ENERGY FACTS NORWAY

Key Facts About the Norwegian Renewable Energy Sector

THE ENERGY SUPPLY SYSTEM

ELECTRICITY PRODUCTION

Norway has the highest share of electricity produced from renewable sources in Europe, and the lowest emissions from the power sector.

In the beginning of 2023, the power supply in Norway had a total installed production capacity of 39 703 MW. In a normal year, the Norwegian power plants produce about 156 TWh. In 2021, Norway set a new production record with a total power production of 157.1 TWh. In 2022, there was low levels of water inflow to the reservoirs, and the total power production was 146.1 TWh.

1769 HYDROPOWER PLANTS

About 88% of Norwegian production capacity

1240 STORAGE RESERVOIRS

Total storage capacity is 87 TWh

65 WIND FARMS

About 11% of Norwegian production capacity

Features of the Norwegian power supply system

Hydropower accounts for most of the Norwegian power supply, and the resource base for production depends on the precipitation in a given year. This is a significant difference compared to the rest of Europe where security of supply is mainly secured through thermal power plants, with fuels available in the energy markets.

A special feature of the Norwegian hydropower system is its high storage capacity. Norway has half of Europe's reservoir storage capacity, and more than 75 % of Norwegian production capacity is flexible. Production can be rapidly increased and decreased as needed, at low cost. This is important because there must be a balance between production and consumption at all times in the power system. The growing share of intermittent production technologies, such as wind and solar, makes it even more vital that there is flexibility available in the rest of the system.

The power market in Norway was deregulated in 1991, when few countries had market-based power systems. The market is now a fundamental element of the Norwegian power supply. Electricity prices provide long-term investment signals and play an important part in short-term balancing of supply, demand and transmission.

Renewable power plants are generally located where there is access to resources. Production capacity is therefore unequally distributed between different regions of Norway. A well-developed power grid is vital for transmitting electricity to consumers in all parts of the country.

The Norwegian power system is closely integrated with the other Nordic systems, both in physical terms and through market integration. In turn, the Nordic market is integrated with the rest of Europe through cross-border interconnectors to the Netherlands, Germany, the Baltic states and Poland. Integration with other countries' power systems, the well-developed power grid and the characteristics of hydropower production make Norway's power supply system very flexible, reducing vulnerability to fluctuations in production between seasons and years.

HYDROPOWER

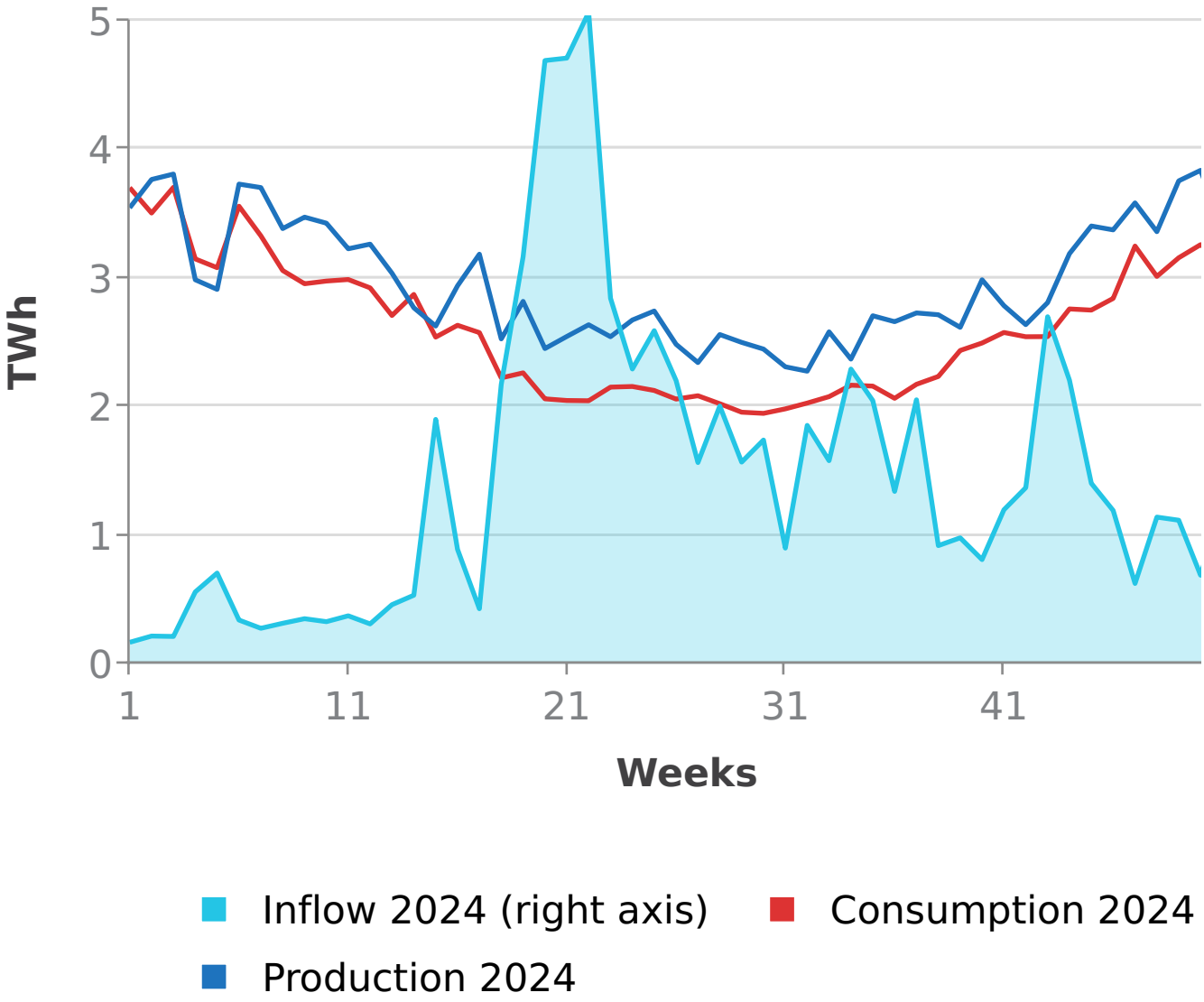
Hydropower is still the mainstay of the Norwegian electricity system. At the beginning of 2023, there were 1 769 hydropower plants in Norway, with a combined installed capacity of 33 691 MW. In a normal year, the Norwegian hydropower plants produce 136.49 TWh, which is about 88% of Norway's total power production.

