SWITZERLAND

PHOTOVOLTAIC TECHNOLOGY STATUS AND PROSPECTS

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Fig.80 - In 2021, a first larger agro-photovoltaic plant was put into operation in Switzerland. The technology was developed by the start-up Insoligt and is based on translucent solar modules, where the transparency can be varied using optical micro-tracking. The installation covers 165 m2 on a raspberry production farm. Other participants in this pilot project, supported by the SFOE, are Romande Energie as utility and Agroscope, the national centre of excellence for agricultural research (Image source: Insolight SA)

NATIONAL PV POLICY PROGRAMME

The "Energy Strategy 2050" forms the basis for Switzerland to transform its energy system in a sustainable and climate-friendly way. It is closely linked to national climate policy, where Switzerland has committed to halving its emissions by 2030 compared to 1990 as part of the Paris Climate Agreement, with the goal of climate neutrality by 2050. To define measures for the period 2021 to 2030, a complete revision of the CO_2 Act was envisaged with a series of measures for road and air transport and for the industrial and building sector. However, the Act failed to pass in a popular referendum in 2021 for several reasons. Climate measures already adopted in the existing CO_2 Act, which were limited in time, will be extended. The political discussion for a follow-up solution to achieve the goals of the Paris Climate Agreement continues. The government communicated that the already defined benchmarks of a halving target for emissions by 2030 and net zero by 2050 shall be adhered to and opened a consultation on a revised CO_2 Act in mid-December 2021. The new proposal addresses sectors that are central to climate protection, buildings and mobility with financing programmes for building renovation and the switch to climate-friendly heating systems, with funds for the development of charging infrastructure for electric vehicles, the conversion of bus fleets, risk coverage for the expansion of district heating networks and blending quotas for renewable aviation fuels (similar to regulations in the EU).

Mid-2021, the government passed a law on a secure electricity supply with renewables, which includes a revision of the Energy and Electricity Supply Act and is intended to strengthen the expansion of domestic renewable energies and Switzerland's security of supply, especially for the winter season. Measures proposed therein, like the introduction of a hydropower reserve for winter electricity supply, will be debated in parliament early in 2022. As in other countries, the political discussion about security of supply is in full swing, especially with regard to the electricity sector.

Photovoltaic power is the most important form of

renewable energy

in Switzerland after hydropower.

In parallel, nuclear power plants will be decommissioned in the coming decades and no new nuclear power plants are planned to be built. In winter, so far demand has been offset by imports from abroad, but future developments are uncertain, also due to the lack of an electricity agreement with the EU.

For an increasing number of stakeholders, targets for the development of photovoltaics in Switzerland are not ambitious enough. Apart from more ambitious expansion targets, points are brought into the discussion such as (1) an increase in the grid surcharge for promotion as well as a uniformly regulated purchase tariff in order to improve investment security for national plants, (2) the establishment of local energy communities or (3) a nationally uniform obligation to use suitable surfaces on new buildings. Also in 2021, a parliamentary initiative to extend the promotion of renewable energies (including photovoltaics) with investment contributions until 2030 was adopted by parliament to prevent a gap after the feed-in tariff system, limited to the end of 2022.

RESEARCH, DEVELOPMENT & DEMONSTRATION

In Switzerland, approximately 35 million Euros of public funding is used for Research Technology & Development (RTD) in the field of photovoltaics (figures for 2020), 20 % thereof for pilot and demonstration. A large part of these funds is deployed competitively through various funding sources, with projects in the European context accounting for a large share. 92 projects are

currently (31.1.2022) ongoing in various technology areas: 10 % in the area of Crystalline silicon, 19 % in the area of other cell technologies (perovskite, CIGS), 6 % on tandem approaches, 14 % on module technology and module testing, 10 % on BIPV, 7 % for grid integration, 7 % in new mounting technologies and the rest in different areas (LCA, forecasting etc.)

