PV Systems - Components and Concepts

PV Modules II - Temperature Dependency of PV Output

Week 7.2.2

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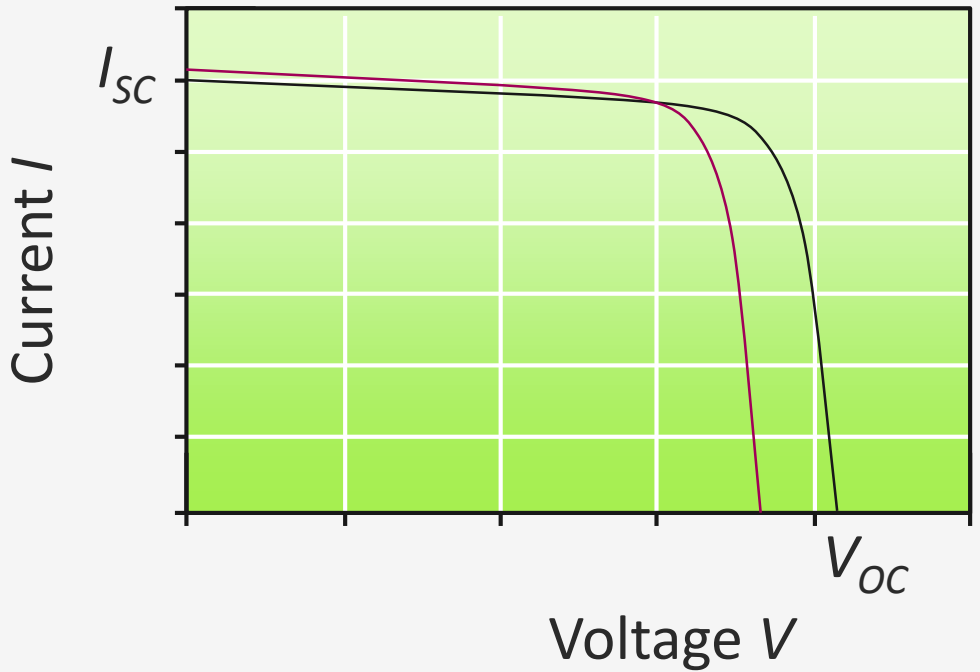
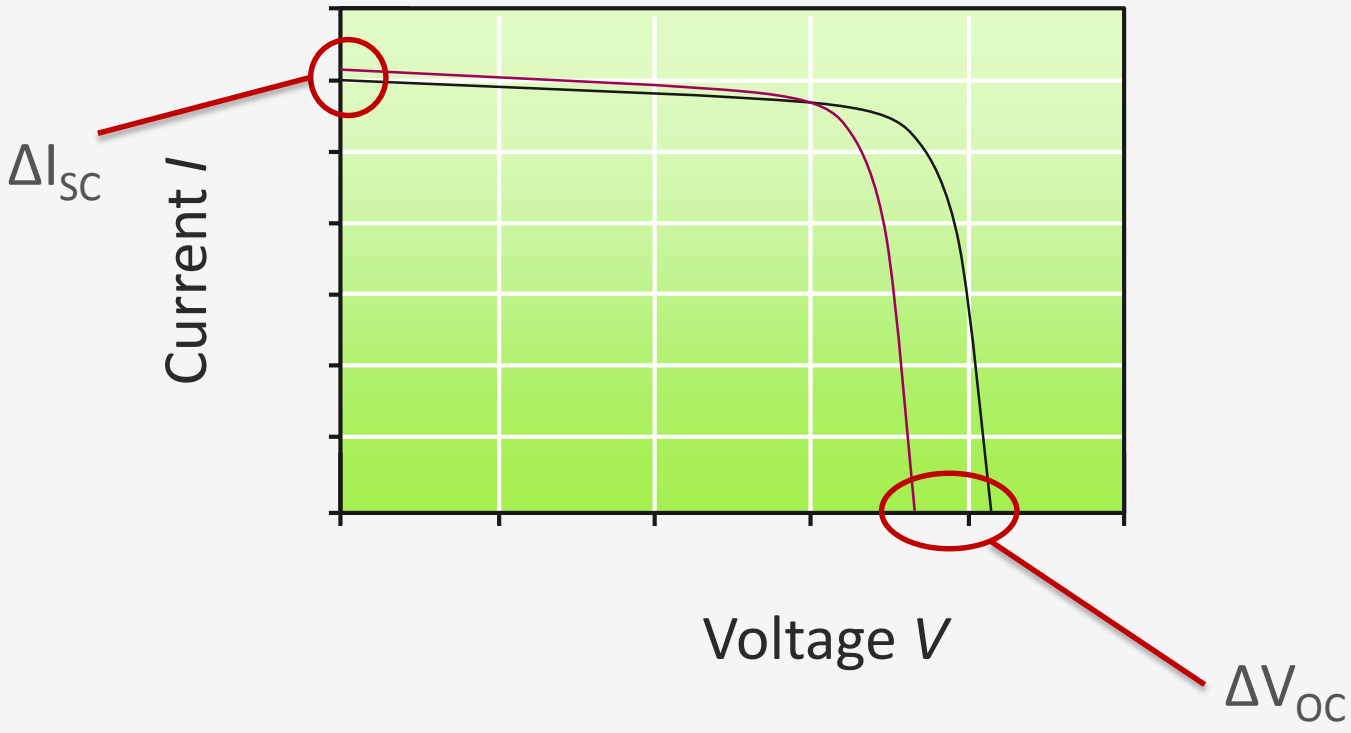
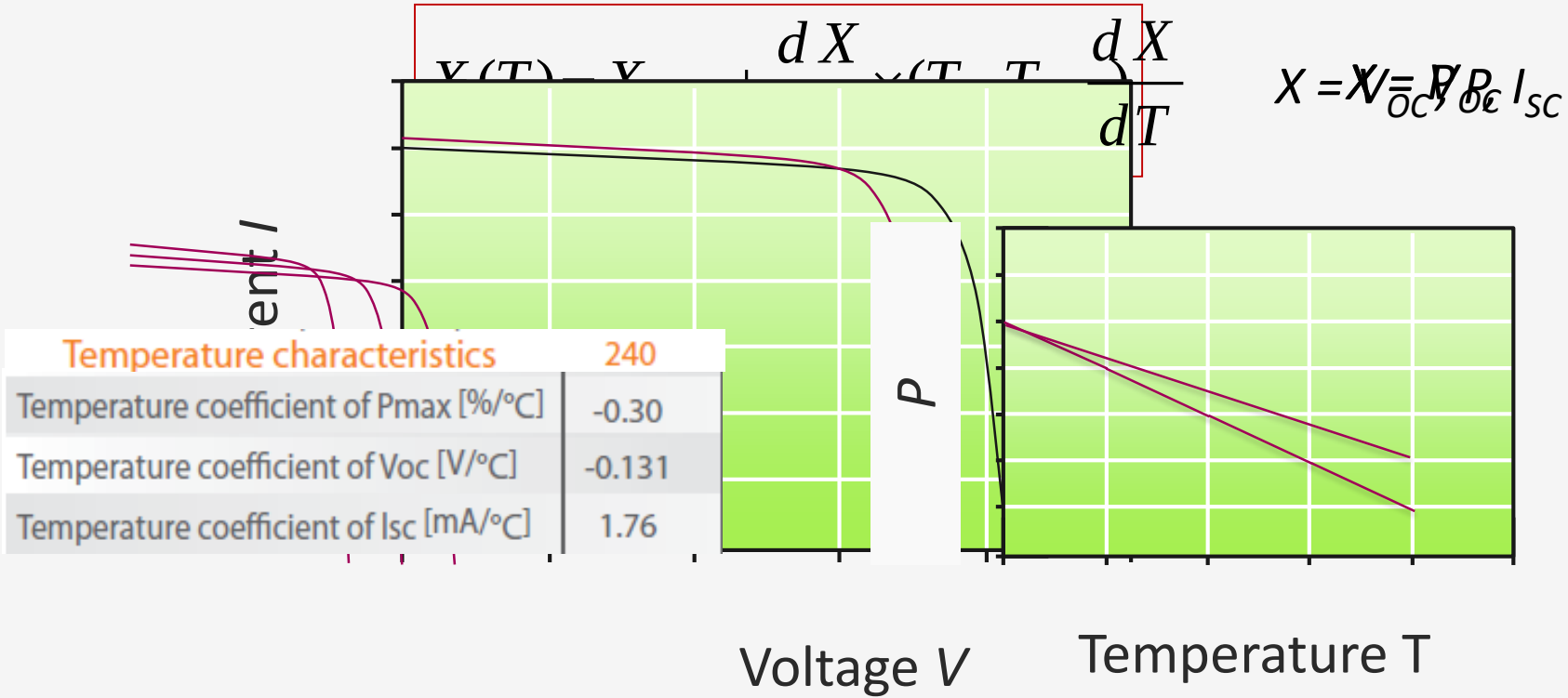
Temperature effect on a PV module



