

Area: 7.

INHERENT UNCERTAINTY OF ENERGY RATINGS OF MULTI-JUNCTION CELLS BY FLUCTUATION OF ATMOSPHERIC PARAMETERS

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It is known that the module using multi-junction cells (incl. CVD) spectrum change (Figure 1). Spectrum change can be predictable if it is dominated by air mass. The problem is a considerable influence of fluctuation of atmospheric parameters. Thus, it is an inherent cause of uncertainty of energy rating.

Thanks to the increased interests to solar spectrum, many measurement data were collected. However, they were not utilized well. Our target is to extract optical parameters and analyze their impact to PV performance. These parameters were extract by data fitting calculation (Figure 2-4).

A Monte Carlo simulation of module performance using the acquired distribution of atmospheric parameters were done (Figure 5). The influence of fluctuation of atmospheric condition and resultant spectrum fluctuation is huge and inherently give plus or minus 10 % (relative) error of energy rating. Note that fluctuation of the atmospheric parameters (inherent variance) is 32 % of the total variance of the measured efficiency of the measured output of the power plant using 3-junction cells.

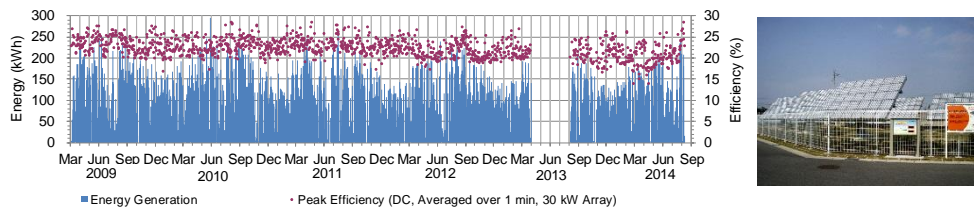


Figure 1: Monitored performance of the Tokoname 30 kW power plant using **3-junction solar cells**.

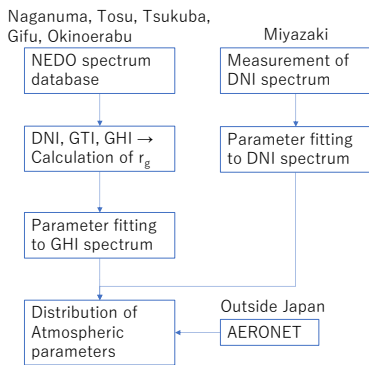


Figure 2: Flow-chart of collecting distribution of atmospheric parameters.

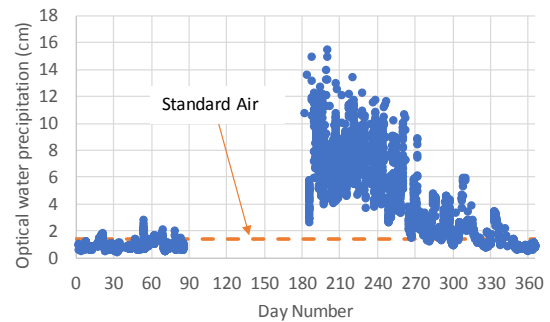


Figure 4: Example of the extraction of atmospheric parameters from NEDO spectrum database (water precipitation, Tosu site)

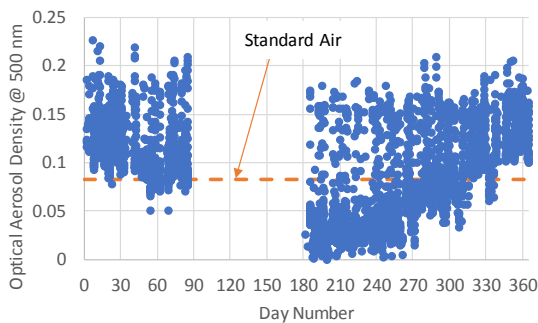


Figure 3: Example of the extraction of atmospheric parameters from NEDO spectrum database (aerosol density, Tosu site)

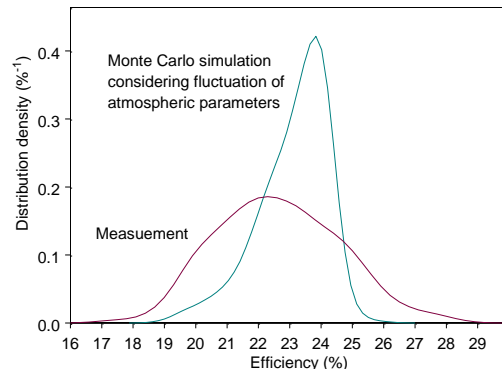


Figure 5: Comparison of the simulated and measured distribution of efficiency.