Electrical and Electronics Systems Research

The Electrical and Electronics Systems Research Division performs research that translates the science and engineering of measurement, instrumentation, signal processing, and electric machines into technology solutions that ensure America's security and prosperity by addressing energy, environmental, nuclear, and security challenges.

Our core programs focus on the design and development of electronics and detectors for major experiments; power electronics from concept to prototypes; sensors and controls for the electricity grid, manufacturing, nuclear power plants, and buildings; technologies to advance the production and integration of renewable energy; measurements and controls for nuclear applications and stable isotope production; nondestructive evaluation techniques for structures in the nuclear and oil and gas industries; and imaging and signals research in the area of identity science.

Innovating Electronics, Communications, Sensors and Controls

Our core programs address critical scientific challenges in eight interdisciplinary research themes across the environmental dimensions of energy, global and regional change, and sustainability.

Dynamic systems analysis—Researches and deploys technical solutions involving system modeling, development, and testing that support isotope separation, system diagnostics, and national security

Electric energy systems integration—Provides science and technology solutions for the integration of devices and systems into electrical energy infrastructure ecosystems, with a focus on advanced, multidisciplinary power electronics research; spans applications in several areas including buildings, transportation, grid, and national security

Electrical systems engineering and integration—Researches, develops, and deploys instrumentation and control systems; system validation and environmental testing; robust data collection systems; and testing to support isotope separation and national security

Imaging, signals, and machine learning—Develops image- and signal-based measurement systems, algorithms, and high-performance machine learning solutions for national security, environmental and biological research, and manufacturing

142 Staff

8 Core research groups

91 Patents*

1 Governor's Chair

150 Invention disclosures*

24 IEEE senior members

* last 5 years

"We're pushing the envelope with our science and technology, while matching our capabilities with others at the lab to create stronger R&D teams."

Rick Raines, *Director, Electrical and Electronics Systems Research Division*

OAK RIDGE National Laboratory

U.S. DEPARTMENT OF ENERGY

Power and energy systems—Accelerates the transition of science into practice for a cost-effective, secure, reliable, and sustainable electricity grid of the future

Power electronics and electric machinery—Provides innovations in power electronics and electric machinery to support the transportation, grid, and renewables sectors

Radio frequency, communications, and intelligent systems—Provides wireless communications and networking technologies and strategies, signal signature learning systems, and radio frequency–based measurement systems to support energy and national security

Sensors and embedded systems—Develops novel or specialized sensor technologies, creates complex instrumentation systems that require special attention to sensor integration details, and conducts feedback control-related modeling and algorithm R&D in order to advance the state of the art of measurement technologies, methods, and their use in energy and national security applications

At ORNL's Grid Operations Analytics Laboratory, scientists are developing breakthroughs in monitoring, modeling, controls, and hardware to enhance power grid security and resilience.

Strengthening Grid Security and Resilience

EESRD's staff works closely with public and private partners to develop breakthroughs for the resilience and security of one of the nation's most critical assets: the power grid. ORNL's close working relationship with the Chattanooga Electric Power Board has resulted in a living laboratory where EESRD breakthroughs in visualization and monitoring are being tested and implemented to create one of the most modern, efficient, and secure grid networks in the nation. We are working with Southern Company on two Smart Neighborhood projects in Alabama and Georgia where EESRD technology is managing microgrid resources—solar power and battery energy storage—as well as smart home appliances to give homeowners precise control over their power supply and demand at a lower cost while ensuring reliable service.

R&D Facilities

Grid Research Integration and Deployment Center combines electrification research activities across the utility, buildings and vehicle space into one open-access facility.

National Transportation Research Center is the Department of Energy's only designated user facility focused on a wide range of mobility research, including vehicle electrification and cybersecure intelligent systems.

CONTACT:

Rick Raines
Director, Electrical and Electronics
Systems Research Division

rainesra@ornl.gov
865-241-7390

One Bethel Valley Road,
Oak Ridge, TN 37830

ornl.gov/eesrd