Transmission and Distribution
Overview and
Materials Research Wish List

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Electricity Infrastructure

Electric power supply is one of the most critical infrastructure systems in the nation.

- Lighting
- Running motors
- Heating and Cooling
- Communication and computing — electricity is the currency of information!
Strategic Focus Areas

- Specifically limiting discussions to Transmission and Distribution Applications
  - Supporting technology such as generation, robotics, distributed resources, and analytics/visualization not included, but have their own materials wish lists
Substation Transformers
Other Substation Equipment
Transmission Infrastructure
Transmission System Applications

Types of Advanced Conductors

1. Metal Core
2. Carbon Fiber Core
3. Metallic Carbon Fiber Core

Evaluation Different for Different Type
Distribution System Applications
GR-13-07 Unbalanced Static Current Compensator

**Objective**
- Eliminate negative- and zero-sequence current components in substation transformers (upstream currents) by balancing the load in each line of a three-phase distribution system.
- Achieve unity power factor at the substation by compensating for downstream reactive loads.
- Demonstrate viability of the equipment with a scaled-down prototype.

**Technical Approach**
- Attach each feeder phase to an H-bridge inverter coupled using a distribution transformer.
- Develop a single-phase α-β/D-Q reference frame-based current controller to compensate for real and reactive powers separately.
- Using Matlab/SIMULINK™ software evaluate the controller for full and scaled-down prototypes.
- Construct and test a scaled-down prototype.

**Schematic Diagram**

**Simulation Results**
Sensors - - - Everywhere
Discussion