Annual Report
Editorial

Positive momentum and progress in the areas of innovation, grid expansion and international cooperation

Adrian Bult, Chairman of the Board of Directors, and Yves Zumwald, CEO

Dear readers,

Swissgrid's key responsibility is to ensure the secure and stable operation of the transmission system. We were able to guarantee availability of over 99.9 percent in 2024. However, as already specified in our Strategy 2027, the challenges we face are increasing as the transformation of the electricity system progresses.

In the reporting year, transnational electricity trade in Europe led to more transit, which put a strain on our grid infrastructure. We were increasingly forced to reduce the capacity available at the national borders in order to keep the Swiss grid stable. However, Swissgrid was also repeatedly confronted with major imbalances within Switzerland. The capacities for electricity generation from photovoltaics are now so high that deviations between the forecasts provided by energy producers and their production in real time are having an impact on system frequency. Swissgrid had to request large volumes of control energy at short notice several times during the reporting year in order to keep the grid stable. The relevant costs will be borne by electricity consumers.

Swissgrid is rising to meet these challenges in close cooperation with its partners in the sector and with

innovative solutions. In the «PV-Forecasting» project, for example, Swissgrid prepares forecasts on photovoltaic production several times a day with a high regional and temporal resolution. These forecasts allow any imbalances in the balance groups to be analysed and countermeasures to be defined.

Swissgrid has reached important milestones with its grid infrastructure. We were able to commission a new transformer in the Mettlen substation, while work began at the Lachmatt substation to modernise the 380 kV switchgear and add a coupling transformer. A major step forwards was taken on the Mörel – Ulrichen grid project thanks to the installation of the conductors between Mörel-Filet and Ernen. Swissgrid has also finalised the technical report on the «Strategic Grid 2040» and submitted it to ElCom for review. The transmission grid is the key to a sustainable energy future. However, rapid modernisation is jeopardised by lengthy approval procedures. We therefore welcome the Federal Council's efforts to speed up the procedures with the «Grid express» proposal.

The conclusion of negotiations with the transmission system operators in the «Core» capacity calculation region and the approval of the methodology by the relevant regulatory authorities represented another success. Although this alleviates the situation regarding unplanned load flows on the northern border, it is no substitute for an electricity agreement between Switzerland and the EU. Swissgrid therefore welcomes the successful conclusion of negotiations in this regard.

In the spring of 2024, Swissgrid presented its first integrated Annual and Sustainability Report, improving its rating as a result. We are delighted by this achievement, which motivates us to continue our advances in this area. The topic of sustainability is also firmly established in Strategy 2027. Climate targets are a key part of this strategy. Our defined CO_2 reduction path involves reducing emissions by 50 percent by 2030 and by 90 percent by 2040. Negative emission technologies will also be used.

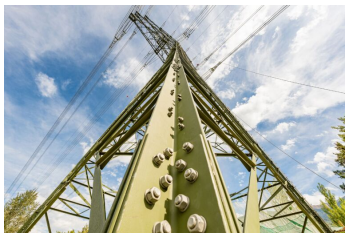
We continue to face a variety of challenges. Swissgrid has prepared itself accordingly to enable the company to rise to meet these challenges successfully in the future.

Adrian Bult
Chairman of the Board of Directors

Yves Zumwald
CEO

Annual Report
Year in review

The modernisation of the grid is progressing well. In the reporting year, Swissgrid was able to commission a new transformer system in the Mettlen substation in the canton of Lucerne, for example. Similarly, progress is being made on important grid projects in the canton of Valais. In addition, Swissgrid has finished planning the Strategic Grid 2040. The areas of innovation and digitalisation are also experiencing positive momentum, while Swissgrid is demonstrating a strong commitment to achieving greater integration into European processes.



IoT project: new sensors and scenarios for monitoring pylons

Three years ago, Swissgrid launched the «Pylonian» Internet-of-Things project. This involved placing sensors on pylons to measure variables such as pylon vibrations, pylon inclination, temperature and solar radiation. Swissgrid uses this data to monitor the condition of the transmission pylons. In the reporting year, Swissgrid installed additional types of sensors, particularly weather stations, to help forecast production capacity from renewable energy resources. Swissgrid also implemented «Sensorian», a telecommunication and sensor-independent platform that can host any type of sensor data on the Swissgrid data platform in a scalable, secure and flexible manner. In addition, experiments were conducted to simulate real events in order to link the data collected with potentially dangerous situations. This will allow the system to predict possible dangers so that Swissgrid employees can initiate measures at an early stage to prevent damage to the pylons.

Swissgrid ensures cooperation with the «Core» region

Switzerland is now part of the capacity calculations for transnational electricity trade in Central Europe. Although this will improve grid stability, it is no substitute for an electricity agreement. Swissgrid has reached an agreement on the joint coordination of cross-border capacities with the grid operators in the «Core» region, which is an association of countries in Central and Eastern Europe. This coordination also concerns the calculation of the capacities required for energy exchange between Switzerland, Austria, Germany and France. Until now, the Swiss grid has not been included in the planning of short-term (day-ahead) energy exchange, for example between France and Germany. Cooperation with the «Core» region will make it easier for Swissgrid

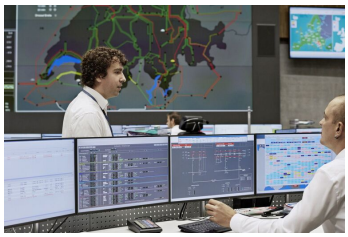
to control electricity flows through Switzerland. This will increase grid stability.

Investment, repair and maintenance costs for the grid in 2024

In the reporting year, Swissgrid invested CHF 256.3 million in the renovation and expansion of the transmission system. Swissgrid spent a total of CHF 58.3 million on the repair and maintenance of the transmission system. This work includes the replacement of conductors, the revision of circuit breakers, corrosion protection for supporting structures, avalanche protection and the repair of installations after a damaging event.

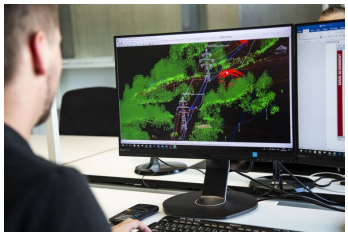
Strategic Grid 2040

The grid is the backbone of a secure and sustainable supply of electricity and is essential for the prosperity and high quality of life in Switzerland. Urgent grid development is needed to cope with the growing demand for electricity and increasingly decentralised, volatile power generation. Swissgrid is planning the grid of the future with national and international partners in the energy industry. In the summer of 2024, Swissgrid finished planning the target grid for 2040 and submitted its report to the Electricity Commission for review. The results of this review and the subsequent publication of the Strategic Grid 2040 are expected in Q2/2025.



New control system for the Swiss high-voltage grid

The software used by Swissgrid to control and monitor the Swiss high-voltage grid will have to be replaced over the next few years in order to meet the increasing challenges of grid operations. The new control system consists of three main components: the «SCADA» system monitors and controls Swissgrid's systems, i.e. the substations and the extra-high-voltage grid. The «EMS Core System» analyses the status of the current grid situation and various scenarios. «EMS Case Builder» creates different scenarios and visualises the results obtained from EMS Core, allowing the System Operation Specialists in the grid control room to anticipate possible developments in the grid.



