New high alpine PV-installation on the “Top of Europe”

14. Nationale Photovoltaik-Tagung , 22.-23. Februar 2016, Bern

Prof. Urs Muntwyler, Thomas Schott, PD Dr. Eva Schuepbach, Franziska Kuonen

Partners:

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie (BFE)

SCCER – FURIES
Shaping the FUtuRe SWIss Electrical InfraStructure

PV LAB

Alpine PV-installations deliver high amounts of winter electricity. Their future contribution towards the implementation of the Swiss Energy Strategy 2050 may hence be of outmost importance.
A project in the Swiss Centre for Competence in Energy Research (SCCER FURIES) offers the chance to address the above issues.

Swiss PV Monitoring Network

The Photovoltaic Laboratory (PV LAB) at Bern University of Applied Sciences (BFH) in Switzerland has conducted field monitoring of PV-installations for decades (Table 1).

Table 1: Specifications of the PV-installation sites selected for this study.

Site	lat/long	masl	Module	Inverter	Installation	Monitoring Start
High Alpine: Joch 1	46.55°N, 7.98°O	3'454	Siemens M75	ASP TopClass 2500/4 Grid III	27.10.1993	29.10.1993
Joch 2	46.55°N, 7.98°O	3'454	Sunpower X21 345	SolarMax 3000P	01.09.2014	01.09.2014
Pre-Alps	46.56°N, 7.86°O	2'677	Siemens M55	ASP TopClass 4000/6 Grid III	21.12.1992	22.12.1992
Jura Mountains	47.16°N, 6.99°O	1'270	Siemens M55	ABB	28.04.1992	01.06.2001
Swiss Bassin	46.96°N, 7.46°O	540	Siemens M55	ASP TopClass 4000/6 Grid III	24.06.1992	01.07.1992

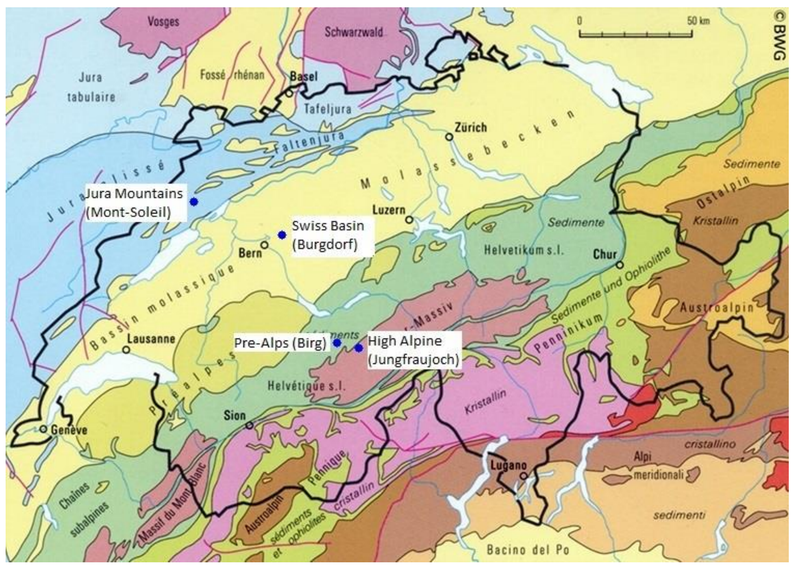

Fig. 1: The topographic regions in Switzerland with PV-installation sites operated by the PV LAB.

High alpine PV-installation Jungfraujoch

At Jungfraujoch (3 454 m asl), the PV LAB at BFH Burgdorf compares the electricity output difference of new PV technology (2014) as compared to the state-of-the-art technology 20 years ago (1993).

First Comparisons

Old (Joch 1) and new (Joch 2) PV-technology at Jungfraujoch

	Joch 1	Joch 2
Tilt:	90°	90°
Module:	Siemens M75	Sunpower X21 345
Inverter:	ASP TopClass 2500	2xSolarMax 3000P
P_{Gen}:	1'152 Wp (nominal)	2x1380Wp
Installation:	October 1993	September 2014

Fig. 2: Position of the PV modules on the Jungfraujoch research building (Joch 1 (right): PV-installation 1993; Joch 2 (left): PV-installation 2014).

As the new PV modules (2014) have an efficiency of 21% (as compared to 12% in 1993) we expect a double energy production per m². But how is the normalized energy yield?

