Transmission and Distribution Overview and Materials Research Wish List

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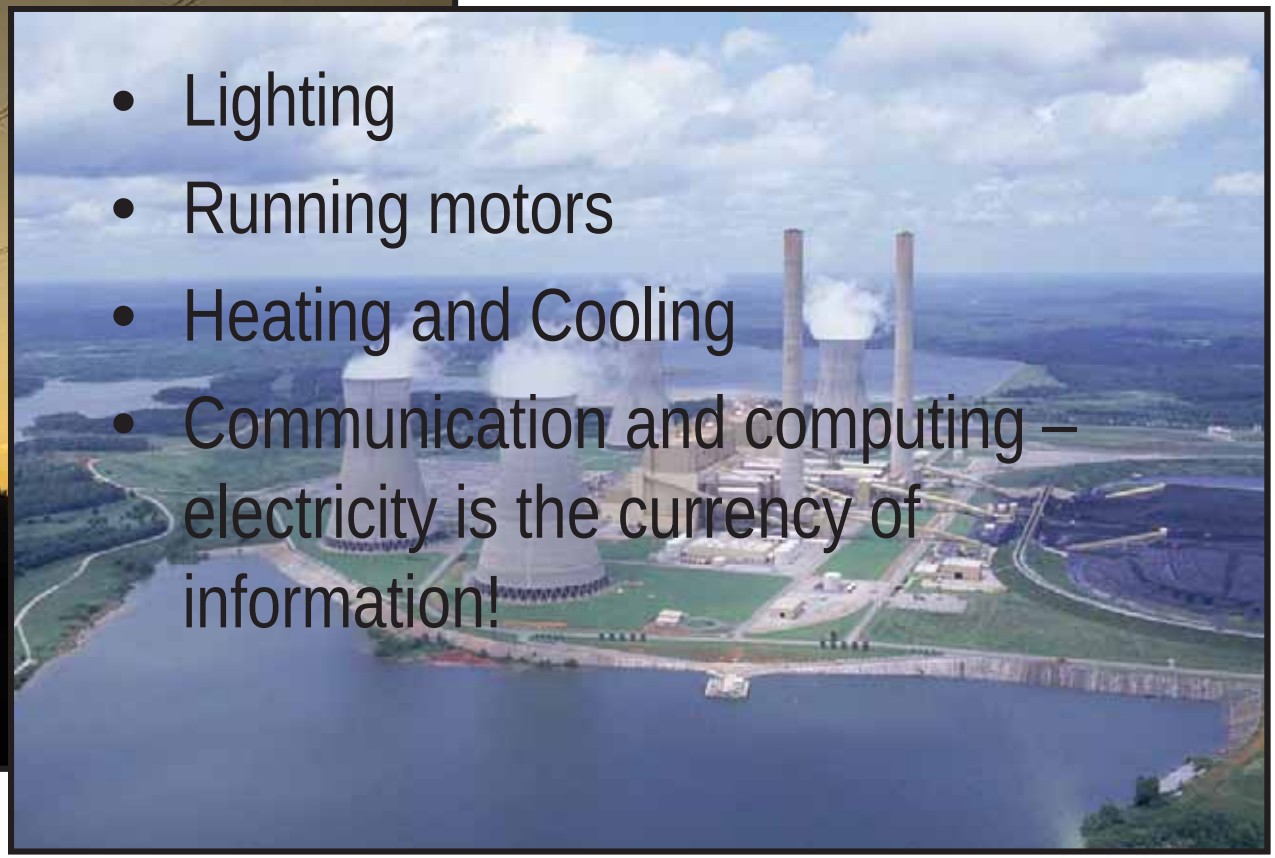
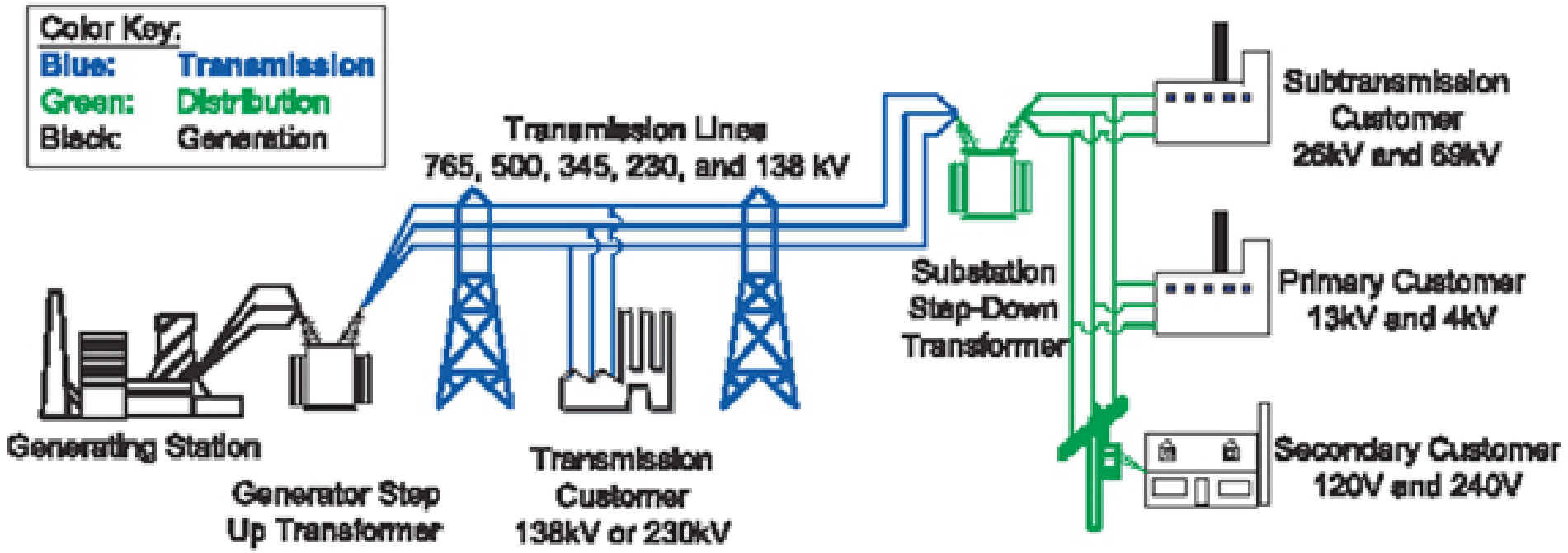
Electricity Infrastructure

