Modular and Scalable Sustainable Infrastructure for the SIUC Campus

This project provides state-of-the-art infrastructure for renewable energy, control, and wireless communication courses at the SIUC campus. Its unique feature of providing sustainable wireless communication will have an impact beyond the classroom and into the Carbondale community.

Principal Investigators (PI)

- Spyros Tragoudas, (chief) PI.
  - General project management.
- *Constantine Hatziadoniu*, Co-PI.
  - Power and Energy systems, PV array and battery management, data collection.
- Haibo Wang, Co-PI.
  - Sensors
- Aruma Baduge, Co-PI.
  - Communications, design and management of base stations, system resilience.
- Iraklis Anagnostopoulos, Arash Komaee, Co-PIs.
  - SCADA, embedded software, control room software integration.

Technical Characteristics: Energy Efficiency and Resiliency

- Contributing to energy efficiency:
  - The PV array can provide a small portion of the daily needs of the engineering building: Estimated at around 5% of its average annual energy needs.
  - Batteries can smooth the PV array output to improve the overall power quality.
- Back-up energy from batteries for the Engineering Building.
  - In the event of an outage, the energy stored in the batteries can provide continuous power flow to critical loads in the building.
  - This function is presently accomplished by an on-site diesel generator.

Technical Characteristics: Communications Resiliency

- Contributing to communications resiliency:
  - Communication stations are going to be installed at different buildings: Morris library, University police on Campus and City Police and City fire station.
  - These stations will be provided with back-up power (e.g. PV arrays and battery storage).
  - On the event of a cellular disruption due to a disaster, the communication system is designed to provide uninterrupted emergency channels for first responders on campus and the City.
  - Two disaster levels are considered in the contingency plan:
    - Cellular tower interruption but uninterrupted internet service.
    - Both cellular and internet are interrupted.

Anticipated Project Impacts

- Data collection and analysis will yield useful information for the operation of the project. The results will be used to determine how to scale up the PV array and the storage for similar projects in Illinois or elsewhere.
- A real-life laboratory for training students in renewable energy systems and storage.
  - Demonstrate the operation of PV arrays and storage and the associated SCADA system.
  - Demonstrate the viability of the BESS as a reliable back-up power source: potential to replace the existing back-up diesel generator.
  - Demonstrate the function of the battery to smooth out the PV array output (due to the PV array intermittent nature) and improve power quality.

Wider Relevance of the Project

- Overall 30% of ECE students are from southern Illinois; a high percentage is first generation university students; in general of lower income than the state average.
- Many of our graduates find a job in Illinois and many of those in power utilities including local utilities. Some also in Kentucky utilities.
- Utilities are expected to benefit from future engineers with related exposure to these systems as part of their curricular studies.
- The ECE department at SIUC has a long-standing research collaboration with Ameren.
- The project will provide a testbed for PV plus storage systems that can strengthen and enlarge this collaboration.