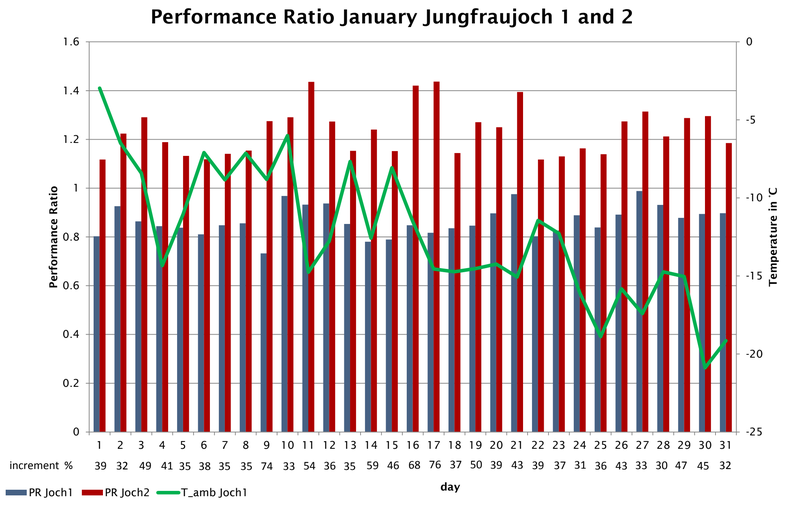

Fig. 3: Performance ratio between the old and new PV technology at Jungfraujoch in January 2015 and June 2015.

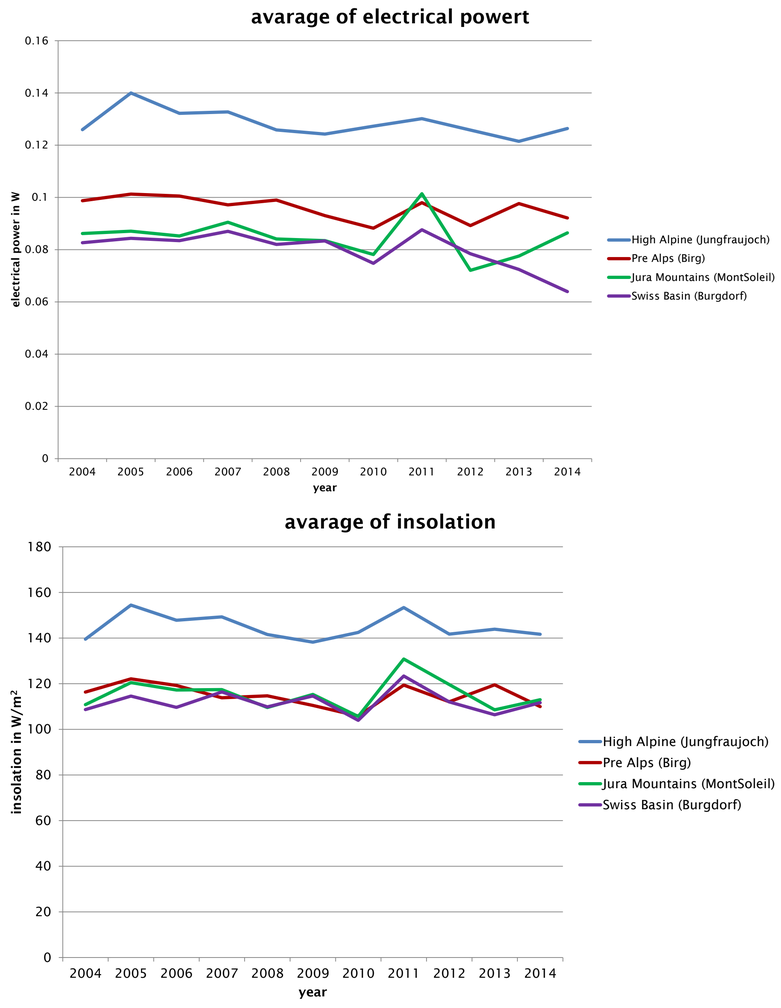

Fig. 4: Comparison of insolation and energy yield among the four typical topographic Swiss regions.

The performance ratio in January and June 2015 (Fig. 3) provides evidence that the new technology at Jungfraujoch increases the performance ratio (PR) by about 30%.

Open Questions

The “thick” wavers (about 300µm) from the 1990es resisted well to the climate stress at high altitude (e.g., insolation as shown in Fig. 4). But how will the new, thinner wavers (about 180µm) endure the alpine climate? We will know it in a couple years!

Our research efforts offer valuable new insight into alpine electricity production. The data we collect assist researchers, practitioners, insurance companies and the Swiss Government in implementing the Energy Strategy 2050.

Further Information

www.pvtest.ch
urs.muntwyler@bfh.ch

Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

- Engineering and Information Technology
- Photovoltaic Laboratory

Prof. Urs Muntwyler
Jlcoweg 1 | 3400 Burgdorf | Switzerland
www.pvtest.ch | iem.bfh.ch/photovoltaik | urs.muntwyler@bfh.ch