Water inflow and installed capacity determine how much hydropower the Norwegian system can produce. Inflow varies considerably during the year and from one year to another. The water inflow is highest during the spring, normally declines towards the end of summer but increases again during the autumn. Inflow is generally very low in the winter months.

Norway has more than 1240 hydropower storage reservoirs with a total capacity of 87 TWh. The 30 largest reservoirs provide about half the storage capacity. Total reservoir capacity corresponds to 70% of annual Norwegian electricity consumption. Most of the reservoirs were constructed before 1990. Upgrading and expansion of hydropower plants has made it possible to utilize the reservoirs more fully.

Inflow, consumtion and production of electricity in Norway, 2024

Updated: 03.04.2025
Source: NVE


TWh
5
4
3
2
1
0
1
11
21
31
41
Weeks
Inflow 2024 (right axis)
Consumption 2024
Production 2024

Flexible and intermittent capacity

Electricity production capacity is generally split into two categories, flexible and intermittent. If production is flexible, power plants can adjust production to market developments. Many power plants in Norway have storage reservoirs and production can therefore be adjusted within the constraints set by the licence and the watercourse itself.

Wind and solar power are intermittent; electricity can only be generated when the energy is available. The same applies to run-of-river power plants and small-scale hydropower plants. However a number of the large run-of-river power plants in Norway lie downstream of storage hydropower plants in the same river system, and this influences their production patterns. Some small hydropower plants make use of the head of water between reservoirs.

More than 75 % of Norway's production capacity is flexible.

By using storage reservoirs, flexible hydropower plants can produce electricity even in periods when there is little precipitation and inflow is low. The large available reservoir storage capacity makes it possible to even out production over years, seasons, weeks and days, within the constraints set by the licence and the watercourse itself.

A high proportion of the energy used for heating in Norway is electricity, and electricity prices and production from storage hydropower plants are therefore generally highest in winter.

Production of intermittent hydropower automatically varies with changes in water inflow. Production is high during spring and summer, when consumption is lowest.

The flexibility of power plants and reservoirs varies. Some hydropower plants with small reservoirs offer short-term flexibility, and can transfer production from base-load hours (at night) to peak-load hours (daytime). Hydropower plants with larger reservoirs can store water for longer periods so that they produce electricity in winter, when consumption and prices are highest. Norway's largest reservoir, Blåsjø, has a capacity of 7.8 TWh and can hold three years' normal inflow. However, when the hydropower plants are working at full capacity, the reservoir could be emptied in 7–8 months. Very large reservoirs like Blåsjø are intended to store water in years when precipitation is high for use in drier years. Much of Norway's reservoir capacity is concentrated in the mountains in the southern half of the country (in the counties Telemark, Rogaland, Hordaland and Sogn og Fjordane), and further north in Nordland.

Reservoirs make it possible to manage water use to maximise income from the available water resources. For society as a whole, the aim is to spread production so as to make optimal use of water inflow over the year, or in some cases over several years. To ensure that this happens, there must be financial incentives for producers that reflect the underlying physical conditions. The market therefore plays an important part in ensuring efficient management of water stored in the reservoirs.

Market adaptation by producers

The variable costs of hydropower production are low, since water, the actual energy source, is free. An owner of a run-of-river power plant will therefore be willing to generate electricity even if the prices is only just above zero. The same principle applies to intermittent production technologies such as wind and solar power. Intermittent production is generally independent of price, but varies with weather conditions. Thermal power production, for example at coal-fired, gas-fired and nuclear power plants, is profitable provided that the electricity price covers the production costs at the time of production. These depend to a large degree on the prices of coal, gas and CO2 emission allowances.

Hydropower producers who can store water will assess the situation differently. They constantly need to consider whether to produce electricity immediately, or to retain the water in reservoirs. It is the difference between the current and the expected electricity price that determines whether it is profitable to store water for short or longer periods.

