The Solar Power Forecasting Initiative (SPFI)

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Some High Points of Solar Power:

1) Peak supply coincides with peak demand (especially true in the California’s Central Valley)
2) Energy can be generated where and when it is most needed

Some Low Points of Solar Power:

1) Intermittence of the source (due to troposphere activity or “cloud cover”) may lead to grid stress
2) Energy storage through low intensity periods and/or night
• The problems of intermittence and storage can be managed simultaneously to mitigate their impact on the power grid

• Does Thermal Solar Power has a natural advantage in terms of energy storage over Direct Conversion (PV)?

• Information about the immediate future (< 24h) is a key factor in managing storage and handling fluctuation periods
THE SPFI APPROACH

remote sensing

solar stations

radar data

Time-resolved DNI and Global Horizontal Irradiance data for the entire state of California leading to short-term forecasting.

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Spatial data such as O2, CO2, water vapor, aerosol, cloud index derived from various sources of satellite data and ground stations are organized and processed in a GIS system, which supports the solar model to calculate near real-time global and direct nominal solar irradiance. The irradiance maps will then be distributed to users via webGIS technology.

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DIRECT NORMAL IRRADIANCE MAPPING

Example of satellite data image processing using atmospheric models under development at UC Merced: Direct Normal Irradiance (DNI) for January 1, 2008 based on the GOES-WEST satellite data.

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Does it work?
Comparison between measured and deterministically modeled DNI (Bird/Schillings model)

X-axis: UTC time; Y-axis: value of DNI (W/M²). Seven days were selected in late June and early July, 2007 (Model implemented by H. Liu and Q. Guo at UCM, data from CSU Humboldt).
Next Step: Forecasting

- Real-time and historical satellite data
- Current and historical weather data
- Weather forecasting (d-5) data: Tmin, Tmax, UV level, Precipitation, Air Quality, Wind, etc.
- Ground Solar data from selected locations

Stochastic Self-Learning Genetic Algorithm (SSLGA) Model

Solar Power Forecasting Center

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The SPFI network will eventually include 20–30 ground stations equipped with calibration-quality instruments to determine independently diffuse, DNI and GHI. Several of these ground stations will be equipped with IR/UV detectors.
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