Purpose

This section covers security of supply and the energy transition.

Security of supply

See the «Security of supply» section of the Annual Report.

Energy transition

Energy production in Europe is undergoing a rapid transition from large centralised power plants to decentralised, renewable energy resources. Transmission and distribution grids are playing a vital role in this transformation. Firstly, they form the backbone for locally consumed, decentrally produced energy, for example by photovoltaic and hydropower plants. Secondly, they make it possible to connect remote production sites to consumer centres.

What is more, energy production from wind power and photovoltaic plants fluctuates because it is directly dependent on the weather. This makes it difficult to ensure the secure operation of the transmission grid, as energy volumes may be fed into the grid unexpectedly or the electricity available in the grid may be insufficient. Reliable forecasts of the expected volumes of energy produced at all levels of grid operations and an efficient transmission system are key prerequisites for the success of the energy transition.

Swissgrid is affected by the transition to decentralised energy production both as the operator of the Swiss extra-high-voltage grid and as part of the European interconnected grid. Close cooperation between operators at all grid levels, energy producers and consumers is crucial, both nationally and internationally. As the

number of private photovoltaic systems increases, so does the importance of companies and households as energy producers. They feed the energy they have produced directly into the local distribution grid, which is often the responsibility of a regional distribution grid operator. These grid operators will play a much more active role in the future as a result of the energy transition. Greater requirements will be placed on them, particularly with regard to the accuracy of feed-in and consumption forecasts.

In addition to the photovoltaic systems already mentioned, the other components that will play an important role in future grid operations include heat pumps and electricity storage systems, e.g. for electric vehicles. Heat pumps could be programmed to heat buildings at appropriate times, for instance, with the building itself acting as a heat accumulator. The water storage tanks in heat pumps could also serve as buffers. The batteries in electric vehicles can be used both as storage reserves for surplus volumes of energy and as a source of control energy. However, this is subject to technical prerequisites and necessitates intelligent grids (smart grids). Swissgrid calls its strategy for an intelligent transmission grid the «Grid of the future».

Switzerland plays a central role in the European interconnected grid. Firstly, the transmission grid is an important transit axis that also benefits Switzerland. Secondly, Switzerland is dependent on energy exchange with Europe both as a consumer (electricity importer) and as a producer (electricity exporter). The shift towards decentralised energy production is politically desirable both in Switzerland (Energy Strategy 2050) and in Europe, and is a necessity in order to achieve the decarbonisation of the energy system. As the operator of the Swiss transmission system, Swissgrid is supporting this change.

GRI 3-3

Ambition and goals

Swissgrid's aim is to support the transformation of the energy system in Switzerland and to guarantee grid-related security of supply regardless of the degree of integration into EU processes.

GRI 3-3

Management approach

The energy system in Switzerland and Europe is undergoing radical change. The rapid expansion of production from solar power and, in the future, from wind power, poses additional challenges for ensuring the uninterrupted and efficient operation of the extra-high-voltage grid. The electricity market in Switzerland no longer consists of a few large centralised power plants on the supply side and a large number of customers on the demand side. Huge numbers of smaller photovoltaic plants are becoming a significant production factor. Swissgrid is backing this development towards renewable energy resources through its flexible, data-based operation of the transmission grid and is thereby making its contribution to the energy transition.

To help bring about the transition, Swissgrid is implementing tools and measures in the following four areas:

- **Flexibility:** Swissgrid is committed to developing products that provide incentives for making sufficient flexibility available for secure grid operations at all times. This flexibility can also increasingly be provided by small, decentralised producers and consumers.
- **Forecasting capability:** Energy from wind and photovoltaic production is subject to continuous fluctuations. Swissgrid is working with its industry partners to develop reliable forecasting tools based on the exchange of relevant measurement data so that the transmission grid can be controlled efficiently at all times.
- **Infrastructure:** Swissgrid provides an efficient transmission grid that creates the best possible framework conditions for achieving the Confederation's Energy Strategy 2050 and the pan-European energy

transition.

