SUPSI · Zürcher Hochschule für Angewandte Wissenschaften zhaw · Berner Fachhochschule · OST Ostschweizer Fachhochschule

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ALIENCE—ALPINE PV COMPETENCE

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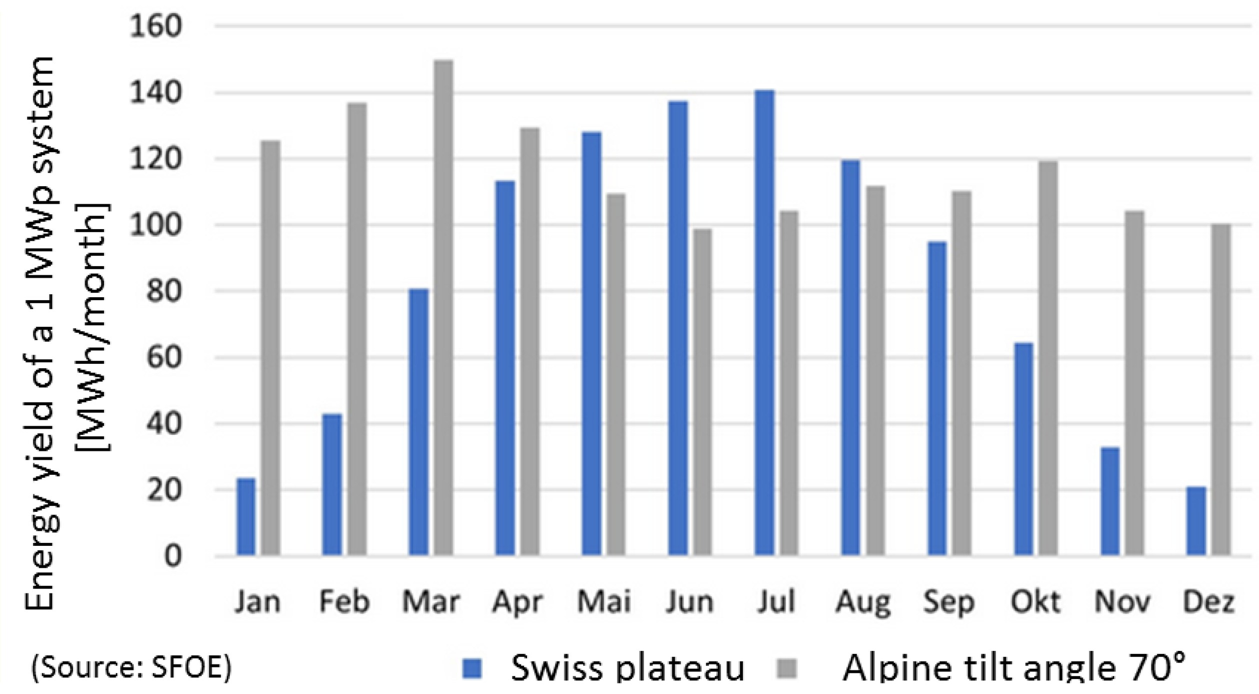
Why Alpine?

PV energy production in winter is relatively low for systems on the Swiss plateau. PV systems in alpine regions have many advantages, such as;

- High irradiation, especially in winter
- Additional radiation due to the high albedo of snow
- Low module temperatures

As a result of these advantages, Alpine PV systems can have higher energy yields, especially during the winter months.



Challenges of Alpine PV Systems

Alpine PV systems face a unique challenge compared to conventional PV systems. These unique challenges are;

- Higher mechanical loads (Wind and snow) on PV modules and sub-construction
- Higher UV radiation which could cause increased ageing of polymeric materials and new cell technologies
- Larger temperature change could create larger thermomechanical stress on module materials

Structure of the ALIENCE Project

1.System Design

2.Module Evaluation

3.Outdoor Measurement Techniques and Quality Control of Systems

4.System Aspects

5.Dissemination Platform

1. System Design

The optimization of the energy yield for Alpine PV systems is investigated through the simulation of different system designs and ground cover ratios for various ground slopes and azimuths. It is important to note that each alpine PV system must be customized to the local conditions and requires specific planning. The results of this research will provide valuable guidance for the design and implementation of Alpine PV systems.

