How does one provide rapid transition and adoption of research in the TCIPG testbed? Released various IEEE bus models in several simulator formats. Security: Deployed advanced metering infrastructure (AMI). Develop and share an open, modular, and exercise-based training curriculum for cyber security in the smart grid.

RESEARCH PLAN
• Develop and share new cyber-physical and experimentation models and technologies to enhance experimentation capabilities. Continue to expand the testbed capabilities, features, and functionality through strategic integration of equipment. Develop and share integration glue that provides unique capabilities in the testbed environment. Leverage existing and emerging research from other areas when it can advance the goals of the testbed effort. Develop and share an open, modular, and exercise-based training curriculum for cyber security in the smart grid.

HIGHLIGHTED RESEARCH RESULTS

BROADER IMPACT
• Enabling advanced research for smart grid efforts throughout the world via federation and collaboration. Flexible framework leverages tailored operating constraints to use resources efficiently for research, education, and training. Open for collaborative research, facility-driven use, sponsored research, education and training, and technical testing.

CAPABILITIES

ASSETS
• RTDS, PowerWorld, PSSE, PSCAD, PSIFL, DSAtools, DynRed. RINSE, testBench, LabView, OSI PI, OSI Monarch, SEL suites, PGDA. Full range of open-source power grid tools (openDNP3, openPDC, openPG, openXDA/openFLE, openHistorian, SIEGate, GridLAB-D). Substation computers, relays, PMUs, testing equipment, PLCs, security gateways, NI platforms. Power analysis tools, PDCs, data analytics. Full AMI deployment, TCIPG Smart Meter Research Platform. RTUs, F-Nets, 4-quadrant amps, oscilloscopes, firewalls, embedded devices, sensors, spectrum analyzers, SIEMs, IDSes, RF capture, GPS signal generation, GPS clocks. Home EMS, energy and environmental monitoring devices, ZigBee, automation, building automation controls. Display wall, visualization platforms (STI, RTDMS), training platforms. Mu Dynamics, Fortify, security research tools, IBM Tivoli suite. DETER integration and cyber-physical extension via federation.

USE CASES
• Provide a multifaceted approach to security through testbeds, education and training, field testing, and tool creation. Facilitate collaboration among researchers and industry to work towards creation of more resilient critical infrastructure. Facilitate rapid transition and adoption of research in industry. Provide positive real-world impact through engagement. Allow for cutting-edge smart grid security research.