Digital asset management: more efficient planning, construction and maintenance

Swissgrid will manage the extra-high-voltage grid digitally in the future in order to increase the reliability, capacity and efficiency of the grid. The aim is to increase availability and reduce costs by means of digital asset management. Digitalisation will play a crucial role. A digital grid image (digital twin) will be used to optimise the entire value chain – from planning and construction through to operation. The Asset Management 4.0 program will coordinate all the related projects. Various technological decisions were made in the program during the reporting year. Software solutions will be used to efficiently model asset data, for example.

Digital asset management: greater efficiency thanks to drones

Autonomous drones and artificial intelligence help Swissgrid to optimise the maintenance and operation of the transmission system. Both technologies are digitalising asset management. Drones are used for line inspections to monitor the condition of the grid. In the long term, drones will also provide data during initial inspections following disturbances in order to quickly assess damage so that repair work can start immediately. The inspection images from the drones are scrutinised by experts. To optimise this process, Swissgrid is working with other grid operators to develop AI algorithms that can automatically detect potential damage. Drones ensure safe access to locations that are otherwise difficult to reach, as well as reducing the carbon footprint in relation to conventional methods such as helicopter flights. Following a preliminary study, a two-year pilot phase has been in progress since mid-2023, during which Swissgrid has been preparing the groundwork for potentially expanding its use of the technology.

Procurement of the hydropower reserve for the winter of 2024/2025

In the summer, Swissgrid procured the hydropower reserve for the winter of 2024/25 by carrying out an auction on behalf of the Federal Electricity Commission (ElCom). This reserve is intended to safeguard Switzerland's supply of energy and is available for use between February and May 2025 if required. The total volume amounts to 250 GWh at an average price of 66.12 euros/MWh. The invitation to tender was issued in three tranches, and bids were reviewed and approved by ElCom.

PV forecasts to ensure grid stability

Swissgrid prepares forecasts several times a day based on publicly available data on the photovoltaic plants installed in Switzerland. These forecasts show the expected PV production capacity with a high regional and temporal resolution. This data can be used for various purposes, for example to analyse imbalances in the balance groups and to counteract them proactively. This will create direct added value for system operation. The next step will be to integrate the forecasts into other applications and to link them to PV measurement data for validation.

Safety: raising awareness about the operation of a critical infrastructure

Swissgrid operates the Swiss transmission grid and is responsible for one of the country's most critical infrastructures. The safety of Swissgrid's own employees is a top priority for the company, which is why it places the emphasis on personal protection. In the reporting year, Swissgrid focussed on promoting safe employee behaviour on the road, whether in private vehicles, on their way to work or on business trips. Every year, key topics are defined in various safety areas in order to raise employee awareness about their importance.

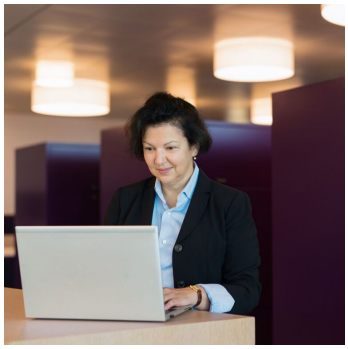
Cybersecurity: a new management structure to strengthen information security

As part of the implementation of the Cyber Security 2027 domain strategy, a new management structure for information security was established in the reporting year. Experts in information security and cybersecurity were appointed in all operational areas. These specialists are actively involved in cybersecurity processes to ensure that information security and cybersecurity requirements are taken into account at an early stage both in projects and in the day-to-day operations of the specialist departments. This initiative will enable Swissgrid to address concerns regarding information security and cybersecurity proactively on an ongoing basis.

Human resources: a high level of expertise

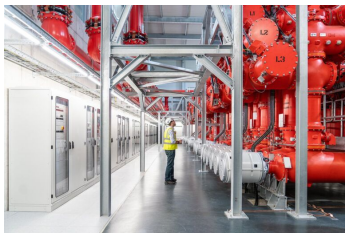
Swissgrid has defined the skills needed for the successful implementation of its strategy and conducted a 360-degree assessment to evaluate the level of expertise of employees. This assessment showed that the level of expertise is at an encouragingly high level and that no general measures are required to increase it. Individual development needs are addressed as part of employees'

personal development plans.



Human resources: protection of personal integrity

Swissgrid assumes its responsibility as an attractive employer and has defined the protection of personal integrity in the workplace as a focus topic. Employees and managers were given special training on prevention, behaviour and procedures in the event of a potential breach of personal integrity. Particular emphasis was placed on the personal responsibility of each and every individual.



Human resources: employee survey shows an improvement in all areas

A survey of all Swissgrid employees once again produced very positive results. Firstly, the participation rate was very high. Secondly, Swissgrid was able to improve the results in all areas in relation to the 2022 survey. The further increase in «genuinely satisfied» employees was particularly encouraging. This result is much higher than for comparable companies. Swissgrid conducts its employee survey every two years.

Roll-out of the latest generation of SAP

The «ERP Way Forward» project involved replacing Swissgrid's previous SAP system with the latest generation of the SAP ERP system. Swissgrid successfully completed the project in spring 2024. «Support SAP Cloud» services were introduced to extend the main functions. Swissgrid was able to simplify the entire system landscape. Various additional systems, such as planning and analysis software, are now integrated into the standard functions. Thanks to this harmonisation, Swissgrid has created the basis for extensively digitalising and mapping the majority of business processes in a single system.

Cooperation between grid operators

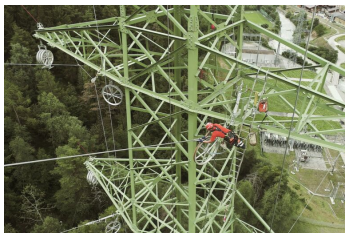
As a result of the energy transition, the number of decentralised, flexible energy resources in the grid is growing. The number of photovoltaic plants in Switzerland has experienced a huge rise. Electric vehicles and heat pumps are particularly important on the consumer side. Swissgrid is working with industry partners to develop a joint market for grid and ancillary services in order to coordinate the use of these flexible resources to ensure stable grid operation.

After an initial pilot project focussing on data interchange (phase A), the concept was revised in phase B as planned until the end of 2024. The improved concept will now be tested during phase C. The focus will be on market processes, combining simulations and real data.

Renovation of the Mettlen and Lachmatt substations

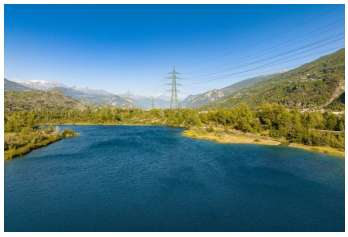
The Mettlen substation in the canton of Lucerne is an important node for supplying electricity to Central Switzerland. Swissgrid has modernised the transformation system from 380 to 220 kilovolts to ensure that the system will continue to meet grid requirements in the future. Two new 800 MVA transformers were built to replace the existing 600 MVA transformer, more than doubling transformer capacity.

