2021 Summer Strategic Planning Meeting

List of sponsored projects in power and energy

Power systems related (sponsor in paratheses)

Operation and control

- Mitigation of Cascading Outages Using a Multi-Layer Interaction Graph Model (ORNL)
- Semi-Analytical Simulation to Accommodate Multi-timescale Grid Dynamics with Increasing Power Electronics Devices (Argonne National Laboratory)
- Intelligent Phasor-EMT Partitioning (I-PEP) for Accelerated Large-scale IBR Integration Studies (DOE SETO/NREL)
- Towards enhanced grid robustness: Augmenting grid regulating capabilities through discrete controls on emerging power technologies (NSF)
- Ensuring Resilient Operation of the Future Power System with High Levels of Renewables using Switched Mode Devices (NSF)
- National Transmission Resilience and Reliability (ORNL)
- Risk-calibrated energy bids for systems with high renewable penetration (ARPA-E).
- Quantifying Reliability and Resilience Benefits of Advanced Techniques (Duke)
- Adaptive Oscillation Damping Control (EPRI, NYPA, SEC, TERNA)
- System inertia trending study (Dominion)

Monitoring and modeling

- PMU-Based Voltage Stability Monitoring and Control (GEIRINA)
- PMU-Based Early Warning and Control of Power System Oscillations (GEIRINA)
- Parallel-in-Time Power System Simulation (ORNL)
- Watching Grid Infrastructure Stealthily via Proxies *(*ARPA-e/DOE)
- Cloud-based integrated model-and-measurement analytics for power system applications (Dominion)
- Mitigation and modelling for ground fault overvoltages of inverter based DERs (NYSERDA)
- Grid Interpreter: Model Translation for High Performing Smart Grid Applications (NYSERDA)
- Advanced Thevenin equivalent computation methods
- Graph-Learning-Assisted State and Event Tracking for Solar-Penetrated Power Grids with Heterogeneous Data Sources (DOE)
- A Comprehensive Approach to Monitoring Active Distribution Systems (NSF)
- Robust Distributed State Estimator for Interconnected Transmission and Distribution Networks (NSF)
- Speeding Up the Dissipating Energy Flow Based Oscillation Source Detection (Hitachi)
- Forced oscillation source location (TVA)
- Optical voltage and current sensor review (ORNL)
- Distribution PMU application review (ORNL)
- Optimal PMU Placement (TVA)
- Identification and Correction of Network Parameter Errors (ISO-New England)
- Non-Divergent State Estimator for Large Scale Power Grids (PJM)
- Fault Detection and Location Using Power Line Communication Devices (LLNL)
- Multi-Area Robust and Scalable Linear State Estimation (PJM)
- Implementing Event Detection Tools Based on PMUs (SOCO)
- Measurement-based Model reduction (ISO-NE, TVA)

Artificial intelligence and data analytics applications

- Adaptive dynamic coordination of damping controllers through deep reinforcement and transfer learning (NSF)
- CPS: Medium: Secure Constrained Machine Learning for Critical Infrastructure (NSF)
- DeepGrid: A Deep Learning Computing System for Resilient Grid Operations (NYSERDA)
- Fast Security Assessment with Cascading Contingencies and Emergency Control for Power System Operation (GEIRINA)
- Improving Nuclear Power Plant Efficiency through Data Analytics (DOE)
- AI Enabled Predictive Maintenance Digital Twins for Advanced Nuclear Reactors (GE-Global Research)
- A Holistic Artificial Intelligence Tool to Mitigate Human Factor Uncertainty in Operation and Maintenance
- Data-driven method for detection of transient instability (NSF)
- From AlphaGo to Power System Artificial Intelligence (NSF)
- Reinforcement Learning for Smart Grid Transactive Energy Systems (ORNL)
- Machine Learning for Identifying Protective Relay Violations (ORNL)
- Multi-agent Deep Reinforcement Learning Method for Power System Emergency Control Under Cascading Contingencies (GEIRINA)

