

Oak Ridge National Laboratory  
**BUILDING TECHNOLOGIES  
LICENSING OPPORTUNITIES**

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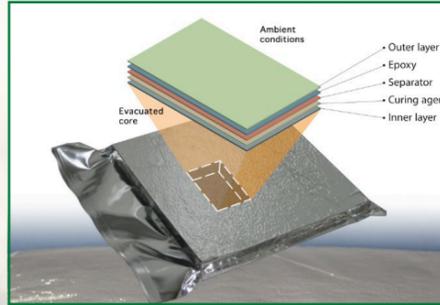
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# Building Technologies Licensing Opportunities at ORNL

ORNL researchers are working with the US Department of Energy (DOE), industry, and academia to develop new building technologies that contribute to energy security, energy affordability, grid resilience, reduced environmental impact, and benefit to the US economy. ORNL is leading the way in the advancement of current and next-generation building technologies encompassing building equipment, passive and dynamic envelopes, advanced energy storage, building energy modeling, sensors, transactive controls and improved energy management. ORNL scientists have access to resources such as the Building Technologies Research and Integration Center (BTRIC), which is the DOE's only user facility dedicated to performing early-stage research and development (R&D) in building technologies.



## Building Envelope

The building envelope—comprising walls, windows, roof, and foundation—separates the indoor and outdoor environments and primarily determines the amount of energy that is required to heat, cool, and ventilate a building. The balance between a building's envelope and heating, ventilation, and air conditioning system plays a key role in determining the level of comfort and indoor air quality.

To cost-effectively improve the energy efficiency, moisture-durability, and environmental sustainability of building envelopes, ORNL is exploring new and emerging materials, components, and systems as well as the fundamentals of heat, air, and moisture transfer. Research is also focused on developing thermal energy storage and multifunctional dynamic solutions where the envelope serves as a filter that selectively accepts or rejects solar radiation and outdoor air, depending on the need for heating, cooling, ventilation, and lighting.



## Building Systems Integration

The buildings industry encompasses designers, builders, construction materials and components manufacturers, distributors, dealers, and other vendors and service providers. Whether coming together for new construction or retrofitting established structures, these stakeholders often face research limitations and challenges when integrating new components, equipment, and systems. Building systems integration activities at ORNL provides the means for our industry partners to evaluate their products in low-risk, realistic test bed environments before market introduction.

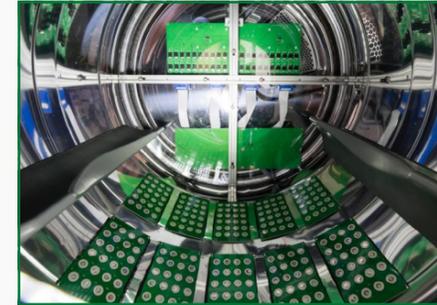
In ORNL's residential and light-commercial building test beds, an average occupant effect on energy use is imposed using process control so that realistic loads, operating conditions, and interactive effects are provided for technology evaluation and physical validation of models. Some technologies, such as system- and building-level controls or fault detection and diagnostics systems, also benefit from use of test buildings during the development process. The facilities and expertise available at BTRIC are also well suited to address renewable energy and building-to-grid integration challenges with our industry partners.



## Buildings-to-Grid

Buildings consume approximately 73% of the electricity produced in the United States, but through advanced automation and controls that can orchestrate the buildings-to-grid needs without interrupting comfort, we have an opportunity to reduce that consumption by 20%–30%. Significant mutual benefit to building occupants/owners and to the utilities can be achieved if this opportunity is addressed: building occupants gain greater control of their energy use, while reduced power generation and cost benefit the grid.

ORNL's buildings-to-grid R&D is focused on the development of low-cost wireless sensors and advanced transactive controls technologies to enable buildings-to-grid connectivity. The cost of sensor technology has hindered widespread utilization of building automation systems, but ORNL's low-cost sensor manufacturing approach has enabled significant cost reductions in wireless self-powered peel and stick sensors that are able to measure a multitude of parameters—temperature, relative humidity, and light level.



## Energy Efficient Equipment

Indoor amenities that improve consumer health and productivity—heating, cooling, hot water, and refrigeration—can be provided while consuming less energy through advances in building equipment. These amenities represent more than half of the energy used in US residential and commercial buildings. ORNL's R&D supports the development of affordable next-generation, transformative energy-efficient technologies enabling building equipment and systems to play an active role in grid-interactive efficient buildings. Since the 1970s, ORNL has executed numerous equipment technology R&D collaborations with industry and university partners. Through use of extensive experimental facilities, advanced hardware-based design models, and incorporation of emerging materials, our research has helped industry launch some of the most energy-efficient building equipment technologies on the market today.



## Licensing Success Story: Quanex IG Systems

Quanex IG Systems, a business unit of Quanex Building Products, has licensed a method developed at ORNL to produce a highly insulating material that exhibits unique physical and structural properties for optimal thermal insulation performance. The low-cost material can be used as an additive to increase thermal insulation performance when applied to a variety of building products. Houston-based Quanex designs and makes energy-efficient components associated with windows and doors for original equipment manufacturers. The company plans to incorporate and scale up ORNL's technology into their existing processes to produce low-cost thermal insulation for the building products industry.

*"The technology has been verified on the lab scale and shows promise as an additive in composite materials for thermal insulation at the commercial scale," said Sean Hummel, Director of Research and Development at Quanex IG Systems. "ORNL has demonstrated that their process is energy efficient and creates less waste, which yields the lower cost additive."*