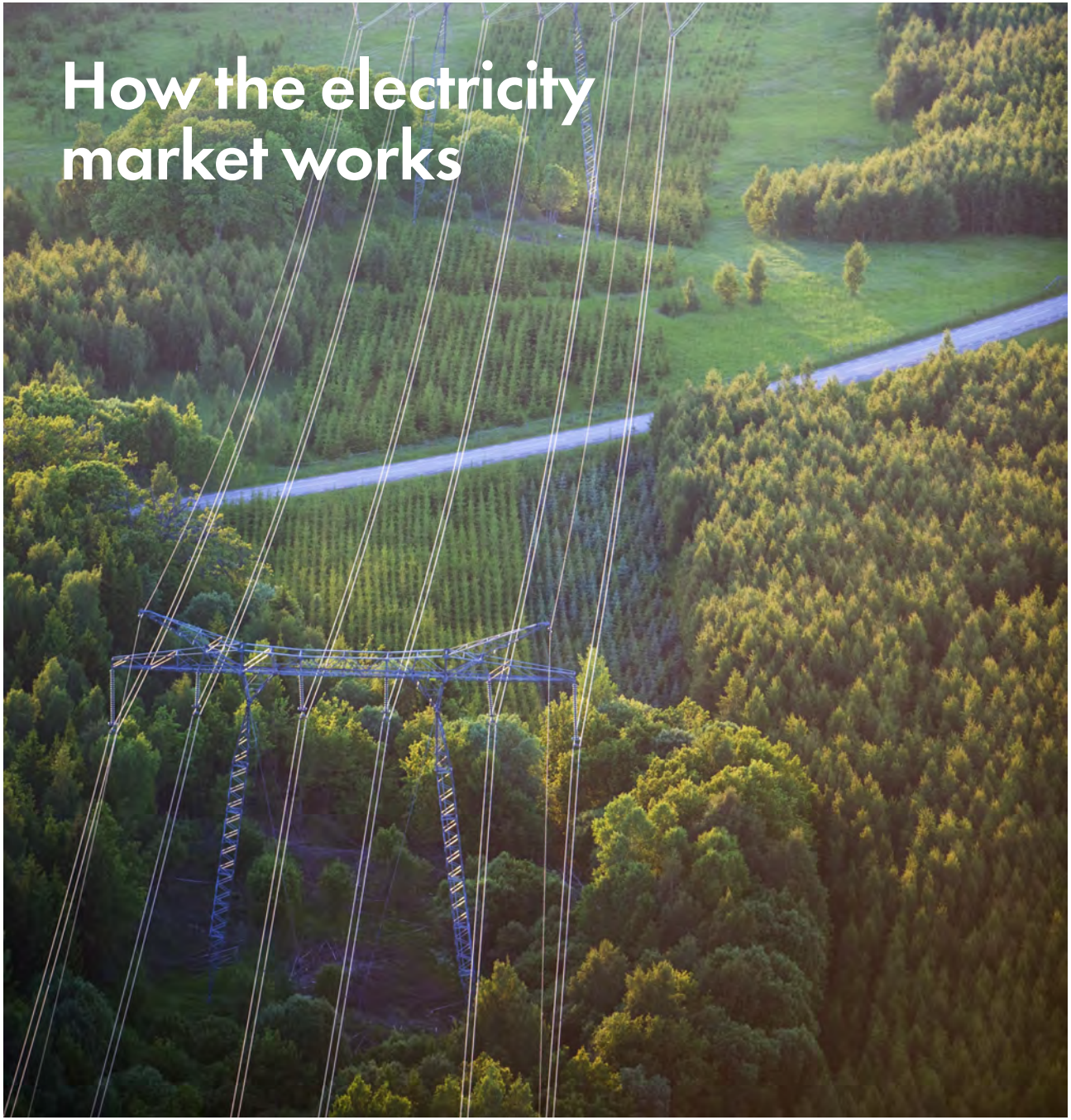


How the electricity market works

Electricity networks are perhaps the most important infrastructure of a modern society. They must be robust, comprehensive, modern and sufficiently developed to ensure that everybody receive the electricity they need – when they need it. The grids are also a prerequisite for more renewable energy and the electrification of transport and industries. In this sense, they play a key role in the climate transition.

