SUNY POLYTECHNIC INSTITUTE

CATN2 Center for Advanced Technology in Nanomaterials and Nanoelectronics

SUNY Polytechnic Institute's Photo Voltaic Test-Bed Assets

Smart Energy Test-bed (SET)

The Research Foundation for SUNY on behalf of SUNY Polytechnic Institute's (SUNY Poly) Colleges of Nanoscale Science & Engineering (CNSE) created the Smart Energy Test-bed for manufacturers, developers and installers for in-depth, pre-commercial product testing of emerging fuel cell, photovoltaic (PV), backup power integration, and natural gas purification and reformation technologies through National Grid's Renewable Energy & Economic Development (REED) grant. The result of a collaboration with the Japanese government's investment by the New Energy and Industrial Technology Development Organization (NEDO), Shimizu, and Fuji, and Solar Frontier, this real-time, real-condition test lab has supported installers, developers and manufacturers on ways to be competitive within the industry and region by alleviating the costly burden of prototype testing and verification.

The Smart Energy Test-bed (SET) operates under ZEN and includes:

- Photo Voltaic Production-scale Test Bed composed of sixteen 2 megawatt (MW) PV solar power arrays (14,000 modules/site) sites totaling 32 MW utility-scale installations in the Capital Region;
- Roof Top PV Module Test-bed located on the roof level of NanoFab North and NanoFab East;
- Phosphoric Acid Fuel Cell (PAFC) Test-bed providing 100kw power and 147 kw waste heat;
- Capacitor Energy Storage Test-Bed (CES Test-bed) for ultra-capacitor evaluation;
- Power Back-up Synchronization Test-bed (PBS Test-bed) for power quality and resiliency testing.

Photo Voltaic Production-scale Test-bed (PVP Test-bed)

The 32 MW of offsite PV installations are being leveraged as test-beds that are monitoring a distributed utility-scale PV installation while creating an interactive web portal to house the data for educational and research purposes. Data points for each site includes power output (for each inverter), time of day (15 minutes intervals), hour angle of the sun, temperature at 2 and 9 meters off the ground, array tilt, array azimuth angle, declination angle, incidence angle, latitude and longitude, relative humidity, precipitation, wind speed and direction, solar insolation, and others.

Copper Indium Gallium Selenide (CIGS) Solar Array Evaluation Project
SET is composed of one ~2MW PV array system using Copper Indium Gallium Selenide (CIGS) thin film technology using 14,000 panels, and one ~2MW PV array system using widely used crystal silicon (cSi). While cSi PV has higher efficiency than CIGS during full sun exposure, CIGS thin film solar cells offer increased power generation during cloudy conditions. SET is operating a production-level (2MW/each) side-by-side comparison in Oppenheim New York located in the Amsterdam area of the Mohawk Valley in order to compare the effects of cloudy weather on production and to discover which performs "better" in terms of price, weight, size, etc. Application of machine learning will then be applied to predict the performance of each technology for different locations in the nation.

Specific details about the panels are:

Oppenheim North (cSi) - 1,942.56 kW
- Module Type (Quantity) - JA Solar JAM6(K)-72-355/PR (5,472)
- Inverter Type (Quantity) - Sungrow SG60KU-M 66kW (21)
- Crystalline Si
- Array Tilt 30 degrees

Oppenheim South (CIGS) - 2,310.00 kW
- Module Type (Quantity) - Solar Frontier SF-165-S (14,000)
- Inverter Type (Quantity) - Sungrow SG60KU-M 66kW (30)
- CIS
- Array Tilt 25 degrees

2.0 MW CIGS (Left) and c-Si (Right) PV installations in Oppenheim, NY.

Roof-Top PV Module Test-Bed (RPM Test-bed)

Located on the roof levels or NanoFab North and NanoFab East, the Roof-Top PV Module (RPM) Test-bed is designed to demonstrate the commercial viability of lightweight, rack-less roof integration methods and hardware in conjunction with commercially available high-efficiency, rigid, thin-film PV module technologies for thermoplastic or thermoset (TPO/EPDM) membrane roofs for commercial/industrial buildings. A DAS system is used to collect performance data that is stored in a centralized storage and analytics system.The Test-bed demonstrates four installations on a commercial rooftop using the lightweight Sollega mounts with Solar Frontier modules which include multiple 20-30kW sub-arrays configured in varying experimental conditions including:

1) South facing, Ballasted Sollega Fastrack, String inverters
2) South facing, Non-penetrating anchor Sollega Fastrack, String inverter
3) East-West facing, Non-penetrating anchor Sollega Fastrack, DC Optimizers
4) South facing, Non-penetrating anchor Sollega Fastrack, DC Optimizers