The individual elements of the first transformer, which was commissioned in September 2024, were delivered in the spring via heavy-load vehicles able to transport over 200 tonnes each. In May 2024, Swissgrid started construction work at the Lachmatt substation in the canton of Basel-Landschaft, which is an important node for supplying electricity to north-west Switzerland. This project involves modernising the 380 kV switchgear and adding a coupling transformer to the substation.



Mörel – Ulrichen grid project: conductor installation complete

A new 380 kV line is being built between Mörel and Ulrichen. In 2024, Swissgrid completed the assembly work and installed the conductors between Mörel-Filet and Ernen. According to the current project planning, commissioning will not be possible until the end of 2026 at the earliest, as soon as Valgrid's new 65 kV substation in Ernen is ready for operation. The line is important so that all the electricity generated by the hydropower plants in the Valais can be transported away from the production sites.



«Grid express» proposal for faster line replacement

An extra-high-voltage line has a service life of around 80 years. Around two-thirds of the transmission system is now between 50 and 80 years old. Since the complete replacement of overhead lines is often subject to a sectoral plan procedure, it can take 15 years or more from the start of planning to the construction of the line. In order to shorten planning procedures, the Federal Council completed the consultation process on a draft bill for the expansion

and modernisation of the grids in the reporting year. The «Grid express» proposal, which will be debated by Parliament in 2025, stipulates that a sectoral plan procedure will no longer be required for replacing extra-high-voltage lines on existing routes. This would make the planning period around half as long, which would have a positive impact on the stability of the Swiss transmission grid.

Bickigen – Chippis grid project: delay despite the rejection of complaints

As with the Mörel – Ulrichen grid project, the Bickigen – Chippis project also focuses on transporting energy generated by hydropower. This energy is produced in the Valais and is mostly used in Central Switzerland. The voltage on the Gemmi line between the Bickigen substation in the canton of Berne and Chippis in the Valais therefore needs to be increased from 220 to 380 kilovolts. However, this expansion will also be delayed, and will now take at least another two years. Although the Federal Administrative Court dismissed the majority of the complaints against the project in January 2024, the planning approval dossier was referred back to the Swiss Federal Office of Energy to examine possible solutions for additional noise reduction.

Very high availability of the transmission grid

In the past reporting year, Swissgrid guaranteed an availability of the transmission grid of over 99.9% (previous year also over 99.9%).

Grid operations proved to be challenging in the reporting year. Large snow reserves led to high electricity production from hydropower. On 30 June 2024, Swissgrid registered record-high exports of 8,794 MW. In June, July and August 2024, Swiss spot prices fell below German spot prices for the very first time. High exports from France and imports to Germany dominated the situation across Europe. In the summer in particular, these factors, combined with the shutdown of grid elements for construction and maintenance work, led to congestion in the Swiss grid, which necessitated the use of large amounts of redispatching energy.

Swissgrid recorded an increase in deviations of the system frequency from the setpoint frequency of 50 hertz. This was mainly due to discrepancies between the PV energy actually produced and the forecasts of the lower grid levels. Coordinated procedures therefore had to be put into practice by European transmission system operators on several occasions. Swissgrid and the German transmission system operator Amprion work together as coordination centres to keep the frequency within the standard range throughout Europe.

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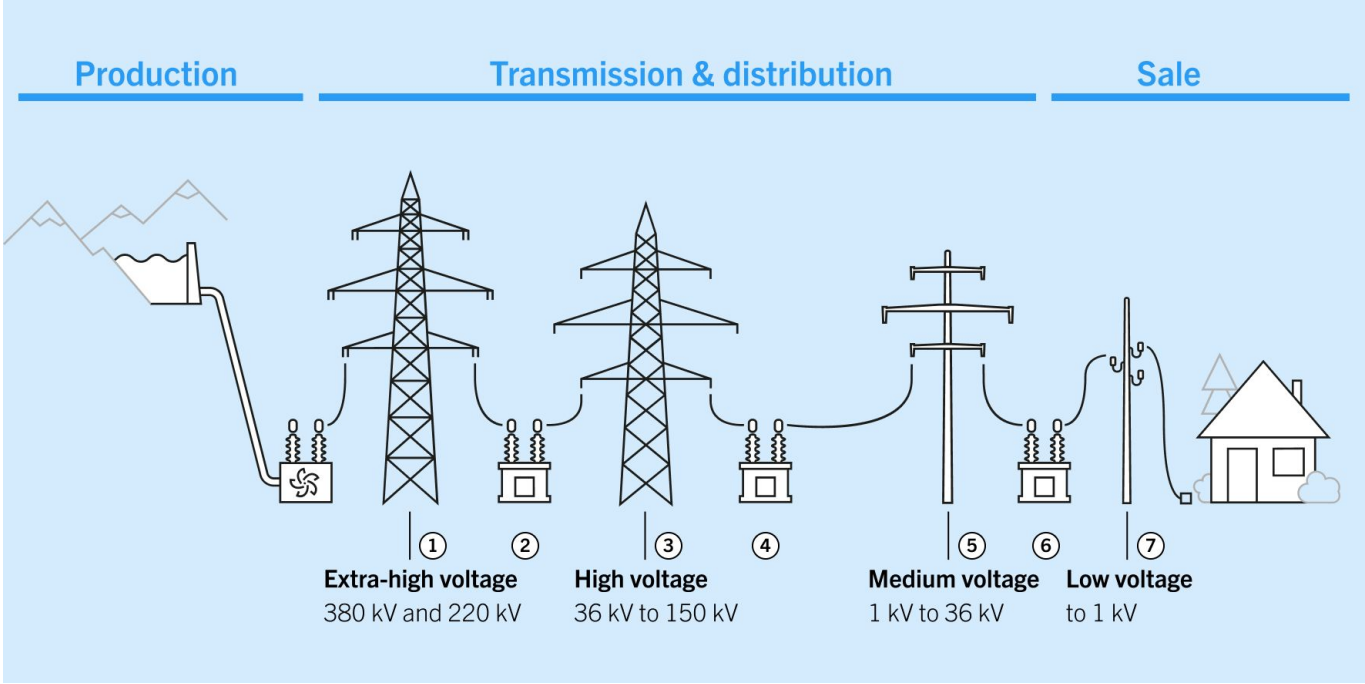
GRI 2-6

Swissgrid is the national grid company and owner of the Swiss extra-high-voltage grid. Its mandate is governed by the Electricity Supply Act (ESA, SR 734.7) and the Electricity Supply Ordinance (ESO, SR 734.71) The Federal Electricity Commission (ElCom) monitors compliance with these regulations. Swissgrid is responsible for the operation, maintenance, renewal and expansion of the Swiss transmission grid. In doing so, the company makes an important contribution to security of supply in Switzerland.