The Swedish electricity network comprises the transmission grid, regional networks and local networks. The transmission grid, also referred to as the national grid, is owned by state-run Svenska kraftnät, while the regional and local networks are owned by some 160 electricity network companies. Ellevio, Vattenfall and E.ON are Sweden's largest electricity network owners.

Due to the fact that it is not socioeconomically profitable to build parallel networks, the electricity networks are known as natural monopolies subject to governmental revenue regulation.

Electricity users and producers are connected to the grid where they live and work and thus become customers of the network company.

No other European country has as many network companies as Sweden. Many of them are small, municipally-owned and limited to individual municipalities and urban areas. Ellevio pursues an acquisition strategy through which we want to grow by purchasing additional networks, primarily those connected to our existing networks, but also other types of grid that enable us to help accelerate electrification and thus access to fossil-free energy. Being a major network owner creates interconnectivity benefits and gives customers access

to our extensive investment programme which modernises, digitalises and expands the networks.

In 2023, Ellevio AB's parent company, Ellevio Holding 4 AB, acquired Markbygden Net AB, a modern transmission network that connects large parts of Europe's largest wind farm, Markbygden 1101 outside Piteå. The acquisition established the Ellevio Group in northern Sweden and brought it closer to several major electricity producers and Sweden's most electricity-intensive sectors.

Regulated market

Electricity network operations are regulated. This means that Ellevio is monitored and reviewed by a public authority, the Swedish Energy Markets Inspectorate (Ei), which also decides what revenue we are allowed to charge our customers. This network regulation is based on the Electricity Act and seeks to ensure that the electricity grids provide high quality and security of supply.

Revenue frameworks in the regulation are to compensate network companies for reasonable costs linked to managing their business and a reasonable yield on investments made. According to the Swedish Electricity Act, the prices that customers pay to the network companies should be fair, objective and non-discriminatory. Permitted revenues for network companies are decided in advance for periods of four years at a time.

The public authority Ei, or the Energy Markets Inspectorate, supervises network companies and thus also decides how high the permitted revenue should be.

The permitted revenue comprises four parts:

- Compensation to cover the network company's interest on loans to make investments and ensure a return for owners (known as "compensation for capital costs")
- Compensation for aspects such as overhead networks, network losses and public authority fees (known as "non-controllable costs")
- Compensation for troubleshooting during power outages, customer service, operational monitoring, staff costs, etc. (known as "controllable costs")
- A quality parameter whereby network companies can obtain deductions or additions to permitted revenue depending on the quality of electricity network operations.

Overhead networks are the electricity networks that deliver electricity to our grids; Svenska kraftnät's transmission grid is included in this along with others' regional grids. The cost of network losses, also known as transmission losses, refers to the costs we incur when purchasing electricity as compensation for network losses – in other words, the energy lost during transmission.

As a network company, we must also charge taxes and fees to customers and pass these on in full to the state. This refers to both VAT and energy tax.

Electricity network regulation for 2020–2023 and 2024–2027

The revenue regulation that applied for the period 2020–2023 was appealed by Ellevio and another 120 companies, mainly because the Weighted Average Capital Cost (WACC) was far from sufficient to enable the required investments. The electricity network companies won in court and, based on the judgement, Ei has been tasked with taking new decisions on the revenue framework for the period. Ei plans to make decisions on preliminary revenue frameworks for the period 2020–2023 during the second quarter of 2024 and reconciliation decisions no later than October 31, 2024.

In December 2023, Ei took the first decisions on the permitted revenues for the period 2024–2027. The remaining decisions for 2024–2027 were taken in the first quarter of 2024. The revenues correspond to a weighted average capital cost (WACC) of 4.53 percent. Ellevio and other network operators have announced that they will not appeal the WACC.

→ Read more about the different operators on the electricity market at ellevio.se.

