm pores size, and mixtures without the CPG 75. Ethanol or acetone will be purified from all mixtures to focus on the chemical reaction of the HDESs with CPG 75 to confirm possible chemical separation. To compare these mixtures, Small and Wide Angle X-ray Scattering (SWAXS) will be used to measure the different intensities and observations for densities and chemical separations to store potential chemical energy.

What You Like Best About the Summer Research Project/Experience:
What I like best about this summer research project is the knowledge I am gaining every day along with the number of friendships I keep building along the way. Being a University student is not easy, especially a first generation, building friendships with people who have the same ambition as I has allowed me to understand we all have a journey ahead of us and the decisions we make along the way are up to us, but those decisions will define the success our hard work will bring. Learning something new every day does not mean you're behind; it just comes to show that we'll never know everything, but we can always try to learn the most we can.

Silvestre Guillen

College/University: University of Texas at El Paso

Field of Study: Biological Sciences

Research Advisor: Dr. José L. Bañuelos

Research Location: Nanomaterials, Interfaces, and Confinement for Energy & the Environment (NICE^2) Laboratory, Department of Physics

Project Title: Electrode-Induced Nanostructures of Surface-Active Ionic Liquids (SAILs) on Planar Interfaces

Description of Your Summer Project:
Surface-Active Ionic Liquids (SAILs) are surfactants with long alkyl chains that have a wide range of applications. Research on SAILs has shown their tendency to become nearly frictionless when a voltage is applied to them. In this project, a voltage current will be applied to Highly Oriented Pyrolytic Graphite (HOPG), which is classified as a superconductor and will serve as a planar interface for passing a controlled electric current on SAILs. By using Grazing Incidence Small Angle X-ray Scattering (GI-SAXS), we aim to understand the various properties SAILs exhibit when exposed to an electric current. This experiment will provide insights into how this reaction can be applied to scenarios requiring a frictionless surface, potentially leading to more efficient surfaces for use in various settings, from laboratory experiments to industrial applications, thereby enhancing long-term energy efficiency.

What You Like Best About the Summer Research Project/Experience:
What I like best about my summer research experience is the opportunity to work on a project I am passionate about. Seeing my fellow lab members make progress on their projects has made me feel like I have an important role in the research community, where my contributions make a significant impact. Expanding my skills and knowledge in both my project and research in general has been a fulfilling and unique experience. This has helped me become a better and more experienced researcher, and I hope to guide and help exceed incoming researchers in the future.

Elisa Morales Figueras

College/University: Universidad Ana G. Méndez, Recinto de Gurabo

Field of Study: Chemistry

Research Advisor: Dr. José L. Bañuelos

Research Location: Nanomaterials, Interfaces, and Confinement for Energy & the Environment (NICE^2) Laboratory

Project Title: Nanocontainers Based on Surface Active Ionic Liquids for nanoparticle Synthesis

Description of Your Summer Project:
This summer project involves synthesizing nanoparticles using Surface Active Ionic Liquids (SAILs) such as P14666 AOT, N8888 AOT, and P14666 DS as surfactants, with isooctane as the solvent, and water. Three different SAILs concentrations will be tested to determine which concentration leads to the most effective nanoparticle synthesis. The nanoparticles will then be analyzed using Small Angle X-ray Scattering (SAXS) and Wide Angle X-ray Scattering (WAXS). These instruments will be used to characterize the samples, providing structural information about the nanoparticles. Once the nanoparticles' sizes are controlled, it is hoped that they will impact our energy systems by being considered for applications in electrodes for energy storage or catalysis.

What You Like Best About the Summer Research Project/Experience:
I am particularly excited about this project because it involves cutting-edge research in nanotechnology, a field that has the potential to revolutionize various industries. The opportunity to explore practical applications of nanoparticles in energy storage and catalysis is especially appealing to me, as these are critical areas for developing sustainable energy solutions. Additionally, I am eager to develop my technical skills in synthesizing nanoparticles and using advanced characterization techniques like SAXS and WAXS. I look forward to learning from experienced researchers and contributing to scientific knowledge in a meaningful way.

