Photovoltaic (PV) Winter Electricity in the Swiss Energy Strategy 2050

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The Swiss Energy Strategy 2050 aims to phase out the five nuclear power plants in Switzerland by 2050, and at least 12 TWh (of 20 TWh) will stem from solar energy. 40-50 GWp of PV will be needed in Switzerland by 2050. Overproduction in summertime will be a problem which can be tackled by using "PV curtailment". It is suggested to considerably increase the number of PV installations in the Swiss Basin. To compensate losses due to snow and fog, installations in the mountain regions in Switzerland as well as vertical installations should be considered.

Introduction

Because of low filling levels of hydropower storage dams at the end of winter, PV power is highly needed: 40-50 GWp of PV are necessary until 2050 to produce enough power. As PV installed above 1000m produces a fine share of power in wintertime, that can be one of the solutions.

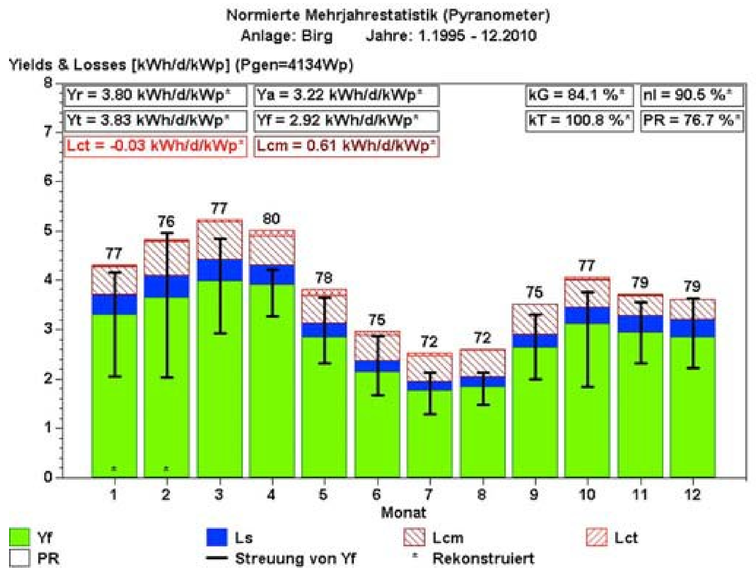

Figure 1: Standardized multi-year statistics for the years 1995-2010 of the high-alpine PV plant Birg (2'677 amsl, angle of attack ß = 90 °).

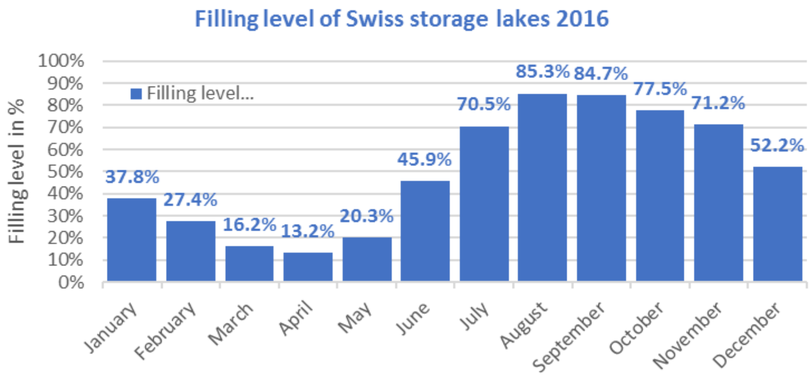

Figure 2: Solar charging station carport at BFH in Burgdorf – "fuel" for 30 years!

Challenges

With 40-50 GWp of PV we will generate a surplus power production of about 300% in summertime. Furthermore we need to tackle the losses in electricity production from PV in winter during snow coverage of the PV panels and during fog in the Swiss Basin where around 25 days of fog are measured each year. But installing PV in high alpine regions to avoid fog and reach high production values during winter is expensive: installations are far away from infrastructure and sites hard to reach. The number of days of fog decreased in the last years.

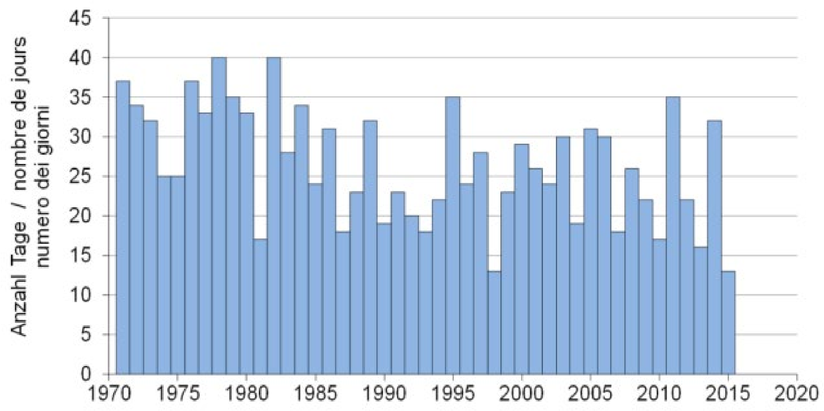

Figure 2: Number of fog days from 1970 to 2016 at the station of Meteoschweiz in Zürich-Fluntern in the Swiss Basin goes down. This trend can be seen in most of the Swiss Basin.

Outlook

We recommend to install about 40-50 GWp: most of it should be installed in the Swiss Basin, where installations are cheap. To tackle overproduction in summer, vertical panels (angle of attack = 90°), PV curtailment, smart loads and batteries should be used to cut production peaks.

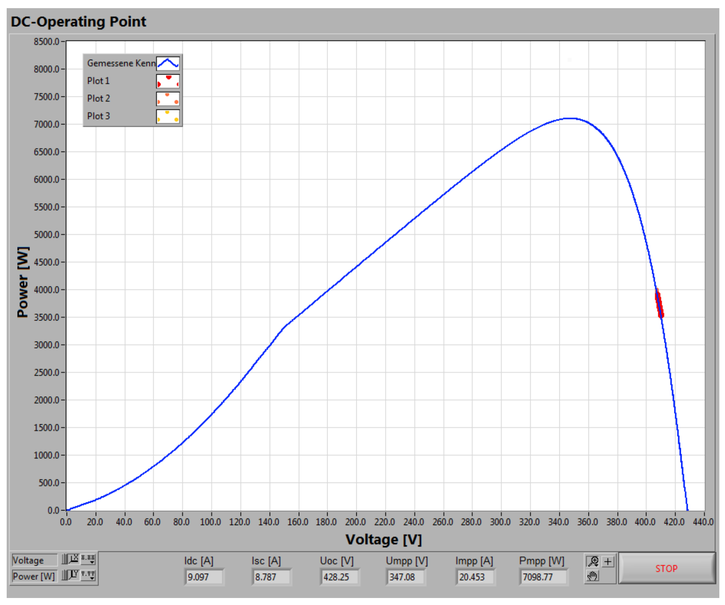

Figure 4: PV inverter with 50% curtailment: software and hardware solutions are available to do so.

Figure 5: Balcony balustrades can be used to install PV panels vertically and to cut production peaks

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