CONTRACTORS PLAY IMPORTANT ROLE

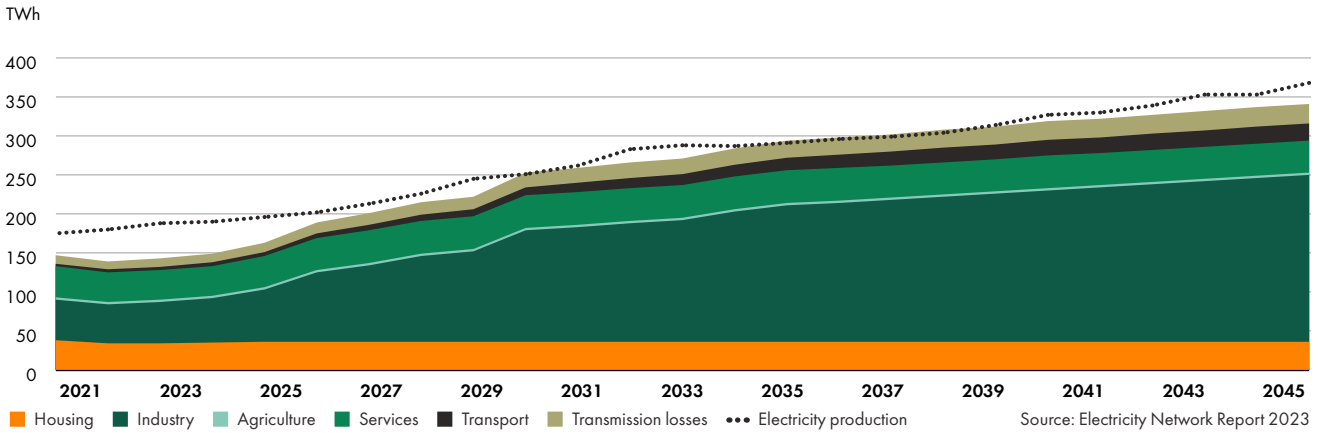
Ellevio procures contractors to maintain, troubleshoot and build the electricity network. They are therefore a very important part of the Swedish electricity network market – not least in terms of the coming years, when the pace of investment will need to be increased even further.

Currently, Ellevio has no in-house employees who work in the field; all physical work on our network is carried out via contractors. It is thus of the utmost importance to have a close dialogue and collaboration with those contractors, not least on issues concerning the environment, personal safety at the workplace and cooperation to reduce our climate impact. Ellevio has a continuous and close dialogue with its contractors and sets out sustainability criteria in procurements.

Market conditions and trends in 2023

Sweden needs a smart electricity system with significantly greater capacity and flexibility than the one in place today. Achieving this will require significant investment in the electricity grids. At the same time, global security concerns are increasing and the climate crisis is driving changes in technology, regulation and policy.

Expected electricity consumption by sector, 2021–2045



Source: Electricity Network Report 2023

More stable electricity market but unstable operating environment

Following the electricity price crisis in 2022, electricity prices returned to more normal levels in 2023, with good availability of hydropower, well-filled European gas stocks and fully operational nuclear power plants all making a contribution. At the end of the year, however, prices remained relatively high and volatile.

The security situation deteriorated in 2023 and was largely characterised by geopolitical turbulence due to the continuing war in Ukraine and the war between Hamas and Israel that started in October.

Protective security and preparedness efforts thus continued to grow in importance across the energy sector. Ellevio works continuously to strengthen its ability to withstand antagonistic influences, and collaborates with other operators in the energy industry and with authorities. In 2023, Ellevio received a decision from Svenska kraftnät which specified that we must carry out defence planning to increase preparedness in the event of war.

Dramatic increase in electricity demand in future

The transition to a fossil-free society will lead to a dramatic increase in demand for electricity across the country – and thus also a major need for network investments.

Sweden's electricity consumption has remained more or less static since the 1980s, but within 20 years the demand for electricity is expected to double. The main drivers of this increase in electricity consumption are new industrial establishments and the electrification of the transport sector, as well as the conversion of existing industry from fossil fuels to electricity.

