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<td>Author Company</td>
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HERE COMES THE SUN

Solar Products and Services

CAISO Solar Symposium, January 29th, 2009

Jeff Lerner (jlerner@3tier.com)
Talk Outline

✓ Company History
✓ Forecasting Across Renewables
✓ Solar Products
3TIER History

- Founded 1999 - HQ in Seattle
- International offices
  - Panama (‘07)
  - India and Europe (‘08)
  - Asia-Pacific (‘09)
- Founded and run by scientists and engineers to put the best of academic research into practice
- Focused on the renewable energy sector
  - 8,500 MW wind energy forecasting
  - 3,500 MW hydropower forecasting
  - Extensive international wind resource assessment
  - Solar is emerging
Forecasting Across Renewables

» Hydro
  › Regional scale short range
  › Long-range and seasonal outlook

» Wind
  › Minutes to months ahead power forecast
  › Extensive operational experience in over 20 states
  › Custom configuration of open source regional NWP models
  › In-house proprietary software

» Solar
  › Conducted solar forecasts for NREL Western States Integration Study (WSIS)
  › Operational solar forecast product under development
3TIER Solar Products

» FirstLook Website – Freely available clickable map of annual-mean GHI data

» GIS Data Layer – Annual-mean and monthly-mean GHI, DNI, and DIF data

» FullView Site Analysis – Time series analysis at a single location using our 12-year hourly data set. Data can be calibrated (and validated) using on-site obs data.

» FullView Comprehensive Analysis – Customizable analysis at a site or over a region that includes analysis of meteorological fields: wind speed, temperature, etc.

» Western Hemisphere Solar Map – 12 year satellite-derived irradiance map
3TIER Solar Products

Western Hemisphere Solar Irradiance Map

» Hourly values of GHI, DNI, and DIF over a 12 year period (1997-2008)

» Based on 1-km GOES-East/West visible satellite data)

Table 3: Average hourly diffuse irradiance in kWh/m²/day. Times reported in the first column are in local standard time (LST). Hourly and monthly average values are shown in the right column and bottom row, respectively.

» Solar Forecast accuracy “should” beat that of a 24 X 12 table!
The Wind Forecasting Template – Will it Work for Solar?
Solar Forecasting – Big Challenges

» Yes We Can! ….forecast irradiance (NWP, satellite, and AI models)….BUT:

» Power conversion non-standard and complex
  » Concentrated solar energy refractive modeling
  » Solar thermal heat inertia and capacity modeling
  » Proprietary information on conversion for newer, advanced materials not easily accessible

» Calibration and testing needed for large-scale solar “power curve” database
  » Analogous to wind turbine-specific response curves

» No “one-size-fits-all” approach to forecasting

Should Forecast Service Providers be expected to develop complex site- specific models?
3TIER Solar Forecasting Future

» Based on required accuracy and scheduling needs of utility, grid operator, trading firm.

» Is built upon our expertise in hydro/wind forecasting and solar assessment
  » Customized NWP configuration (e.g., cloud parameterization, soil model, radiation scheme)
  » Statistical post-processing (MOS correction)
  » Observational database (satellite, pyrheliometer, off-site observations)
  » Incorporation of historical satellite record for robust expected error prediction and baseline forecast performance metrics
We would like to hear from you on:

- Plant operating plans
- Any standards used (or being developed)
- Grid integration plans
- Distributed generation