New software and fast data logger to examine and analyse energy yield data from PV at Jungfraujoch

Urs Muntwyler[1], Franziska Kuonen[1], Thomas Schott[1], Eva Schüpbach[1]

[1]Bern University of Applied Sciences BFH, Dept. Engineering and Information Technology (EIT),
Electrical Engineering and Information Technology / Photovoltaic Laboratory (PV LAB),
Burgdorf, Switzerland

urs.muntwyler@bfh.ch

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1. Development of new software

The PV LAB of Bern University of Applied Sciences BFH has measured the energy yield from PV at Jungfraujoch past the last 25 years. In 2014, a new PV installation was mounted at Jungfraujoch, alongside the former PV plant installed in 1993 (see HFSJG Activity Report 2014, pp. 138-142 and Figure 1). To examine and compare the data measured at both PV installations at Jungfraujoch, a new software was developed in 2018. A fast, new data logger to differentiate noise in the data was also installed.

The new database system was developed by Master student Franziska Kuonen and consists of several parts (see Figure 2):

Database: The software inserts the new measured data in the existing database every hour and sends a daily e-mail notification to the PV LAB at BFH on any measurement errors that occurred.

Administration: The software allows to edit the measured data and to manually import additional measurements. It also enables the user to create new PV systems, modules, inverters, etc. in the database.

Website: With the software, the measured data and other information can statistically be analysed, illustrated and displayed on the Website.

The Website is currently only accessible BFH internally and for co-workers who have VPN access. The system is still in development.

Compared to the PVGraf2000 software used by the PV LAB to examine the measured PV data at Jungfraujoch until now, the advantages of the new software and data base are the following:

(I) Comparison of different PV plants in the same graph and extension of the graphical illustration beyond diurnal values. This is very helpful for the comparison of the PV energy yield data measured at Jungfraujoch with the 1993 and 2014 PV installation.

(II) Export all data contained in a graph to a csv-file, what enables the user to analyse both specific time windows as well as long periods.

2. Working with the new software

Different PV module technologies were mounted on the (same) façade of the Jungfraujoch building (Figure 1) in 1993 and 2014. High alpine PV façades are an interesting way to produce more winter electricity in the framework of the "Energiestrategie 2050". The PV installations at Jungfraujoch are hence an important reference.

Using the new software, the values measured on both PV installations can now be displayed in one graph (Figure 3). As an example, we demonstrate this using the measured temperature of the PV surfaces. PV yield is strongly influenced by the temperature of the solar cell. Low temperature (below 25°C) enhances the PV production over the nominal values.

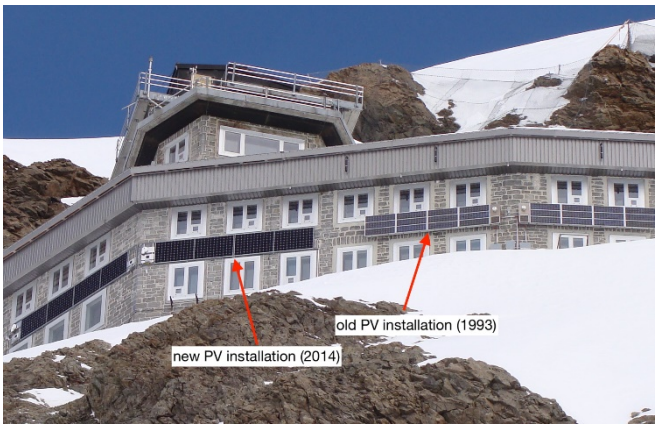

Figure 1. New (2014) and old (1993) PV modules installed on the façade of the Jungfraujoch building.