Major technological transformations are under way in areas such as basic industry, the steel industry in northern Sweden and the transport sector. The direction is clear: the energy transition is progressing, and the electricity system needs to be expanded and modernised.

According to the Electricity Network Report 2023, produced by Ellevio together with Sweco, Sweden is estimated to need as much as 340 TWh of electricity by 2045. That is roughly an additional one-and-a-half Sweden's compared to today.

There are expected to be major differences in electricity consumption between different parts of the country, with northern Sweden increasing the most due to large industrial projects in green steel, hydrogen and battery manufacturing. But the trend is also dramatic in other parts of the country.

The future requires solutions that can support households and companies in the energy transition. It is therefore important for Ellevio to collaborate with customers and partners to electrify Sweden together.

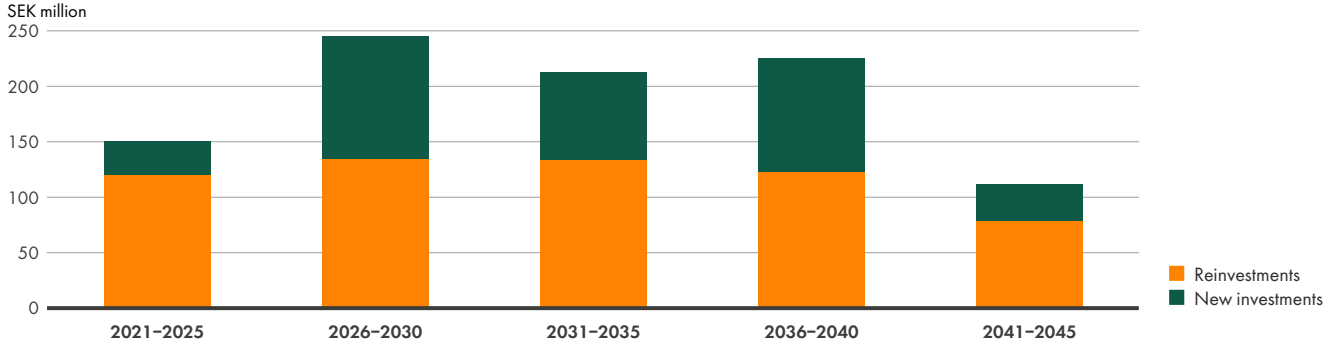
Need for major investments in electricity grids

Ensuring the success of the transition to an electrified, fossil-free society thus requires major investment. Sweden currently has an ageing electricity network. Major parts of it have reached their technical service life and need replacing. Moreover, the transition requires a smart and more flexible electricity system, which is why network companies must make the largest investments in the electricity network in decades.

The Electricity Network Report forecasts that network investments totalling SEK 945 billion will be needed in Sweden by 2045. As a comparison, the Swedish national budget for 2023 amounts to just over SEK 1,000 billion. The investments are needed above all to meet the sharp increase in electricity consumption, but also to maintain the current level of service. Moreover, a large share of the investments need to be made in the next ten years. According to the report, the largest percentage increase in electricity consumption will be seen in Norrbotten, while the largest investments in terms of Swedish kronor will be needed in metropolitan regions, as it is particularly expensive to expand the grids in densely populated areas.

Sweco has based the Electricity Network Report on current expertise, statistics and analyses of the forecast short-term trend and a long-term scenario analysis with a high degree of geographical detail, laying out scenarios for a high and fast and a low and slow rate of electrification.

Electricity network investment needs in Sweden, 2021–2045



The forecast in the new report was adjusted upwards from the SEK 670 billion forecast in the Electricity Network Report 2022. The background to the increase is partly a rise in expected electricity demand, and partly an increased number of planned projects and a more detailed analysis of the market.

Ellevio has a balanced investment programme focusing on sustainability, reliability and digitalisation. In 2023, network investments totalled SEK 3,594 million and the pace of investment is expected to increase significantly in the coming years.

Long investment horizon

Network operations require a very long planning horizon, as we are responsible for infrastructure that needs to function for many decades to come. At the same time, network companies require extensive access to capital and need to take long-term responsibility. This places strict long-term planning demands on us, our owners – and not least the network regulation that sets the framework for the market. To create the conditions for necessary investment and to promote efficiency, good resource utilisation and incentives for flexibility solutions, Ellevio works to ensure that Sweden's electricity network companies have a long-term and predictable revenue regulation.

