Predicting kWh / kWp performance for amorphous silicon thin film modules

**ABSTRACT**
To evaluate the field kWh / kWp performance of tandem junction a-Si modules, a long term test program has been set up with test sites in Africa, Europe, Asia, Australia and the United States.

**INTRODUCTION**
1. a-Si performance does not depend linearly with insolation, it depends on recent history, solar spectrum, angle of incidence etc.
2. Crystalline Silicon equations do not work with a-Si
3. Empirical equations have been used to model a-Si kWh / kWp performance from real logged data

**DEFINITIONS**
Specific Yield SY = kWh / Pmax / time
e.g. if a 100Wp Pmax module gives 400 Wh / day then the SY = 400 / 100 = 4 / day
Performance Ratio PR = Performance Ratio (dimensionless)

**SYCALC**

This Paper
SYcalc = \( \Sigma I_{irr} * ( A + B * \Sigma I_{irr} + C * \text{avgTamb} + D * \text{avgWS} ) \)

Emperical Sizing Model
PVUSA [ref 2] \( P_{calc} = \Sigma I_{irr} * ( A + B * \Sigma I_{irr} + C * \text{avgTamb} + D * \text{avgWS} ) \)

**FITTING THE EMPIRICAL MODEL**

**MODELLING ACCURACY HOURLY AND DAILY**

**CONCLUSIONS**
- A new empirical model has been developed which accurately predicts the performance of a-Si arrays and modules
- Hourly or daily data can be modelled equally well
- The model has been used in a Sizing program to predict kWh / kWp values expected from a-Si arrays around the world

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**REFERENCES**
- 1. PVG Utility Photovoltaic Group, 1800 M Street, N.W., Suite 300, Washington, DC 20036-5802, U.S.A. eMail: upvg@ttcorp.com
- 2. PVUSA
- 3. METEONORM Metatest, Fabrikstr 14, CH-3012 Bern, Switzerland office@metatest.ch

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