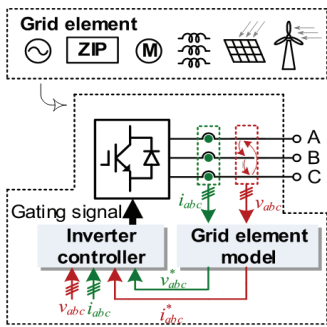


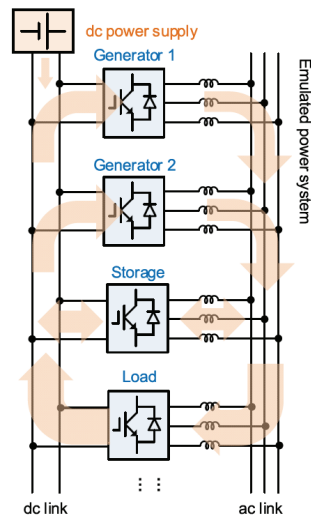
Overview

The CURENT Hardware Testbed (HTB) is a power electronics-based reconfigurable real-time grid emulator platform, which uses power electronics inverters to emulate the external properties of typical grid elements, including sources, loads, energy storage, and transmission/ distribution equipment. The HTB system contains real elements of power flow, measurement, communication, protection, and control that mimic what would be seen in an actual electric grid, providing realistic system scenarios to evaluate proposed new systems and controls with sufficient details and multiple time-scales.

Emulation Principles



Emulator operating principle



Emulators	Available emulator modules	
Generator Emulator	Synchronous generator	
Load Emulator	Single and three-phase induction machines, variable speed drives, EV chargers, data center power supplies, LED lighting	
	Constant impedance, constant current, and constant power load (ZIP)	
Wind Emulator	Type IV full converter wind turbine with permanent magnetic synchronous generator (PMSG)	
Solar Emulator	Type III wind turbine with doubly-fed induction generator (DFIG)	
	Solar panel with two-stage PV inverter	
Transmission Line Emulator	Back-to-back converter to emulate AC transmission lines with FACTS compensation devices and fault emulation	
Energy Storage Emulator	Batteries (Li-Ion, PbAcid, and flow), flywheels, supercapacitors	
Voltage Type	RT Simulator Interface	
Current Type	Integrate RTDS with HTB	
	HVDC Emulator	Multi-terminal HVDC represents lines and converter stations
	Fault and Protection Emulator	Emulate short circuit faults at buses and on lines – demonstrate system relay protection

Available emulator modules

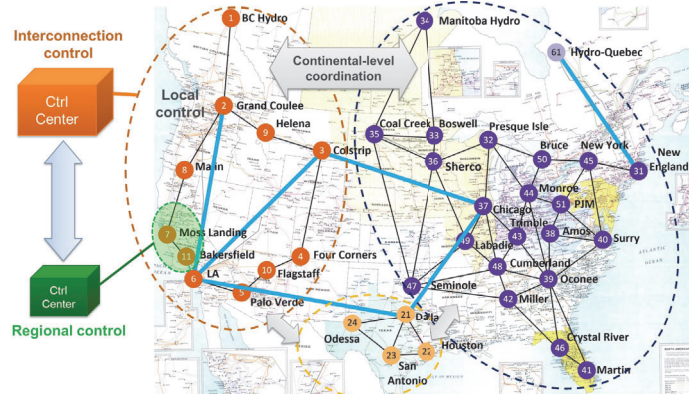
Point of Contact



Leon Tolbert
HTB Project Lead
Phone: +1-865-974-2881
Email: tolbert@utk.edu

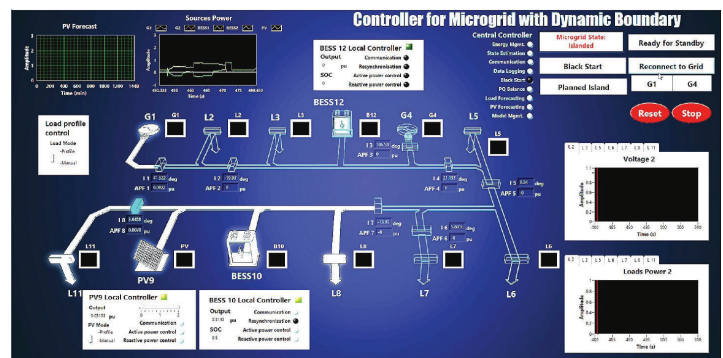
Demonstration Scenarios

North America Grid with HVDC Overlay



- Demonstrate security/stability assessment
- Demonstrate ability of HVDC overlay to provide continent-level coordination between the three grids: EI, ERCOT, WECC
- Evaluate high penetration (>80%) of renewables

Microgrid with Dynamic Boundary



- Demonstrate an actual microgrid in the Electric Power Board (EPB) system in Chattanooga, TN
- Test control schemes for black start, islanded operation, re-synchronization, system protection