OFFICE OF RESEARCH
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FACULTY CLUSTERS

Collaboration Meets Innovation

UCF's Biionix Cluster Shows Its Strength with Top Research and Awards

By: Robert Wells

UCF Resilient, Intelligent and Sustainable Energy Systems Center Sees Major Successes

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Over the past year, UCF's Resilient, Intelligent and Sustainable Energy Systems, or RISES, cluster has evolved into a university research center and has achieved major accomplishments in funding, academics, and lab space.

"There is a critical need to design a more robust and agile electric power network," says center director Zhihua Qu, a Pegasus Professor in UCF's Department of Electrical and Computer Engineering and RISES' director. "Natural disasters, malicious attacks, or human errors disrupt our nation's energy and infrastructure systems. The vulnerability of the electric energy systems and the power grid represents a critical national challenge due to the dependence of nearly all infrastructure systems on electric energy."

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The main objective of the RISES Center is to build a strong research portfolio in resilient and secure electric power systems by collaborating with utilities, industry, national labs, municipalities, and government agencies.

Some of the most recent large awards RISES received came from the U.S. Department of Energy and totaled more than $14 million.

These awards were:

- Secure and Resilient Operations Using Open-Source Distributed Systems Platform. This is a $4.75 million award from the U.S. DOE, Solar Energy Technologies Office. Researchers Wei Sun, Zhihua Qu, and Aleksandar Dimitrovski from the Department of Electrical and Computer Engineering are working on the project.
- Understanding Critical Failure Modes and Degradation Mechanisms in Fielded Photovoltaic Modules. This is a $2.5 million award from DOE SETO. Kris Davis, an assistant professor in UCF's Department of Materials Science and Engineering, is leading the project.
- Autonomous Inverter Controls for Resilient and Secure Grid Operation: Vector Control Design for Grid Forming. This is a $3.75 million award from DOE SETO. Qu and Sun are leading the research.
- Building Intelligence with Layered Defense using Security-Constrained Optimization and Security Risk Detection. This is a $3.75 million award from the DOE Buildings Energy Efficiency Frontiers & Innovation Technologies. Researchers Qun Zhou Sun, George Atia, Qu, and Sun are working together on the grant. Qun Zhou Sun is an assistant professor, and Atia is an associate professor, both in UCF's Department of Electrical and Computer Engineering.

This year also saw the launch of the College of Engineering and Computer Science's graduate certificate program in resilient energy systems, which will help people boost their skill set in this increasingly important field, Qu says.

RISES also established its newest externally funded laboratory, known as the Microgrid Control Lab, that will focus on resilient microgrids and long-duration battery research.

Since 2017, the center has received substantial support from industry to create:

- The Siemens Digital Grid Lab, which is supported by Siemens Digital Grid and is packed with the latest utility-grade software and hardware for researching the optimal operation and protection of power systems.
- The Smart Infrastructure Data Analytics Lab, supported by Siemens Smart Infrastructure, uses cutting-edge technology to research consumer interactions with power grids, including timing, smart buildings, solar energy, and batteries. Orlando Utilities Commission provided support to develop data-driven forecast and optimization of photovoltaic power or energy from the sun.

- An Internet-of-Things security testbed supplied by Siemens Ruggedcom was installed at the Cyber-Physical Systems & Control Laboratory, which is a lab focused on developing tools and algorithms for optimizing and controlling cyber and physical systems.
- The Microgrid Control Lab, supported by both General Electric and Florida Power and Light, investigates safe, reliable, efficient, and secure ways to operate microgrids and large-scale power distribution networks composed of mainly renewable energy sources. Duke Energy also provided funds to install a long-duration battery testbed in the lab.
- The Autonomous Unmanned Systems Lab, equipped by L3Harris, focuses upon research in modeling, distributed sensing, control, and real-time decision making.

Total award funding for 2020 for RISES was more than $2.8 million.