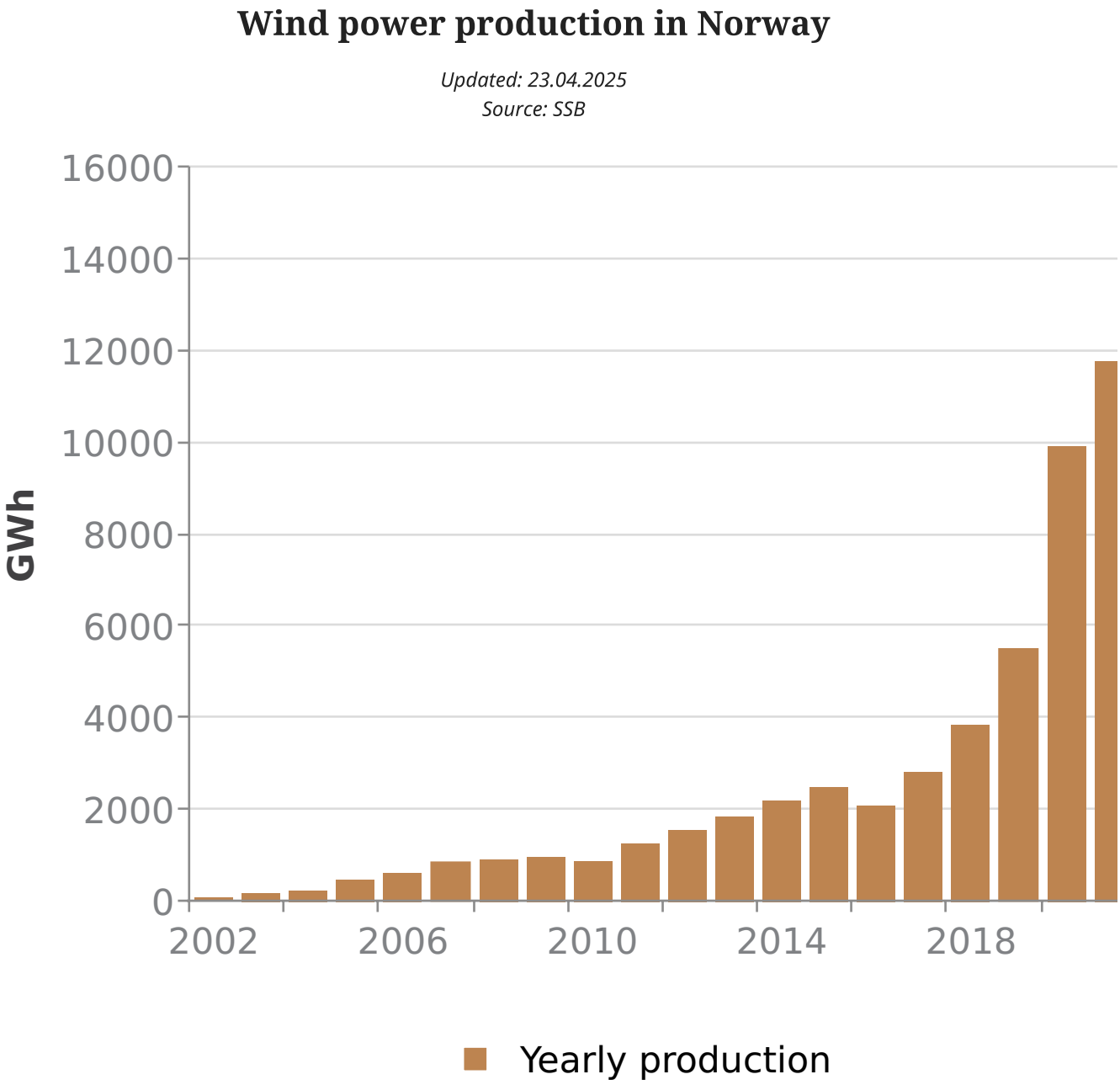
It is challenging to manage storage reservoirs, because it is impossible to be sure how inflow will vary in future or how market conditions will develop. Reservoir management therefore requires considerable local knowledge and the ability to interpret changing, complex and uncertain information on inflow, consumption and market developments.

At Norwegian storage hydropower plants, production is also regulated in line with short-term price developments, which are closely related to the volume of intermittent power production in the other Nordic countries and the rest of Europe.

It is also necessary to maintain a balance in the power supply system as a whole as production and consumption change during the day and within each hour. Hydropower production can be rapidly regulated up and down at relatively low cost. In thermal power plants, on the other hand, it can be time-consuming and costly to regulate production. This means that Norwegian power plants are useful for meeting the short-term need for flexibility, which is growing because the share of intermittent production is increasing in Nordic and other European power supply systems. Well-functioning, integrated markets and a well-developed power grid are an essential basis for this.

WIND POWER

At the beginning of 2023, there were 65 wind farms in Norway, with an installed capacity of 5073 MW. This corresponds to about 16.9 TWh in a normal year. Production from wind power plants fluctuates with weather conditions. Wind conditions can vary a lot between days, weeks and months.

