Software Modeling of FLATCON® CPV Systems

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INTRODUCTION

• By introducing a Utilization Factor (UF) this poster presents a way of making standard PV software compatible with FLATCON® CPV
• CPV has to offer the same kind of yield predictability as flat plate PV
• PV simulation programs currently do not consider the peculiarities of CPV like the influence of the DNI spectrum

SIMULATION OF THE DNI SPECTRUM

• The current of the III-V multi-junction cells depends on the DNI spectrum due to the serial interconnection of the sub cells
• The characteristic figure Y quantifies the ‘red’ or ‘blue’ emphasis of a spectrum:

\[ Y = \frac{R_{\text{sun, em}}}{R_{\text{sun, com}}} = \int \frac{R_{\text{em, sun}}(\lambda) T(\lambda) \ SR_{\lambda}(\lambda) d\lambda}{\int R_{\text{com, sun}}(\lambda) T(\lambda) \ SR_{\lambda}(\lambda) d\lambda} \]

• ‘Blue’ emphasized spectra result in \( Y > 1 \), ‘red’ emphasized spectra result in \( Y < 1 \)

SUMULATION OF THE DNI SPECTRUM (CONTINUED)

• The SMARTS2 algorithm was evaluated and proved to be useful for detailed assessments, but not necessary for the daily use
• The spectral emphasis Y can be deduced from a linear fit against the air mass with sufficient accuracy

CONCLUSION

• A Utilization Factor (UF) function is defined which depends on air mass, DNI and ambient temperature. The coefficients \( c_1 \), \( c_2 \) and \( c_3 \) are adjusted by means of error minimization:

\[ UF(AM, DNI, T_{ambi}) = c_1 \cdot uf(AM) + c_2 \cdot uf(DNI) + c_3 \cdot uf(T_{ambi}) \]

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