SEK 3,594 m

Ellevio's electricity network investments, 2023

Permit processes remain an obstacle

Time-consuming permit processes are slowing down the requisite investments in the electricity network. Lead times from decision to implemented project can be as long as ten years.

Back in August 2021, a new law took effect with the aim of shortening lead times for expanding the electricity network. However, several important measures remain and the government has proposed further efforts to reduce lead times. Two final reports have been produced but not yet legislated. In November 2023, Ei published the report "Verkställ korta ledtider" ("Achieve short lead times"), which put forward a number of important proposals, including the possibility of reducing authorities' lead times by 30 percent. They could be achieved, for example, by conducting line concession processes and dialogues with landowners simultaneously.

Inquiry on landowner compensation

In August 2023, the government appointed an inquiry to review the compensation paid to landowners who provide land for the construction of electricity grids. One of the objectives was to pinpoint compensation models that could help ensure greater acceptance of the intrusion caused by power lines.

Energy policy with strong consensus on important role of electrification

Sweden's energy policy took a partially new direction in 2023, emphasising that the climate issue is international in nature and requires international action, and that technological development and more fossil-free electricity are prerequisites. Sweden's climate target of net zero emissions by 2045 remains in place while the emphasis on large-scale electrification was strengthened further.

The government also presented ambitions for a strong and rapid expansion of nuclear power. Furthermore, wind power is expected to remain an important part of the fossil-free energy mix and the government is working to increase the expansion of offshore wind power and solar parks.

In late 2023, the Government published a memorandum for the upcoming energy policy bill. It concluded that extensive expansion of the electricity network, electricity production and storage is required to meet society's increased demand for electricity.

Raised electricity tax and Fit for 55

Despite a consensus on increased demand for electricity, the role of electrification in the climate transition and the need to combat cost increases in society, the government increased energy taxes in both 2023 and 2024. In January 2023, the increase was 4 öre per kWh to 49 öre per kWh. On 1 January 2024, the tax was again indexed upwards, this time by around 9 percent due to higher inflation. As of January 2024, the tax is therefore 53.5 öre per kWh including VAT.

At a European level, large parts of the EU's Fit for 55 climate package were finalised in 2023. The package includes legislation in the areas of climate, energy and transport and aims to ensure that EU countries reduce greenhouse gas emissions by at least 55 percent by 2030 and achieve climate neutrality by 2050.

Lobbying for long-term and predictable regulation

Together with the sector, Ellevio pursues efforts to explain the importance of a long-term and predictable revenue regulation and appropriate conditions for the electricity network market. Several political initiatives and collaborations within the sector are also under way, both at an EU and a national level, to establish the framework for the future electricity market.

Clean Energy Package to reduce dependence on fossil fuels

The EU's Clean Energy Package is designed to make the EU a leader in the global transition to clean energy. The regulatory package contains reforms in areas such as energy security, the EU's internal energy market, energy efficiency, financial dependency on fossil fuels and grants for research and innovation.

For network companies, the Clean Energy Package entails adopting a partially new role – from being a network manager to being a system operator. The new requirements also include development plans for all electricity networks, stricter connection requirements and the use of flexible services. The requirement to separate business activities into different legal entities has also increased, and Ellevio AB thus only conducts electricity network operations, while Ellevio Energy Solutions AB develops other types of services.

In Sweden, legislation has been adjusted to comply with the EU directive. The amendments entered into force on 1 July 2022 with a transitional period for the legal separation of operations until 31 December 2023. Ellevio has therefore continued the work of adapting its operations during 2023. Some work remained to be completed in early 2024.

Cyber security risks – heightened preparedness

Security initiatives at Ellevio are a high priority and include protective security, civil preparedness, information and cyber security and physical and personal protection. The unstable global political situation has led to increased efforts in this area. One of the most important aspects of the electricity network of the future is cyber security. Just like banks, teleoperators and suppliers of critical functions, we at Ellevio work to maximise the opportunities afforded by digitalisation while minimising the risks for society, the electricity network and our customers.