Joseph Munoz

College/University: University of Texas at El Paso

Field of Study: Mechanical Engineering

Research Advisor: Dr. Yirong Lin

Research Location: El Paso, Texas

Project Title: The Development of the Processing Parameters for a Functional Graded Ultra-High Temperature Ceramic

Description of Your Summer Project:
To optimize the rheological properties for a ceramic loaded slurry referred to as an ink. This ink will be utilized in an additive manufacturing technique known as paste extrusion to manufacture a functional graded ceramic. The ceramic will then be heat treated to promote densification and create a functional graded ultra-high temperature ceramic. This is beneficial for the energy sector due to ceramics tremendous mechanical properties and novel quality of directing heat away parallel to the material as opposed to through the material; which allows the protection of crucial and sensitive electronic systems.

What You Like Best About the Summer Research Project/Experience:
I always loved to learn and this project involved learning about completely different worlds of science and combining them in a creative manner. Rheology, additive manufacturing, and thermal treatment are all unique and mastering each one allowed for a novel material in the scientific community. I loved mastering these concepts both theoretically and experimentally and the team I had the privilege to work alongside.

Bryan I. Rodriguez Tirado

College/University: Universidad Ana G. Mendez

Field of Study: Civil Engineering

Research Advisor: Dr. Jose L. Banuelos

Research Location: University of El Paso Texas

Project Title: Mineral Nucleation and Growth in Nanopores and Planar Interfaces

Description of Your Summer Project:
Direct Air Capture (DAC) using magnesium oxide (MgO) reduces greenhouse gases, aiding climate change mitigation. Though energy-intensive, it becomes sustainable with renewable energy and efficient heat recovery. Deploying DAC requires significant infrastructure and integration with existing systems. Captured CO_2 can be stored or used in synthetic fuels, promoting a circular economy. Economic viability depends on improving efficiency and lowering costs, supported by government incentives and regulations.

What You Like Best About the Summer Research Project/Experience:
This experience is something that is new to me and very different of what I have been doing with my major. The university is helpful throughout this summer and doing this project helps me figure out of what I want to do later in my career and UTEP is helping me a lot with this. Working as a research assistant for Dr Banuelos is interesting because we are coming up with so many ideas and trying to see everything and make sure this all connects to our projects and see if they are changes and keep trying to make more ideas. this summer has been so fun working in all of this

Zachary Chanoi

College/University: University of Texas at El Paso

Field of Study: Mechanical Engineering

Research Advisor: Ashley Daniszewski, Dushyant Shekhawat & Pranjali Muley

Research Location: NETL Morgantown WV

Project Title: Fundamental Study of Role of Microwave Irradiation for Catalytic Reactions using Carbon Dioxide as a Probe Molecule

Description of Your Summer Project:
As the global demand for the reduction of greenhouse gas emissions, the need to capture and utilize carbon dioxide in new and innovative ways is rapidly increasing. This summer project will explore the catalytic utilization of carbon dioxide to produce value-added chemicals using microwave technology. We will identify suitable catalysts systems and test different reaction parameters using advanced microwave reactors systems, while also investigating what's happening on the surface of the catalyst using novel in situ microwave FT-IR. This will result in a fundamental understanding of microwave technology's role in assisting in catalytic performance and utilization of carbon dioxide.

What You Like Best About the Summer Research Project/Experience:
Being able to work closely with mentors such as Ashley has been the best part of my summer NETL experience. There are many advanced instruments at NETL Morgantown that are not available at my university. Without guidance, learning to properly utilize such equipment would be daunting. Having a mentor that is both knowledgeable and eager to help makes learning equally fun as it is useful. I have been able to utilize the new skills I have learned during the summer to improve my own PhD research. I have also enjoyed the camaraderie between all the interns and the abundance of nature in Morgantown. This experience has made me want to pursue a career doing research at a federal laboratory.