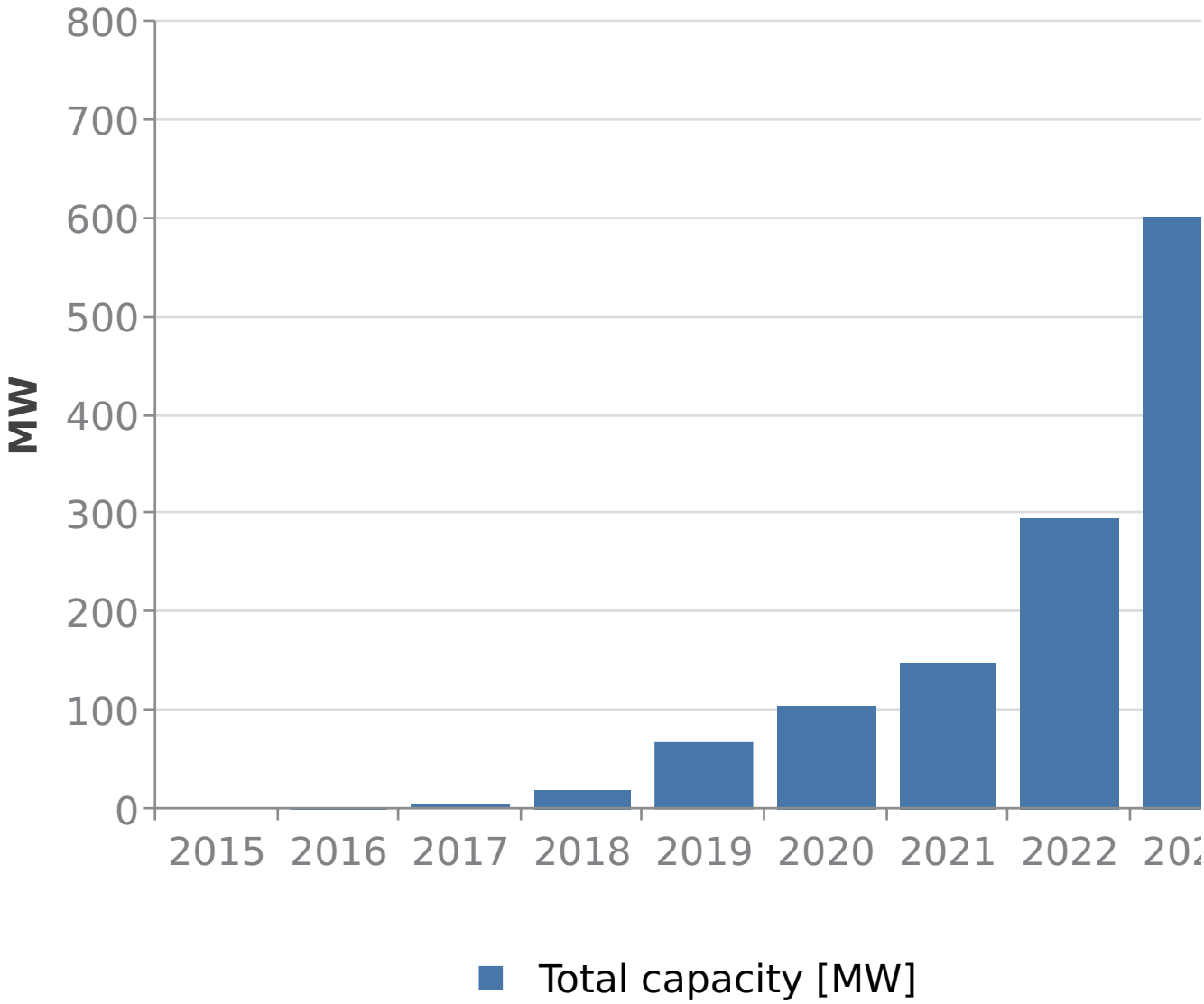


SOLAR POWER

At the beginning of 2023, the total installed capacity of solar power was 299 MW in Norway. In 2023, more than 90% of the installed capacity was connected to the Norwegian power grid. About 5% of the solar power in Norway had an installed capacity of more than 50 kW in 2023. In 2023, most of the solar power in Norway is installed on the roofs of households and industry, and primarily cover their own consumption. As of 31 March 2023, there are no dedicated solar power plants in Norway. During 2022, approximately 153 MW of new solar power was installed in Norway.

Development in grid-connected installed capacity for solar power in Norway

Updated: 23.04.2025
Source: Elhub and NVE



THERMAL POWER PLANTS

Norway’s thermal power plants accounted for about 1.5% of the total production capacity in 2023. Many of the power plants are located in large industrial installations that use the electricity generated themselves. Hence, production often depends on the electricity needs of the industry. These power plants use a variety of energy sources, including municipal waste, industrial waste, surplus heat, oil, natural gas and coal. There are 30 thermal power plants in Norway, with a total installed capacity of about 642 MW.

