



TRANSFORMING POWER

WHAT'S NEXT FOR ENERGY IN NORTH CAROLINA

UNC Charlotte's Energy Production & Infrastructure Center (EPIC) is helping North Carolina meet its goal to reduce carbon emissions by 70% by 2030 and reach net zero by 2050. Groundbreaking research and preparing students as leaders in dynamic, evolving fields are driving this effort.

"EPIC's founding mission prioritizes its role as a workforce developer," said Mike Mazzola, Duke Energy Distinguished Professor and director of EPIC for The William States Lee College of Engineering. "Knowledge transitions when our students graduate and start their careers, deepening our impact on the field of transformational energy."

A recent \$41.2 million investment from the N.C. General Assembly for "Engineering North Carolina's Future" allows UNC Charlotte to recruit an additional 2,000 students over the next five years in engineering, computer science and data science — as well as hire additional world-class faculty and expand facilities and academic programs.

With support from the U.S. Department of Energy and more than 250 regional partners, here are four ways UNC Charlotte is driving unparalleled advancements in critical areas of need for North Carolina.

MICROGRID RESILIENCE

Microgrids — networks of electricity users with a central supply source — attach to a centralized energy grid; their design allows them to function autonomously if the primary grid becomes inoperable. Across North Carolina, microgrids provide essential backup — and keep communities operating — during major power outages.

In EPIC's Duke Energy Smart Grid Laboratory, researchers are developing ways to strengthen microgrids to improve their resilience. A \$3.5 million grant from the DOE is supporting development and testing of control strategies to enhance the reliability of microgrids state- and nationwide.

"Through our partnership with DOE, we are demonstrating how microgrid technology helps communities better prepare for and mitigate the costs associated with power disruptions — more equitably and safely than today," said Robert Cox, EPIC's associate director. "EPIC is on the leading edge of a solution to a problem that will improve lives throughout North Carolina."

NUCLEAR CONSTRUCTION

Nuclear energy, the world's second-largest source of low-carbon electricity behind hydropower, is a clean energy option. However, energy companies have shied away from it due to a combination of factors, such as permitting issues, construction of infrastructure that houses the reactor, and the cost and time to complete projects.

With support from the DOE's National Reactor Innovation Center, EPIC is showing how "digital twins" help reduce overruns, making nuclear energy more affordable and attainable. Most used in advanced manufacturing, a digital replica of the as-built infrastructure is used by inspectors, designers and constructors to answer questions that arise during construction and reduce downtime.

Currently part of the DOE's Advanced Construction Technology Initiative led by GE Hitachi, the approach is solidifying EPIC as part of the nation's go-to research team for bringing digital techniques to nuclear construction, according to Cox.

"Our work is getting the U.S. back on track to complete nuclear projects on cost and on time," he said.

SECURING ENERGY INFRASTRUCTURE

Critical energy infrastructures are constantly vulnerable to intentional disruptions by hackers and cyber criminals, whose interference damages supply chains and other business operations — such as last year's attack on the Colonial Pipeline.

A solution lies in the development of security features integrated into a system's hardware in addition to its software, eliminating the need for passwords — widely considered any system's weakest link. Fareena Saqib, associate professor of electrical and computer engineering, who leads UNC Charlotte's Hardware and Embedded Security Lab, is researching ways to make hardware security an intrinsic feature of any device. "Any device should — and can — be responsible for keeping itself secure," she said.

As part of the federal government's priority to fill thousands of cybersecurity jobs that require specialized training, Saqib is leading a consortium of universities that is developing certification programs in cybersecurity and artificial intelligence. These programs, supported by the



U.S. Department of Defense and National Security Agency, are available to transitioning military personnel and first responders through UNC Charlotte and its three consortium partners across the country.

ELECTRIC VEHICLE SOLUTIONS

As North Carolina emerges as a key hub for electric vehicle manufacturing with more than \$1 billion in recent investments by Toyota and VinFast, and Arrival announcing its North American headquarters in Charlotte, EPIC is developing ways to support the state's leadership in this growing industry. Last winter, EPIC unveiled PoleVolt™, an innovation with potential to benefit car owners who live in multifamily housing or urban areas without a dedicated charging source.

Harnessing energy from existing infrastructure and street lights, this technology — currently in a pilot phase — is supported by the U.S. Department of Energy's Vehicle Technology Office and was developed in partnership with Duke Energy, the city of Charlotte and the Centralina Regional Council.

"PoleVolt™ is a great example of what can be accomplished through a productive public-private partnership," said Cox. "It shows how researchers and students — working collaboratively with industry experts — apply research to real problems and develop cost-effective solutions that support people as well as regional industries."

For more details, visit epic.charlotte.edu



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