TECHNICAL STRATEGIC CHOICE:
POWER ELECTRONIC SYSTEMS AND APPLICATIONS

TECHNICAL CHALLENGES:
FAULT DETECTION & MITIGATION

- GPS-BASED “SMART” RECLOSER
- DC CIRCUIT PROTECTION
- SOLID-STATE FAULT CURRENT LIMITATION
- RELIABILITY OF GRID-CONNECTED POWER ELECTRONICS

IMBALANCES IN 3-PHASE FEEDERS

SUB-SYNCHRONOUS RESONANCE MITIGATION

COMPENSATION FOR NON-PERIODIC CURRENTS

QUANTIFYING THE IMPACT OF FACTS
- POWER SYSTEM STATE ESTIMATION
- ROLE OF PMUs IN EVALUATION OF PV IMPACT
- IMPACT OF DG ON POWER QUALITY
- RAPID VOLTAGE COLLAPSE

SYSTEM COMPENSATION AND FAULT DETECTION

RED: WORK TO BE DONE
GREEN: ONGOING
BLUE: COMPLETED
YELLOW: PROPOSED

TECHNICAL CHALLENGES:
COMPENSATION TECHNIQUES

RELIABILITY OF GRID-CONNECTED POWER ELECTRONICS

TECHNICAL CHALLENGES:
POWER QUALITY AND RELIABILITY ASSESSMENT
TECHNICAL STRATEGIC CHOICE:
POWER ELECTRONIC SYSTEMS AND APPLICATIONS

TECHNICAL CHALLENGES:
RESOURCE MANAGEMENT

- POWER SYSTEM STATE ESTIMATION
- TRANSMISSION PLANNING IMPROVEMENTS
- ROLE OF PMUs IN EVALUATION OF PV IMPACT
- PV INVERTER CONTROL
- SUB-SYNCHRONOUS RESONANCE MITIGATION
- DISTRIBUTED COMPENSATOR PROTOTYPE
- IMBALANCES IN 3-PHASE FEEDERS
- HIGH STEP-UP/DOWN SiC MMC
- SOLID STATE TRANSFORMERS
- MOBILE POWER SUBSTATION

TECHNICAL CHALLENGES:
COORDINATION OF CONVERTERS

- DISTRIBUTED POWER QUALITY IMPROVEMENT
- DISTRIBUTED CONVERTER CONTROL

TECHNICAL CHALLENGES:
ENERGY ACTUATORS

- DEMAND-SIDE RESOURCE MANAGEMENT AND POWER FLOW CONTROL

RED: WORK TO BE DONE
GREEN: ONGOING
BLUE: COMPLETED
YELLOW: PROPOSED
TECHNICAL STRATEGIC CHOICE:
POWER ELECTRONIC SYSTEMS AND APPLICATIONS

TECHNICAL CHALLENGES:
ENERGY FLOW CONTROL
- IMBALANCES IN 3-PHASE FEEDERS
- DISTRIBUTED COMPENSATOR PROTOTYPE
- PV INVERTER CONTROL
- DISTRIBUTION LEVEL UPFC

TECHNICAL CHALLENGES:
DEMAND-SIDE RESOURCES
- ROLE OF PMUs IN EVALUATION OF PV IMPACT
- FUTURE HYBRID MICROGRIDS
- IMPACT OF DG ON POWER QUALITY
- HYBRID MICROGRID

TECHNICAL CHALLENGES:
MIcroGRID SYSTEM STUDIES
- MICROGRID M-P AUTONOMOUS CONTROL CONCEPT
- RED: WORK TO BE DONE
- GREEN: ONGOING
- BLUE: COMPLETED
- YELLOW: PROPOSED

DISTRIBUTED ENERGY AND MICROGRID MANAGEMENT
TECHNICAL STRATEGIC CHOICE:
ADVANCED POWER TECHNOLOGIES

TECHNICAL CHALLENGES:
FABRICATION & DESIGN OF POWER ELECTRONIC MODULES

- MODULE LAYOUT SYNTHESIS TOOL
- MODELING OF GaN DEVICES
- SOLID STATE TRANSFORMERS
- WIDE BANDGAP OPTICAL ISOLATION
- POWER DENSE ELECTRONIC INTERFACES
- SMART GREEN POWER NODE ELECTRONICS
- DC CIRCUIT PROTECTION
- MMC FOR TRANS LEVEL BATT STORAGE

TECHNICAL CHALLENGES:
HIGH CURRENT/HIGH VOLTAGE

- OPTIMIZATION AND RELIABILITY OF POWER ELECTRONIC MODULES

TECHNICAL CHALLENGES:
DEMONSTRATORS

- NEW POWER TECHNOLOGY DEMONSTRATORS

ADVANCED GRID TIED POWER TECHNOLOGIES

RED: WORK TO BE DONE
GREEN: ON GOING
BLUE: COMPLETED
TECHNICAL STRATEGIC CHOICE:
SOLID-STATE TRANSFORMER & MOBILE POWER SUBSTATIONS

TECHNICAL CHALLENGES:
TOPOLOGIES

SOLID STATE TRANSFORMER
HIGH STEP-UP TRANSFORMERLESS TOPOLOGIES
MEDIUM-VOLTAGE THREE-PHASE TOPOLOGIES
MOBILE POWER SUBSTATION

TECHNICAL CHALLENGES:
MEDIUM & HIGH FREQUENCY MAGNETICS

MEDIUM & HIGH FREQUENCY THREE-PHASE TRANSFORMER
BASIC INSULATION LEVEL (BIL) COMPATIBLE WITH DISTRIBUTION SYSTEMS
RELIABILITY STUDIES OF HIGH VOLTAGE POWER MODULE FOR GRID TIED APPLICATIONS

TECHNICAL CHALLENGES:
SENSING AND CONTROL

TECHNICAL CHALLENGES:
RELIABILITY

SOLID STATE TRANSFORMER & MOBILE POWER SUBSTATION

RED: WORK TO BE DONE
GREEN: ON GOING
BLUE: COMPLETED
TECHNICAL STRATEGIC CHOICE:
GRID TIED POWER ELECTRONIC MODULES

TECHNICAL CHALLENGES: MODULE DESIGN/FABRICATION
- MODULE LAYOUT SYNTHESIS TOOL
- FABRICATION OF POWER MODULES
- HIGH VOLTAGE DIELECTRIC FOR POWER MODULES
- SERIES CONNECTION OF SIC DEVICES IN POWER MODULE
- PARASITIC MITIGATION OF POWER MODULE
- PARALLELING OF SIC DEVICES

TECHNICAL CHALLENGES: OPTIMIZATION AND DESIGN
- OPTIMIZATION AND RELIABILITY OF POWER ELECTRONIC MODULES
- ELECTROMAGNETIC INTEFEERENCE AND OTHER MODULE DESIGN ISSUES
- 3 D MODULES
- WIDE BANDGAP DEVICE RELIABILITY
- RELIABILITY STUDIES OF HIGH VOLTAGE POWER MODULE FOR GRID TIED APPLICATIONS

GRID TIED POWER ELECTRONIC MODULES (20KV, 1000A)

RED: WORK TO BE DONE
GREEN: ONGOING
BLUE: COMPLETED
YELLOW: COLLABORATION AREA