Summary of Workshop Input

March 2011

BROOKHAVEN NATIONAL LABORATORY

a passion for discovery

Office of Science
U.S. DEPARTMENT OF ENERGY

Purpose

The purpose of this workshop is to define the parameters for extensive, outward focused co-laboratory that facilitates the development and deployment of advanced solar energy systems and associated challenges with grid integration

- identify current issues and future challenges related to deployment of solar energy systems in the northeast US
- refine our initial concepts for the mission and research focus areas
- better define the infrastructure, capabilities, facilities & equipment needed to support the mission
- Identify transactional issues or concerns (IP, user agreements..)

What we heard…

- There are significant and substantial technical, economic, environmental, and policy issues facing solar power developments in the Northeast. Many are distinctly regional in character.
- An appropriately focused Northeast Solar Energy Research Center at BNL could serve a key role in providing high-quality data, analyses, and other information to support the expansion of solar power in the NE.

What we heard…

- Systems performance and grid integration are key technical challenges
  - What are the differences between real solar plant performance and predicted performance?
  - How will high levels of DG impact the grid (distribution side)?
  - How do cloud patterns affect plant performance as a function of system geometry and spatial layout? (think about spatial filtering…)
- High quality solar resource data from the NE has value
  - There is a paucity of data to support system development
  - There is a paucity of data on cloud and weather patterns to predict system performance
  - Models for prediction can make pretty good predictions of solar variability, there certainly is room for improvement

What we heard…

- A dedicated array or arrays would serve multiple purposes
  - Testing of new inverter technologies & designs: micro and macro
  - Document performance of differing technologies in NE conditions
  - Reliability and degradation
  - Array size between 700kW -1000kW, reconfigurable, spatial layout
- Data from LISF and other NE solar systems is of value
  - Performance vs. prediction
  - M&O costs: # dedicated operators, maintenance schedules, on-site spares, etc.
  - Disturbance data & experiences

What we heard…

- Cost vs. value of storage is far from a solved problem
  - Which technologies? Where? When?
  - What is the value vs. cost? Can it be made economical?
  - Data on systems performance with integrated storage is lacking
- Technical Performance is Not Enough
  - Ecological and environmental impacts (both pro and con). Smart design will maximize system value.
  - Policies (RPS) and incentive programs are helping to drive (e.g. utility rebates, loan programs, etc) solar expansion.
  - Techno-economic modeling and analysis could help to support policy and incentive program development, but utilities and policymakers don't have the same agenda, per se.
  - Key Partnerships (e.g. BP Solar, EPRI, SEPA, AMSC, GE, LIPA…DOE…NYSERDA….) are vital to success
  - We need to remain focused on the market drivers of our partners

What we heard…

- Locating NSERC at a Federally owned facility has benefits
  - No building permits
  - UL certification not required to test new technologies iundera actual field conditions
  - Facility access can be made available using standardized access agreements already being implemented for existing user facilities
  - Research expertise can be leveraged
- Locating the research array on BNL brownfield could provide useful information
  - Utility interest in building solar on landfills – could learn from BNL project

Based on what we heard, BNL's initial plans for developing the NSERC will be guided by the following …

Draft NSERC Vision Statement…

- The vision for NSERC is to be a nationally recognized resource for advancing the adoption and deployment of solar energy, particularly in the northeastern United States

Draft NSERC Mission Statement…

- The Mission for the NSERC will be to
  - Identify scientific, technical, and policy-related barriers to the broad adoption and deployment of solar energy systems in the northeast region
  - Conceptualize and develop new approaches and solutions to overcome these barriers, and advance them from discovery to deployment

Draft NSERC Business Model…

- NSERC will be a DOE User Facility
  - Owned by DOE
  - Operated by BNL contractor (currently BSA)
  - Open to public (user facility) –standard access agreements
- NSERC will host Sponsored Research
  - DOE sponsored research via proposals by BSA
  - Collaborative sponsored research via CRADAs
  - Collaborative research via joint proposals
- Standardized Agreements will be Used
  - Data sharing
  - Intellectual Property
- Advisory Committee will be Established
  - Provide guidance on research

NSERC Preliminary Research Agenda…

- 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 for Deployment 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
- Educational Outreach
  - Student education and workforce development

NSERC will include a dedicated research array for field testing of solar system technologies…

- Solar PV Array Size and Type
  - 500kw to 1.0 MW – targeted size of 700kw for testing centralized inverters
  - Target voltage level of 1,000V (600V 2nd choice)
  - Connected to BNL electrical distribution system
  - Multiple panel technologies with Crystalline Silicone PV modules making up the bulk of the array
- Array Configuration
  - Multiple, small (25kW/50kW/100kw) arrays that can be interconnected and re-configured for different testing scenarios, as needed
  - Capability for testing macro, micro and mixed inverters
  - Fixed tilt and Trackers
  - Re-configurable to simulate different operating scenarios
  - Open racks for comparison tests of other PV technologies

NSERC will include a dedicated research array for field testing of solar system technologies…

- BOP Equipment
  - Capability for running macro and micro inverters
  - Standard inverters available for module testing
  - Capability to incorporate storage technologies
  - Load capability to enable disconnecting from the BNL system for test purposes

- Research Instrumentation
  - Similar to LISF (meteorological, solar resource, power quality)
  - Utilize the LISF base station (do not duplicate)
  - String-level current sensors
  - High Sample Rates – 1 sec data
  - RS-485 capability for access to string-level data, met data, and solar resource data

NSERC will include laboratories to support solar energy research projects…

- Solar Energy Research Labs
  - Standardized testing of solar system components
  - Solar Resource Simulators, Load simulators, I V Curve Testing
  - Environmental chambers – (duplicate environmental conditions for electronics installed on modules)
  - Failure Analyses
  - UL and IEC Test Conditions for Modules and Inverters
- Environmental Research Lab
  - Environmental, health and safety aspects of photovoltaic systems
  - Life-cycle analyses
- Meteorological Services Lab
  - On site Met services
- Data Acquisition Lab
- Instrumentation/Calibration Lab