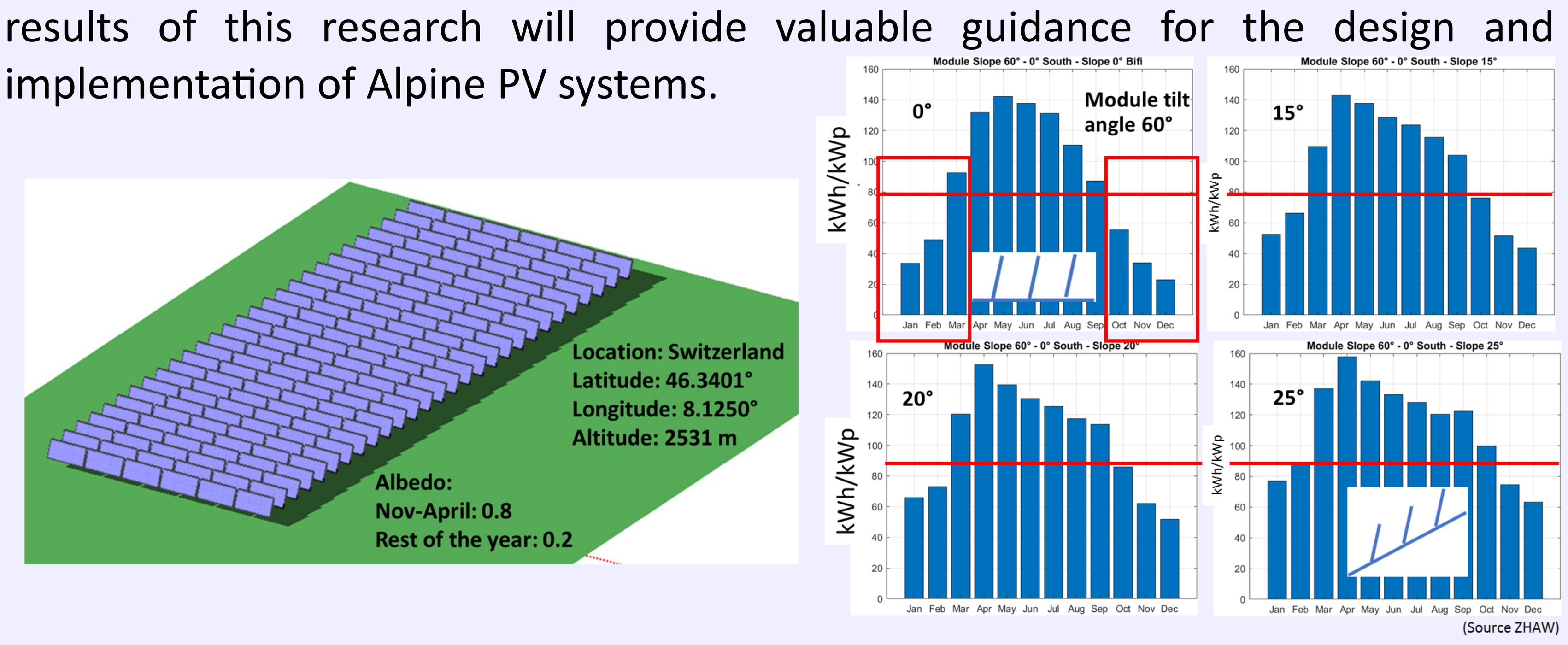


Figure 1: Specific energy yield simulations of south-facing Alpine PV systems for various ground slopes using PVSyst, bifacial modules mounted at 60° tilt angle with GCR = 100%.

2. Module Evaluation

Two of the **most relevant failure modes** in terms of frequency and/or severity are here chosen and tested on a set of 2 different so-called alpine modules with different BOM in comparison to a standard farmed glass/backsheet module.

The aim is to demonstrate the differences between **Alpine and standard modules and the durability of these modules under field-representative stress levels**.

Some features of some Alpine PV modules in the PV market;

- Higher mechanical load (8000 Pa / 816 kg/m² instead of 5400 Pa)
- Wind suction (4500 Pa)
- Reinforced frames/back rails/mounting solutions
- Special mounting solutions
- Thicker/hardened glass (4mm front glass instead of 3,2mm)
- Extended hail resistance (55 mm instead of 25 mm Ø)

3. Outdoor Measurements Technique and Quality Control of Systems

1. Preparation of an overview of measurement methods and measuring devices for alpine PV systems

- Monitoring (permanent measurements in the field)
- One-time measurements in the field (e.g. UV, IR, EL, IV, insulation)
- Measurements in the lab

2. Data evaluation

- Relevance of onsite measurements in the planning as well as the operation phase compared to available data sets
- **MONITERED DATA IS NEEDED!**

4. System Aspects

- System-specific and generally applicable solution concepts are collected, described and discussed.
- Generic findings and rules are compiled and developed.
- Create added value for the project planning of new installations.
- For example, curtailment vs. grid expansion will be discussed by simulating / calculating the financially optimum sizing ratio.

