

DEFINING THE MINIMUM CELL TEMPERATURE FOR CALCULATING THE MAXIMUM DC VOLTAGE WITH STC VALUES

For the design of a photovoltaic system, the cell temperature limits established on the international market are minimum $-10\text{ }^{\circ}\text{C}$ and maximum $+70\text{ }^{\circ}\text{C}$. Commonly these temperatures are used with the STC values of a module for the calculation of the extreme voltages.

Especially in countries with a high level of solar irradiation and mostly also high temperatures this is a quite unrealistic expectation.

Using the Minimum Ambient Temperature of a site as Minimum Cell Temperature and the STC values of a module to calculate the Maximum DC Voltage, the result is clearly overestimating the real Maximum DC Voltage!
(see figure 3)

The lowest expected ambient temperature of a certain site, often easily can be found from official recordings, web research and so on.
(In the examples the Minimum Ambient Temperature is at $0\text{ }^{\circ}\text{C}$.)
Actually these lowest temperatures normally don't appear with high irradianations.

Defining the Minimum Cell Temperature at $+10\text{ }^{\circ}\text{C}$ higher than the Minimum Ambient Temperature

When calculating the Maximum DC Voltage with STC values and setting the **Minimum Cell Temperature $+10\text{ }^{\circ}\text{C}$ above the Minimum Ambient Temperature** the result is **still providing a safety of approximately $10\text{ }^{\circ}\text{C}$** to the real behavior of the cell (module). (see figure 3)

As shown in Figure 3, a calculation with the established formula and a minimum cell temperature of $+10\text{ }^{\circ}\text{C}$ will still provide safety even if the ambient temperature would drop below $0\text{ }^{\circ}\text{C}$!
(A calculation with a minimum cell temperature of $+10\text{ }^{\circ}\text{C}$ could be critical only from ambient temperatures below $-10\text{ }^{\circ}\text{C}$!)

Taking into account, that the lowest temperatures appear at night, modules are mounted on roofs where the surrounding air temperature is higher (heated up from the building, less dissipation of heat) and so on, even a higher difference ($> +10\text{ }^{\circ}\text{C}$) between the lowest Minimum Ambient Temperature and the lowest Minimum Cell Temperature can be assumed.

All these influences and correlations can be seen in innumerable PV systems, monitored and equipped with sensors.