



Report 2023

Switzerland

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Authors Katja Maus, Swiss Federal Office of Energy; Lionel Perret, Planair SA.

By the end of 2023, Switzerland had 47 large wind turbines in operation with a total rated power of 100 MW. These turbines produced 0.17 TWh of electricity in 2023. Six wind turbines were built in 2023 (Wind parc Ste-Croix) but started producing energy only at the beginning of 2024.

A cost-covering feed-in tariff (FIT) for renewable energy in Switzerland has existed since 2009 [1]. A new scheme with an investment subsidy of 60% has also entered into force in 2022. These policies offer an attractive economic framework for wind energy, but the authorisation process is causing a long delay, in worst cases up to 25-years. About 2 TWh of projects are under development. A new feed in tariff proposal is being discussed, aiming at reducing the

subsidy per kWh while also considering subsidies for investments.

Internationally cross-linked research activities in 2023 focused on cold climates, complex terrain, aviation cohabitation and social acceptance.

Highlight(s)

- The very long approval process still delays wind energy

Table 1. Key National Statistics 2023: Switzerland

Total (net) installed wind power capacity*	100.35 MW
Total offshore capacity	0 MW
New wind power capacity installed	13.8 MW
Decommissioned capacity (in 2023)	0 MW
Total electrical energy output from wind	0.17 GWh
Wind-generated electricity as percent of national electricity demand	0.3%
Average national capacity factor**	22.2%
Target	4.3 TWh
National wind energy RD&D budget	6.92 mio CHF (2022 most recent)

* Including the 6 wind turbines at Ste-Croix.

**Without the 6 wind turbines at Ste-Croix that start operation in 2024.

deployment.

- The last federal court has positively judged six projects with 133 MW / 274 GWh.
- In 2022, the Swiss Federal Office of Energy updated the sustainable potential of wind energy from 4 TWh to 30 TWh.
- In 2023, a new wind power plant was built at Ste-Croix with six wind turbines.

Market Development

Targets and Policy

The Energy Strategy foresees an additional 39 TWh from renewable energy by 2050. The new proposed law also anticipates another 35 TWh in 2035 and 45 TWh in 2050. Wind energy should contribute 4.3 TWh/yr to this target (with intermediate goals of 0.3 TWh in 2025 and 1.2 TWh in 2035), the Swiss Wind Association aims at 9 TWh by 2050.

In terms of support schemes, the previous FIT scheme is now over, and a new scheme has been introduced

based on investment subsidies supporting wind energy deployment from 2022 (investment subsidies up to 60%). This scheme has the disadvantage of not covering the long-term market price risks and has a long permitting process. It is therefore presenting too much risk for wind energy projects. This scheme could be attractive for community-owned wind turbines, but the authorisation process for such smaller projects still needs to be defined.

A levy on electricity consumption finances the cost of the FIT. The maximum levy is 23 CHF/MWh (around 21.2 EUR/MWh; 23.8 USD/MWh), which is used to develop a fund to support renewable energies in Switzerland. The FIT for wind turbines that announced/registered for it in 2022 was between 130 CHF/MWh and 230 CHF/MWh. The payment period expands over 15 years. This scheme is a contract for difference, which implied that with the market price being at the very high end in 2022, wind turbine operators under this scheme had to give money back to the fund. The 41 wind turbines provided about 9.6 million CHF (EUR 10.1 million; USD 11.2 million) to the fund in 2022. In 2024, a new proposal to update the

support mechanism for wind energy is suggesting a choice between FIT or fixed investment subsidy.

Progress and Operational Details

Approximately 57% of Switzerland's electricity production comes from renewable sources, with hydropower being the biggest contributor (92%). Wind power generation currently provides 0.3% of Swiss electricity consumption. Projects already in advanced planning stages represent an additional 360 MW, while early-stage projects represent roughly 600 MW. The advanced stage projects should be realised in the next 3-5 years.

Matters Affecting Growth and Work to Remove Barriers

Lengthy planning procedures significantly hinder Swiss wind energy growth. Stakeholders at different authority levels must first give their authorisation, and voters must (typically) also approve specific projects in the local areas.