Drivers – Sweden's electricity system undergoing fundamental change

The climate crisis and technological developments have created completely new conditions for Sweden's electricity system in recent years. A new energy mix, increased digitalisation, electrification of transport and industry, capacity shortages, security threats and new EU requirements are some of the drivers leading to a fundamental change in Sweden's electricity system.

Drivers

Climate crisis and expanded grids

2023 was a dismal year for the climate. Greenhouse gas emissions continued to rise, as did temperatures. 2023 was the warmest year on record and the targets in the Paris Agreement now appear difficult to meet.

The consensus on electrification and expanded fossil-free power generation as key measures to reduce Swedish emissions has strengthened, and in 2023 the government also emphasised this in its revised energy policy. It is also increasingly important to reduce dependence on imported fossil fuels.

By 2045, electricity consumption in Sweden is expected to increase from the current 145 TWh to up to 340 TWh. This means even more stringent requirements placed on electricity grids. Without expanded grids, electricity will not be delivered to where it is needed when it is needed. The need for investment is estimated to amount to a total of SEK 945 billion by 2045, according to the Electricity Network Report 2023.

Since the early 1990s, electricity consumption in Sweden has remained more or less constant. This is partly due to new technologies and partly because improvements to energy efficiency have compensated for some of the growth. Energy efficiency improvements are continuing to be made; if they were not, electricity demand would increase even more in the future.

An electrified future

Increased electrification is thus crucial to achieving the climate targets, but electrification also favours Sweden's development through areas such as new jobs, cutting-edge technology development and regional development. A modern and reliable electricity system is also a prerequisite for Sweden maintaining a leading industrial sector in the future.

The largest sources of greenhouse gas emissions in Sweden are industry and the transport sector, which together account for 65 percent of the country's domestic emissions. Planning for the replacement of oil, coal and gas with electricity is under way on a broad scale.

Electrification of transport and industry

The transition to an electrified transport sector is moving rapidly and many major vehicle manufacturers have ambitious targets. This trend is needed; the climate and environmental effects of an electric vehicle fleet are huge. Domestic transport accounts for nearly a third of greenhouse gas emissions in Sweden today accordning to Swedish Environmental Protection Agency.

In addition to reducing CO_2 emissions, the local environment is also affected by improved air quality and reduced traffic noise. However, for the transition to work, an extensive expansion of charging points is needed, both for private vehicles and heavy, commercial traffic.

Today, more than one in ten cars are now plug-ins. So far, plug-in cars have expanded faster than the charging infrastructure. But over the past year, the growth rate of public charging points in Sweden has increased more than twice as much as the growth rate of plug-in cars, meaning that the infrastructure is starting to catch up. The deployment of charging infrastructure for heavy goods vehicles has also started to gain momentum. Key drivers include the EU's AFIR regulation with its strict requirements for charging infrastructure along Europe's roads, the introduction of green zones in major cities, and manufacturers' heavy focus on plug-in vehicles and machines.

Electrified industrial sector

Rapid developments towards electrified processes are also under way within industry. Thanks to technological breakthroughs, Swedish industry is now heading for a comprehensive transition that could have huge positive effects on the emission of greenhouse gases. If it succeeds, emissions will be reduced while electricity consumption will increase sharply. Large-scale projects are underway in the steel industry, among others, while similar breakthroughs are underway in other sectors. Industry is simultaneously becoming increasingly efficient, which could help curb the increase in electricity consumption.