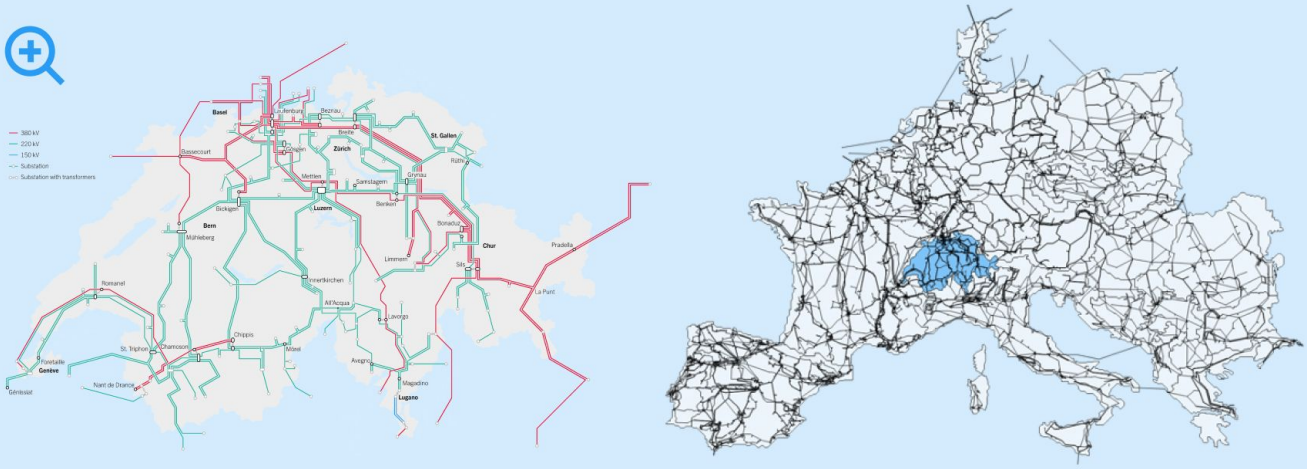
Value chain of the Swiss electricity industry

The Swiss transmission grid is a relevant part of the supply chain for the Swiss electricity system. This is made up of four areas: electricity generation, transmission, distribution and sale. Electrical energy is transmitted and distributed via a total of seven grid levels. These are the extra-high, high, medium (1, 3 and 5) and low-voltage levels (7), and three connecting transformer levels (2, 4 and 6). Immediately after being generated in large power plants, electrical energy is fed into grid level 1, the transmission system. The following grid levels take care of the national, regional and local distribution of electricity as far as the power outlet, and transform it as required. Given the increase in decentralised energy production, the feed-in to the grid, for example of energy from photovoltaic plants, is increasingly taking place via the distribution grids.



Swissgrid is responsible for grid level 1 and therefore for the secure transmission of large volumes of electrical energy over long distances. The Swiss transmission grid consists of 380 and 220 kilovolt lines extending over a length of 6,700 kilometres and supported by more than 12,000 electricity pylons. For the extra-high-voltage grid to function smoothly, it needs an elaborate infrastructure consisting of perfectly harmonised components. These include the two grid control rooms in Aarau and Prilly, 125 substations with a total of 147 switchgears and 25 transformers, as well as protection and station control technology.

The transmission system in 2024



In addition to the domestic transmission of electricity, the Swiss transmission grid also enables the import, export and transit of energy. With 41 international connection lines, it is closely integrated into the European interconnected grid. The Swiss transmission grid plays an important role in the cross-border transport of electrical energy throughout Europe. Today, the European interconnected grid guarantees a secure supply of electricity for more than 530 million consumers in over 30 countries.

Key figures: the transmission system in 2024

147 switchgears

6,700 kilometres long

2 grid control rooms

Voltage of **380** and **220** kilovolts

12,000 electricity pylons

41 cross-border lines

7 locations

GDI 2-1

The missions of the national grid company

In accordance with the Electricity Supply Act, Swissgrid ensures the non-discriminatory, reliable and efficient operation of the transmission system at all times as an essential basis for the secure supply of electricity in

Switzerland. At the grid control rooms in Aarau and Prilly, the company ensures that the system frequency of 50 hertz is constantly maintained and that electrical energy is transported safely. Swissgrid also coordinates the schedules of Swiss power plant operators and electricity traders, eliminates and minimises congestion and prevents overloads in the grid.

The company is responsible for the planning, replacement, expansion, maintenance and repair of the entire extra-high-voltage grid infrastructure. Swissgrid invests not only in the operation and modernisation of the grid to ensure grid-related security of supply, but also in market development. It helps to develop trading platforms for control energy and ensures cross-border capacities for energy exchange.

Due to the close integration of the Swiss transmission grid with the European interconnected grid, Swissgrid has an important role to play in Europe. As Coordination Centre South, it ensures smooth system management with European transmission system operators by monitoring the frequency of the European extra-high-voltage grid in association with the German transmission system operator Amprion (Coordination Centre North). Swissgrid is involved in the coordination of operational security processes and the European exchange of electricity.

It also helps plan pan-European grid expansion. Swissgrid works with foreign transmission system operators and represents Switzerland's interests in the corresponding bodies.

From now on, Switzerland will be included in the capacity calculation for transnational electricity trade in Central Europe. Swissgrid and the transmission system operators in the «Core» region have signed a corresponding agreement, which was approved by the applicable regulatory authorities in the reporting year (see the «Year in review» section).

Establishment as the Swiss transmission system owner

Swissgrid was founded in 2005 in view of the gradual liberalisation of the Swiss electricity market with the aim of harmonising and centrally operating Switzerland's transmission system. Prior to that, different electricity grid companies were simultaneously responsible for power transmission in Switzerland. Since 2008, the Electricity Supply Act (ESA) has stipulated that the transmission system must be owned by the national grid company. As the national grid company, Swissgrid has been in charge of the operation and safety of the extra-high-voltage grid since 2009.

Swissgrid took over ownership of the grid in 2013 and has since been responsible for its maintenance and expansion. Swissgrid's headquarters are located in Aarau, while the redundant site is in Prilly. Swissgrid also operates bases in Castione, Landquart, Laufenburg, Ostermundigen and Uznach.

Business activities in a strictly regulated environment

Swissgrid operates in a strictly regulated environment (see the «Regulatory business model» section). Providing consumers with a secure supply of electricity is in the public interest and requires a reliable and efficient infrastructure. On account of its economic characteristics, the grid also represents a natural monopoly, which is recognised as a legal monopoly under ESA and ESO. Consequently, there is an undisputed need for regulation to ensure a grid infrastructure and grid management that are as efficient as possible. This task is performed by the Swiss Federal Office of Energy SFOE and – as the supervisory authority for the implementation of ESA and ESO – the Federal Electricity Commission (ElCom). In accordance with the law, Swissgrid is established as a public limited company under private law with its registered office in Switzerland. The grid company must also ensure that the majority of its capital and the associated voting rights belong directly or indirectly to the cantons and municipalities (see the «Corporate structure and shareholders» section.