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

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Substation Transformers

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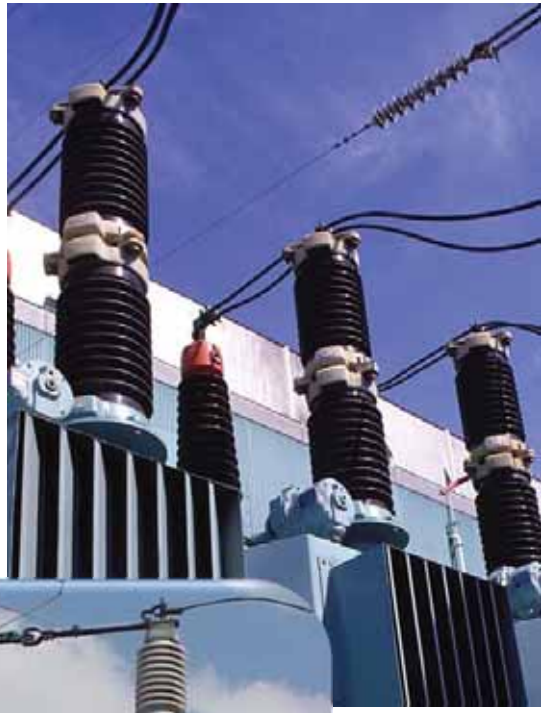
Other Substation Equipment



