

Update on BNL's Solar Energy Research Plans

*Presented to CAC by Bob Lofaro
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BROOKHAVEN
NATIONAL LABORATORY

a passion for discovery



First, BP Solar is going out of business, but this will not impact BNL's plans for solar energy research!

- BP Solar will meet all of its contractual commitments with regard to supporting BNL's solar energy research agenda
 - Access to LISF for research data
 - Support for developing a separate solar research array
- BNL is continuing with its original plans for solar energy research
 - Installing instruments in LISF
 - Developing a separate research array



The LISF is complete and is now operating to generate up to 32MW of power for Long Island



BNL has completed installing a suite of instruments in the LISF for research purposes

- Solar Resource Data

- Field-based pyranometers: 32 pairs to measure direct and diffuse irradiance across the entire array
- Baseline irradiance: precision measurement of irradiance at base station to quantify uncertainties in field data
- Solar tracking measurements
- Rotating shadowband radiometer



Meteorological Data

- Temperature (air and panel)
- Relative Humidity
- Barometric Pressure
- Wind speed and direction
- Rain gauge



- Total Sky Imagers – Clouds

- Electrical Performance Data

- Power quality monitors at all inverters, collection substation, and LIPA feeders to BNL
- DC current and voltage at all strings



Our research plans remain to address key issues with utility-scale solar plants

■ Variability and Non-Dispatchability

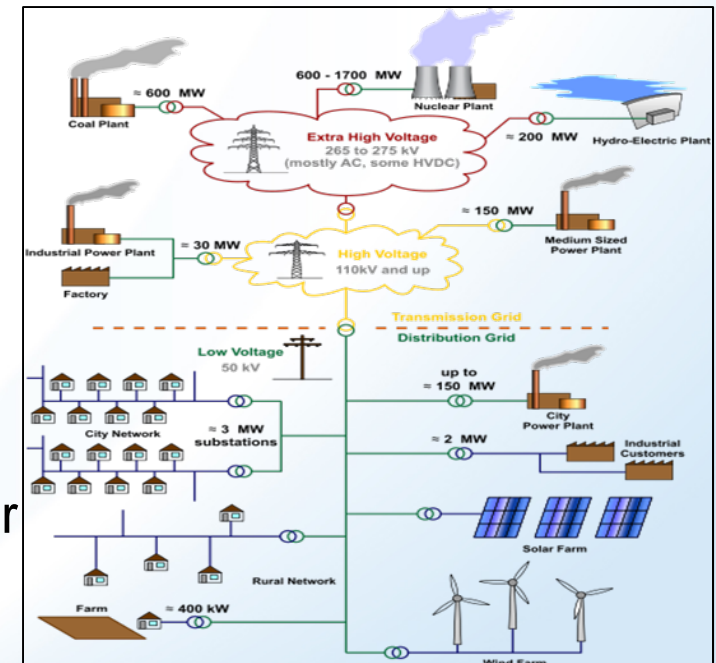
- Solar energy varies
- Solar generation cannot be dispatched when needed

■ Grid Integration

- Grid is not designed for two-way power flow or distributed generation
- Distributed generation can adversely impact grid control