Distribution systems and microgrids

- GMLC Duke Energy: Increasing Distribution System Resiliency Using Flexible DER and Microgrid Assets Enabled by OpenFMB(DOE)
- A Power Balancing Router for Distribution Level Power Grid with High Renewable Energy Penetration (OneUT)
- Resilient Distribution Systems (RDS) Enabled by Responsive Resident Building Loads (ORNL)
- Correlation Between Grid Resiliency and Architectural Approaches for Managing Behind-the-Meter Resources (EPRI)
- AGIS: Advanced Grid Integration Studies for adopting emerging technologies (ORNL)
- Model-Free Adaptive Control (MFAC) for Autonomous and Resilient Microgrids (DOD)
- Intelligent Control of Refrigerating Load for Peak Reduction (State of Tennessee)
- Cyber-Physical Dynamic System (CPDS) Modeling for Frequency Regulation and AGC Services of Distributed Energy Storage Resources (NREL)
- Support for Resilient Operation of Networked Community Microgrid with High Solar Penetration (ORNL)
- GMLC CITADELs Networked Microgrids Project (ORNL)
- A Smart and Flexible Microgrid and Its Controller (ARPA-e)
- Multi-functional High-efficiency High-density Medium Voltage SiC Based Asynchronous Microgrid Power Conditioning System Module (PowerAmerica)
- SiC Based Modular Transformer-less MW-Scale Power Conditioning System and Control for Flexible Manufacturing Plants (DOE)
- SiC Based Modular Transformer-less MW-Scale Power Conditioning System and Control for Flexible CHP System (DOE)

Power electronics and systems for the grid

- Rapidly Attainable Increases in Transmission Capacity Using Power-Electronics (DOE/Achillea Research)
- Continuously Variable Series Reactor for Distribution System Applications (ORNL)
- Model Validation Workflows for Dominion Energy's Power Plants Leveraging Modelica and the FMI Technologies (Dominion)

- Integrated Controller-Hardware-in-the-Loop Testing of Converter-Interfaced Distributed Energy Resources (NYSERDA)
- Secure Reliable and Stable Power Systems (ORNL)
- Fast active power control of renewable resources to enhance transient stability (NSF)
- VSC-HVDC Interties for Urban Power Grid Enhancement (ABB - Hitachi)
- Hybrid HVDC system for Cross-seam Interconnections (ABB - Hitachi)

Power electronics and other systems for grid support

- Optimal Co-Design of Integrated Thermal-Electrical Networks and Control Systems for Grid-interactive Efficient District (GED) Energy Systems (DOE)
- GRIDx - The Autonomous Digital Grid (King Abdullah University of Science and Technology)
- Development of the Cryogenic Hydrogen-Energy Electric Transport Aircraft (CHEETA) Design Concept (NASA)
- A Cyber-Attack Detection Platform for Cyber Security of Digital Instrumentation and Control Systems (DOE)
- Economic Risk-Informed Maintenance Planning and Asset Management
- Innovative Enhanced Automation Control Strategies for Multi-Unit SMRs
- Design and Intelligent Optimization of the Thermal Storage and Energy Distribution for the TerraPower Molten Chloride Fast Reactor in an Integrated Energy System (ARPA-e)
- NY Subway System with ESS (ConEd)
- Energy storage system for FIDVR control (ConEd)
- Battery SOH Calculation (ConEd)
- PV vs Gas study at Chester Field (Dominion)
- Distributed solar generation fault current study (Dominion)
- Automation on relay setting generation (Dominion)
- DG voltage study during un-intentional islanding (Dominion)

Power electronics focused (sponsor in parentheses)

Power systems and grid related

- GMLC HUB: Auxiliary power supply for a 10 kV H-bridge (ORNL)
- Design-Oriented Education and Hands-on Training with WBG Power Electronics for the Next Generation Power Engineering Workforce (DOE)
- Battery Management Test System for Energy Storage Technologies (ORNL)
- Evaluation and Application of Voltage-Bidirectional GaN GITs (ABB)

Transportation

- Lightweight converter design for UAVs (ARL)
- Superconducting Motor and Cryo-Cooled Inverter Engine: SOARING (Raytheon/ARPA-e)
- Ultra-Light Tightly-Integrated Modular Aviation-Transportation Enabling Solid-State Circuit Breaker (ARPA-e)
- Advance Power Electronics Technology for Future Aircraft (Boeing)
- A Smart and Highly Compact Power Electronics Box to Provide Universal Charging Technologies (OBC, Wireless and DC Fast Charging) along with DCDC (Magna)
- Research and Development of An FPGA based Three-phase High-efficiency SiC Inverter for Electric Vehicles (Mercedes-Benz)
- GaN 800V module with double sided cooling in a 3L half bridge configuration (Volkswagen)
- Smart, Compact and Efficient 1MW EV Chargers (ARPA-e)

Other

- CAREER: Unified Design Framework for Advanced Power Electronics (NSF)
- High current, regulated switched capacitor battery charger for cell phones (TI)
  Wireless power transfer loss simulation and demonstrator for fast charging (Volkswagen)
- Integrated high efficiency all-GaN wireless power supply for mobile electronics (Power America)
- WBG Device Current Measurement Techniques (Keysight)
- A High-Efficiency, High-Power-Density Integrated DC/DC with OBC Using SiC and GaN Devices for Electric Vehicles (Hella)
- Packaging A Top-cooled 650V/>150A GaN Power Modules with Insulated Thermal Pads and Gate-Drive Circuit (PowerAmerica)