

PNNL CAPABILITIES FOR GRID-INTERACTIVE EFFICIENT BUILDINGS

Environmental Chambers

- Side-by-side, 484-square-foot environmental chambers
- Provide a psychrometric capability that enables precise maintenance of temperature and humidity
- Serve as a simulation and testing resource for appliances such as heating, ventilation, and air conditioning (HVAC) systems and heat pumps

INDOOR-OUTDOOR CAPABILITIES

The two chambers are installed at PNNL's Systems Engineering Building (SEB). Each chamber stands 14 feet high and contains 484 square feet of floor space. The chambers are the largest in the U.S. Department of Energy (DOE) national laboratory system.

One chamber simulates the interior of a house or building, including indoor temperatures, humidity, and other factors. The adjacent chamber simulates outdoor conditions.

A heat pump, for example, could be placed in the outdoor chamber, where it would be operated under various paradigms and monitored. At the same time, the heat pump's outputs—air flow, cooling, and other conditions—are collected and measured in

the indoor chamber. All operating conditions can be adjusted to understand an appliance's performance under a wide range of scenarios.

In addition to testing the performance of various appliances, the chambers can be used to evaluate the effectiveness of current testing



The side-by-side environmental chambers offer respective indoor and outdoor simulation capabilities.

procedures; provide data for revising federal appliance standards; and assess the flexibility of HVAC systems to deliver grid services (actions that leverage a building's energy management capabilities to benefit power grid operations and reliability).

The chambers' capabilities ideally will lead to:

- » More efficient operation of energy-using devices
- » Cost savings for consumers
- » Clean energy and grid service objectives
- » Advanced technology development.

SUPPORTING A CLEAN ENERGY FUTURE

The units were funded by the State of Washington's Department of Commerce and installed in 2019. The investments are part of an ongoing effort to establish a research testbed in the state to advance new methods and technologies for a clean energy future.

After installation, the first project to use the chambers involved DOE-funded research related to controlling residential heating and cooling systems as part of a grid-responsive home.

CHAMBER SPECIFICATIONS

- » Each chamber is 22 feet long x 22 feet wide x 14 feet high
- » The chambers' wall panels are poured-in-place urethane for high insulating efficiency, and are joined in a manner that provides a complete vapor barrier system
- » The direct expansion refrigeration system and a time proportioned heater array in each chamber deliver precision-controlled air temperatures
- » Airflow capacity is approximately 15,000 standard cubic feet per minute (scfm) with variable speed drive (indoor), and 30,000 scfm with variable speed drive (outdoor)
- » Temperature control range is 50 to 110°F for indoor simulation, and -20 to 130°F for outdoor simulation



For more information, contact

Dennis Stiles

Pacific Northwest National Laboratory
P.O. Box 999, K9-69, Richland, WA 99352
(509) 375-6374 | dennis.stiles@pnnl.gov