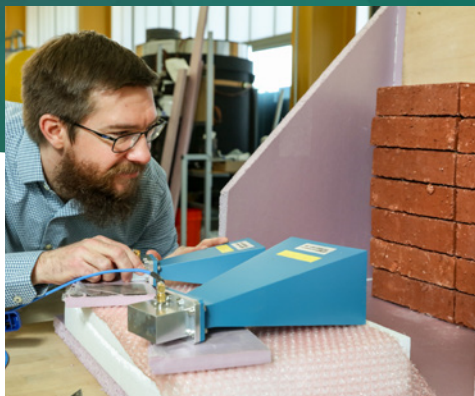




OAK RIDGE NATIONAL LABORATORY

# Energy Science and Technology



The Energy Science and Technology Directorate (ESTD) at Oak Ridge National Laboratory is directly supporting the mission of the U.S. Department of Energy by moving with a sense of urgency to lead the transition to a clean, secure, and sustainable energy future while creating economic opportunities for the nation. ESTD researchers are driving new breakthroughs from science to deployment in support of a transition to net-zero carbon energy, improvements in end-use energy efficiency, and ensuring the transition is based on sustainable resources.

ESTD is accelerating solutions and deployment of new technologies in buildings, electrification and energy infrastructure, manufacturing, and transportation. We leverage the immense and unique scientific and engineering resources at ORNL; key partnerships with industry, academia, and other national laboratories; and sustained leadership working with DOE. Foundational to our impact are world-class research and operations teams, four DOE national user facilities, a culture of creativity and innovation, and a passion for the mission.



"Our team is defining and deploying a path to a clean, secure, and sustainable energy future by leveraging the one-of-a-kind science portfolio of ORNL in partnership with industry, academia, federal agencies, and other national laboratories. This foundation of science and partnership with an unwavering passion for the mission is enabling breakthroughs and innovations that were once thought impossible."

— Associate Laboratory Director  
Energy Science and Technology Directorate  
**Robert Wagner**

# Research

**Buildings and Transportation Science**—Delivers scientific discoveries to accelerate transformative buildings- and transportation-related technical solutions to ensure a safe, secure, and sustainable energy future

- **Propulsion science**—Drives decarbonized mobility solutions, including electrification and efficient utilization of net-zero carbon fuels with a focus on hard-to-electrify sectors in marine, rail, air, and other off-road applications
- **Vehicle and mobility systems research**—Accelerates development of advanced vehicles and mobility systems through autonomous vehicles, systems integration, and decision science
- **Building technologies research**—Develops and integrates advanced building equipment and dynamic envelope materials to enable affordable, efficient, and resilient buildings

**Manufacturing Science**—Develops advanced manufacturing technologies through research and scale-up of processes and technical capabilities enabling new materials, systems, and products

- **Composites science and technology**—Develops sustainable advanced fiber and polymer processing to create lightweight structures for multiple applications
- **Energy and industrial decarbonization**—Scales up renewable feedstocks for manufacturing processes to reduce energy use and conducts technoeconomic and life-cycle analyses
- **Precision manufacturing and machining**—Designs and implements next-generation manufacturing systems by integrating robotics, automation, controls, and machine tools
- **Secure and digital manufacturing**—Develops a digital manufacturing platform and cyber-secure ecosystem by integrating manufacturing systems enabled by data analytics, process control, and secure communications

**Electrification and Energy Infrastructure**—Generates innovative capabilities for electric energy devices and systems to improve reliability, sustainability, and efficiencies of energy storage systems, electric grid protections and controls, and power electronics

- **Electrification**—Develops innovative energy storage technology solutions and charging infrastructures at scale for transportation and grid
- **Energy systems integration and controls**—Advances energy systems integration and controls to improve the efficiency and resiliency of systems-of-systems architectures
- **Energy sensing, analytics, and communications**—Creates sensing and communications solutions by using advanced sensors, computational sensing, and analytics

## Research Facilities



**DOE Manufacturing Demonstration Facility (MDF)** houses integrated capabilities that drive the development of new materials, software, and systems for various advanced manufacturing technologies. MDF delivers manufacturing energy efficiency improvements and supports the secure production of clean energy products.



**DOE National Transportation Research Center** helps industry, academia, and other agencies accelerate the development and deployment of efficient and secure transportation technologies. Research focuses on electrification, emissions reduction, connected and autonomous vehicles, materials, and data and decision science for a decarbonized future.



**DOE Building Technologies Research and Integration Center** delivers breakthroughs to improve the energy efficiency and environmental compatibility of residential and commercial buildings, focusing on building envelopes, equipment, building systems integration, energy storage, building-to-grid interactions, sensors, transactive controls, and modeling and simulation.



**DOE Carbon Fiber Technology Facility (CFTF)** provides a platform for evaluating new processing technologies and identifying high-potential low-cost raw materials, including textile, lignin, polymer, and hydrocarbon-based precursors. Leveraging the CFTF's capabilities, ORNL is developing low-cost carbon fiber materials with desired structural properties and is co-optimizing feedstocks and processing conditions.



**ORNL Grid Research Integration and Deployment Center** delivers hardware and software solutions for the grid, including power electronics and battery innovations from concept to deployment, in support of decarbonizing the utility, buildings, and electric vehicle infrastructure sectors while advancing an integrated, secure, and resilient power grid.

By the numbers  
2015–2022

~2,000 journal publications

890 invention disclosures

262 patent applications

224 issued patents

69 patent licenses

241 cooperative R&D agreements

148 strategic partnership projects

### CONTACT

Robert Wagner  
Associate Laboratory Director  
Energy Science and  
Technology Directorate  
cleanenergy@ornl.gov  
865-576-3711  
One Bethel Valley Road  
Oak Ridge, TN 37831



www.ornl.gov/  
estd