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Mission

As the national grid company, Swissgrid ensures the secure transport of electricity via both the national grid and the transmission grid connected to the European electricity system. This electricity forms the basis for the high quality of life and prosperity in Switzerland and Europe. Thanks to the central role it plays in the energy system, Swissgrid is actively shaping its sustainable transformation.

For more information on the transformation of the energy system, see the «Energy transition» section. Details of the sustainable development of the transmission grid are given in the «Environmental protection», «Biodiversity» and «Circular economy» sections.

GRI 203-1, 203-2

Security of supply

As a transmission system operator, Swissgrid is responsible for a critical infrastructure. Secure and efficient grids are of vital importance in order to guarantee the supply of electricity. The Federal Office for Civil Protection (FOCP) considers an electricity shortage to be the greatest financial risk for Switzerland. A major, nationwide power failure also ranks in the top ten[1] in the expected damage category. The Swiss transmission grid is closely interlinked with the European interconnected grid and, due to its central location in Europe, plays a key role in the exchange of electrical energy in Europe. An outage or disruption to the grid can therefore have far-reaching consequences that extend beyond Switzerland's borders.

[1]Federal Office for Civil Protection, report on the national risk analysis (disasters and emergencies in Switzerland 2020)

Grid-related security of supply – the sum of various components

In order to ensure a high level of grid-related security of supply and to protect the grid from an outage, Swissgrid takes action at various points.

Ensuring grid operations – around the clock

In Swissgrid's capacity as Coordination Centre South, its grid control rooms are responsible for ensuring the permanent balance between electricity generation and consumption to maintain a constant system frequency of 50 hertz – not only for Switzerland, but also for Europe. The grid control rooms also monitor the capacity utilisation of the transmission system and intervene in the event of congestion, impending line overloads or failures of grid elements. When operating its grid, Swissgrid follows the n-1 principle, which is an essential rule for ensuring secure transmission system operation.

This principle states that if any one grid element fails, no other element may be overloaded. Long-term planning is necessary for secure grid operation: this takes into account aspects such as the decommissioning of lines and power plants, as well as the schedules of power plant operators and electricity traders, which include all electricity exchange transactions in Switzerland and abroad. Swissgrid continuously coordinates its planning and real-time operations with the European transmission system operators.

Helping to shape and develop markets – in Switzerland and Europe

Another prerequisite for a high level of grid-related security of supply is the availability of control power to compensate for short-term deviations between production and consumption (balancing measures) and to manage grid congestion. That is why Swissgrid is continuously optimising the Swiss market for control power and cooperating with European transmission system operators.

The transmission system operators are also tasked with providing sufficient capacity on international interconnection lines for international electricity trading. In order to avoid grid congestion and to ensure non-discriminatory access, Swissgrid allocates capacity at the Swiss border by means of auctions. These processes are carried out in close coordination with the neighbouring transmission system operators.

Cooperation with Europe – in all areas

Swissgrid and the European transmission system operators cooperate closely in areas such as grid operations, control power markets and congestion management. The EU regulatory requirements for system operation are implemented to ensure that all grid operators adhere to the same rules in the interconnected grid. Cooperation across Europe is also crucial for the successful integration of increasingly decentralised energy sources into the overall system.

Due to the lack of an electricity agreement between Switzerland and the EU, it is becoming increasingly difficult for Swissgrid to help shape these pan-European developments. This has a negative impact on grid security, and hence on Switzerland's security of supply. The exclusion of Swissgrid from European platforms and coordination processes increases the risk of unplanned load flows in the Swiss transmission grid. Swissgrid is therefore taking various measures to counteract Switzerland's growing isolation (see the «Stakeholder engagement» section). Swissgrid welcomes the fact that Switzerland was able to successfully conclude negotiations on an electricity agreement with the EU.

Ensuring safety – at all levels

Important prerequisites for grid-related security of supply include a resilient grid infrastructure and the availability of IT and communication systems. To ensure the safe and reliable operation of the Swiss transmission grid, Swissgrid pursues an integral security policy.

This defines the objectives and framework for action for implementing precautions in a consistent and coordinated way according to standardised rules. The purpose of integral security management is, on the one hand, to protect people and the environment from negative influences caused by Swissgrid's activities and, on the other hand, to protect Swissgrid's employees, installations, systems and information from adverse effects.

Swissgrid's integral safety policy

Swissgrid's integral approach to safety management comprises seven security domains: operational security, physical security, information security, integral risk management, crisis management and business continuity management, as well as health protection, occupational safety and environmental protection. The integral safety policy sets out Swissgrid's safety objectives and regulates the essential aspects required for the effective implementation of company-wide integral safety management. These include the principles, the overarching framework conditions and domain-specific requirements, and security organisation.

Operational security

The aim of operational security is to ensure that Swissgrid provides a secure service in every grid state. It is based on the processes and elements of safety risk management, such as the reporting system, event investigation, safety risk analysis, safety culture and clearly defined roles and responsibilities. In particular, operational security aims to ensure that work can be carried out reliably in complex grid and system operations, and that the corresponding processes and instructions function properly. The following specific methods and processes are used, among others:

- Independent, continuous observation of operations with the aim of identifying instructions that are inappropriate or prone to errors, or procedures that deviate from the instructions, and improving them by means of incident analyses.
- The principles of «human factors» for designing a robust working environment that is tailored to people's characteristics.

A competence management system that consistently ensures and documents basic training, the retention of knowledge and skills, the further training of employees (especially in grid and system operations), and the building up of experience.

Physical security

The aim of this security domain is to ensure the physical security of employees, of third parties and of the Swissgrid infrastructure.

Swissgrid has developed its own company-wide standards based on best practice in order to meet the requirements of a critical infrastructure. Among other things, they take into account the ISO/IEC 27002 standard, the industry recommendation of the Association of Swiss Electricity Companies (VSE) and the regulations of the Federal Inspectorate for Heavy Current Installations (ESTI).

Information security

The aim of the «information security» domain is to guarantee the confidentiality, availability and integrity of data and information in physical form or based on Information and Communication Technology (ICT) systems for business and operating technology.

A risk-based information security management system built according to international standards, such as the standards of the ISO/IEC 27000 family, defines the regulations and measures to be applied. This management system supports the entire implementation process from implementation through to review and further development.

The basic measures to be applied and measures specific to the energy sector are derived and implemented from the same family of standards.

Crisis management and business continuity management

Swissgrid's crisis management and business continuity management (BCM) have the common goal of ensuring flexible incident management that is adapted to the situation so that the continuity of critical processes required for Swissgrid's key responsibility can be guaranteed in the event of an incident. Crisis management and BCM serve to continue Swissgrid's mission in accordance with the defined framework conditions, subject to certain restrictions, in the event of deviations from the normal situation. They are based on Swissgrid's mandate in accordance with Art. 20 ESA and Art. 5 ESO, the ENTSO-E requirements set out in the framework agreement between transmission system operators in the continental European synchronous zone on the minimum standards for joint operation of the transmission system, the Transmission Code, the VSE industry document, and the requirements of the Federal Office for Civil Protection.