Melvin Foster

College/University: University of New Mexico

Field of Study: 1. Nanoscience, 2. Microsystems Engineering

Research Advisor: David Tucker

Research Location: NETL Morgantown WV

Project Title: The Development of the Processing Parameters for a Functional Graded Ultra-High Temperature Ceramic

Description of Your Summer Project:
My research is to discover problems with the Solid Oxide Fuel Cell/Solid Oxide Electrolysis Cell (SOFC/SOEC) integrating to a hybrid Gas Turbine (GT) energy system, thus generating electric energy. To examine more closely the (SOFC/SOEC) generating designs, system controls, and energy output. I want to explore all design plots through MATLAB and EBSILON software, to exhibit failure in the energy system and provide detailed answers and solutions. The advanced system control of this specific hybrid system is to target higher efficiencies to generate power and control current environmental damage. (SOFC/SOEC)+ (GT) combinations are the showcase for generating renewable energy with fossil energy. The dynamic studies of Advanced Research Projects Agency-Energy have shown that this essential hybrid system can greatly address the energy crisis.

What You Like Best About the Summer Research Project/Experience:
The ORISE CHRES program experience gains me an opportunity to network here in the eastern section of the US. It provided my learning experience to understand advanced system integrated hybrid energy models, applications, real time questions concerning energy distribution. These models include schemes that solve problems for consumers that have essential impact on human development. The applications involved are providing a foundation for energy release and storage. Examples are methane burned energy to power the turbine combined with solid oxide fuel cells/solid oxide electrolysis cells to complete a Hybrid generating resource. I am currently addressing my education to complete a Ph. D. program and these resources here at Department of Energy are greatly enhance these opportunities. Thank you.

Braian Diaz Aquino

College/University: University of Puerto Rico, Mayaguez

Field of Study: Electrical Engineering

Research Advisor: Kathy Brown

Research Location: LLNL

Project Title: UAS Guidance and Flight Restrictions

Description of Your Summer Project:
My research this summer is to review and evaluate operation of Unmanned Aircraft Systems (UAS) and guidance. I am analyzing airspace classifications for LLNL, evaluating options for future experiments, and/or providing other alternatives for a more controlled airspace environment. I also help with programming related to equipment and the electrical system for Mini-Tubular Ceramic (MTC) Automation. The MTC project's objective is to make high temperature ceramic HEPA filters from electrospun nanofiber sheets, rolling them into tubes and cutting them in small pieces, converting them into ceramics, and then placing them inside a container that will be the overall filter. This type of filters can survive in wet and hot conditions (e.g., fire scenarios).

What You Like Best About the Summer Research Project/Experience:
What I most like about my summer research project is that I am able to work on new things, new technology, and have the opportunity to apply knowledge gained from my career and projects.

I especially enjoy the LLNL experience. It is a different environment where I can work on projects of your interest and explore new topics, meet with Subject Matter Experts (SME) and tour their different facilities around LLNL.

Jorge E. Jiménez Ortiz

College/University: Ana G. Mendez Recinto de Gurabo

Field of Study: Mechanical Engineering

Research Advisor: Dr. Eric Bukovsky

Research Location: LLNL

Project Title: Modelling the Effect of Small Quantity of Explosives on Drywall Using FEA Models

Description of Your Summer Project:
The effects of small quantity of explosives on common construction materials are relatively unknow, at least from a modelling point of view. This summer I was tasked with researching and modelling these effects, especially on drywall. To achieve this, first we had to understand the physics behind this explosion where for this the program COMSOL Multiphysics was used. Next step is to get the mechanical properties of drywall so this simulation can be modelled properly. The end goal with all of this is to be able to build a lab to test small quantity explosives where its inside walls are made of drywall.

What You Like Best About the Summer Research Project/Experience:
Being here at the lab is a great opportunity to explore and learn about future possibilities for your STEM career. There are so many departments doing very different things, and everybody is willing to talk about their work. This opens a sea of possibilities and it's encouraged by your mentors to go out and explore and network around the lab which is something you don't see in many other places.