Temperature effect on a PV module



Temperature coefficients



Temperature characteristics	240
Temperature coefficient of Pmax [%/°C]	-0.30
Temperature coefficient of Voc [V/°C]	-0.131
Temperature coefficient of Isc [mA/°C]	1.76

Source: Sanyo. Models HIT-NxxxSE10

Example – Temperature effects

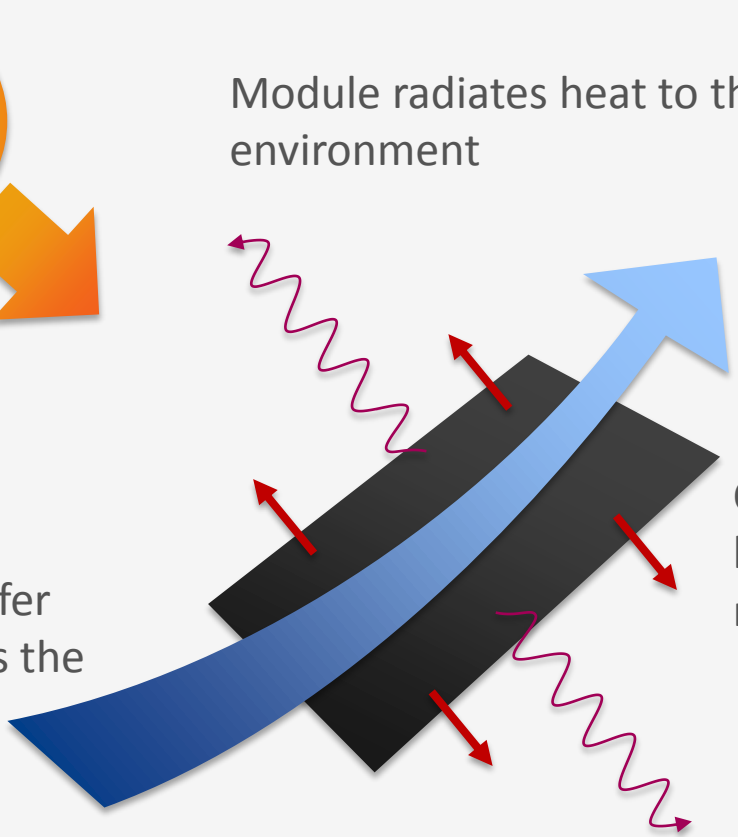
$$P_{mpp,STC} = 250W$$

