2008 Solar Annual Review Meeting
Solar Resource Characterization

Session: Modeling and Analysis
Company or Organization: National Renewable Energy Laboratory

Presented by Dave Renné: david_renne@nrel.gov
Team members: Steve Wilcox, Ray George, Tom Stoffel, Daryl Myers, Donna Heimiller

NREL/PR-670-43358
Presented at the Solar Energy Technologies Program (SETP) Annual Program Review Meeting held April 22-24, 2008 in Austin, Texas
This project supports the Solar America Initiative by:

- Meeting increasing demands for expertise in and products on solar radiation data and models
  - Production and distribution of reliable, accurate domestic and international solar resource data
  - Benchmarking and cross-comparison of solar irradiance models
  - Coordination with the international community (IEA/SHC Task 36, WMO)
- Reducing data uncertainties and increasing temporal and spatial data resolutions
- Developing and testing short term solar resource forecasts
- Evaluating methods for producing long term data sets from short term observations
- Conducting measurement activities at selected sites
Project Overview

- Addresses several key requirements:
  - Demands for reliable, site-time specific solar resource and weather data
  - Short-term solar forecasts: Tools to extrapolate short term data sets to long term records
  - Improved understanding of interannual solar resource variability
  - Measured data to support project deployments
  - Geospatial analysis of solar resource data, especially as inputs to analytical tools
  - Improved data accessibility
- In FY08 Solar Resource Assessment is co-funded by PV and by CSP, with additional plans for support from grid-integration studies
- Also in FY08, Solar Resource Characterization has been combined with Metrology
<table>
<thead>
<tr>
<th>AGREEMENT</th>
<th>ACTIVITY</th>
<th>FY08 FUNDING</th>
<th>MILESTONE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Resource Characterization (ID: 15153)</td>
<td>Solar Resource Forecasting $160K</td>
<td>36374: Complete a test and validation of a solar resource forecasting application (Level 5)</td>
<td>Sept-08</td>
<td></td>
</tr>
<tr>
<td>Solar Resource Data Products and Product Development</td>
<td></td>
<td>$390K</td>
<td>Status report on methodologies for improving solar resource spatial and temporal resolutions (Level 5)</td>
<td>Sept-08</td>
</tr>
<tr>
<td>GIS Applications for Decision Support Systems</td>
<td></td>
<td>$30K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSP Resource Assessment (ID: 16728)</td>
<td>Annual DNI and Resource Mapping and Data Outreach $50K</td>
<td>36440: Complete beta test version of an updated DNI resource web application providing access to time-series data, mapping of avg. DNI, and interannual variability of DNI for southwestern U.S. (Level 4)</td>
<td>Beta version completed March-08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High Resolution Bankable Data $380K/$155K = $535K</td>
<td>36441: Deploy up to 12 weather and solar radiation meas. Stations at key locations designated by CSP (Level 5)</td>
<td>Sept-08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interannual Variability of the Solar Resource $90K/$50K = $140K</td>
<td>36442: Publish tech. report summarizing investigation of interannual variability of solar radiation (Level 5)</td>
<td>Sept-08</td>
<td></td>
</tr>
</tbody>
</table>

- 1454 Ground Stations
- 1991-2005
- Distributed by NCDC

- Gridded Satellite-Derived
- 10-km Resolution
- 1998-2005
- Provided by SUNY/Albany
Satellite-Derived Solar Data Benchmarking Activities under IEA/SHC Task 36: NASA Example

Comparison of SRB(V2.8) and BSRN Data for All BSRN Sites for 1992 - 2005

Monthly Mean

Source: Zhang and Stackhouse, NASA/LaRC
Comparison of TMY3’s for Various Yearly Spans with Original 1961-1990 TMY2

Source: Steve Wilcox and Ray George, NREL

Final TMY3’s (about 1000 stations) to be released by end of April 2008.
Beta Test Version of Solar Power Prospector: 1) Selection of grid cell
Beta Test Version of Solar Power Prospector: 2) Download Tool, Appears Once Cell is Selected (5 years of data have been selected)
Beta Test Version of Solar Power Prospector: 3) Data Files Selected in Download Tool are Unzipped
Proposed Solar Monitoring Stations to Support Industry Deployments (CSP Program)

<table>
<thead>
<tr>
<th>Tier 1 Station - Thermopile Radiometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>● 3 component measurements</td>
</tr>
<tr>
<td>● Lower uncertainty (1% to 3%)</td>
</tr>
<tr>
<td>● Optimal data QA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 2 Station - Rotating Shadowband Radiometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>● 2 component measurements (calculates DNI)</td>
</tr>
<tr>
<td>● Higher uncertainty (5% to 10%)</td>
</tr>
<tr>
<td>● Single pyranometer</td>
</tr>
</tbody>
</table>

Industry participants fund equipment and station operations

NREL funds design, deployment, and data processing/archiving

Numerous requests for participation

Tier 1

Tier 2
## Project Update

<table>
<thead>
<tr>
<th>Planned work since last Program Review</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete 2007 IEA/SHC Task 36 Annual Report</td>
<td>Feb-08</td>
</tr>
<tr>
<td>Initiate Solar Resource Forecasting Studies and provide preliminary validation results for western U.S.</td>
<td>Ongoing (PV, CSP)</td>
</tr>
<tr>
<td>Release TMY3 data sets from new NSRDB</td>
<td>April 08</td>
</tr>
<tr>
<td>IEA/SCH Annual Report on preliminary model benchmarking and solar resource forecasting results</td>
<td>Sep-08</td>
</tr>
<tr>
<td>Develop enhancements to solar models, including an-house modeling capability</td>
<td>Ongoing (PV, CSP)</td>
</tr>
<tr>
<td>Continue development of GIS and analytical tools for displaying and interpreting resource data</td>
<td>Ongoing (PV, CSP)</td>
</tr>
<tr>
<td>Develop tools for extrapolating short term data sets to long-term and interannual data sets (CSP)</td>
<td>Sep-08</td>
</tr>
<tr>
<td>Install up to 12 solar monitoring stations to support CSP industry deployments</td>
<td>Sep-08</td>
</tr>
</tbody>
</table>
Out-Year Plans

- **FY09:**
  - Solar resource forecasting feasibility study
  - NSRDB updates (through CY 2008)
  - Production of 1983-1998 10-km satellite data using NASA’s 100-km resolution data
  - IEA/SHC Task 36 reports on benchmarking of satellite-based solar resource techniques; solar forecasting methods
  - Improved customer interface to web-based data portals

- **FY10:**
  - Validation of high time/space resolution solar forecast methodology
  - Report on operational forecast tool(s)
  - Upgraded satellite-based solar resource methodology with improved AOD and terrain inputs
  - Completion of IEA/SHC Task 36 final reports
  - Web-accessible measurement data for new monitoring stations
Obstacle Discussion

- Satellite-Derived Data are Now Being Developed by and for the Private Sector
  - Commercialization activities limit availability of recent data for public distribution (i.e. 2006 and 2007 – probably 2008)
  - Affects ability to accomplish mission related to updating and distributing NSRDBs
- Indicates dramatic increase in demand for solar resource data
- Solution
  - Developing capability in-house
  - Exploring collaborations with NASA for global coverage