Accuracy of Outdoor PV Module Temperature Monitoring Applications

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Objectives

- To evaluate and compare different types of temperature sensors for long term outdoor monitoring of PV modules.
- To evaluate the difference between temperature measurement at the backsheet of PV module, back surface of cells and calculation from $V_{oc}$ (EN60904-5).
- To evaluate the feasibility of digital temperature sensors DS18B20 for long term PV temperature monitoring.

Results

- Additional heating of cells due to isolation at the back of cell A is less than 1 °C.
- Temperature, irradiance and wind data for a typical clear sky day.
- Locations of laminated PT sensors behind two cells in the middle area of the PV module and a photo of temperature sensors arrangement at the back side of PV module.
- Test by shading the PV module shows adequate time response of all sensors.
- Temperature deviations of each sensor according to temperature from $V_{oc}$.
- DS sensor with different XPS isolations compared to covered PT at the back side.

Conclusion

- Temperature calculated from $V_{oc}$ give very accurate results at irradiances above 200 W/m² if parameters of PV module at STC conditions are known.
- Among sensors attached at the back side, covered PT and TC sensors deliver the best results in range of 1-2 °C of lower temperature in average.
- DS sensors exhibit similar results to PT if they are properly isolated and are more suitable for simultaneous temperature acquisition at many locations.
- XPS insulation of sensors at the back side causes a slight temperature raise of the cell area around, however less than 1 °C in average.