The existence and proper functioning of crisis management and BCM correspond to the necessary level of basic protection. Swissgrid's business continuity management system, based on the ISO 223xx series, is being continuously developed for this purpose within the framework of a roadmap approved by the Executive Board, including annual targets. Among other things, it describes the creation of BCM specifications, the regular verification of BCM scenarios, and the development, testing and practising of risk-based business continuity plans. Business impact analysis is used to identify the critical processes required for Swissgrid's key responsibility and their requirements for restoring process performance, which are to be taken into account within the BCM framework. At the same time, this determines the corresponding level of protection. This analysis is repeated as necessary and reviewed on a regular basis. In addition, Swissgrid employees are trained to apply the correct conduct in the event of an incident as part of crisis exercises, and the functionality of existing systems and processes is checked. The implemented BCM processes are tested on an ongoing basis.

Every year, additional exercises lasting several days are conducted at the simulation centres in Prilly and Aarau. The aim of these exercises is to simulate a major disturbance or blackout and to practise grid restoration. Swissgrid, all distribution system and power plant operators connected to the transmission system, and the operators of restoration cells participate in these exercises.

In the reporting year, Swissgrid was part of the Federal Office for Civil Protection's general emergency exercise to simulate an emergency event at one of the three nuclear power plants currently in operation in Switzerland.

Swissgrid envisages that, in the event of a major event, personnel will be gathered at decentralised sites in Switzerland in order to carry out the necessary work on site. This procedure is repeated and practised with the involvement of external partners.

The status of BCM implementation and the company's business continuity capability are regularly reported to the Executive Board and the Board of Directors.

The topics of occupational health and safety and environmental protection are explored in greater detail in the «Occupational health and safety» section.

Key figures for grid-related security of supply

The transformation of the energy system is bringing new challenges for ensuring grid-related security of supply. Swissgrid addresses these challenges in its Strategy 2027 (see the «Strategy 2027» section). Swissgrid also describes the challenges and framework conditions in detail in the Sustainability Report (see the «Energy transition» section). Key figures on the energy flow and the use of control energy are also

included in this section.

Despite an increase in the average duration of interruption due to an incident in the canton of Glarus in November 2024, Swissgrid was able to guarantee an availability of the transmission grid of well over 99.9%.

	2024	2023
Number of supply failures in the meshed grid	1	1
Average duration of interruption	94 minutes	40 minutes
Energy not supplied in the meshed grid	2 MWh	113 MWh

«Energy not supplied»: both in the reporting year and in 2023, one line suffered an unplanned outage. However, the load connected to the line was considerably higher in 2023, which is why the volume of «Energy not supplied» was higher in 2023 than in the reporting year.

in GWh	2024	2023
Transported energy	69,609	74,134
Imported energy	25,262	27,017
Exported energy	39,175	32,888
Transit energy	22,155	21,591
Active power losses absolute	985	919
Positive control energy	963	1,033
Negative control energy	556	694

Active power losses of transported energy	1.41%	1.24%
Ratio of «energy not supplied» to transported energy	2.9E-8	1.5E-6

Continuing to ensure grid-related security of supply in the future

The transformation of the energy system is bringing new challenges for ensuring grid-related security of supply. Swissgrid addresses these challenges in its Strategy 2027 (see the «Strategy 2027» section). Swissgrid also describes the challenges and framework conditions in detail in the Sustainability Report (see the «Energy transition» section). Key figures on the reliability of the grid, the energy flow and the use of control energy are also included in this section.

GRI 203-1, 203-2

Grid transfer capacity

Swissgrid's aim is to provide a grid infrastructure that offers high availability and capacities, and that meets the requirements of the future energy system. This requires long-term planning, modernisation and optimisation of the grid, as well as ongoing inspection, maintenance and servicing.

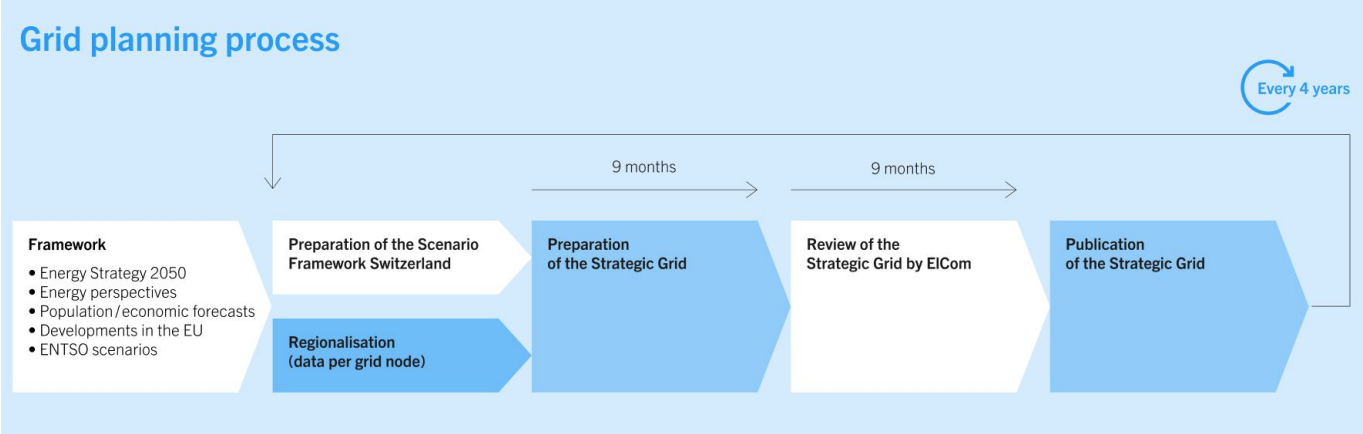
Planning the grid – the Strategic Grid

The requirements placed on the grid have changed significantly in recent years. This trend will intensify in the

coming decades as part of the energy transition. The Swiss Federal Office of Energy has set out these changes in the scenario framework for Switzerland, which contains national target values for each generation technology and consumer group for the years 2030 and 2040.

Swissgrid is developing the Strategic Grid 2040 on the basis of this scenario framework. In addition, Swissgrid receives information on the regional development of production and consumption within Switzerland from SBB and from the distribution system and power plant operators that are directly connected to the transmission system. Swissgrid uses this data to determine grid development requirements.

The process for the Strategic Grid 2040 is already well advanced. In 2024, Swissgrid will finalise the planning and submit it to the Federal Electricity Commission (ElCom) for review. Swissgrid will then publish the strategic grid in spring 2025. For the first time, this planning is based on the legal basis established in the «Electricity Network Strategy». It will be repeated every four years in the future.



Investment in the grid infrastructure – modernisation in line with demand

Swissgrid continuously invests in its grid infrastructure to ensure a secure, efficient grid in line with demand. The current modernisation projects are set out in the Strategic Grid 2025 and represent an investment volume of around CHF 2.5 billion. The grid projects included in the Strategic Grid 2025 are designed to eliminate existing congestion, ensure the transport of energy from large power plants in the Alps to urban centres, and strengthen the connection to the European grid.