$$\frac{dP}{dT} = -2W/^{o}C$$

$$T = 30^{o}C$$

$$P = 250W + (-2W/^{o}C)(30^{o}C - 25^{o}C) = 240W$$

Effects of temperature in a PV module



Sun heats module

Module radiates heat to the environment

Conductive heat loss by heat flow from one material to another

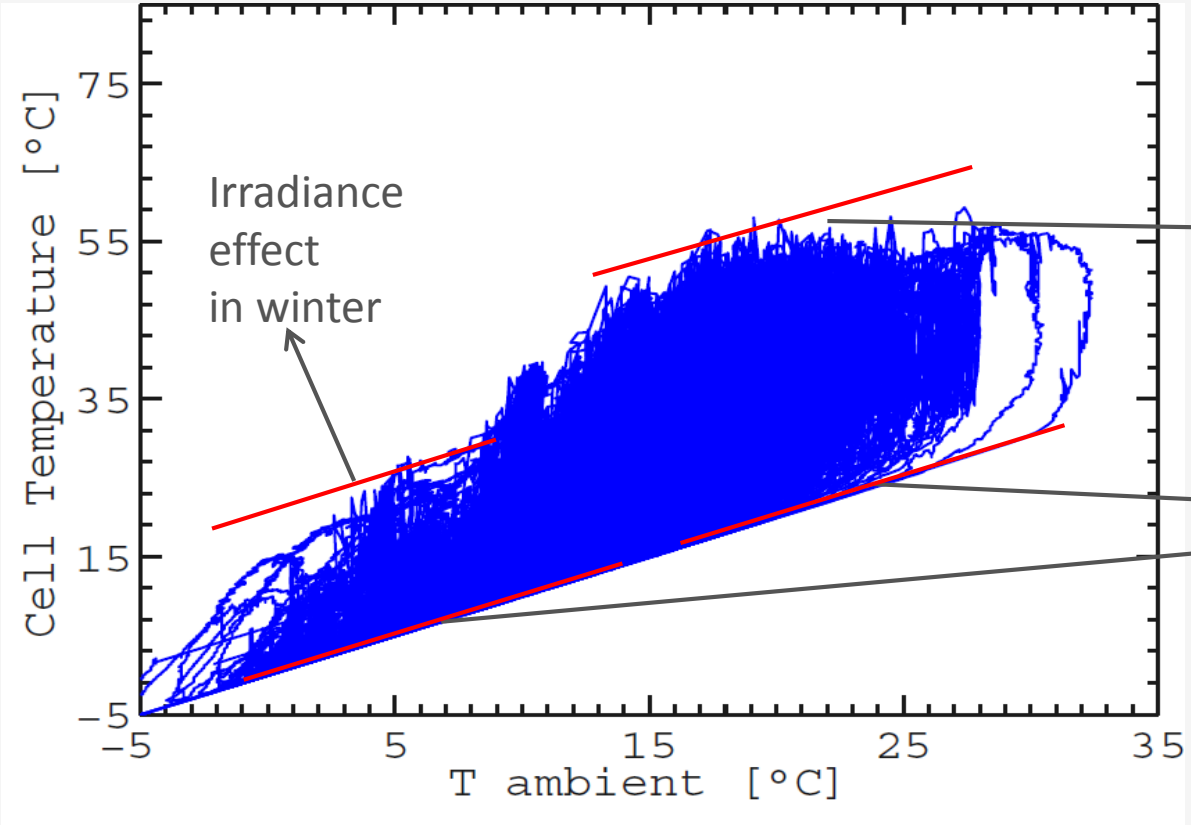
Convective heat transfer caused by wind across the module

