SunShot
U.S. Department of Energy

SHINES Program Review 2017

Project Title:
Microgrid-Integrated Solar-Storage Technology (MISST)
Principal Investigator:
Shay Bahramirad

Presenters:
Manuel Avendaño and Fred Gomos

Commonwealth Edison

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Introduction and Project Background

- The proposed technology, referred to as **Microgrid-Integrated Solar-Storage Technology (MISST)**, will address availability and variability issues inherent in the solar photovoltaic (PV) technology by utilizing smart inverters for solar PV/battery storage and working synergistically with other components within a community microgrid

- The proposed MISST project will deploy high-power solar PV and a high-power Battery Energy Storage System (BESS) in the Bronzeville Community Microgrid (BCM), which is designed to be controlled by the DOE-funded microgrid cluster controller and to be connected to the DOE-funded 12 MW Illinois Institute of Technology (IIT) microgrid

- The total installed solar and storage capacity will be the required to achieve instantaneous PV/storage power penetration levels between 20% and 35% of the microgrid's peak load apparent power but higher penetration levels could be achieved.

Project Team and Key Contributions

Commonwealth Edison (ComEd)

- Will lead the overall project and will be responsible for the engineering, design and deployment of the project.

Illinois Institute of Technology (IIT)

- Responsible for developing the smart inverter technology and enhancing the Microgrid Master controller for the MISST solution

University of Denver (DU)

- Responsible for developing short term load forecasting methodology, and the data collection, analysis and overall documentation and reporting for the project .

National Renewable Energy Laboratory (NREL)

- Responsible to validating LCOE analysis and servicing a technical quality control for the project

Argonne National Laboratory (ANL)

- Investigating engineering design requirements for the MISST solution and developing test plans for validating the smart inverter technology.

Project Objectives

- Demonstrate the capabilities of MISST to accommodate high levels of solar PV generation through the following:

    1. *Smart Inverters* – implementing robust droop control strategy for both solar PV and energy storage systems, which allows them to function as conventional synchronous generators
    2. *Efficient Battery Storage* – that provides a smooth power output from solar plants, stores excess solar energy, and mitigate the steep ramps in solar power output
    3. *Microgrid Control* – maximize benefits of solar PV generation through coordinated operation with demand response and energy storage

- Demonstrate the merits of solar PV energy coupled with battery energy storage to achieve better economic, resiliency and reliability outcomes in the context of a microgrid

- Enable widespread sustainable deployments of low-cost, flexible, and reliable PV generation in microgrids

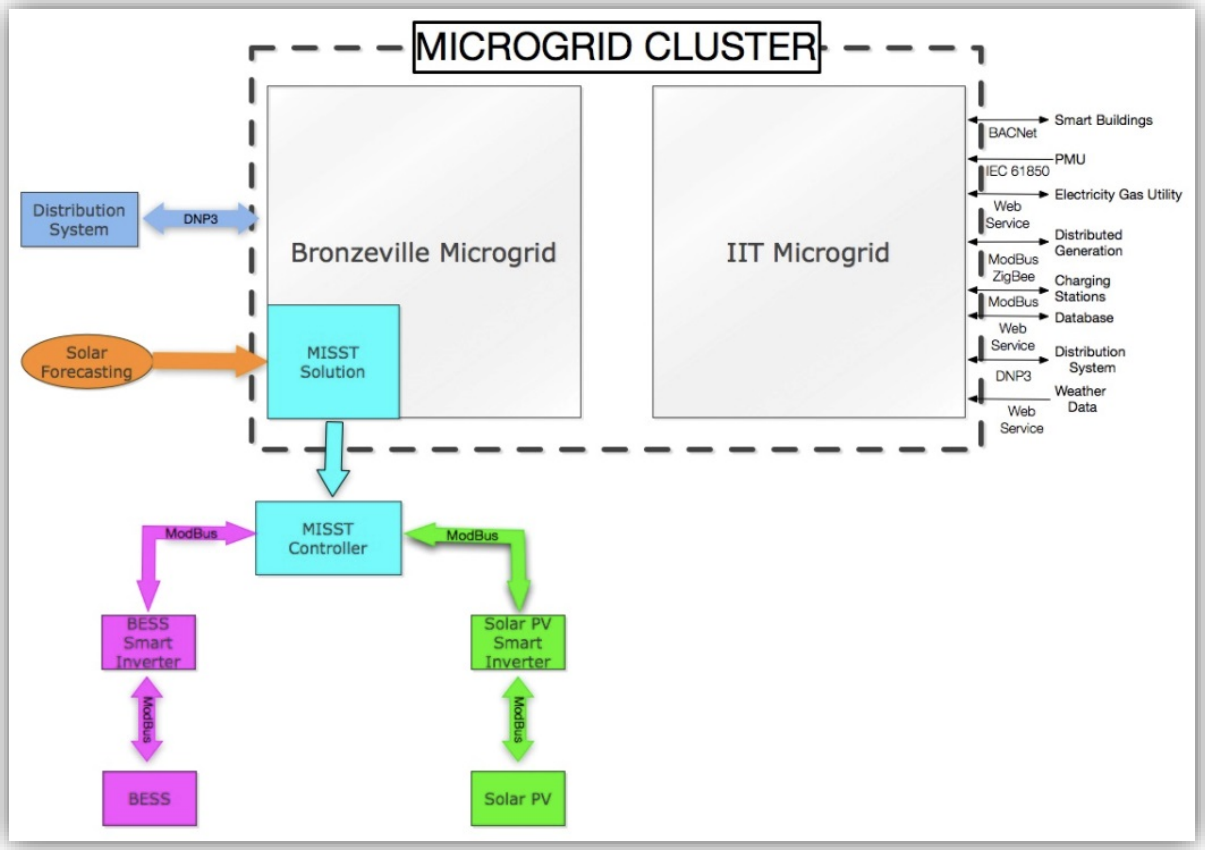
Unique Innovations and Key Contributions

- Practical implementation of seamless and coordinated control between the Microgrid Master Controller and the MISST controller
- Successful utility-scale practical implementation of hierarchical and coordinated solution on a real-life distribution system
- Facilitate the implementation of the Distributed Energy Management System (DERMS) concept
- Optimal integration of PV and energy storage systems in an islandable microgrid
- Frequency control of the solar PV/energy storage system for frequency regulation services to enhance the economics of solar-storage technology

Scope of Work

The technical tasks in the proposed three-year project include:

- Design the integrated solar-storage system
- Develop the proposed smart inverter technology
- Enhance the existing microgrid controller
- Design, procure, and deploy the solar PV system
- Design, procure, and deploy the BESS
- Collect data and conduct data analyses



Current Status and Next Steps

- At the end of 2016 the team was able to resolve all the open contractual issues with the DOE and accept the award. The performance period from the project commenced on Jan 1st.
- The team is currently finalizing Statements of Work and sub recipient agreements with our university and national lab partners.
- The team kick off is scheduled for February 13th and work on an accelerated schedule to complete the deliverables of the 1st budget period.
- ComEd is also in the process of bringing on board vendor partners for the implementation phase of the project

Project Desired Outcomes

The MISST solution will have the following features:

1. Be grid-connected
2. Consist of solar PV plant and energy storage
3. Utilize smart inverters
4. Be capable of operating in conjunction with smart loads
5. Enable demand response
6. Incorporate solar and load forecasting into decisions
7. Be interoperable internally and externally using standard protocols