Task 10. Photovoltaic System Energy Evaluation: Status

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Objectives

- Develop/modify simulation model to estimate more accurate:
  - Energy prediction over selected period, typically annual, based on TMY weather data.
  - Hourly and daily power/energy output using actual measured weather data to compare with measured outputs for verifying proper system operation.
  - Monthly system energy variations to determine the auxiliary power or battery storage needed.

Approach

- Model will use detailed PV module maximum power matrix at seven irradiance levels and four module temperatures (per IEC 61853, Part 1).
- Model will be applicable to all PV cell technologies, including X-Si, TFS, CdTe, CIGS, GaAs, others.
- Model will calculate DC and AC wiring and component power losses more accurately by using their specifications rather than “ball park” value of the power losses.
- Model will use specific inverter efficiency curve instead of generic inverter efficiency curve.

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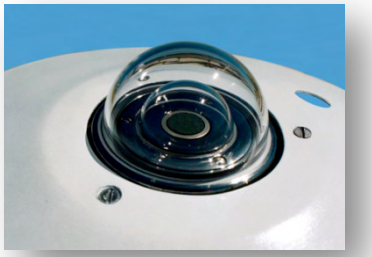
Improved Simulation Model Input Data and Output



Site-Specific TMY Hourly Data
(solar irradiance, ambient temperature, wind speed and direction, etc.)

Inverter Efficiency Curve

DC Power Output

AC Power Output

Simulation Model → **- / ~** → **n = mx24 Σ n = 1** → **AC Energy Output for Selected Period of m Days**

Module Power Output Matrix
(at 7 irradiance levels and 4 module temperatures, per IEC 1853, Part 1)

PV Array Description
(array tilt, number of modules in series and parallel, component specs including wiring, switches, circuit breakers, disconnects, etc.)

Status

- Objectives and approach described and discussed between the Task Partners: PowerMark, FSEC, NREL, ASU and NCSU.
- Webinar presented on the subject on October 7, 2010.
- Stakeholders input requested on the objectives, approach and implementation.
- Presentation at the Solar ABCs Stakeholders Meeting.

- The End

IEC 61853-1:

PHOTOVOLTAIC (PV) MODULE PERFORMANCE TESTING AND ENERGY RATING – Part 1: Irradiance and temperature performance measurements and power rating

P_{max}, I_{sc}, V_{oc}, and V_{max} versus Irradiance and Temperature

Irradiance (W/m^2)	Spectrum	Module Temperature			
		15°C	25°C	50°C	75°C
1100	AM1.5	NA			
1000	AM1.5				
800	AM1.5				
600	AM1.5				
400	AM1.5				NA
200	AM1.5				NA
100	AM1.5			NA	NA

Indoor & Outdoor Test Methods

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Approach (Cont'd)

- Year-to-year variations in solar irradiance can be accounted by:

  Corrected Predicted Annual Performance (kWh) = Predicted Annual Performance with TMY data x (Actual Annual Irradiance / TMY Annual Irradiance)