■ Environmental Impacts

- Understand the impacts utility-scale solar PV plants can have on local ecology



Source: <http://www.soldata.dk/pyr-80spc.htm>

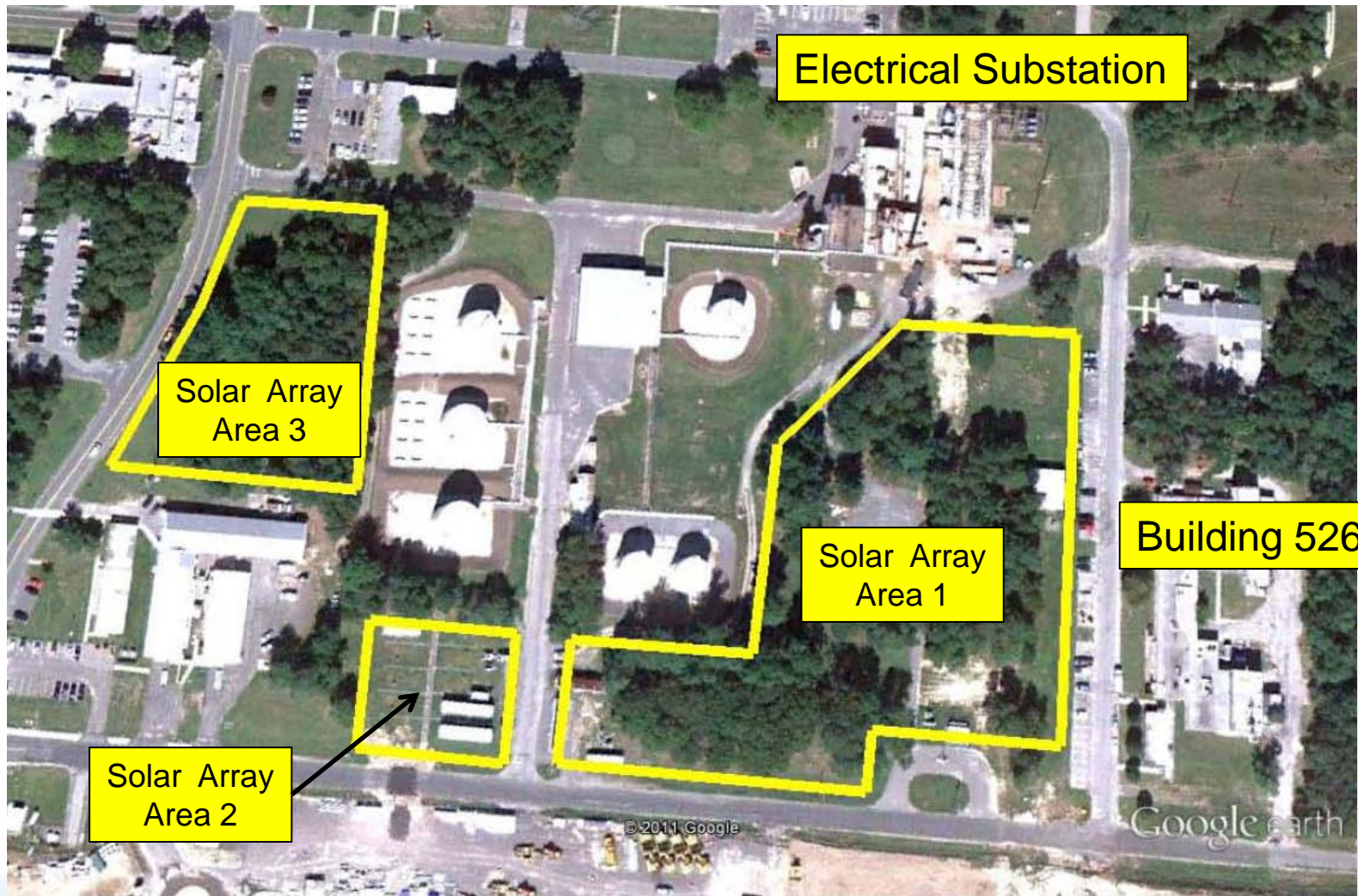
BNL is also proceeding with developing the Northeast Solar Energy Research Center (NSERC)

- Supplement research using the LISF array
 - Dedicated research array for field testing
 - Laboratory space for standardized testing
- NSERC will enable research in various other areas of interest to the solar industry
 - Field testing under actual northeast conditions
 - Technology development test bed
- Energy would be delivered directly into the BNL electrical system
 - Help with sustainability goals

Development of the research array is underway

- Specifications developed
 - 1MW array
 - Reconfigurable architecture
 - All power delivered to BNL
- A site has been identified for the research array
 - Brookhaven Ave - across from NSLS-II
- Architect-Engineering firm hired
 - Blue Oak Energy (designed LISF)
- Current schedule
 - Conceptual design study underway
 - Final design expected March 2012
 - Construction expected to start Spring 2012
 - Array expected to be operational Fall 2012

The research array will be located across from NSLS-II in 3 areas comprising ~6.5 acres of land



Google earth



This site was selected after considering several other locations

- Several other sites were considered
 - Rejected due to issues with excessive tree clearing and/or interconnection costs
- Site selected is best suited for the research array
 - Close proximity to electrical substation
 - Minimizes tree clearing
 - Use of brown field (Area 3)
 - Close proximity to future headquarters for renewable energy research in Building 526
- The combined LISF and Research Array fits within the original 200 acre environmental review
 - LISF 193.4 acres
 - Research Array 6.5 acres

Preliminary Research Agenda for NSERC

- **Smart Grid Integration Studies**
 - Research on strategies that improve communication and control
 - Techniques for integrating large numbers of systems into utility grids
- **Energy Storage Research**
 - Value propositions for integrated grid-level storage
 - Evaluation of storage and control alternatives
 - Reduce intermittency, resource extension
 - Frequency regulation capability
- **Field Testing of New Technologies**
 - Evaluation and testing of new design concepts, such as inverters with capability for voltage regulation and VAR control
 - Comparison of performance for components and systems using different technologies
- **Reliability and Degradation Studies**
 - Long-term reliability and degradation studies under Northeast conditions
 - Standardized test conditions to evaluate component degradation
 - Post mortem testing and failure analyses