

EPRI

ELECTRIC POWER
RESEARCH INSTITUTE

EPRI's Photovoltaic Research Needs

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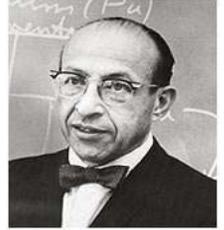
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**Planning Workshop for a New Northeast
Solar Energy Research Center**
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About EPRI

EPRI's Founder
Chauncey Starr



Mission: To conduct research on key issues facing the electricity sector ...on behalf of its members, energy stakeholders, and society.

- The Electric Power Research Institute, Inc. (EPRI), founded in 1973, conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public.
- An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, health, safety and the environment.
- EPRI's members represent more than 90 percent of the electricity generated and delivered in the United States, and international participation extends to 40 countries.
- EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; and Lenox, Mass.

EPRI Member PV Research Priorities

- Capital costs
- Annual Performance
- Response to varying meteorological inputs
- Grid integration characteristics
- Ongoing O&M costs



Capital Costs

- Cost of goods
- Installation costs
- Efficiency due to learning
- Reduction in BOP
- 600V DC vs 1000V DC



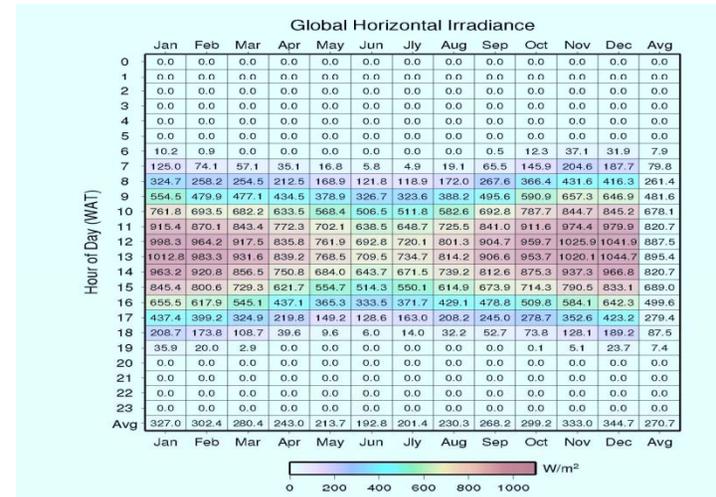
Courtesy of First Solar

EPRI/BNL collaboration opportunities:

- Document costs and installation

Annual Performance

- Annual performance compared to modeled performance
- Year over year variability
- Degradation rates
- Forecasting output

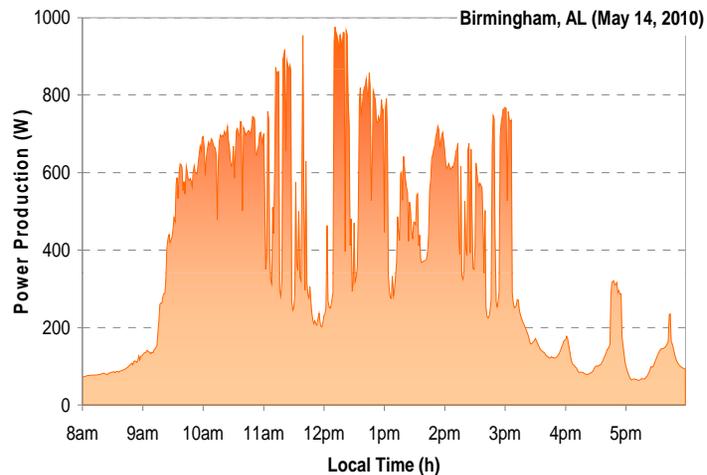


EPRI/BNL collaboration opportunities:

- Data collection
- Modeling validation and verification
- Forecast error calculations

Response to Varying Meteorological Inputs

- Measured difference in output of same technology in different climates
- Transient response of system to various types of clouds
- String/array layout relative to predominate cloud direction

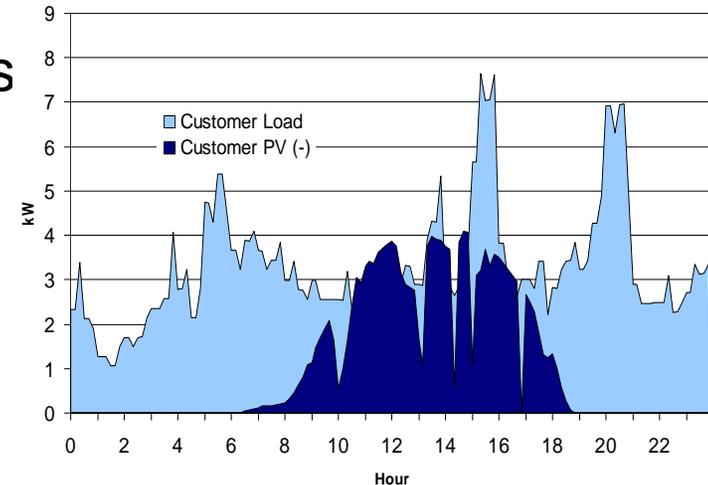


EPRI/BNL collaboration opportunities:

- Instrumentation, monitoring, and data analysis
- Reconfigurable array

Grid Integration Characteristics

- Impacts of high penetration on distribution & transmission systems
- PV output data synthesis for plants not yet built
- Disturbance data for dynamic model development/validation
- Reliability effects



EPRI/BNL collaboration opportunities:

- Detailed electrical event data on grid
- Smart inverters
- Storage

Ongoing O&M costs

- Staffing levels
- Proactive versus reactive maintenance
- Optimal level of spares onsite
- Optimal frequency of washing
- BOP maintenance



EPRI/BNL collaboration opportunities:

- Document O&M activities
- Washing “trials”

Existing or proposed EPRI projects for 2011

- Central station PV
 - Correlate transient responses to cloud passage
 - Determine whether larger arrays and/or spatial distribution is effective in dampening fluctuations
 - Model cloud effects
 - PV dynamic model development/validation
 - System operating impacts of PV variability/uncertainty
 - PV degradation
 - O&M practices
- Participate in NREL PV database development

Instrumentation, data collection and analysis is key!

Existing or proposed EPRI projects for 2011

- Distributed PV
 - Distribution PV project
 - Characterize performance and variability
 - Multi-node single PV panel, rack and data collection system
 - PV integration on distribution system
 - Analyze impacts of PV on specific distribution circuits
 - Identify economics and feasibility of high penetration rates
 - Identify means for accommodating PV (e.g., advanced inverter control, storage, etc)
 - O&M practices

Instrumentation, data collection and analysis is key!



Together...Shaping the Future of Electricity