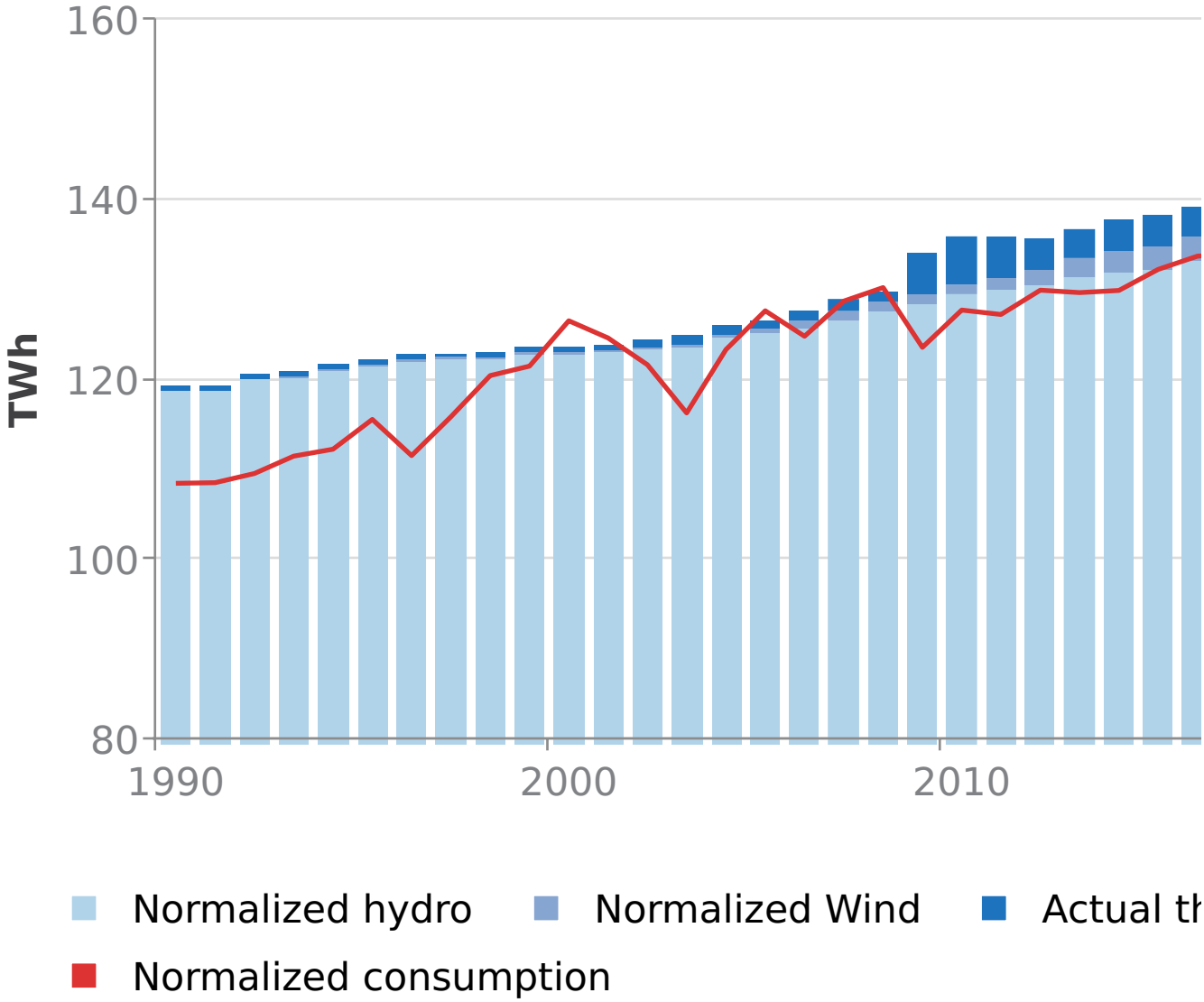
THE POWER BALANCE

The power balance expresses the relationship between production and consumption and indicates whether the Norwegian power system is a net exporter or importer in a particular year. There are wide variations from year to year. Generally, consumption fluctuates with temperature and production with water inflow and wind conditions. The underlying situation in the Norwegian power supply system can be illustrated by comparing Norwegian production capacity in a normal year with electricity consumption corrected for temperature, as in the figure below.

At the beginning of the 1990s, there was a considerable surplus in the Norwegian power supply system, which became apparent when the market was deregulated. This was followed by a period of falling investments in new electricity production and relatively high growth in consumption, resulting in a reduction in the power surplus by the early 2000s. After the 2008–2009 financial crisis, the power surplus has increased again as a result of weaker growth in consumption and higher electricity production. In 2022, Norway had a power surplus of 12.5 TWh. There is great uncertainty in how the power surplus will evolve in the years to come, and this depends on a wide range of factors. In the years to come, a high increase in power consumption is expected, which may contribute to a lower power surplus.

Normalized production and consumption of electricity 1990-2020, TWh

Updated: 23.02.2021
Source: NVE, Nordpool



HEAT SUPPLY

Norway has a cold climate, and a large part of its energy consumption is used for heating.

SUPPLY AND DEMAND

Norway has a cold climate, and a large part of its energy consumption is used for heating. Unlike most other countries, the dominant source for heating is electricity. The high proportion of electric heating can put pressure on the power supply during cold periods.

Households account for about half of the total energy consumption used for heating and cooling in Norway. The industry accounts for about 25 percent, while the service sector accounts for just under 25 percent.

DISTRICT HEATING

In 2022, 6.3 TWh of district heating was delivered to end users. District heating can be produced with many different types of fuel. Waste incineration covered about 45 percent of the production in 2022. The share of bioenergy has increased over the last ten years, while the use of fossil fuels has decreased. In 2022, fossil gas and diesel and fuel oils accounted for 3.3 percent of district heating production.

District heating mainly supplies larger buildings. The service sector accounts for about two thirds of the consumption, in buildings such as hospitals, cultural, educational, and office buildings. District heating is also used in apartment buildings and industry.

District heating interacts well with the electric power system. By substituting electricity consumption in winter, district heating can limit the need for investments in the power system. Some district heating plants can also use electricity when the power price is low, or other energy carriers when the power price is high.

HEAT PUMPS

Over one million heat pumps have been installed in Norway. Most of these are air-to-air heat pumps in households, while a significant number of larger heat pumps are installed in commercial buildings and in the industry. According to the Norwegian Water Resources and Energy Directorate (NVE), 18.8 TWh of heat was produced by heat pumps in 2021, with an electricity consumption of 8.1 TWh.

