



Electric Power Systems Laboratory

■ The Electric Power Systems Lab at the University of Pittsburgh, sponsored in-kind by Eaton, is a multi-use facility for research and educational activities. Located on the Swanson School of Engineering's Energy Floor, the lab provides opportunities for faculty and graduate students to perform advanced work in the areas of AC microgrid developments, smart grid technologies, power electronics devices and systems, renewable energy systems and integration, controls and communications, automation and relaying, distribution engineering, power quality, electrical safety, energy management, energy storage, and other emerging electric power technology areas.

The educational components integrate new course developments in electric power engineering focused on these same emerging areas, utilizing the equipment and technologies of the laboratory. The facility design was inspired by Eaton's Power System Experience Center in Warrendale, Pa. A course in electric power quality is offered to undergraduates every spring and is the capstone laboratory course for those obtaining the electric power concentration in the electrical and computer engineering department. Numerous senior design projects are conducted in the lab each year as well as industry sponsored undergraduate projects.

- **Technical Specifications:** Maximum power capacity: 480-V, 200-A, and 75 kVA.
- **Core Equipment:** Main electrical infrastructure, motor control center, switchboard, protection, motor-generator sets, power factor correction equipment, isolation transformers, and other miscellaneous components.
- **External Components (as of 2014):** Solar PV panels, donated by John A. Swanson, PhD '66, are integrated into the lab (including AC and DC interfaces).
- **Future Enhancements:** Provisions have also been made for incorporating a gas-fired generator and potentially a micro-wind turbine. A custom made sag generator is also integrated into the main infrastructure where sag depth and duration can be controlled.

The Workbenches

Six custom-designed workbenches are innovative features of the laboratory. The workbenches were designed, prototyped, and tested by Eaton and Pitt throughout 2013, and are intended for integration into the overall laboratory environment, and are compatible with the other power system equipment and components.

Each bench is capable of functioning as a stand-alone entity. The overall objective of the workbench design is to seamlessly combine the configurable load banks and programmable logic controller (PLC) into the workstations, providing a wide array of functionality, while minimizing space within the facility. Each bench includes resistive, inductive, capacitive, and harmonic loads, with auxiliary connections for other loads and the capability to feed an external motor control center (MCC). Advanced metering devices are integrated to communicate readings throughout the entirety of the lab and allow students to clearly view all of the electrical phenomena within the bench.

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