Hello,

I have encountered a discrepancy regarding calculations in PVsyst software related to the impact of temperature variations on PV panel performance. It is commonly understood that when two PV panels have the same average surface temperature, the panel with a uniform temperature distribution should theoretically produce more electricity compared to a panel with variable temperature across its surface. However, when applying the formulas from the tutorial, my calculations suggest that both panels yield the same level of electricity production, which I believe is incorrect.

To illustrate with a simplified example, let's consider two photovoltaic-thermal (PVT) systems, each comprising only two PV cells:

- In PVT1, the cells have temperatures of 20°C and 40°C.
- In PVT2, both cells are at a uniform temperature of 30°C.

Despite the average surface temperature being the same for both panels, should there not be a difference in their electrical outputs due to the uniformity of temperature in PVT2 versus the temperature variation in PVT1?

Could you please help clarify this discrepancy? Following calculations is based on your tutorial.

$$P_{Expected} = P_{nom} \times (1 + \beta \times (T_{avg} - 25))$$

For PVT1:

- Cell 1 at 20°C: $P(20) = 100W \times [1 - 0.004 \times (20 - 25)] = 100W \times [1 + 0.02] = 102W$
- Cell 2 at 40°C: $P(40) = 100W \times [1 - 0.004 \times (40 - 25)] = 100W \times [1 - 0.06] = 94W$

The total output for PVT1 would be the sum of the power outputs from both cells. However, if these cells are connected in series, the current would be limited by the cell with the lower current (likely the one at higher temperature, the 40°C cell). If they are connected in parallel, the voltage would be the same across both cells, but the currents would add up. For this example, let's consider they are connected in parallel:

$$P_{total_{PVT1}} = P(20) + P(40) = 102W + 94W = 196W$$

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For PVT2, both cells are at 30°C:

- Cell 1 at 30°C: $P(30) = 100W \times [1 - 0.004 \times (30 - 25)] = 100W \times [1 - 0.02] = 98W$
- Cell 2 at 30°C: $P(30) = 100W \times [1 - 0.004 \times (30 - 25)] = 100W \times [1 - 0.02] = 98W$

Since both cells are at the same temperature, they would perform equally, and if connected in parallel, their outputs would add up:

$$P_{total_{PVT2}} = P(30) + P(30) = 98W + 98W = 196W$$

To summarize:

- PVT1's total output (with cells at 20°C and 40°C): 196W
- PVT2's total output (with both cells at 30°C): 196W

In this particular case, with the given temperatures and assumptions, both PVT1 and PVT2 have the same total electrical output, despite the temperature differences. However, it's important to note that in real-world conditions, the mismatch in temperatures can lead to efficiency losses due to non-ideal conditions such as shading, uneven heating, and other factors not considered in this simplified example. Additionally, the thermal behavior of cells could also impact their performance, and this interaction is more complex in an actual PVT system.