NOCT model

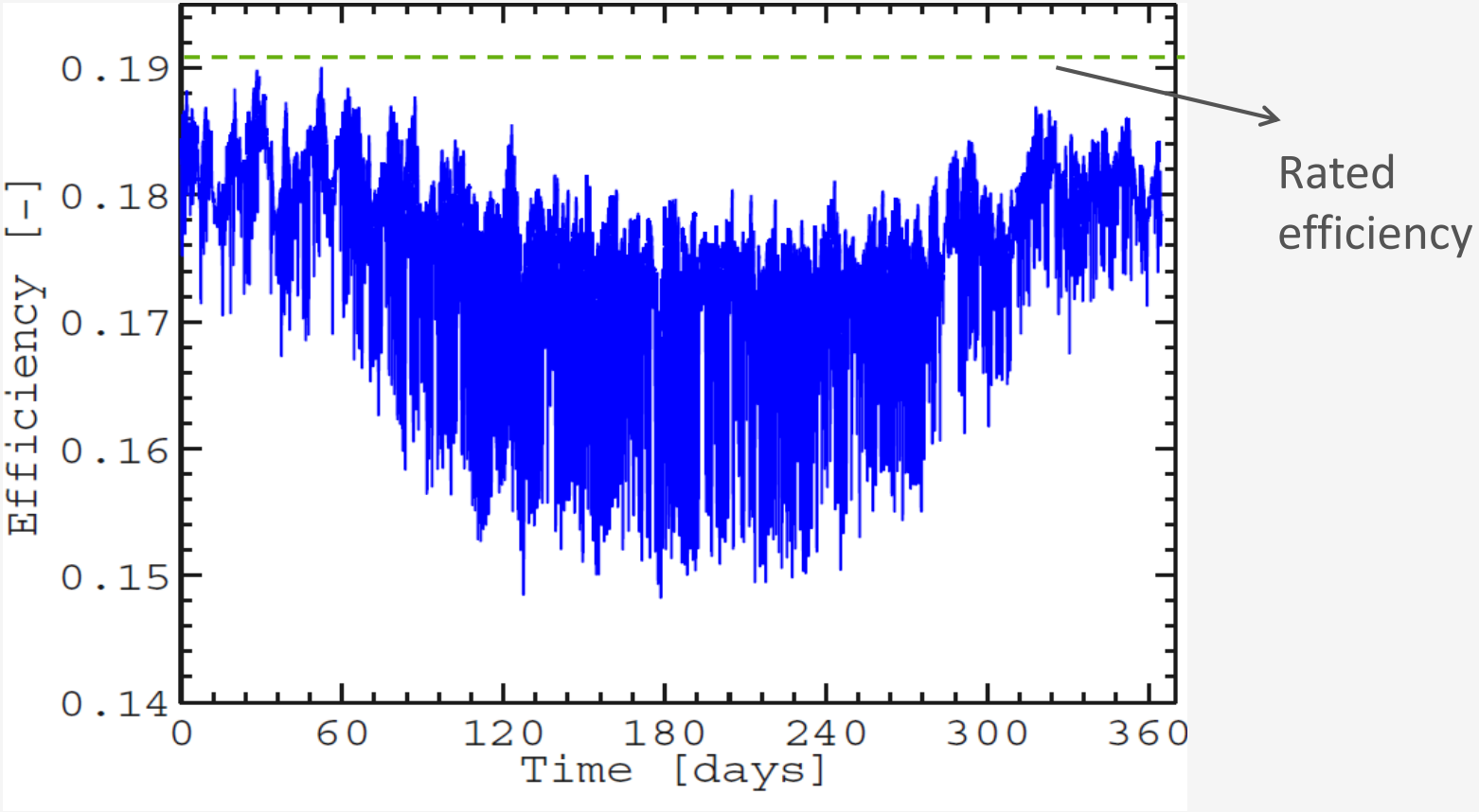
$$T_{cell} = T_{ambient} + G \times \frac{(NOCT - 20°C)}{800\ W/m^2}$$

Source: Trinuruk et al. (Renewable Energy 2009)