Different energy mix – and new start for nuclear power

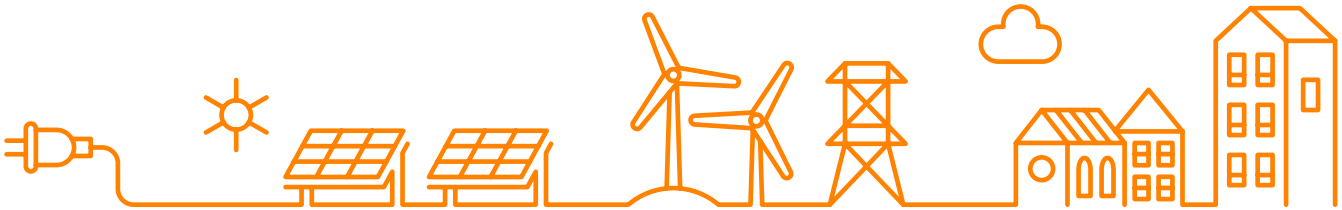
The Swedish energy system is built to manage predictable electricity production from a limited number of large facilities based on hydropower, nuclear power and CHP (Combined Heat and Power). However, the reality looks different now. More and more electricity is being supplied by renewable energy sources, mainly wind but also solar power. The supply of these varies greatly with the season and weather, which limits the possibility of controlling production. The electricity system must now be able to manage an irregular inflow, with rapid and sharp fluctuations in electricity production. This requires investment and new solutions.

To meet the increased demand for electricity, the Swedish government presented a new direction in 2023 that involves a major and rapid expansion of nuclear power. Nuclear power currently accounts for about 30 percent of Swedish energy production.

Wind power – which has been extended at a rapid pace in recent years – is also considered to remain an important part of the fossil-free energy mix, and the government's aim is to increase the expansion of both onshore and offshore wind power and solar parks. Ellevio is noticing strong demand mainly for wind power, but also for solar power. In 2023, there was a clear increase in activity in large-scale solar installations.

More "prosumers"

More and more consumers are producing and selling their own electricity by connecting solar panels to the network and transferring their surplus electricity. They are often referred to as "prosumers". In late 2023, Ellevio had 31,500 customers who were micro-producers of solar electricity – an increase of 67 percent compared with the previous year. On specific days and at specific times, the network therefore needs to receive locally produced surplus electricity, while on other days it needs to distribute electricity from power stations far away. Greater flexibility is needed in the electricity system.



New storage and system-balance solutions

Managing surpluses is a key factor of the electricity system of the future. When more electricity is produced than is used, solutions are needed to take advantage of the surplus. These could include transferring the electricity to other parts of the country, exporting it or storing it. The technological developments here are moving fast, but the solutions are still young and often untested.

A crucial technology for the electricity system to accommodate more renewable electricity production is battery storage, and investments in energy storage are being made in several parts of the country by an increasing number of operators. Energy storage facilities (also known as network batteries) also contribute to the balance of the electricity system by enabling rapid recharging or discharging.

One of the operators in the market for innovative energy solutions is Ellevio Energy Solutions AB, which was founded in 2022 and is part of the same group as Ellevio AB.

Expanded capacity, smart solutions and flexible consumption

To manage imbalances in both electricity supply and demand, more local production, investments in national, regional and local networks and innovative digital solutions for smarter management of the electricity system are needed. Flexible consumption also needs to increase by giving consumers incentives and tools to consume electricity in a flexible way, thus reducing the maximum load on the grid. In the future, conditional connection agreements that allow network companies to reduce customers' electricity consumption when the grid is under most strain will be able to help the situation.

Ellevio Energy Solutions is electrifying Sweden's businesses

Ellevio Energy Solutions AB is part of the Ellevio Group – separated from the electricity network business at Ellevio AB – which helps companies transition to an electrified, fossil-free business. Energy Solutions customises electrical installations, battery solutions and charging solutions under the banner of Power-as-a-Service. This means that the company designs, builds, operates and owns electricity-intensive plants for customers. In addition to enabling electrification, the business contributes to a better balance in the electricity system.

The business is growing rapidly, with events in 2023 including the following:

- In Grums, the first BESS (Battery Energy Storage Systems), a 10 MW/11 MWh rechargeable battery system, was inaugurated. Since June 2023, it has been helping to balance the electricity system, see adjacent image.

- A decision was taken to invest in three more BESS projects totalling 70 MW. These are expected to become operational in 2024 and 2025.
- The company signed its first Power-as-a-Service contracts totalling SEK 120 million. The deals include a 10 MW/10 MWh battery storage facility for an industrial and data centre customer and a customised battery solution for Skaraslättens Transport, including a BESS facility.