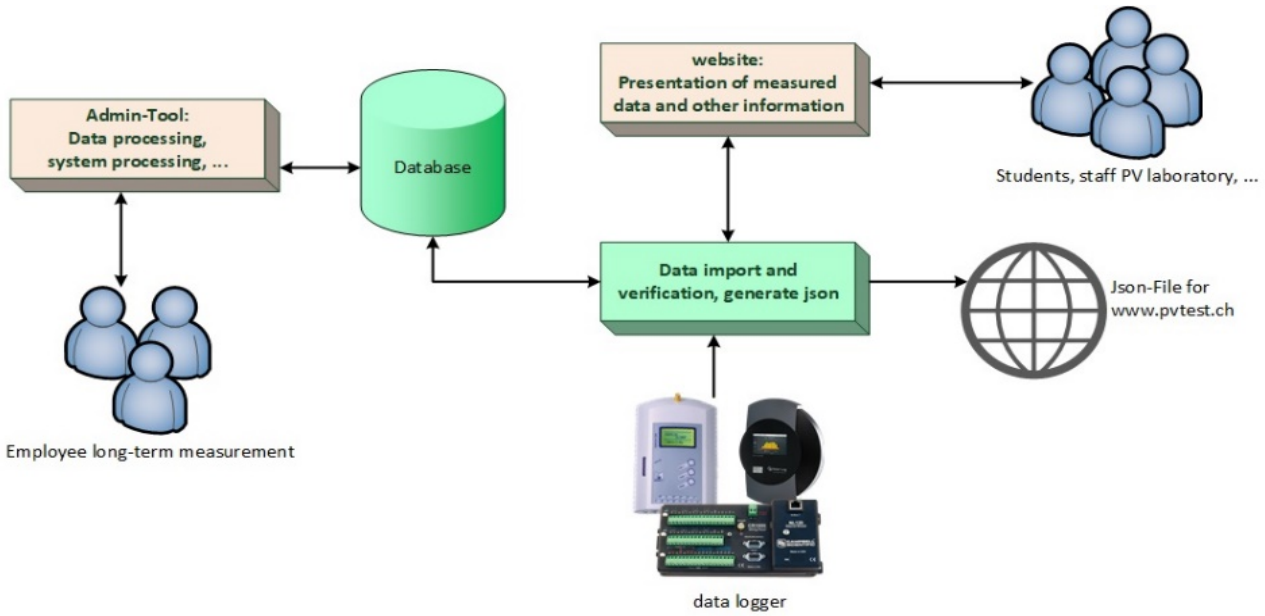

Figure 2. Database system.

Figure 3 illustrates the temperature data for the year 2017 measured on the old PV installation ("Joch12") since autumn 1993 and the new PV installation ("Joch21") since autumn 2014.

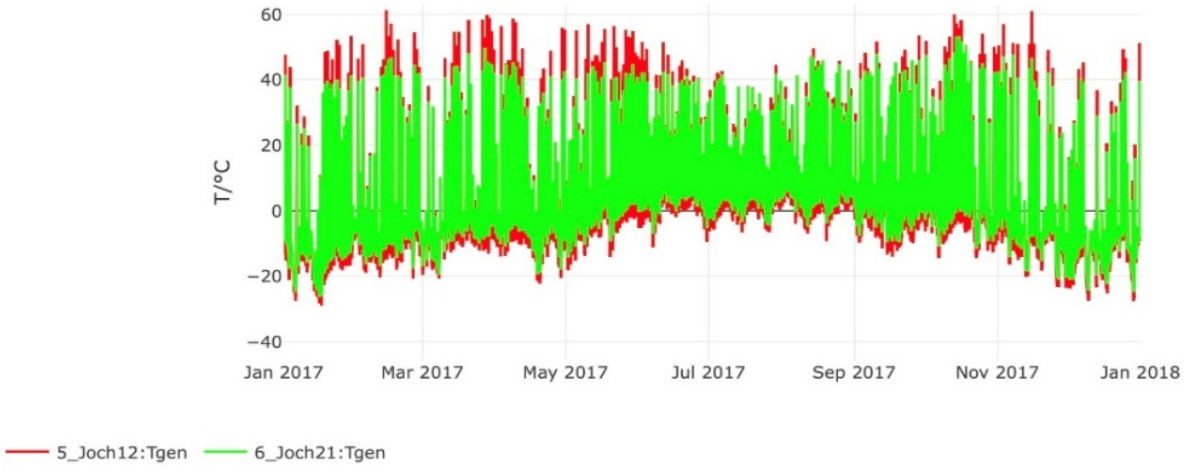

Figure 3. Time series of temperature in 2017 measured on the two PV installations at Jungfraujoch ("Joch 12" = 1993 PV installation; "Joch 21" = 2014 PV installation).

