

Renewable Energy and Conservation

Providing abundant, cheap, renewable energy for homes, businesses and other end users is a global, conservation imperative that requires innovative research strategies across disciplines. UNT is distinguishing itself as a leader in sustainable energy research and serves as a research pipeline for diverse energy and conservation projects in three thrust areas: Distributed Renewable Power Generation, Smart Grid Transmission, and Building Energy Conservation. Projects aim to provide affordable photovoltaic systems and wider utilization of wind power; cost effective, high-energy efficient building products; and key grid-tie solutions for wide penetration of distributed renewable energy. Breadth of specialization and collaboration advance research across materials science, mechanical and energy engineering, electrical engineering, engineering technology, and the physical and social science fields. Expertise in regulatory policy and environmental economics provides important support for the development of public policy and practice governing energy consumption. A complement of resources give researchers a competitive advantage and include cutting-edge research facilities with powerful micro/nano fabrication instruments and clean room, a zero-energy house as a working/living lab, award-winning faculty, and distinguished partners in government and industry.

- **A new, 1,200 sq. ft. zero-energy house is both a working laboratory, where ground-breaking research, materials and technologies are tested, and a living space that demonstrates “net-zero” energy consumption; no other university in the nation offers this resource**
- **Enterprising research developments at the forefront of alternative energy technologies:** 1) *novel home construction designs maximizing user-oriented energy efficiency for reduced energy and water consumption, improved indoor air quality, and environmental compatibility;* 2) *innovative solar PV technology;* 3) *next-generation solar cells;* 4) *sustainable and resilient engineering systems;* and 5) *atomistic experiments of surface materials used for microelectronic, energy, environmental, and biomedical applications*
- **Distinguished partners in government and industry include the Department of Energy, Gulf Power, Egg Geothermal, the Semiconductor Research Corporation, the Airforce Research Laboratory, and NuconSteel**
- **First university in the USA to integrate renewable technology into a football stadium and an athletic complex—one of the largest human power plants in the country based on captured kinetic energy produced by exercise machines**

Representative Faculty

Nandika D’Souza, Professor of Mechanical and Energy Engineering and Materials Science and Engineering: *renewable “green” bioproducts and biofibers*

Jincheng Du, Assistant Professor of Materials Science and Engineering: *atomistic modeling and electronic structures of energy materials*

Aleksandra Fortier, Assistant Professor of Mechanical and Energy Engineering: *reliability analysis of Pb-Free electronic systems*

Todd Jewell, Professor and Chair of Economics: *telecommunications and regulatory policy*

Alan Needleman, Professor of Materials Science and Engineering: *continuum mechanics; and computational modeling of deformation and fracture processes in structural materials*

Mohammad Omary, Professor of Chemistry: *metal-organic semiconductors and nanomaterials for energy-saving, harvesting and storage*

Michael Nieswiadomy, Director of the Center for Environmental Economic Studies and Research; and Professor of Economics: *environmental economics*

Yong Tao, Director of PACCAR Technology Institute; PACCAR Chair; Chair and Professor of Mechanical and Energy Engineering: *innovative high-performance building construction; and energy efficiency strategies*

Yan Wan, Assistant Professor of Electrical Engineering: *large scale network modeling; and analysis and control*

Cheng Yu, Associate Professor of Engineering Technology: *construction engineering; structural stability; and building hazards mitigation*



Select Research Resources

PACCAR Technology Institute

paccar.unt.edu

PACCAR is an interdisciplinary, university research center that advances diverse projects related to alternative energy and energy efficiency of buildings and industrial processes for the benefit of local and global communities. Combining innovative technology and entrepreneurship with research and education, PACCAR involves academic researchers and industry experts from physical and social sciences and engineering disciplines.

Zero-energy Research Laboratory

The new, 1,200 square-foot facility, currently under construction, is a living space and also a working laboratory designed to test emerging, sustainable technologies and materials to achieve a net-zero consumption of energy in buildings. The structure is expandable to include multiple alternative energy sources such as solar and wind to support a wide range of research; no other university in the nation offers this resource.

Office of Sustainability

sustainable.unt.edu

The Office promotes environmental sustainability through four primary action areas: research, outreach, operations, and teaching. Developments include the Climate Action Plan; power grid infrastructures based on wind and electrical energy technologies; sustainable green spaces; an active recycling program; and tech transfer assistance to commercialize new technologies.

Electrical Engineering Laboratories

engineering.unt.edu/electrical/research/labs

UNT's EE labs provide state-of-the-art instrumentation and advanced software. These include the **Autonomous Systems Laboratory**, which investigates problems in wireless sensor networks, robotic systems, and airborne networks; and the **Wireless Systems and Sensor Networks Laboratory**, which focuses on system-level issues critical for the design of high-performance wireless networks and intelligent sensor networks.

Polymer Mechanical and Rheology Laboratory

This UNT-based lab focuses on structure property relationships to increase the reliability of materials. Tensile, creep, fatigue, compression and shear testing is done in thermally controlled conditions with sophisticated instruments such as the Leistritz Twin Screw Extruder for biopolymer blending.

Adaptable, Multi-functional Reaction Frame Lab

www.etec.unt.edu/public/cyu/lab.htm

The Frame Lab provides flexibility for multiple performance and durability tests, including static and cyclic shear wall tests; web crippling tests on cold-formed steel sections; tension tests on structures; flexible testing on beams; and load bearing tests.

CART: Center for Advanced Research and Technology

research.unt.edu/cart

CART is one of the most advanced university research facilities in the nation for materials analysis, from atomic scale to macro scales, with a suite of sophisticated instruments used for true 3-D characterization, processing and cross-disciplinary analysis located next to a clean room so that materials can be synthesized, tested, and transferred in close proximity under controlled conditions. UNT is among an elite group of public institutions nationwide to offer these open access resources.

Contributing Research Clusters:

Renewable Energy and Conservation

reac.unt.edu

Renewable Bioproducts

renewablebioproducts.unt.edu