Generally, the Swiss population

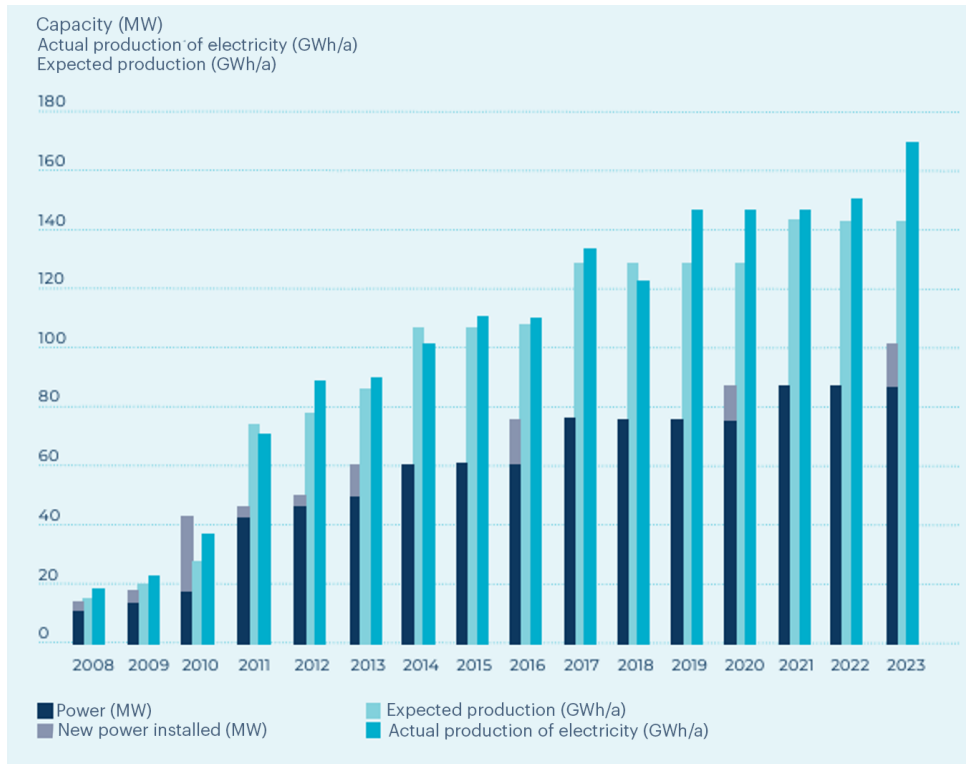


Figure 1: Annual installed wind capacity, cumulative capacity and wind energy production (planned and effective) in Switzerland from 2008 to 2023.

favours wind energy, as confirmed by votes at national and local levels. However, the opposition is very well organised and manages to polarise discussions on specific topics while systematically using every possible channel of appeal, which slows down the planning procedures.

New energy laws were discussed and adopted in 2023 aiming at accelerating the energy transition. In June 2023, a new dedicated law for Wind Energy was adopted, reducing the permitting time for wind projects in an advanced status, resulting in reductions from the previous situation with a permit process duration of up to 25 years. With this new law, six wind energy projects in the planning phase will benefit from this regulation change, and it is estimated that they will be built in 2025-2026, three years before originally planned.

Some Cantons (provinces) opened combined procedures for land use planning and building permitting. With the energy crises, several improvements in permitting processes

are discussed on the national level. The most advanced is about reducing the number of courts involved in the last step of wind energy authorisations.

RD&D Activities

National RD&D Priorities and Budget

The Swiss R&D priorities are organised around the plant, the turbine and innovative wind energy technologies.

- The Plant:
 - Development of data-related methods for the planning, layout and operation of wind parks.
 - Development and validation of control strategies for optimising overall operational performance (e.g., concerning forecasts and shut-down algorithms).

- The Turbine:
 - Component optimisation, especially for the use of wind energy in complex terrain.
 - Development and validation of components for use in cold climates and for accurate forecasting of ice formation.
 - Noise abatement strategies.
- Alternative wind energy technologies above 1 MW.