It is evident that the temperature maxima and minima of the two PV plants installed at Jungfraujoch in 1993 and 2014 are different in 2017. These differences may be interpreted in terms of different installation techniques. While the old PV modules installed in 1993 were fixed on rods placed about 30 cm from the wall, the new PV modules in 2014 were mounted directly on the wall.

Figure 4 shows a zoom and specific detail in the graph of Figure 3.

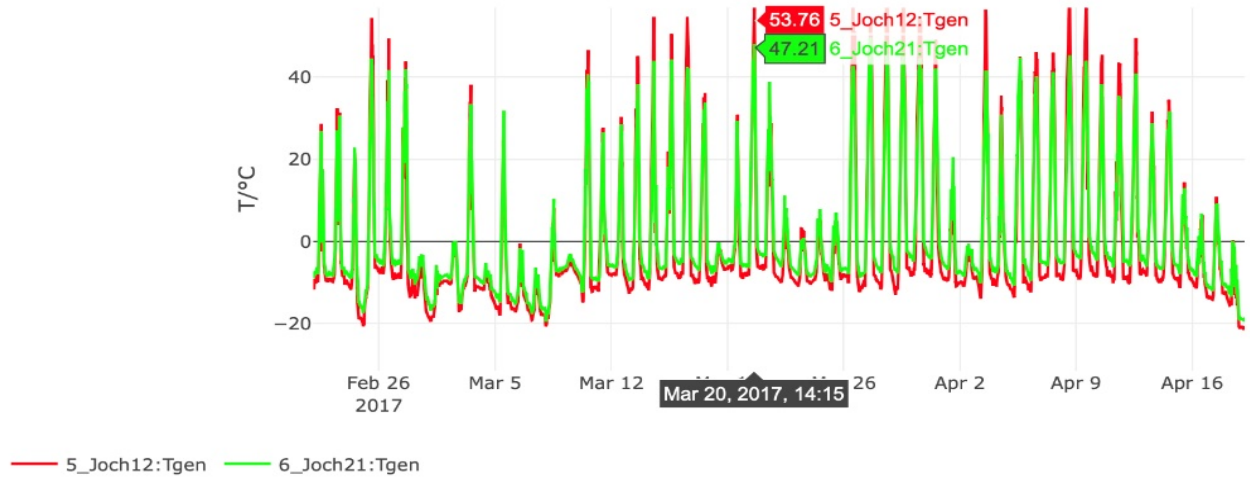

Figure 4. Zooming a detail in the graph of Figure 3.

3. Special data logger for noise pattern detection

A very fast special data logger to detect the electro-magnetic noise of the conductors connecting the PV modules with the converter was installed in August 2018. Its one of about 10 data loggers installed on Swiss PV plants monitored by the BFH PV LAB.

The objective of installing the new data logger is to recognise and differentiate noise invoked by an electrical arc from "normal" noise, i.e., noise due to the inverter and environmental influences.

Electrical arcs in a PV system can arise when the connection is faulty or when a conductor breaks. This can lead to a fire that can destroy the PV installation. The PV LAB at BFH ist currently working on an arc detector for the detection of direct current DC arcs in PV installations.

Figure 5. New fast data logger for noise detection mounted above the two PV inverters at Jungfraujoch.

References

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Internet data bases

http://www.pvtest.ch
http://www.societe-mont-soleil.ch/
http://sccer-furies.epfl.ch

Collaborating partners / networks

Studiengesellschaft Mont Soleil
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Address

Bern University of Applied Sciences BFH
Dept. Engineering and Information Technology (EIT)
Photovoltaic Laboratory (PV LAB)
CH-3400 Burgdorf
Switzerland

Contact

Prof. Urs Muntwyler
Tel.: +41 34 426 6837
e-mail: urs.muntwyler@bfh.ch