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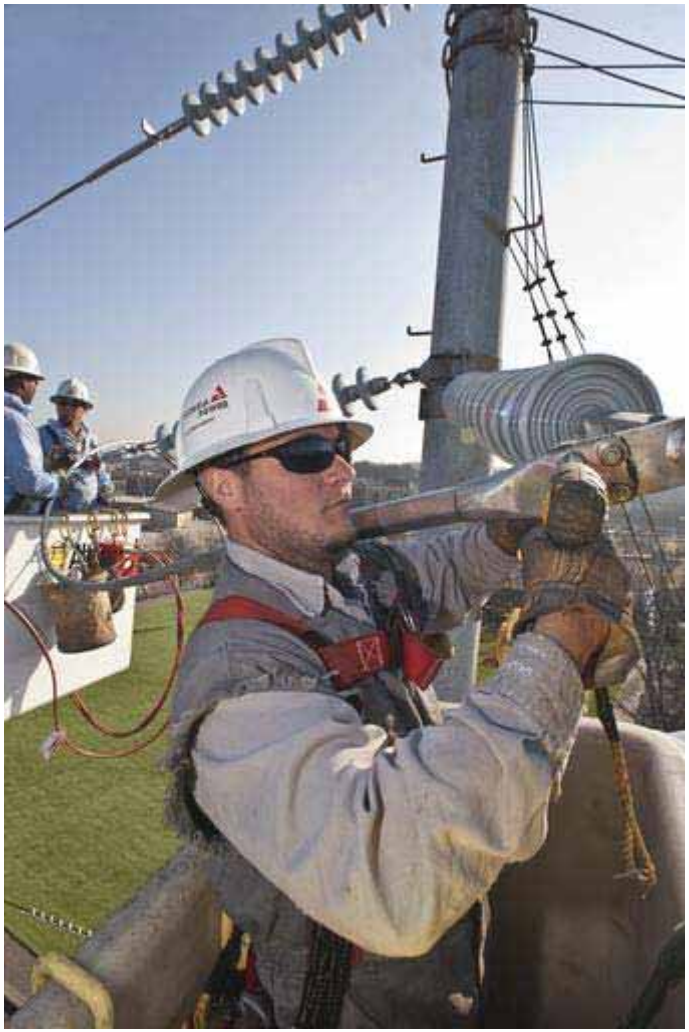
Transmission Infrastructure



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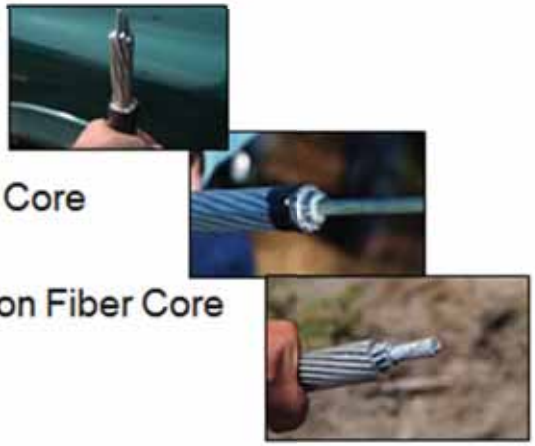
Transmission System Applications

Types of Advanced Conductors

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



Evaluation Different for Different Type

Distribution System Applications

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GR-13-07 Unbalanced Static Current Compensator

GRid-connected Advanced Power Electronic Systems

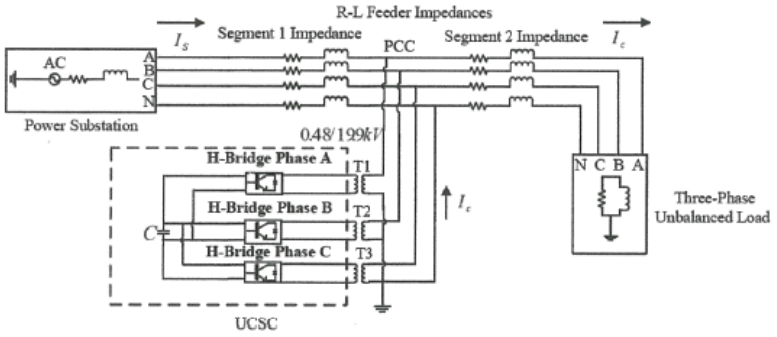
Objective

- 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.