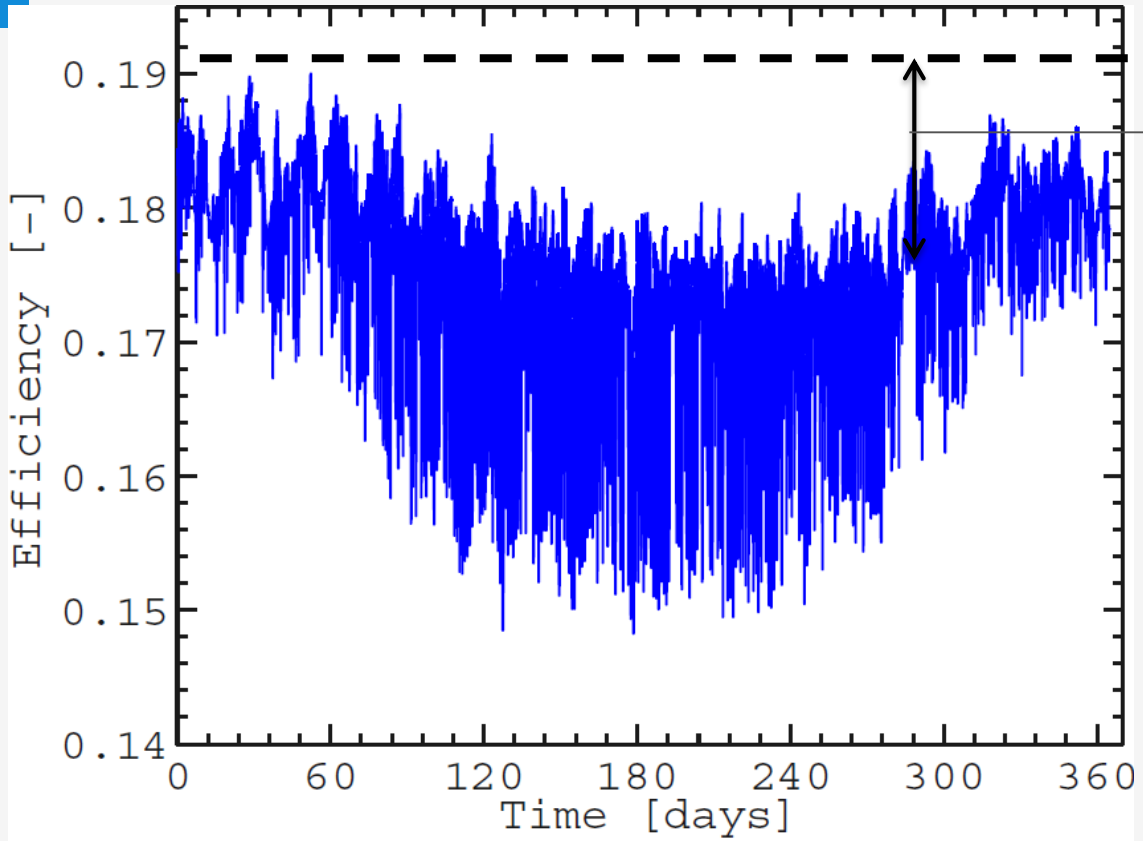
Cell temperature



PV module efficiency



Module Ideality Factor (MIF)