In 2023, the budget for wind energy-related R&D and demonstration projects was approximately 6.92 million CHF (EUR 7.09 million; USD 7.59 million). The total budget includes the national Wind Program of the Swiss Federal Office of Energy, with approximately 0.4 million CHF allocated to the wind energy sector for information activities, quality assurance measures, and supporting regional and communal planning authorities [2]. Budget-wise, the trend for 2024 is the same as for 2023.

National Research Initiatives and Results

WindSPORES:

Policy-relevant wind power deployment scenarios for Switzerland [3]. This project has focused on showing the value of wind energy by studying the correlation of wind patterns between Swiss regions. The findings of the project demonstrate there is a wide range of cost-effective wind power deployment options, including spatially concentrated or distributed scenarios. The overall conclusion is that there is a large techno-economic potential for wind power in the Swiss energy system. Wind power can provide overall system benefits, like reduced need for storage and electrolysis capacity and increased robustness when comparing with scenarios based exclusively on solar PV.

AMM-Fauna:

The AMM-Fauna project developed an advanced optical monitoring system for wind turbines to detect bat collisions and proximity flights. The system uses IR sensors and cameras mounted on a mobile platform with two modes of operation. It overcomes the limitations of existing IR cameras in terms of resolution, coverage, sensitivity and identification. The project, which will run until 2024, aims to improve the system's performance in different weather conditions and expand its target detection capabilities.

Collaborative Research

Switzerland is involved in the following IEA Wind TCP Tasks:

- Task 11: Base Technology Information Exchange Wind SCOUT (Operating Agent).
- Task 28: Social Acceptance of Wind Energy Projects.
- Task 32: LIDAR: Wind Lidar Systems for Wind Energy Deployment LIDAR.

- Task 34: Working Together to Resolve Environmental Effects of Wind Energy (WREN).
- Task 47: Aerodynamics.
- Task 48: Airborne Wind Energy.
- Task 52: Large-Scale Wind Lidar.
- Task 54: Cold Climate Wind Power.

Impact of Wind Energy

Environmental Impact

Carbowind study results [5] indicated that the impact on carbon reduction with new installed wind power plants is significant with 378 g/kWh, despite the almost completely carbon neutral electricity generation mix. This study considers the relevant import of carbon-based electricity during winter in Switzerland. Wind power generation, combined with solar power, is expected to replace power generated by nuclear power plants which are expected to be shut down at the end of their lifetime.

Economic Benefits and Industry Development

The Swiss industry is active in several wind energy fields:

- Development and production of chemical products for rotor blades, such as resins or adhesives (Gurit Heberlein, SIKA, Huntsman, Clariant).
- Grid connection (Hitachi Energy, ABB).
- Development and production of power electronics such as inverters (ABB, VonRoll).
- Services in the field of site assessments and project development (Meteotest, Interwind, NEK, New Energy Scout, etc.).

Next Term

There are currently six wind power projects in an advanced status. After the new dedicated law for Wind Energy was adopted in 2023, the permitting time for will be reduced, and it is estimated that they will be built in 2025-2026, three years before originally planned.

References

[1] Swiss Federal Office of Energy (2022). Feed-in remuneration at cost. Download from: <https://www.bfe.admin.ch/bfe/en/home/foerderung/renewable-energy/feed-in-remuneration-at-cost.html>

[2] Swiss Federal Office of Energy (n.d.). Energy 2050+. Download from: <https://www.bfe.admin.ch/bfe/en/home/policy/energy-perspectives-2050-plus.html>

[3] WindSPORES – Policy-relevant wind power deployment scenarios for Switzerland (2023). <https://www.aramis.admin.ch/Grunddaten/?ProjectID=48588>

[4] AMM-Fauna Autonomous multi-sensor monitoring of birds to assess collisions and flight avoidance near wind farms (2023). <https://www.aramis.admin.ch/Grunddaten/?ProjectID=49520>

[5] UNIGE Carbowind (2020). Download from: <https://archive-ouverte.unige.ch/unige:144762>