

# BUILDINGS & CONNECTED SYSTEMS

PNNL's Buildings and Connected Systems group is transforming the way building systems are evaluated, operated, and integrated into surrounding communities, resulting in measurable improvements in resource use, operational efficiency, and occupant productivity.

Our group brings together 80 research engineers, scientists, and program managers with expertise in building energy and water systems, building design, energy and water infrastructure, data analytics, and software engineering. We are a geographically distributed team with offices in Richland, WA, Seattle, WA, Portland, OR, and Arlington, VA.

## Research Capabilities



### Performance Evaluation

- Develop methods for assessing sites and building systems for energy and water efficiency and resilience
- Lead assessments and site resilience planning to manage risk of energy and water disruptions
- Analyze advanced technology solutions, such as microgrids and alternative water systems
- Test and validate emerging technologies through field demonstrations and specialized testing facilities (e.g. two environmentally-controlled chambers)

### Controls Optimization & Networking

- Training and demonstration of onsite Re-tuning™ of building control systems
- Developing and testing methods for predictive fault detection and diagnostics (FDD)
- Building controls systems integration to enable remote evaluations and FDD through enterprise systems

### Building Energy Simulation

As the primary research organization supporting the DOE Building Energy Codes Program, our building performance modeling methods provide the basis for recommendations to enhance building energy codes with cost-effective, sustainable, resilient, and grid-interactive efficient building technologies, and inform appliance standards and test procedures. Our research includes:

- Large-scale building parametric analysis
- Technology evaluation through prototype modeling for their national impacts
- Equipment and end-use load modeling

### Data Analytics & Tools

- Develop and test advanced data analysis methods to model building systems and resource consumption to gain insights, using disparate building data streams
- Work across disciplines to apply state-of-the-art techniques to a variety of building domain problems
- Create and disseminate building performance assessment, system optimization, and code compliance tools

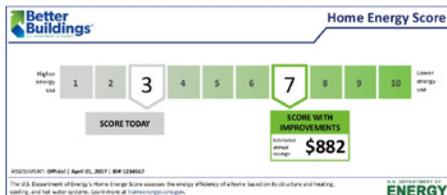
# Building Tools

PNNL develops and maintains innovative tools to help facility managers evaluate and optimize building energy and water performance and operations. Most of these tools are publicly available to commercial building operators and energy and water management professionals.

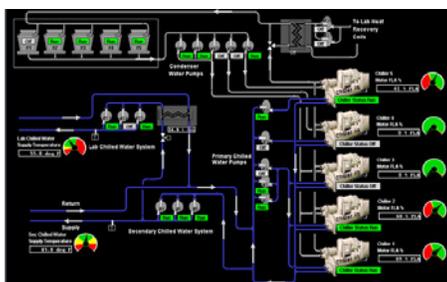
**Building Energy Asset Score** A national standardized tool for assessing the physical and structural energy efficiency of commercial and multifamily residential buildings.



**Home Energy Score** A national energy efficiency rating system and tool for single-family homes and townhouses. It estimates home energy use, associated costs, and provides energy solutions to cost-effectively improve the home's efficiency.



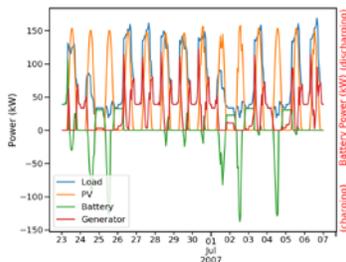
**Decision Support for Operations and Maintenance (DSOM)** An advanced O&M system that integrates plant operations, fuel management, and maintenance processes. The DSOM package provides plant operators with the information they need for cost-effective operational decisions creating savings in fuel, personnel, maintenance, and power plant life extension.



**Facility Energy Decision System (FEDS)** An easy-to-use building energy efficiency software tool that quickly and objectively identifies energy efficiency improvements that maximize life-cycle savings. It simulates building systems and energy use and analyzes the cost and performance impacts of thousands of combinations of potential efficiency measures.



**Microgrid Component Optimization for Resilience (MCOR)** Streamlines the design process for microgrids intended specifically for resilience. MCOR uses a stochastic model to simulate microgrid power dispatch under a large range of outage conditions to quantify the confidence that a given system configuration will meet a site's resilience goals under varying circumstances.



**REScheck™ and COMcheck™** Software that makes it easy for architects, builders, designers, and contractors to determine whether new commercial or residential buildings, additions, and alterations meet the requirements of the IECC and ASHRAE Standard 90.1, as well as several state-specific codes. They also simplify compliance for building officials, plan checkers, and inspectors by allowing them to quickly determine if a building project meets the code.



**Volttron** An open-source tool that provides an environment where data and devices connect seamlessly and securely to make decisions based on user needs and preferences.



**Water Balance Tool** A software tool that produces a campus-wide water balance by calculating water consumption across multiple water end-uses and comparing the end-uses to the campus' total water supply. A water balance identifies the largest water consumers and potential system losses to help prioritize water-saving opportunities.



**Alternative Water Sources Maps** A series of alternative water maps to help federal agencies strategically plan where to implement alternative water projects to help offset the use of fresh surface water and groundwater, including harvested rainwater, AHU condensate, and reclaimed wastewater.

For more information on the Buildings & Connected Systems group or working with PNNL, contact:

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**ENERGY**