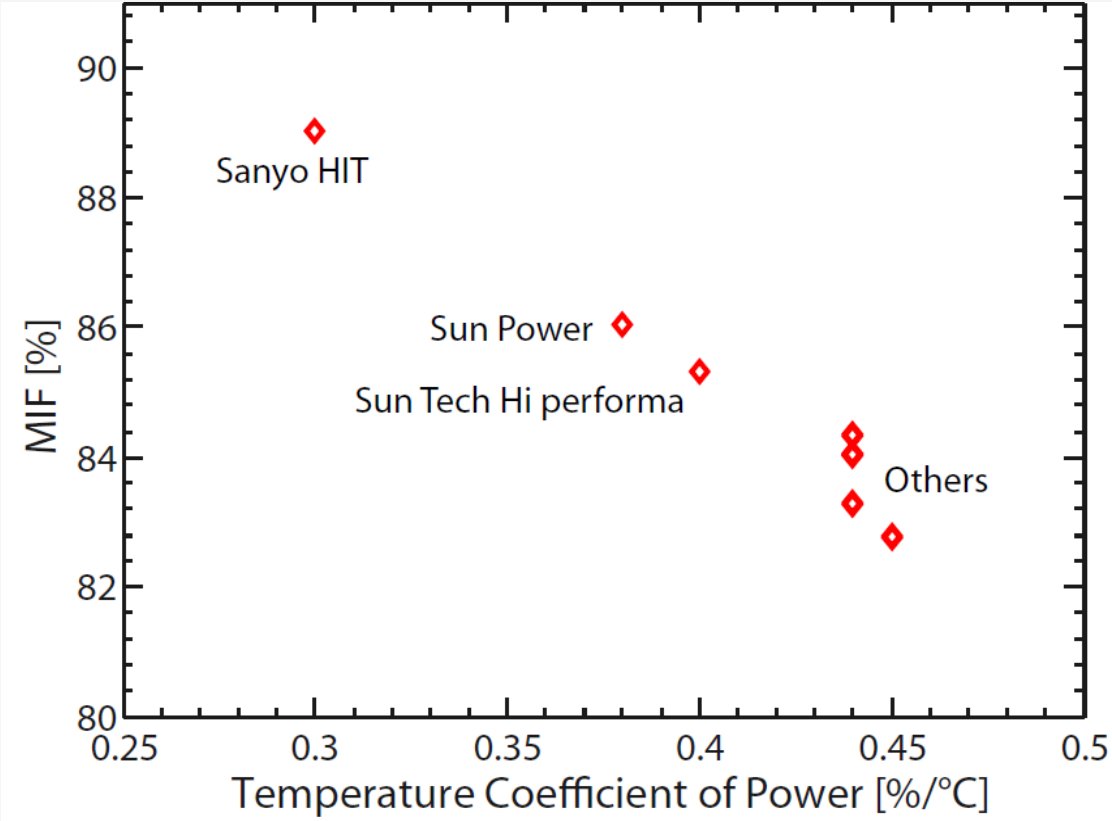


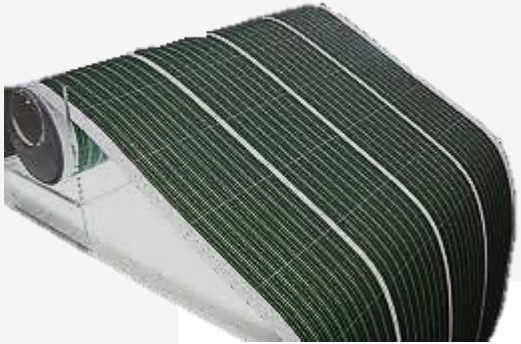
$$MIF = \frac{E_{PV,T}}{E_{\exp ected}}$$

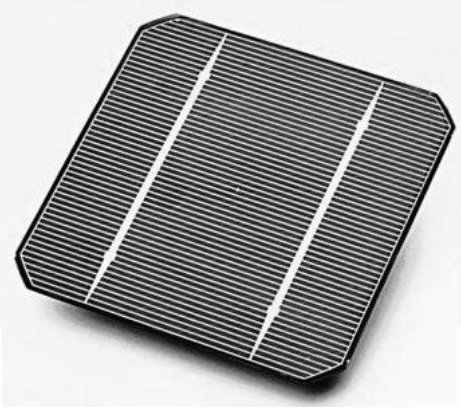
$E_{PV,T}$ = annual PV yield with temperature effect

$E_{expected}$ = expected annual PV yield without temperature effect

Module Ideality Factor (MIF)







Thank you for your attention!