1. PV power equation

$$P_{PV} = P_{STC} \cdot \frac{G}{G_{STC}} \cdot [1+\gamma(T_c - T_{STC})]$$

2. Cell temperature model

Cell temperature is not ambient temperature. It is estimated using **NOCT model**:

$$T_c = T_a + \frac{NOCT - 20}{800} \cdot G$$

3. Final combined equation

$$P_{PV} = P_{STC} \cdot \frac{G}{1000} \cdot \left[1+\gamma\left(T_a + \frac{NOCT - 20}{800} G - 25\right)\right]$$

Symbol	Meaning	
T_a	Ambient temperature (°C)	
$NOCT$	Nominal operating cell temperature (≈ 45°C)	
P_{PV}	Actual PV output power (W)	—
P_{STC}	Rated PV power at STC	e.g. 10 kW
G	Plane-of-array irradiance (W/m²)	200–1000
G_{STC}	STC irradiance	**1000 W/m²**
T_c	PV **cell temperature** (°C)	25–70
T_{STC}	STC temperature	**25 °C**
γ	Power temperature coefficient	−0.003 to −0.005 /°C

At STC:

$$P_{STC} = G_{STC} \cdot A \cdot \eta_{ref}$$
$$P_{STC} = 1000 \cdot A \cdot \eta_{ref}$$

So efficiency and area are absorbed into the rated power.

4. Example

10 kW PV system
Irradiance = 800 W/m²
Ambient temperature = 30°C
NOCT = 45°C
$\gamma = -0.004$ /°C

Step 1 – Cell temperature

$$T_c = 30 + \frac{45 - 20}{800} \cdot 800$$
$$T_c = 30 + 25 = 55°C$$

Step 2 – Power

$$P_{PV} = 10 \cdot \frac{800}{1000} \cdot [1 - 0.004(55 - 25)]$$
$$P_{PV} = 8 \cdot [1 - 0.12] = 8 \cdot 0.88 = 7.04\ kW$$