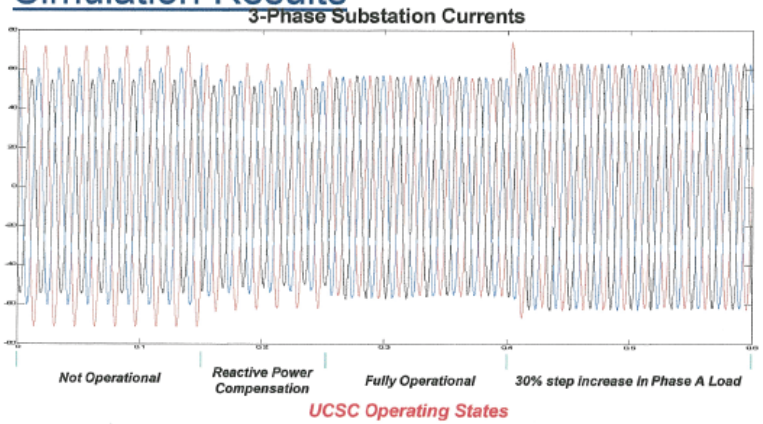
Technical Approach

- 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



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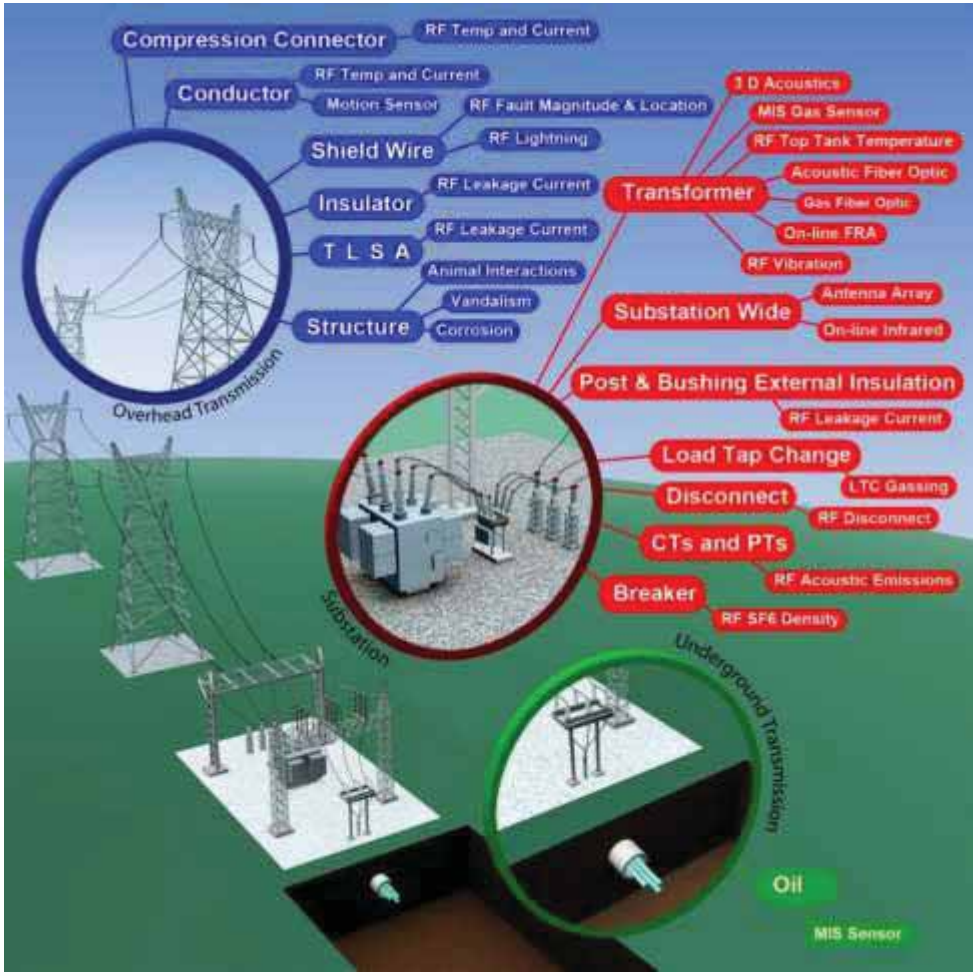
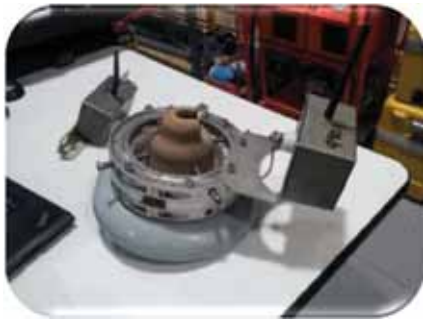
Sensors - - - Everywhere





Discussion