Kevin Donnelly

College/University: University of New Mexico

Field of Study: Nuclear Engineering

Research Advisor: Dr. Christopher Brand

Research Location: LLNL

Project Title: Neutron Flux Measurements using Foil Activation

Description of Your Summer Project:
Accurate measurements of neutron fluxes remains a critical component in many scientific and engineering pursuits. While multiple methods and techniques are used, foil activation remains a consistent and adaptable key in our capabilities to characterize and study the neutron fluxes of various neutron sources. The project I am working on seeks to develop this important diagnostic tool as a permanent capability that can be used with the current and any future neutron generator. This summer I am helping develop an analysis coding frame work to predict and analysis experimental results using MCNP and Python. I will also assist with constructing an HPGe counting station that will allow for consistent and accurate gamma spectroscopy. Finally, I will be running foil irradiation experiments using a D-T neutron generator and measuring the resulting activated foils with an HPGe detector. The goal is to develop both the physical experimental setup as well as the data analysis process to allow for straight-forward and accurate energy and angular characterization of neutron fluxes from neutron generators.

What You Like Best About the Summer Research Project/Experience:
I have greatly enjoyed learning more about the research process, and LLNL in general. Growing and developing my technical and people skills has been a great experience, teaching me many things and building on my past knowledge to make me a better scientist. My interactions with others have been a great experience, whether they be fellow summer interns or people who have been at LLNL for 20 years, have greatly enhanced my time here.

James Tapia

College/University: University of New Mexico

Field of Study: Electrical Engineering (Power System)

Research Advisor: Dr. Ali Bidram

Research Location: The University of New Mexico, Albuquerque, New Mexico

Project Title: Implementation of a Control System for a Three-Phase Inverter

Description of Your Summer Project:
Our project is to design a basic control system for a Semikron inverter through a National Instruments microprocessor. This particular inverter is used in the Microgrid here at the University of New Mexico. The control system would be developed in LabVIEW. Once the control system has been developed in LabVIEW, the program would then be deployed onto the microprocessor board where the functionality of our program will be demonstrated and verified. Once our program has been successfully verified on the board, the board will then be taken back to the UNM Microgrid and tested for complete functionality. This control system we are designing is intended for the inverter to operate in the "grid-following" mode i.e. the voltage and frequency of our inverter must match the voltage and frequency of the grid.

What You Like Best About the Summer Research Project/Experience:
What I like the most about the project experience is learning and figuring out how to get the software and the hardware to interact with one another. I feel that I have learned a lot about LabVIEW and just how capable it is in terms of operating certain hardware devices. There was a lot of searching and reading technical articles and manuals and that gave me the opportunity to learn a lot about LabVIEW and about Inverters in general. This is also my first "internship/research position so I am appreciative of the fact that I am getting my first "hands-on" experience of Electrical Engineering outside of the classroom.

Ricardo A. Acosta Rivera

College/University: University Ana G. Mendez, Gurabo

Field of Study: Computer Engineering

Research Advisor: Dr. Ali Bidram

Research Location: The University of New Mexico, Albuquerque, New Mexico

Project Title: Implementation of a Control System for a Three-Phase Inverter

Description of Your Summer Project:
This summer project consists of programming an NI inverter controller. The controller being used is the "sbRIO-9687 GPIC Universal Interface Board". For us to be able to program it we needed to learn about inverters and their control, LabView, and how to run the board simultaneously with the inverter. A simple vi was created to demonstrate how a three-phase inverter operates in LabView. The most important task is making sure the board works and connects to the inverter located in a power grid. Once we know that it will work, 90% of the work is done.

What You Like Best About the Summer Research Project/Experience:
This summer research project has given me the opportunity to work with equipment I've never seen/heard of in my life. I have learned valuable lessons related to the workspace, collaboration, and problem solving. I get the chance to express myself while learning about new technology that's helping our world function in a faster and safer way, while meeting new people who share the same passions as me.