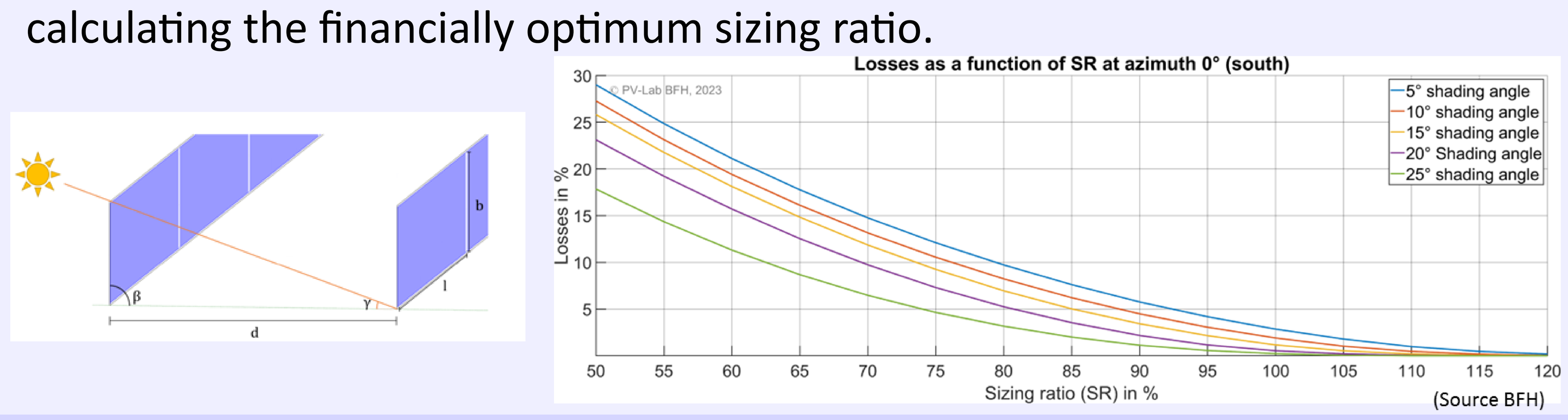
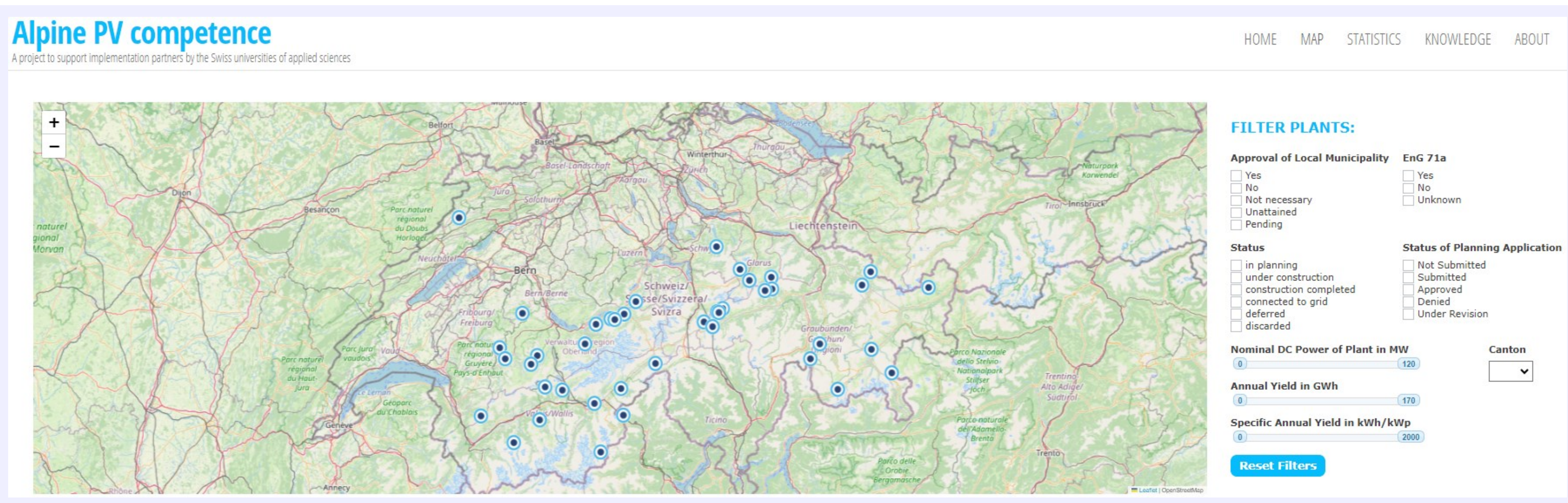


Figure 2: Example of simulated energy losses for south-faced vertically installed bifacial PV modules as a function of Sizing Ratio (SR) (DC/AC power ratio).

5. Dissemination Platform

- Collecting plants and related information.
- Displaying plants in a map with different filter possibilities.
- Showing detailed information to each plant in an additional factsheet.
- Provide different charts to analyse the data.
- Possibility to download the data.
- Wiki like platform to find a lot of detailed technical information.
- **ONLINE MARCH 2024!**



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