BIOENERGY

Bioenergy is an important energy source for the production of heat in Norway. It contributes to energy flexibility and reduction of greenhouse gas emissions. Annual use of bioenergy in Norway has increased from 10 TWh in 1990 to 16 TWh in 2022 Wood burning in households accounts for a large share, with just over 6 TWh in 2021.

SURPLUS HEAT

Industry, data centers, and cooling systems will in most cases generate heat as a by-product. This is often referred to as waste heat or surplus heat. Surplus heat is thermal energy in the form of air, water, steam, or exhaust gas at a higher temperature than the surroundings, and which is not utilized for the facility's primary purpose and thus can be used for other purposes. The extent to which surplus heat can be utilized depends on the quality of the heat source, including temperature level, availability, and quantity. In addition, available technology and customer base will be crucial. The customer base largely depends on the geographical location of the heat resources.

PETROLEUM PRODUCTS

From January 1, 2020, use of mineral oil (oil from fossil sources) for heating buildings has been prohibited. The purpose is to reduce emissions of greenhouse gases. The ban also includes the use of mineral oil for temporary heating of buildings under construction or renovation (construction heat). Agricultural buildings and hospitals with around the clock patient treatment are exempt until 1 January 2025.

Gas heating is very rare in Norway, with a limited domestic gas infrastructure. Since 2017, installing heating solutions based on any fossil fuel, including natural gas, in new buildings has been prohibited. Use of gas is mainly related to industrial activities.

THE ELECTRICITY GRID

The electricity grid enables electricity transport from producers to consumers, and connects Norway’s power system to other countries’ systems.

THE ELECTRICITY GRID IS KEY INFRASTRUCTURE

The three fundamental functions of the power supply system are:

- Production
- Transmission
- Trade

A reliable supply of electricity is crucial in modern society. In business and industry, the public service sector and households, reliable access to electricity is a matter of course. Almost all important public services and functions depend on a well-functioning power system with a reliable supply of electricity.

The electricity grid fulfils a core function in the electricity system, and constitutes key infrastructure in a modern society.

Electricity production resources are often located far from where consumption takes place. A well-developed electricity grid makes it possible to transmit power from the hydropower plants in the southwest and north to consumers in other parts of Norway and abroad.

The grid must be able to cope with both short- and long-term variability in production and consumption in order to ensure that electricity supplies are maintained. The grid system is designed to handle peaks in electricity consumption, which generally occur on the coldest days in cold years, and to allow for import of sufficient quantities of electricity for extended periods, for example in dry years. In addition, the grid must have sufficient capacity to transport electricity out of a region when consumption is low and production is high. The wide variations in domestic production and consumption make it necessary to have sufficient transmission capacity both between different regions of Norway and between Norway and other countries.

Grid levels: Transmission and distribution grid

The Norwegian electricity grid consists of three levels: the transmission grid (operated by Statnett), the regional distribution grid and the local distribution grid. Both the regional and the local distribution grids are considered as distribution systems, as defined by EU legislation.

The **transmission grid** connects producers with consumers in a nationwide system. Interconnectors with other countries are part of the transmission grid. There are specific requirements relating to transmission system operators. In Norway, Statnett is the designated transmission system operator (TSO).

The transmission grid carries a high voltage, usually 300 to 420 kV, but in certain parts of the country there are also lines carrying 132 kV. The total length of the transmission grid is about 12 000 km.

The **regional distribution grid** often links the transmission grid to the distribution grid, and may also include production and consumption radials carrying higher voltages. The regional grid carries a voltage of 33 to 132 kV, and has a total length of about 19 000 km.

The **local distribution grid** consists of the electricity grids that normally supply power to smaller end users. It carries a voltage of up to 22 kV, divided into high-voltage and low-voltage segments. The dividing line between the two segments is 1 kV, and the low-voltage distribution to ordinary customers normally carries 400 V or 230 V. The total length of the high-voltage distribution grid is about 101 000 km.

Large electricity producers are connected to the transmission or regional distribution grid, and smaller ones to the regional or local distribution grid. Major consumers such as power-intensive manufacturing or the petroleum industry are generally connected to the transmission or regional distribution grid. Small-scale consumers such as households, service industries and small-scale manufacturing, are usually connected to the local distribution grid.

ADMINISTRATIVE ORGANISATION OF THE ELECTRICITY GRID

Statnett owns the transmission grid in Norway, and is the transmission system operator (TSO). Statnett is a state-owned enterprise, and the Ministry of Energy is responsible for the state's ownership. Municipalities and county authorities own most of the regional and distribution grids, but there is also some amount of private ownership.

Historically, many grid companies have been part of vertically integrated companies, i.e. companies that are involved in both electricity generation, transmission and/or trading. Today, regulatory provisions require that all grid companies undertake legal undbundling and grid companies with more than 100 000 customers undertake functional unbundling. This makes the distinction between market-based and monopoly activities clearer.

Legal and functional unbundling

Distribution system operators (DSOs) are subject to legal and functional unbundling.

Legal unbundling means that grid operations and production and/or trading activities are carried out by separate companies. In addition, a grid company may not own or be owned by an entity that is engaged in electricity production or trading.

Functional unbundling means that nobody with management responsibilities in a grid company may be involved in the management of other company structures in an integrated company. The parent company or controlling owner is allowed to influence the financial framework for the grid company, but may not be involved in day-to-day management and operations or in investment decisions.

You can read more about regulation of grid operations here.