Christian M. Torres Ortiz

College/University: University of Puerto Rico – Mayaguez

Field of Study: Electrical Engineering

Research Advisor: Dr. Fernando Moreu

Research Location: University of New Mexico, Albuquerque NM

Project Title: Real-Time Monitoring of Wind Turbine Propellers for Advanced Structural Health Monitoring

Description of Your Summer Project:
During this summer's research project, I have been working on an on-site laser-based monitoring system for structural health monitoring. The purpose of this system is to automate the verification process of the state of Wind Turbines during operation. To accomplish this, a laser profiler is used to detect the displacements on the wind turbines along with a galvanometer to redirect the beam towards the rotating propeller blades, allowing for synchronized tracking of their location with an event-based camera.

What You Like Best About the Summer Research Project/Experience:
As my second time participating in the CHRES Research Exchange Program, I get to re-visit the professors and researchers who guided and helped me to expand my knowledge in Electrical Engineering applied in what at the time to me were unknown fields like transportation. This summer I get to work on new and more complex research challenging my existing knowledge and allowing me to grow my skillsets as well as open doors to new opportunities outside of the traditional energy generation/harvesting research topics associated with my major.

Lastly, I enjoy being able to network with professionals in a variety of engineering fields outside of my own and seeing that by putting aside their technical expertise, they are also normal human beings like myself with their hobbies, tastes, and opinions. This helps me feel more comfortable and confident in myself as an aspiring future engineer.

Jahsyel Rojas Ortiz

College/University: University of Puerto Rico – Mayaguez Campus

Field of Study: Software Engineering

Research Advisor: Dr. Fernando Moreu

Research Location: The University of New Mexico, Albuquerque, New Mexico

Project Title: Real-time Tracking of Wind Turbines

Description of Your Summer Project:
Real-time tracking of wind turbines for efficient propellant health monitoring. By integrating Python code, the Dewesoft program, and with an event-based camera engineers can analyze and interpret data effectively. Equipment such as galvanometers, lasers, and other advanced sensors are employed to measure various parameters accurately. These tools ensure precise monitoring, which helps in the early detection of potential issues, optimizing performance, and extending the lifespan of the wind turbines.

Expanding on this, Python's versatility and robust libraries enable complex data processing and visualization, while Dewesoft's powerful software provides real-time data acquisition and analysis capabilities. Galvanometers measure small electrical currents, crucial for detecting anomalies in turbine operation. Lasers offer high-precision measurements of displacement and vibration, allowing for detailed structural health assessments.

What You Like Best About the Summer Research Project/Experience:
What I like best about the summer research project is the hands-on experience with cutting-edge technology and data analysis. Working with real-time tracking systems for wind turbines has been incredibly engaging and informative. I've learned to handle complex data sets and extract meaningful insights. This project has not only enhanced my technical skills but also given me a broader perspective on renewable energy and its maintenance challenges. Collaborating with a dedicated team has made this experience even more rewarding, as we've shared knowledge and supported each other's growth.

Fabiola Reyes

College/University: Universidad de Puerto Rico-Mayagüez

Field of Study: Nuclear Engineering

Research Advisor: Dr. Fernando Moreu

Research Location: The University of New Mexico, Albuquerque, New Mexico

Project Title: Human-robot Interfaces for Emergencies Planning and Control

Description of Your Summer Project:
The project I worked on consists of how robots can be helpful in cases of natural disasters specifically by not having electricity when these natural disasters happen. I worked with a robot called MIR 100, which allows the transportation of objects with ease and, by not having electricity, making it easier to transport essential things and help the person. Using a Vicon camera and a Lewis sensor to accurately and precisely determine the acceleration and displacement of the robot in both ways. In this way we could reach more complicated places for humans and repair the electrical damage that may have been caused by the natural disaster.

What You Like Best About the Summer Research Project/Experience:
I like that in this project, I have been able to put my knowledge to the test. In addition, I have learned many new skills that have allowed me to develop the project and obtain quality results. The project has helped me grow in many aspects, both personal and professional. I have been able to have better preparation for the continuation of my professional career. It has also impacted me on a personal level since I have experienced several natural disasters in which I saw and experienced the pain that these atmospheric events cause.