Need for increased grid capacity and more flexibility

A challenge facing the electricity system is that more and more people are living in cities. There is a lack of capacity in both Stockholm and other cities, which is mainly due to a lack of transmission capacity on Svenska kraftnät's transmission network.

More homes, industries, electrified traffic and ambitious targets to reduce climate emissions mean that the electrification process is constantly growing in greater Stockholm. The ability to utilise electricity grids more efficiently will be key to expanding the region, electrifying it and meeting climate targets.

Network companies are making record investments in a modernised electricity network, but before it is rolled out, capacity could be overwhelmed, for example on cold winter days when electricity consumption is very high. That is why sthlmflex was created in 2020 – a market to enhance flexibility for electricity network customers. Different operators are offered compensation for being flexible with their electricity consumption or electricity production, thus freeing up electric power. sthlmflex has previously been run as a research and development project with Svenska kraftnät as its principal partner. From 2023 onwards, the electricity network companies Ellevio AB, E.ON Energidistribution and Vattenfall Eldistribution are behind the initiative and serve as buyers on the sthlmflex marketplace operated by NODES. Svenska kraftnät is a partner of sthlmflex.

Capacity shortage issues are expected to increase in regional and local networks too if the necessary investments are not implemented soon. Urban planning has long taken the electricity supply for granted without considering the need for expanding the electricity network. This risks threatening both growth and the climate transition.

Industrial establishments also require extensive investments in network capacity. One example is AB Volvo's investment in a battery cell factory in Mariestad. Battery production on that scale requires an enormous amount of network capacity, and Ellevio, which is responsible for supplying that electricity, is therefore facing major investments.

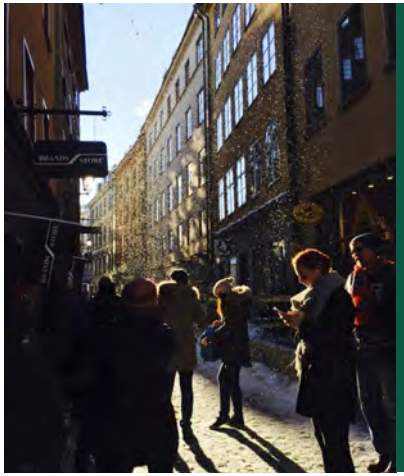
Ellevio's response – how we are electrifying Sweden

We are working every day to electrify Sweden. But we can't do it on our own. We need long-term regulation, broad societal acceptance, skilled contractors and customers who want to contribute to the transition. Here are some examples of our activities in 2023.

As Volvo is building a new battery factory in Mariestad, Ellevio will be responsible for its supply of electricity both during construction and after the factory is completed. The factory's electricity demand will be over 400 MW – about the same amount of power needed by a city the size of Uppsala.

Over the last few years, we have installed 921,000 new, modern electricity meters for our customers. The new meters give customers more control over their electricity consumption and are also an important tool for ensuring shorter power outages.

We work to ensure that regulation provides the right conditions for the energy transition and maintain a close dialogue with decision-makers and industry operators.



As the population of Stockholm grows, more electricity is needed – as is the network to transport it. in 2023, we inaugurated a newly built "electricity highway" between Beckomberga and Bredäng; in Hjorthagen we are rebuilding the important switching station Värtan; and in Skanstull we are working to increase transmission capacity by 1,000 MW. And that is merely a selection of this year's highlights.

We build for and connect wind power. In 2023, we connected 193 MW of new wind power, including the construction of 660 MW of grid capacity in the Tovåsen wind cluster.

In Värmland, we completed the reinforcement of the regional 130 kV line between Munkfors and Kil.

We build electricity with electricity. Even our own operations will, of course, be electrified. By 2030, only electric vehicles and machinery will be used in our projects.

To make it easier for customers to participate in the energy transition, we offer charging solutions. For example, in 2023 we implemented 136 charging infrastructure projects and connected 84 public charging points.

Through the Startup 4 Climate competition, we support the development of new innovations.