

FACILITIES

Advanced Building Controls Laboratory

The Advanced Building Controls Laboratory is dedicated to developing and testing new controls for the built environment. We provide capabilities for benchtop prototyping and testing, remote data collection, archiving and analysis, project team interactions, and presentations to clients and other visitors. The lab includes computers that are networked to buildings on our campus and beyond; software for controls development, simulation, and analysis; a smart white board; displays of operating commercial controllers; benchtop space for controller system assembly; work space for visiting students; and two 80-inch screen monitors used for team discussions and presentations. The lab is currently supporting the DOE-Washington State Clean Energy Fund Clean Energy Transactive Campus (CETC) project, core building controls projects for DOE, and development of the buildings part of the Control of Complex Systems Initiative test bed.

Roof Top Unit (RTU) Advanced Controls Laboratory

The RTU laboratory enables us to develop and test advanced control algorithms and methodologies to optimize operation-saving energy. The RTUs are controlled remotely and are part of our transactive campus. They are an integral part of our groundbreaking work in grid, renewables, and building integration.



Building Energy Systems Group

The Building Energy Systems Group (BES) group is part of the Pacific Northwest National Laboratory's (PNNL's) Energy and Environment Directorate. We help sponsors from the government and private sector optimize performance and achieve resilient systems at the site, building, and technology levels. We do this by developing and using performance assessment tools, advanced controls, programmatic strategy, and implementation support.

We have 55 BES staff members working in Richland, Seattle, Washington, DC, and other off-site locations.

Our signature capabilities are in:

- » Controls Optimization and Re-tuning
- » Rooftop-Unit (RTU) Networking
- » Buildings-Grid Integration
- » Advanced Control Systems Development
- » Comprehensive Energy and Water Evaluations
- » Net-Zero Energy, Water, and Waste Planning
- » Building Rating Systems
- » Energy and Climate Resilience Planning
- » Sustainability Strategy and Behavior Change

CAPABILITIES

Controls Optimization and Re-tuning (CORe™)

We perform controls optimization and re-tuning to capture no- and low-cost energy efficiency improvements in commercial buildings. Re-tuning is a systematic process that involves identifying and correcting operational problems—such as inefficient scheduling, temperature set points, and static pressure set points. In addition, we provide advanced training to building staff—energy, management, operations and maintenance personnel—on the re-tuning process and how to implement re-tuning measures.

RTU Networking

Our research engineers are exploring the role transactive networks could play in optimizing commercial building RTUs for efficiency, cost, and performance—while also enabling RTUs to participate in building-grid transactions. This capability leverages our innovative distributed-control and sensing-software platform, VOLTTRON™, to schedule operations. We work with our sponsors to demonstrate how VOLTTRON can perform specific functions such as fault detection, demand response, weather service, logging service, and others.

Building-Grid Integration

We focus on advancing the concept of integrating buildings with the grid into a transactive energy ecosystem, capable of meeting all clean-energy demands and capacity requirements—from generation to building end use. To this end, the controls and software teams have been working on a transactive framework describing how buildings become energy assets and provide valuable services to owners and occupants.



Building Retrofits, Fault Detection, Diagnostics, and Automapping

We are the Department of Energy (DOE) Building Technologies Office’s primary national laboratory for building controls. As part of this work we devise economical solutions to better identify building performance issues and automatically correct those issues. Alternatively, we may recommend improvements to the building operators by identifying where faults occur and explaining how to fix them.

Comprehensive Energy and Water Evaluation (CEWE)

We conduct evaluations to help federal agencies meet the energy and water-use reduction goals and audit requirements as established by the Energy Independence and Security Act of 2007 and recent executive orders. Our evaluation approach is flexible and tailored to meet the needs of each site. The product of these evaluations is a list of projects—with associated costs and savings—which can be used to solicit investment funding.

For sites requiring rigorous energy evaluations, we offer standard CEWEs. The standard CEWE involves on-site assessments and leverages building modeling capabilities and tools—such as our Facility Energy Decision System (FEDS) software—to identify lifecycle cost-effective retrofits and prioritize options. When we can determine without a rigorous analyses that no viable projects exist at particular site, we provide guidance on remote audit methods to meet evaluation requirements without the cost of a standard audit.

For sites requiring rigorous water assessments, our water-balance studies provide an improved understanding of baseline water performance and help prioritize projects to reach water-reduction goals and mission requirements.

Net Zero Energy, Water and Waste Planning

Federal requirements are driving agencies to design new buildings—and retrofit existing ones—to achieve net-zero energy, water, and waste over the next 10-15 years. We have practical experience developing net-zero roadmaps for numerous federal sites based on robust site-level assessments. Our approach involves a screening process for sites with high potential; conducting site assessments; identifying conservation, efficiency and alternative resource use opportunities; and developing alternative pathways to achieve those goals under different system constraints. We integrate diverse capabilities in whole-building modeling, operations optimization, renewable energy feasibility, alternative water evaluation, microgrid assessment, and waste management to define the best solution.

Building Rating Systems

In partnership with DOE, we developed and are improving the Building Energy Asset Score. This national standardized tool evaluates the physical and structural energy efficiency of commercial and multifamily residential buildings. The tool generates an energy-efficiency score to compare buildings and identify opportunities for energy-efficiency improvements.

This innovative tool is helping a diverse group of stakeholders— including building owners and operators, utility program administrators, architects, state and local governments, and others—make better efficiency-investment decisions.

Our staff members are accredited and have experience using building-performance rating systems, such as Leadership in Energy and Environmental Design (LEED) and the Guiding Principles for High Performance and Sustainable Buildings. We help agencies prioritize candidate buildings and identify the most cost-effective ways to meet the Guiding Principle requirements.



Energy Security and Climate Resilience Planning

We work with agencies to understand how potential impacts from climate change, local electrical infrastructure interruptions, and other factors could influence agency mission, operations, and people. We draw from diverse capabilities in building systems and operations, climate science, and risk science to lead site-level vulnerability assessments and to develop resiliency action plans. Our work is helping agencies increase their building’s resilience against climate impacts or other disruptions.

Sustainability Strategy and Behavior Change

Technology solutions alone are often insufficient to drive sustainability performance. Organizational policies and behaviors must be aligned with and reinforce sustainability objectives. We work with agencies to develop holistic sustainability programs and define strategies that integrate technology, policy, and behavioral solutions. We help our sponsors find synergies across energy, water, waste, and other sustainability performance objectives rather than manage each one in isolation. Our approach is shaped by research on institutional and behavioral change and is grounded in practical experience with sustainability efforts at the agency and site levels.

In addition to project-level support, several of our team members are stationed on-site with agency sponsors to help them address regulatory compliance and sustainability goals. They provide longer-term programmatic support and offer targeted subject-matter expertise in areas such as energy efficiency, renewable energy, and environmental resource management—along with a suite of quantitative tools and processes.