The Photovoltaics RTD Programme of the Swiss Federal Office of Energy (SFOE) involves a broad range of stakeholders and is part of long-standing coordinative activities by the SFOE to support research and development of energy technologies in Switzerland. SFOE funds are deployed in a subsidiary manner to fill gaps in Switzerland's funding landscape. Grants are given to private entities, the domain of the Swiss Federal Institutes of Technology (ETH), universities of applied sciences and universities.

As an R&D-highlight worth mentioning, the nationwide PV hosting capacity and energy storage needs for distribution grids were analysed in the context of a major research collaboration (Swiss Competence Center for Energy Research: Future Swiss Electrical Infrastructure, SCCER-FURIES) Δ. Since nationwide models of distribution grids are usually not available, the problem of estimating those from publicly available datasets was addressed and a method was developed to more accurately calculate the PV generation capacity and extend that capacity with energy storage systems. A detailed regional analysis shows that energy storage requirements are relatively low before rising sharply after 14 GW of installed PV capacity (cumulatively installed until 2020: 3 GW). Cost efficiency is higher for PV systems installed with larger capacity factors. In terms of increasing the PV uptake capacity of highly insulated distribution grids, investments in decentralised storage can be more efficient than installing PV systems with a low capacity factor.

At the Swiss Federal Institute of Technology Lausanne (EPFL) and at the PV Center of CSEM (Centre Suisse d'Electronique et de Microtechnique) in Neuchatel, major research projects are underway in the field of passivating contacts for crystalline silicon solar cells, which are key to a enable higher conversion efficiencies, in a way compatible with industrial production processes. As R&D-highlight in this field, a fabrication process for double-sided contacted c-Si solar cells with localised passivating contacts on the front side was presented◊. Although the approach is first intended for the front side only, it can also be applied to the back side of solar cells for bifacial applications. Promising efficiencies of up to 21.7 % with high open-circuit voltage (>710 mV) and high fill factor (80 %) were demonstrated.

→ Swiss Experts participate currently in 7 PVPS Tasks involving 12 separate entities as listed here

INDUSTRY & MARKET DEVELOPMENT

Swiss power generation in 2020 comprised run-of-river power (25.2 %), hydro storage power (32.9 %), nuclear energy (32.9 %), renewables (5.0 %) and other sources. Renewable power generation increased by 17 % to 3.5 GWh in 2020 compared to 2019, with PV (2.6 GWh in 2020) the largest contribution and the most important renewable power source after hydropower (40.6 GWh). While annual PV capacity expansion between 2015 and 2019 was on average 290 MW, a record of 475 MW was added in 2020. Definitive figures for 2021 are not yet available, but the PV add-on could exceed 600 MW.

In recent years, the PV market in Switzerland has been largely driven by self-consumption. With the aforementioned adjustments to framework conditions and with further political initiatives, the incentives for the construction of larger systems are being improved. Depending on the specific energy scenario, however, further acceleration in PV expansion is necessary to achieve the targeted goals.

Industry players in Switzerland are grouped more or less along the entire photovoltaic value chain. A wide range of competitive technologies, products and services are offered for the growing photovoltaic market. An overview of the players can be found here.

The Swiss solar cell and module manufacturer Meyer Burger started operations at its production site in Germany in 2021 with a first expansion phase of 400 MW, applying the heterojunction/SmartWire technology developed to a large extent in Switzerland. According to Meyer Burger, financing has been secured for an accelerated expansion of further production capacities in order to reach 1.4 GW cell and module production capacity by the end of 2022, as well as to finance further growth. Meanwhile, Meyer Burger also announced plans to ramp up production capacities outside Europe.

Fig.81 - The installation on a raspberry production farm

Δ Countrywide PV hosting capacity and energy storage requirements for distribution networks: The case of Switzerland, Gupta, R., Sossan, F., Paolone, M.; Ap-plied Energy, 280 p116010 (2020)

◊ Localisation of front side passivating contacts for direct metallisation of high-efficiency c-Si solar cells, Meyer, F., Ingenito, A., Díaz León, J., Niquille, X., Allebé, C., Nicolay, S., Haug, F.-J., Ballif, C.; Solar Energy Materi-als and Solar Cells 235 p111455 (2022)