2008 HIGHLIGHTS

SHC Task 36
Solar Resource Knowledge Management

THE ISSUE

Knowledge of solar energy resources is critical when designing and building successful solar water heating systems, concentrating solar power systems, and photovoltaic systems. However, good quality measurements of the solar resource are often expensive and scarce, and are time-consuming and costly to acquire. So scientists from around the world are devising ways to assess the solar energy resources using other data sources, such as weather satellite data.

OUR WORK

The participants in *Task 36: Solar Resource Knowledge Management*, who represent research institutions and private consultancies from around the world, are engaged in producing information products on solar energy resources that will greatly assist policymakers as well as project developers in advancing renewable energy programs worldwide.

The objective of this work is to provide the solar energy industry, the electricity sector, governments, researchers, and renewable energy organizations and institutions with the most suitable and accurate information on solar radiation resources at the Earth's surface in easily-accessible formats and understandable quality metrics. The scope of solar resource assessment information includes historic data sets, currently-derived data products using satellite imagery and other means, and short-term and long-term solar resource forecasts

PARTICIPATING COUNTRIES

Austria
Canada
European Commission
France
Germany
Spain
Switzerland
United States

Task 36 is a five-year collaborative project with IEA's SolarPACES and Photovoltaic Power Systems that will be completed in June 2010.

KEY RESULTS OF 2008

Last year's highlights were key results in developing web services for solar resource products and benchmarking of satellite-based solar resource data sets. A major highlight of 2008 has been the development and testing of a variety of solar resource forecasting methods. Solar resource forecasting is becoming of growing importance towards the cost-effective and successful operation of large-scale grid-tied solar energy systems, both PV and CSP. Utilities and system operators can use the forecasts to predict the approximate amount of energy they can rely upon over the next several hours to the next two to three days. If the operators know with sufficient certainty that the solar energy technologies operating within their system will be on or off, this information can be important to them for determining what other types of back-up systems they may need to plan for to meet forecasted loads.

Figure 1: Location of solar monitoring stations in U.S. where several solar resource forecasting methods are being tested.

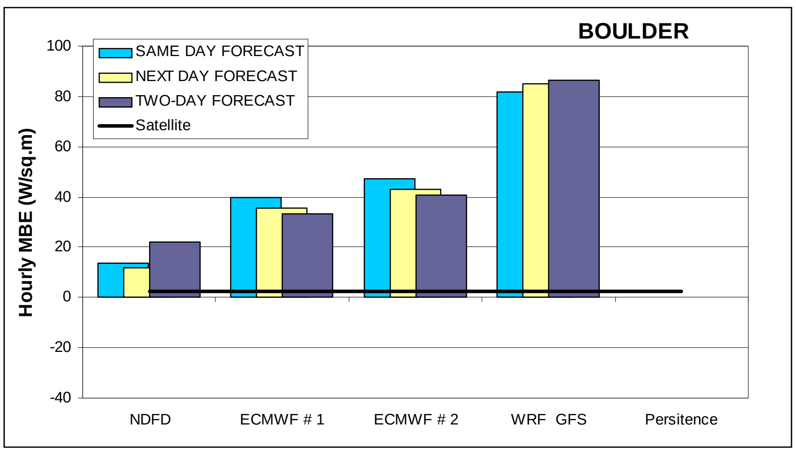

Figure 2: Mean Bias Error for various solar forecasting models compared withy high-quality solar measurements in Boulder, CO.

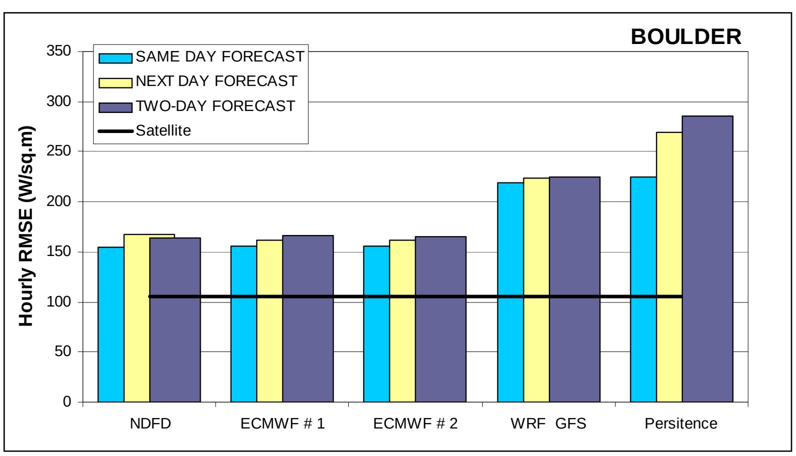

Figure 3: Root Mean Square Errors for various solar forecasting models compared with high-quality solar measurements in Boulder, CO.

One study for which there are preliminary results has been through a collaboration among task participants from Oldenburg University (Germany), Meteotest (Switzerland) and the State University of New York at Albany and NASA Langley Research Center (United States). These initial studies examined 60-hour ahead hourly forecasts from the following publicly-available forecasting sources: two versions of the European Centre for Medium Range Weather Forecasting (ECMWF), the U.S. National Digital Forecasting Database (NDFD), and a version of the Weather Research Forecasting (WRF) model downscaled from the Global Forecast System (GFS), covering the 7-month period from March-September 2007. Forecasts from the NASA Global Modeling and Assimilation Office have also been studied for August and September 2007.

The forecasts were compared against measurements at three high-quality solar monitoring sites in the U.S.: a desert region in Nevada (Desert Rock), a location just east of the Rocky Mountains in Colorado (Boulder), and a humid region in the southeastern U.S. (Goodwin Creek), shown in Figure 1.

Figures 2 and 3 show results of the analysis of Mean Bias Error (MBE) and Root Mean Square Error (RMSE) for the Boulder site. The figures show that for this period of analysis, the forecasts derived from ECMWF performed the best, and the forecasts derived from the WRF model performed less favorably. Although not shown here, model performance was somewhat better at Goodwin Creek and considerably better at Desert Rock. Of course, much further testing of these models is still required, and further results will be reported next year.

As an example of solar resource forecasting work being done in Task 36, CIEMAT (Spain) has been collaborating with Oldenburg (Germany) and other institutions to evaluate the global solar radiation value of the WRF model for 40 monitoring stations in Spain for 2005 at a spatial resolution of 27 km. The study has found that although the WRF model did not reproduce the synoptic conditions in Spain very well, particularly in partially cloudy climates. However, the ECMWF reproduces the synoptic conditions in a much better way; thus it appears that local-scale solar forecasts potentially can be improved by using ECMWF results as boundary conditions for WRF model runs.

UPCOMING WORK

The solar resource forecasting work underway in Task 36 is just one of several examples of how the results from the Task will benefit utilities, system operators, project planners and developers, financial institutions, and many other stakeholders in the solar energy business. Task 36 is focusing on the development of products that will reduce risks in project implementation, increase access to key data products, and provide guidance on the reliability of various solar data sets. By July 2010 a Best Practices Guide will be published by the Task to capture the key findings of the five-year program. During 2009 the Task participants will be considering additional activities that could result in a broader scope as well as a time extension of the Task.

Project Date 2005-2010
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Publications http://www.iea-shc.org/task36/publications/index.html