- **Integration into Europe:** Swissgrid's goal is to continue to operate the Swiss extra-high-voltage grid in a secure and stable manner as part of the European interconnected grid. To achieve this, Swissgrid believes that an electricity agreement with the EU is essential.

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Measures and key figures

In the 2024 financial year, Swissgrid initiated and continued to drive forward the following measures to support the grid-related energy transition in Switzerland:

Photovoltaic (PV) forecasting

While the expansion of electricity generation from photovoltaics in Switzerland is progressing, the availability of data on electricity production from photovoltaic plants and forecasts is still lagging behind. This has an impact on the stability of grid operations and may oblige Swissgrid to use more control energy at higher costs in the short term in order to compensate for the imbalance between production and consumption. As a proactive measure to counter this difficulty, Swissgrid developed a PV forecasting model in the 2024 financial year that provides a solid data base for forecasts, nowcasts and backcasts with regional resolution (see also the «Year in review» section).

PV4Balancing

The aim of the PV4Balancing project is to harness the flexibility potential of photovoltaic plants in Switzerland to stabilise the grid in the future. To this end, Swissgrid launched a project with industry partners in the 2024 financial year to develop a new control power product that will allow the energy produced by photovoltaics to be used as control energy. A pilot project with initial applications in grid operations is planned for the current year. In the long term, the project could help to integrate a larger proportion of photovoltaic electricity generation into the grid whilst mitigating the challenges that volatile electricity production poses to grid stability.

Coordinated use of decentralised energy resources

Cooperation within the electricity sector is a key basis for ensuring the efficient and successful implementation of the Energy Strategy 2050. In the 2024 financial year, Swissgrid worked with industry partners to drive forward the development of a joint market for grid and ancillary services. The aim is to allow the deployment of flexible resources for stable grid operations in a coordinated manner in the future (see also the «Year in review» and «Media release» sections).

Innovation and digitalisation

The energy transition requires a robust transmission grid with sufficient capacity, minimal downtimes and stable grid operations. Innovation and digitalisation are vital if Swissgrid is to take a proactive approach to tackling the associated challenges. In the 2024 financial year, the company continued to drive forward innovative digitalisation projects to support the energy transition. These include the Pylonian project with Internet-of-Things sensors on pylons (see the «Year in review» section), the use of drones and AI to efficiently assess the condition of pylons (insert link after publication of blog post) and the digitalisation of system and operating data (see the «Year in review» section.)

Strategic Grid 2040

In the summer of 2024, Swissgrid finalised its planning of the Strategic Grid 2040 and submitted it to ElCom for review (see the «Year in review» section). One of the objectives of strategic grid planning is to identify the need for action on the grid side in order to transform the energy system. This will enable Swissgrid to make sure that the transmission grid continues to pave the way for the energy transition in the future.

Key figures for transported electricity volumes and control energy

The cross-border exchange of electricity plays a key role in ensuring security of supply and grid stability and in bringing about the energy transition. Swissgrid ensures the connection of the Swiss transmission grid with the European interconnected grid via 41 international interconnection lines and controls the exchange of electricity with neighbouring countries. In the 2024 financial year, the volume of imported electricity decreased slightly compared to the previous year, while export volumes increased by 19%.

In an energy landscape that is increasingly shaped by renewable production, the availability and use of control energy remain crucial for ensuring the stability and reliability of the supply of electricity. The control energy used by Swissgrid reflects the punctual imbalance between production and consumption. Real-time data and forecasting accuracy, especially in connection with photovoltaic production, are important factors for avoiding the use of large volumes of control energy at high costs. Although there were occasional peaks in the 2024 reporting year, the volumes of positive control energy (requests for production capacity) and negative control energy (reduction of production capacity) both decreased on average over the year.

Electricity volumes and control energy (GWh)	2024	2023	2022
Transported energy	69,609	74,134	74,414
Imported energy	25,262	27,017	32,695
Exported energy	39,175	32,888	28,762
Transit energy	22,155	21,591	23,134
Positive control energy	944	1,033	1,118
Negative control energy	550	694	754