Swissgrid has already been able to complete some of the projects from the «Strategic Grid 2025», while others are in the project planning or implementation phase.

Maintenance of a grid that is permanently in use

The Swiss transmission grid is one of the most reliable power grids in the world. To ensure that the grid functions perfectly at all times, it not only needs to be converted and expanded, but must also be continuously inspected, maintained and repaired. Maintenance includes regular cleaning and adjustment of technical systems. If installations are damaged after a storm or avalanche, they must be repaired quickly. Swissgrid also carries out planned repair work, such as the replacement of conductors and insulators, protection against corrosion, the revision of circuit breakers and deforestation. Two-thirds of the Swiss transmission grid, which is over 6,700 kilometres long overall, dates from before 1980. This work is therefore of great importance.

The right grid infrastructure for the transformation of the energy system

The modernisation of the transmission system lays the foundations for a sustainable energy future. At

present, however, the expansion of the grid cannot keep pace with the growth of systems to produce renewable energies. Objections and legal proceedings lead to significant delays in the realisation of grid projects. Swissgrid is committed to ensuring that approval processes are made more efficient and that grid expansion can be driven forward. In the «Grid Transfer Capacity» priority of its «Strategy 2027», Swissgrid also defines measures to increase the capacity of the grid in line with demand and to implement and operate the grid even more efficiently in the future. Digital solutions play a key role in addition to the Strategic Grid 2040. A completely digitalised grid image provides the basis for establishing data-driven system management.

GRI 203-1, 203-2

Innovation and digitalisation

The Research & Digitalisation (R&D) department at Swissgrid plays a key role in the further development of the Swiss extra-high-voltage grid. The department specialists actively drive forward innovation and technology to increase the capacity, security and reliability of the grid. By using state-of-the-art methods such as optimisation procedures and stochastic approaches, the department supports and improves work in all areas of the company. Innovation has a high priority at Swissgrid, which is reflected in its Strategy 2027. The company has set itself the goal of developing into an innovative, highly digitalised company in response to the increasing complexity and volatility of the electricity system resulting from the energy transition and the decentralisation of electricity generation.

To overcome these challenges, Swissgrid is relying on digitalisation as a catalyst for the energy transition. This will enable the company to cope with the growing demands being placed on the grid whilst increasing efficiency in all areas of the company.

By promoting a culture of innovation, for example by means of events such as the «Innovation Days» and «Inspiration Talks», Swissgrid creates an environment in which employees are encouraged to develop and implement new ideas. This is vital, because innovation and digitalisation make an important contribution to ensuring that Switzerland's supply of electricity will remain secure and efficient in the future.

A list of innovation projects is given below:

Use of drones and artificial intelligence

Autonomous drones and artificial intelligence help Swissgrid to optimise the maintenance and operation of the transmission system. Both technologies are digitalising asset management. Drones are used for line inspections to monitor the condition of the grid. In the long term, drones should also be able to quickly assess damage during initial inspections following disturbances and subsequently initiate repairs. The inspection images from the drones are generally scrutinised by experts. To optimise this process, Swissgrid is working with other grid operators to develop AI algorithms that can automatically detect potential damage. Drones ensure safe access to locations that are otherwise difficult to reach, as well as reducing the carbon footprint in relation to conventional methods such as helicopter flights. Following a preliminary study, Swissgrid has been working on a two-year pilot phase since mid-2023 as the basis for a possible broader roll-out.

Internet-of-Things sensors on pylons

Three years ago, Swissgrid launched the «Pylonian» Internet-of-Things project. This involved placing sensors on pylons to measure variables such as pylon vibrations, pylon inclination, temperature and solar radiation. At the end of the reporting year, Swissgrid installed additional types of sensors, particularly weather stations, to help forecast renewable energy production. Swissgrid also implemented «Sensorian», a telecommunication and sensor-independent platform that can host any type of sensor data on the Swissgrid data platform in a scalable, secure and flexible manner. In addition, experiments were conducted to simulate real events in order to link the data collected with potentially dangerous situations. This will allow the system to predict possible dangers so that Swissgrid employees can initiate measures at an early stage to prevent damage to the pylons.

Greater efficiency in grid operations

Forecast of production from photovoltaics

The «PV Forecasts» project aims improve grid stability by creating precise forecasts of solar power generation. To achieve this, the company relies on the use of publicly available data regarding the production capacity of the photovoltaic plants installed and on the collection of detailed sunshine information. These measures are essential for overcoming the challenges of increasing and fluctuating solar power production in the Swiss electricity grid whilst optimising the costs of control energy.

Closer cooperation between transmission and distribution system operators

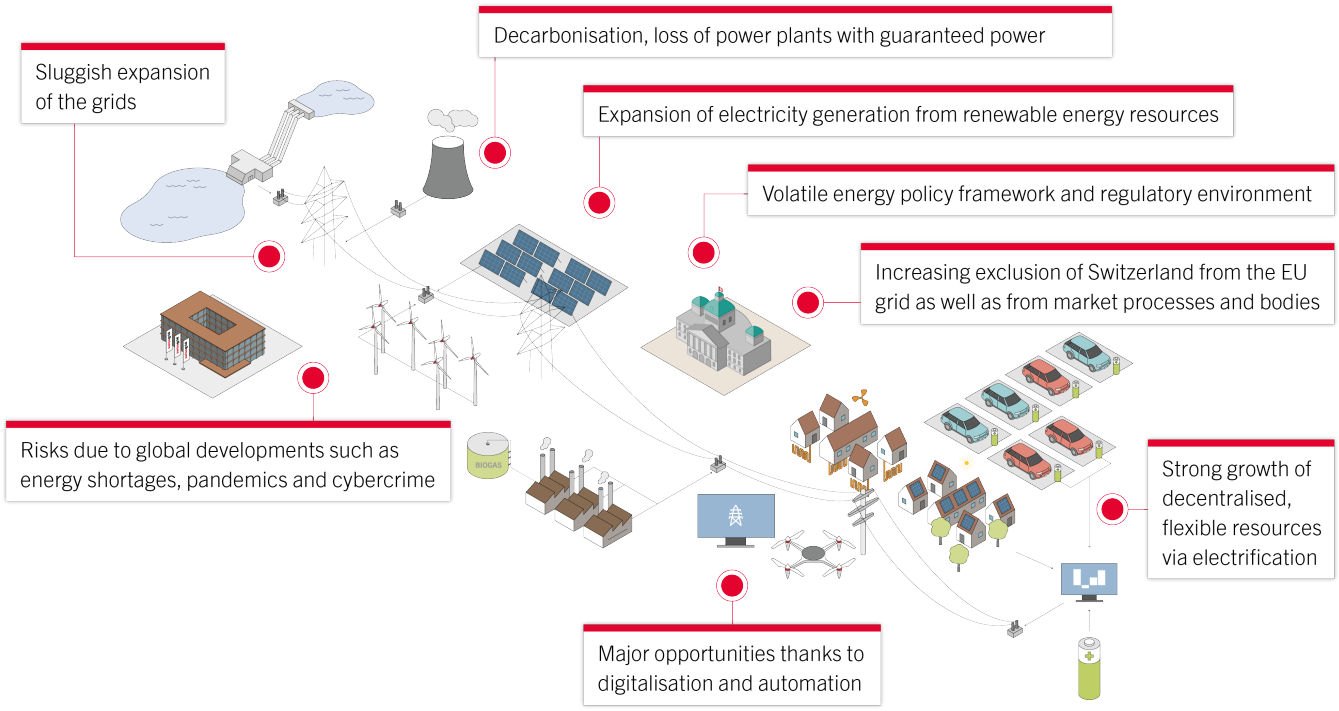
The expansion of photovoltaics, heat pumping technology and electric vehicles requires closer coordination between grid operators in order to ensure secure grid operation. In association with Equigy, Swissgrid and distribution system operator carried out a pilot project to distribute the use of decentralised energy resources in a coordinated manner in order to provide ancillary services. More information can be found in the «Year in review» and «Energy transformation» sections.

