



NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ENERGY SYSTEMS
INTEGRATION FACILITY

U.S. DEPARTMENT OF ENERGY



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Smart Power Laboratory

Research at NREL's Smart Power Laboratory in the Energy Systems Integration Facility (ESIF) focuses on the development and integration of smart technologies including the integration of distributed and renewable energy resources through power electronics and smart energy management for building applications. The 5,300 sq. ft. laboratory is designed to be highly flexible and configurable, essential for a large variety of smart power applications that range from developing advanced inverters and power converters to testing residential and commercial scale meters and control technologies.

Laboratory Specifications

- Hardware-in-the-loop.
- Research Electrical Distribution Bus (REDB) connections to various AC equipments such as grid simulators, load banks, wind turbine simulators and DC equipments, such as DC supply, PV panels, batteries, and DC loads through AC and DC REDB.
- Multiple three-phase AC REDB (250A, 1600A) and DC REDB (250A, 1600A) for running multiple experiments in parallel.
- Three separate and enclosed power electronics test bays with sound-abatement walls for long duration testing of power converters.
- A 96 sq. ft. walk-in fume hood in one of the power electronics test bay to test early prototype systems that have greater risks of failure.
- Instrument and equipment development area for building prototype converters and monitoring equipments.
- Four test bays capable of supporting a variety of household appliances. Each bay represents the load of a house and has connections for 120/240 Volt electric service, water, and natural gas.

Application Scenarios

- Development of power converters for integration of distributed and renewable energy resources
- Development of advanced controls for smart power electronics
- Testing prototype and commercially available power converters for electrical interconnection and performance, advanced functionality, long duration reliability and safety
- Hardware-in-loop development and testing of power electronics systems in smart distribution grid models

- Testing of advanced appliances, home automation, HVAC, and energy management systems
- Research on various new distribution scenarios such as household DC systems, Residential scale generation and storage integrated with the home energy managements systems
- Electric vehicle integration
- Hardware-in-the-loop modeling for the characterization of household loads and generation
- Advanced metering technology, including utility grade smart meters and energy metering

Partner with Us

Work with NREL experts and take advantage of the state-of-the-art capabilities at NREL's Energy Systems Integration Facility to make progress on your projects, which may range from fundamental research to applications engineering. Partners at the ESIF's Smart Power Laboratory may include:

- Smart appliance, home automation, and energy management system manufacturers
- Home automation and energy management system manufacturers
- Power electronics device vendors
- Utilities
- State energy commissions
- Certification laboratories
- Universities
- Other National laboratories

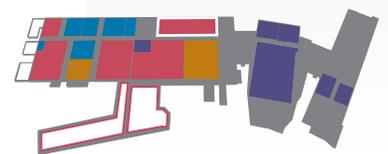
Contact Us

If you are interested in working with NREL's Smart Power Laboratory, please contact:

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Major Laboratory Equipment

- Various mechanical utilities in each test areas such as process cooling water, process heating water, research cooling water (chilled water), dedicated exhaust.
- Various facility power outlets in each test area such as three-phase 480/277 Vac, 208 / 120 Vac, 240 split-phase Vac and 120V single-phase Vac.
- Inverter HIL
- Grid simulator
- AC load banks
- Bidirectional DC supplies
- ELGAR Grid Simulator
- Electronic Load banks.
- Research Chiller
- Research Boiler
- SCADA Data Collection and Control System
- PV Simulator



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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
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