Marielly Rodriguez Gauthier

College/University: University of New Mexico

Field of Study: Mechanical Engineering

Research Advisor: Prof. Georgios Koutsakis

Research Location: Albuquerque, New Mexico

Project Title: Inverse Heat Transfer Models for Heat Flux and Temperature Measurements in Rotation Detonation Engines

Description of Your Summer Project:
Rotating Detonation Engines (RDE) generate shock wave cycle that releases energy extremely fast making it difficult to harness and control. Much of the thermodynamics and heat transfer occurring in the engine such as heat flux and the surface temperature are unknown. In order to find a way to stabilize the shockwaves we need to understand what's happening inside the engine. An approach to determine these unknowns is to use an ultrasonic transducer. This project aims to develop a program that determines those unknowns using inverse heat transfer models. Aerospace companies that manufacture turbine engines can input data such as coating material properties and temperature and output the heat transfer models and other data such as temperature distribution plots.

What You Like Best About the Summer Research Project/Experience:
I really liked that I was working with something that's uncharted territory. Everything is very new and unknown and that means there exciting discoveries to be made. I also got to improve my programming skills and apply them into a field I'm interested in.

Pedro J. Carrasco

College/University: Universidad Ana G. Méndez

Field of Study: Electrical Engineering

Research Advisor: Daniel E. Mera Romo

Research Location: Recinto de Gurabo

Project Title: Optimization of the Portable Power Station with Several Sources of Energy for Emergencies

Description of Your Summer Project:
The Portable Power Station project addresses the urgent need for reliable power sources in emergency situations in areas prone to natural disasters like Puerto Rico. This system integrates three renewable energy sources: solar panels, a micro wind turbine and a bike generator, complemented by battery storage. Designed to supply approximately 6 kWh per day, it can power critical residential loads such as refrigerators, medical devices, and chargers. It is currently on its optimization phase, where measurement circuits previously integrated are being calibrated, on top of further enhancing the portability of this project.

What You Like Best About the Summer Research Project/Experience:
Even though I was initially interested in getting experience as an Electrical Engineer before graduating, but what quickly became my new interest was all the energy sources and how they'd be handled in order to implement all the goals in mind for this project. The automation aspect of this project fascinates me, where just a flip of a switch translates into a steady and reliable source of energy for household appliances and a constant display of how much energy is being generated per each source connected to the station. Additionally, getting to learn about equipment that I'd have normally never used through my studies is always a plus, but getting to see with my own eyes and further contribute to make a project where everything is automated and reliable was and still is the one thing that sticks out for me.

Anthony Ortiz Báez

College/University: Ana G. Méndez University

Field of Study: Computer Engineering

Research Advisor: Daniel E. Mera Romo

Research Location: Gurabo Campus

Project Title: Optimization of the Portable Power Station with Several Sources of Energy for Emergencies

Description of Your Summer Project:
The Portable Power Station project is a critical initiative aimed at providing reliable power sources in emergency situations in areas and towns, like Puerto Rico. This innovative system combines three renewable energy sources: solar panels, a micro wind turbine, and a bike generator, all supported by battery storage. The system can generate up to 6 kWh daily, making it suitable for powering essential household items like refrigerators, medical devices, and other electronics. Currently in the optimization phase, the project focuses on calibrating the previously integrated measurement circuits and enhancing its portability to ensure maximum efficiency and convenience in emergency situations (hurricanes, power cuts, and others).

What You Like Best About the Summer Research Project/Experience:
One of the aspects I enjoyed most about the summer research project was the challenge it presented as a computer engineer. It provided me with a unique opportunity to step out of my comfort zone and explore new areas, particularly in electrical engineering and related fields. From the very beginning, I was excited and motivated to dive into this research project, eager to test new ideas and contribute to successful outcomes. This experience not only broadened my technical knowledge but also allowed me to collaborate with experts from different disciplines, enhancing my problem-solving skills and expanding my professional network. The hands-on experience and interdisciplinary learning have been incredibly rewarding, making this summer research project an invaluable part of my academic and professional growth.

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