GRAPES
GRid-connected Advanced Power Electronic Systems

GRAPES MISSION

The center aims to accelerate the integration of power electronics into the electric grid to enhance stability, flexibility, robustness, and economy.

Key objectives include:

- Developing advanced technologies for grid-connected distributed energy resources, power steering and routing devices, and intelligent load-side devices
- Creating software and tools for controlling embedded and grid-connected power electronics to optimize grid performance and manage loads
- Educating engineers on essential power electronic technologies relevant to member companies

RESEARCH

Research will concentrate on design, development, evaluation, control, and standardization of grid-connected power electronic equipment on both the supply and load side of power systems.

Relevant research areas include:

- Power systems, especially off-grid systems such as in transportation systems (ships, planes, trains, automobiles)
- Power electronics devices, characterization, modeling
- Simulation methods and environments for multidisciplinary dynamic systems

SAMPLE PROJECTS

- Modeling and Design of Clean-Power Inverter Based Resources
- IBR Transient Response Improvements to Transmission Faults
- Novel Electrical Insulators and Partial Discharge Detection Techniques for Resilient Medium Voltage Distribution Systems

GRADUATED PROJECTS

- Resilient MVDC and MVAC/MVDC Distribution Systems
- Energy Storage for Increasing Solar PV Capacity and Improving Voltage Dynamics in Distribution Systems
- Medium Voltage Solid State Circuit Breaker
- Power Dense, Grid Compatible Extreme Fast Charging Stations

PARTNER UNIVERSITIES

UNIVERSITY OF South Carolina

UNIVERSITY OF ARKANSAS

UNIVERSITY of WISCONSIN
UWMILWAUKEE

UNIVERSITY of WISCONSIN
UWMILWAUKEE

College of Engineering & Applied Science

CENTER FOR SUSTAINABLE ELECTRICAL ENERGY SYSTEMS

This center brings together the capabilities of existing Laboratories and Centers within UWM College of Engineering & Applied Science to enhance the collaborations within UWM and with other groups and organizations. Major research and education areas of the center include power electronics, microgrids, energy storage, protection, very high voltage partial discharge and cybersecurity.

Features include:

- Three labs with over 5000 sq-ft and over 500kVA power supply capabilities (three-phase 480 and 208)
- Microgrid with load and source controllers to simulate multiple application implementations.
- Full packages of MATLAB/Simulink, PSIM, PSS/E, and PSCAD
- Hardware in loop setups with National Instrument PXIe Platform with FlexRIO and Digital/Analog I/O, LabView, Compact RIO, Typhoon, and OPAL RT
- High power AC and DC sources, two Tektronix 8 channel oscilloscopes, multiple 4 channel oscilloscopes, two spectrum analyzers, Yaskawa power meters, high voltage and high current probes, power electronics converters and devices
- Two synchronous generators 63 kVA, 100hp dyno, and 600kW AC and DC power loads
- 50kW solar PV and 12kW wind turbine
- 500kW Li-Ion storage and two 45kW natural gas generators
- 6 X 4 X 3 m Semi-Anechoic Chamber for radiated emissions test and characterization.
- Custom designed 30kW Line Impedance Stabilization Networks for conducted EMI test and characterization
- Plug and play NI PXIe system with RF receivers and programmable EMI/EMC measurement capabilities.

An NSF Industry/University Cooperative Research Center

LEVERAGE FOR PARTICIPATING INDUSTRY

- Leverages existing Navy, DOE, and DOD programs at UWM
- Establishment of a smart and connected energy and water systems, Air Force
- Working with industry to characterize a 500kW Hybrid Energy Storage System (HESS).
- Working with industry, Air Force, Naval Facilities, EXWC and Office of Naval Research on digital twin to optimize renewable microgrid designs and performance.
- Working with industry on Machine Learning approach to EMI filter design for Electric Vehicles
- Extremely compact 500 kW, 2000 Hz inverter for high-speed permanent magnet synchronous machines, DOE
- Electric ship initiative, architecture, protection, and energy management; US Navy
- Hybrid and compact integrated energy storage systems
- UWM campus-wide Connected Systems Institute (CSI) with focus on Industrial Internet of Things