STATNETT SF

Statnett is the transmission system operator (TSO) in Norway, and owns the transmission grid in Norway. Statnett is responsible for ensuring that there is an instantaneous balance between the production and consumption of electricity in Norway at all times.

Statnett is responsible for maintaining the instantaneous balance of the power supply system and ensuring that the quality of supply is satisfactory

Electricity cannot easily be stored, so the amount produced must at all times equal consumption. This is referred to as the instantaneous balance in the electricity system. The power market is an essential tool to ensure balance between electricity supply and demand. Statnett uses the results of daily price determination in the day-ahead market as the basis for planning and maintaining the instantaneous balance in the following 24-hour period. The continual process of balancing the electricity system is vital for the operational reliability of the power supply system. If an imbalance arises, the transmission system operator takes steps to restore the balance, for example by adjusting production or consumption.

Furthermore, Statnett has a key role in the development and operation of cross-border interconnectors. This includes extensive cooperation with TSOs and regulators in other European countries. TSOs cooperate through the European Network of Transmission System Operators for Electricity, ENTSO-E. ENTSO-E also plays a part in developing network codes and guidelines for the internal energy market.

A high-voltage power line

POWER EXCHANGE

In 2023, Norway's exchange capacity to other countries is approximately 9000 MW. This is distributed with 4000 MW to Sweden, 1400 MW to Germany, 1400 MW to the United Kingdom, 1600 MW to Denmark, and 700 MW to the Netherlands. 9000 MW corresponds to a theoretical potential for power transmission of 80 TWh per year, but the historical utilization has been lower. In the last decade, the annual exchange between Norway and neighboring countries has been around 26 TWh, with an increase to 33 and 38 TWh after the commissioning of NordLink in 2020 and North Sea Link in 2021, respectively.

The power exchange between Norway and other countries ensures sound overall resource use and improved value creation.

THE POWER MARKET

The power market is an important tool for ensuring cost-efficient use of electricity resources.

A MARKET-BASED POWER SYSTEM

The Norwegian Energy Act is based on the principle that electricity production and trading should be market-based, while grid operations are strictly regulated. The power market ensures that effective use of resources and reasonable prices on electricity. Electricity transmission and distribution is a natural monopoly, and not subject to competition.

An important principle in the regulation of the power supply system is the distinction between monopoly operations and operations that are well suited for competition.

Electricity differs from other goods in the regard that it cannot easily be stored. There must always be an exact balance between generation and consumption. In the wholesale market, prices are determined for each separate hour of the following 24-hour period, based on bids and offers from many different participants, and given the availability of grid capacity. This short-term market adjustment ensures that the production resources with the lowest cost are used first. Electricity prices also provide investment signals because they indicate where there may be a power supply deficit.

Market-based power system

Norway introduced market-based power trading in 1991. Instead of planning a gradual transition to market-based solutions, as many European countries did, Norway opened the market to all customers from the very beginning. Hence, Norway was the first country to provide universal market access.

The power exchange Statnett Marked AS (now Nord Pool AS) became an important element of the market. Even before this, fluctuating hydropower production in different parts of the country created a need for market-based solutions and electricity trading. In 1971, Norwegian producers established a power exchange for spot power (known as *Samkjøringen*). *Samkjøringen* was formalised as early as 1931, and was a result of many years of cooperation and power exchange between power plants.

Today, the Nordic countries are closely linked, both by physical interconnectors, and by financial market integration. Nord Pool, based outside of Oslo, is the exchange for physical power trade for the Nordic and Baltic countries. Nord Pool grew into the world's first international power exchange from 1996 onwards, as Sweden, Denmark and Finland joined. The Nordic market is also integrated, in both physical and financial terms, with power markets in the rest of Europe. Financial power trading in Europe takes place on the Nasdaq exchange in Stockholm. Market participants use Nasdaq for price hedging and to trade in long-term products and derivatives.

AN INTEGRATED MARKET

Norway is part of a joint Nordic power market with Sweden, Denmark and Finland, and is in turn integrated into the wider European power market through interconnectors to the Netherlands, Germany, the Baltic states, Poland and Russia. The last two interconnectors from Norway to Europe became operational during 2021. The Nord Link cable to Germany was put into ordinary operation in May 2021. In addition, the North Sea Link cable to the United Kingdom was put into trial operation in October 2021.

The EU is taking steps to improve integration of the internal energy market and coupling of the European markets. Market coupling in Europe has previously been based on voluntary cooperation and regional initiatives. The Nordic power exchange, Nord Pool, was established at an early stage.

Market coupling ensures that electricity flows in accordance with prices, thus ensuring optimal use of capacity and production resources

Market coupling functions through implicit auctioning, which involves simultaneous calculation of prices and electricity flows between areas in the day-ahead market. Market participants on opposite sides of national borders can make bids and offers hour by hour for the next 24 hours, and do not need to reserve grid capacity in advance.

Harmonisation of electricity market rules in Europe

More closely integrated physical electricity markets require greater harmonisation of technical rules, trading systems and market design.

The EU's third energy market package was adopted in 2009, and consists of five legal acts that reinforce and continue the development of the internal markets for electricity and natural gas. These replaced the legal acts contained in the second energy market package.

The main elements of the third energy market package are concerned with unbundling (reducing vertical integration), strengthening independent regulation of energy markets and developing cross-border infrastructure and security of electricity supply.

