**Introduction**

In Switzerland in the end of the nineties several aesthetically attractive PV plants with special solar tiles (Sunslates) were realised. Pictures of these plants were often shown as examples for a successful building integration of PV plants. In 1999, one of these plants with a peak power of 62.5 kWp was erected on the roof of the regional hospital in Burgdorf (RSE).

The PV laboratory of Bern University of Applied Sciences (BUAS) in Burgdorf has monitored and registered the monthly energy yields of the PV plant RSE over the past eleven years. In this time, the production of the installation degraded seriously. In 2010, the plant produced less than 240 kWh/kWp!

In the summer of 2010, the PV laboratory of BUAS was mandated to carry out several measurements at this plant to assess the reasons for the poor energy yield. The results showed, that the solar tiles were severely degraded and that the system's DC voltage is no longer well matched to the MPP voltage window of the inverter.

**The PV plant RSE**

The plant was commissioned in the end of 1999. The solar generator consists of more than 5'200 Sunslates which are very well integrated into the roof of the hospital. This makes the PV plant very attractive from an aesthetic point of view.

The plant consists of 15 sub-plants with inverters ASP TCG4000/6 (sub-plants 2-14) resp. TCG2500/6 (sub-plants 1 & 15).

**Energy production in eleven years**

In the first year of operation, the PV plant produced 821 kWh/kWp. Due to degradation, this already poor value dropped in course of the next 10 years to only 236 kWh/kWp. In 11 years, the plant produced about 380 MWh. In the same time, a decent PV plant with the same rated power and an average yield of 900 kWh/kWp would have produced about 620 MWh.

**Measuring of the I-V-characteristics**

In July 2010, the PV laboratory of BUAS measured the I-V-characteristics of all solar generators of the 15 sub-plants. The results were shocking. The output power at STC of some sub plants was more than 40% lower than specified in the datasheets. Moreover, the fill factor of these sub plants was less than 50%. This is not acceptable, especially for a plant with c-Si cells.

**Voltage mismatch**

The inverters used in the PV plant have a relatively small MPP tracking window (82...120 V). Even in new condition, the MPP voltage of some strings was slightly below the inverter's tracking window at high cell temperatures. This was already a certain design error. However, because of the degradation of the Sunslates, the MPP voltage is now even much lower. Especially in warm months, the inverter is unable to work at the MPP. Therefore the energy yield is even lower than what would be caused by module degradation only.

**Conclusion**

The BIPV plant presented here looks very good from an aesthetic point of view. However, such degradations affecting energy yield and possibly even compromising security are not acceptable. Moreover, the lightning protection of this plant is critical because the separation distance of the solar generator to the lightning conductors is insufficient and the Sunslates are not in the protected area of a lightning protection system.

Further information about the research activities of the PV laboratory of BUAS on the internet: [www.pvtest.ch](http://www.pvtest.ch)