Innovation and digitalisation as a new priority in Strategy 2027

The new «Innovation and Digitalisation» priority was included in Strategy 2027 in order to develop Swissgrid into an innovative, highly digitalised company (see the «Strategy 2027» section). A comprehensive package of measures creates the prerequisites at the data, technological and personnel levels so that the desired digital transformation can be successfully implemented in the company. The focus is also on developing a culture of innovation. To this end, Swissgrid organised innovation initiatives, during which employees were able to explore exciting topics for the future and receive incentives, and where ideas and interaction were promoted (see the «Attracting, retaining and developing skilled workers» section).

Annual Report
2027 Strategy

In 2022, Swissgrid launched its Strategy 2027 and entered a new five-year strategy period. The company defined five closely linked priorities, four of which were carried over from the previous strategy period and adapted to the current framework conditions. A new focus on «Innovation and Digitalisation» was also added.



After a long period of stability, the electricity industry is now in a state of flux. Fundamental change was triggered by the EU's decision to integrate the European power markets and to decarbonise the energy industry. Pressure to accelerate the transformation of the energy system and decarbonisation has increased more and more due to the newly formulated climate targets within the framework of the «European Green Deal».

These developments affect grid operators in several ways: the expansion of renewable energy production leads to significant changes in production patterns and volatile electricity flows. This poses major challenges for power system control, which are accentuated for Swissgrid by the lack of an electricity agreement between Switzerland and the EU. Switzerland is increasingly excluded from important EU market mechanisms. This results in a greater risk of unplanned electricity flows, a lack of consideration in security-relevant system processes and a reduction in import capacities.

Grid operators face challenges not only due to the changes in the energy system, but also on account of global developments. Threats such as the consequences of climate change for the grid infrastructure or cybercrime make it clear that operators of critical infrastructures must have an exceptionally high level of

protection and readiness.

Digitalisation offers a response to the increasing complexity of the grid operators' environment. For example, the desired digital transformation will make it possible to integrate many of the new, flexible resources profitably into system operation. End-to-end digital processing of the value chain will also open up opportunities for efficiency gains within the company.

Five priorities for Strategy 2027

«Security of Supply»

Strategy 2027 focuses on «Security of Supply» with measures to ensure grid-related security of supply in the long term, regardless of the degree of integration into EU processes, while at the same time supporting the Confederation's energy strategy. Networking and cooperation with Europe are crucial for ensuring a high level of security of supply. As Swissgrid is increasingly marginalised in EU processes due to the lack of an electricity agreement, the company is committed to achieving the highest possible level of integration at a technical level.

To increase the controllability of the grid, Swissgrid is taking structural measures, changing operational processes and using digital solutions for data-driven decision-making in system operation. This package of measures will also help Swissgrid to cope with rising system security risks if Switzerland were to be further excluded from European processes.

Swissgrid wants to harness the potential of all the decentralised resources in the energy system more effectively in the future: it plans to create market platforms in association with the industry, to make these platforms easier to access by means of digital solutions, to better coordinate their flexibility and to use them profitably for grid operations.

«Grid Transfer Capacity»

The transformation of the energy system can only succeed if the grid infrastructure is adapted to the new framework conditions. To this end, Swissgrid is planning the Strategic Grid 2040. The aim of expanding the grid is to adjust its capacities to meet demand and to reduce congestion. Swissgrid will implement more construction projects and put them into practice more quickly by standardising and optimising processes and by using digital solutions for planning and construction.

Maintenance is being automated in many areas, for example by using drones. A completely digitalised grid image – a digital twin of the physical grid – will provide the basis for establishing data-driven plant management in the future. This will allow the status of plants to be monitored more precisely over the entire life cycle and enable the grid to be operated in a more risk-based and efficient manner.

«Innovation and Digitalisation»

Digitalisation is the common denominator of the first two priorities. With its new «Innovation and Digitalisation» priority, Swissgrid is laying the foundations for the desired digital transformation throughout the company.

Firstly, this concerns technological and data-related conditions, such as automation tools and the systematisation of data management. And secondly, it refers to an increase in implementation strength, partly thanks to the more widespread use of agile working methods. In addition to digitalisation, the focus is on the development and implementation of innovations. In order to open up the innovation process, an ecosystem is being built as a collaborative network in which innovations are driven, developed and shared

with partners. In addition, a culture of innovation is being established to promote the skills and potential of employees whilst actively and sustainably pushing ahead with digitalisation ideas and transformation projects within the company.

«Operational Excellence»

In order to successfully implement Strategy 2027, the culture and skills within the company must keep pace with future requirements and continue to be developed. As part of the «Operational Excellence» priority, identified skills gaps are closed by means of programmes tailored to individual needs. Thanks to these and other measures, Swissgrid is simultaneously increasing its attractiveness as an employer, attracting the talent it needs and strengthening the identification of existing and future employees with the company.

Swissgrid is also becoming even more sustainable. It now groups together all areas of sustainability management under «Corporate Social & Environmental Responsibility». Among other things, a targeted selection of UN goals – the Sustainable Development Goals – is being addressed, and comprehensive sustainability reporting is being developed according to the standards of the Global Reporting Initiative.

«Safety & Security»

Security is a top priority for Swissgrid, as the operator of a critical infrastructure. The company is strengthening the resilience of its core processes as part of the «Safety & Security» priority. To do so, Swissgrid is continuously adapting to meet the changing demands placed on companies' security arrangements, emergency response measures, crisis management and business continuity management.

This includes raising the level of protection in substations by means of structural and organisational measures and installing safety systems. In the area of business continuity management, Swissgrid is developing additional solutions to safeguard its key responsibility in the event of an incident. As far as cybersecurity and crisis management are concerned, the focus is on implementing further measures to achieve the desired goals.