The third energy market package also provides the legal authority to adopt supplementary provisions, network codes and binding guidelines. The EU has adopted 8 network codes and guidelines, in the first instance concerning connection and system operation and market design. The figure below provides an overview of electricity network codes and guidelines

In November 2016, the European Commission put forward a new package called 'Clean energy for all Europeans', which includes proposals amending the third energy market package, together with a new regulation. All the legal acts under the "Clean Energy for all Europeans"-package, consisting of 8 new laws, was adopted in the EU in May 2019.

ORGANISATION OF THE POWER MARKET

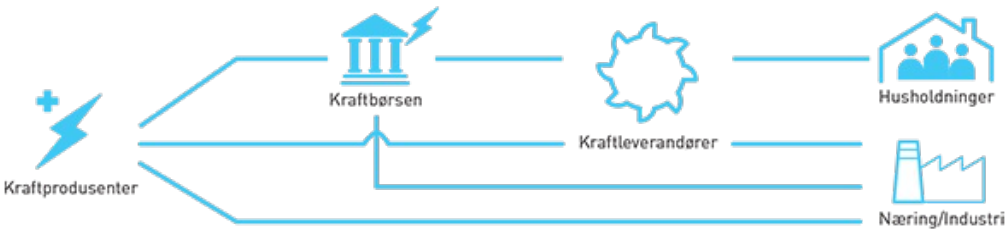


Illustration showing how the power market is organised

Power supplied to the grid follows the laws of physics and flows down the path of least resistance. It is not possible to separate different power deliveries from each other. A consumer who switches on the power has no way of knowing who produced the electricity or how far it has been transported through the grid. The grid companies keep account of how much power each producer delivers and how much each end user consumes, and this forms the basis for settlement. Producers are paid for the volume of power they deliver, and end users pay for their consumption.

The power market can be divided into wholesale and end-user markets. Large volumes are bought and sold in the wholesale market by power producers, brokers, power suppliers, energy companies and large industrial customers. Power suppliers trade on behalf of small and medium-sized end users and small-scale businesses and industry.

The wholesale market consists of several markets where bids are submitted and where prices are determined:

- the day-ahead market
- the continuous intraday market
- the balancing markets

Day-ahead and intraday trading take place on the Nord Pool exchange. Statnett runs the balancing market, as part of its tasks as TSO.

Market participants may also enter into bilateral contracts on purchases and sales of specific volumes of electricity at an agreed price and for delivery in an agreed period.

In the end-user market, individual consumers enter into agreements to purchase electricity from a power supplier of their choice. Norway's end-user market consists of about one-third household customers, one-third industry and one-third medium-sized consumers such as hotels and chain stores.

Balance settlement

Since 1997, Statnett has been responsible for settling the imbalances in the Norwegian power market, a process known as balance settlement. This ensures that all supply and consumption of electricity is correctly settled, and maintain balance in the power market. In this context, balance means that a market participant's actual power generation or consumption must be equal to the volume agreed upon on beforehand. To operate in the wholesale market, participants must have a direct balance agreement with Statnett. Participants must either be responsible for their own balancing or have an agreement with a balance responsible party to settle their imbalances for them.

In 2017, a Nordic balance settlement service was launched. The company eSett Oy provides imbalance settlement services for market participants in Finland, Norway and Sweden. One purpose of this system is to reduce barriers to establishment for balance responsible parties and power suppliers wishing to provide services in more than one country.

THE WHOLESALE MARKET

The day-ahead and intraday markets

The day-ahead market is the primary market for power trading in the Nordic region, and is where the largest volumes are traded on Nord Pool. It is a market for contracts with delivery of physical power hour-by-hour the next day. Participants make bids and offers to the Nord Pool trading system between 08:00 and 12:00 each day. Before 10:00 each day, the TSOs publish trading capacities for each bidding area. The day-ahead auction closes at 12:00 each day. Prices for each hour of the following day are calculated on the basis of the all the purchase and sell orders received and the transmission capacity available.

The Nordic day-ahead market is coupled with the day-ahead markets in much of the rest of Europe through implicit auctioning. This means that market participants bid for energy and transmission capacity at the same time. In addition, a system for price coupling of regions (PCR) now covers the Nordic region and much of the rest of Europe. This solution means that Nord Pool calculates prices in the different regions using a common European algorithm, at the same time every day.

The day-ahead market plays a large part in ensuring a balance between supply and demand. However, events after the auction in the day-ahead market, for example changes in weather forecasts, may mean that actual production or consumption by market participants changes from their position in the day-ahead market. In the intraday market, contracts are continuously traded in the period between clearance in the day-ahead market and up to one hour before the hour of operation. This allows market participants to achieve a balance through trading. Nord Pool now has an intraday market that operates in the Nordic region, the Baltic region, Germany and the UK.

Balancing markets

Although the day-ahead and intraday market creates a balance between production and consumption towards the operating hour, there will still be unforeseen events that disturb the balance in the operating hour. As the system operator, Statnett is responsible for ensuring that the power system is in balance at all times. To ensure the current balance, Statnett uses the balance markets to buy flexibility so that consumption and production can be regulated up or down, depending on the imbalance.

In the Nordics, the balancing markets are divided into fast frequency reserves (FFR), primary reserves (FCR), secondary reserves (aFRR) and tertiary reserves (mFRR). The power system is in balance with a frequency of 50 Hz. Fast frequency reserves, primary and secondary reserves are activated automatically as a response to changes in the frequency, while the tertiary reserves are activated manually by the Nordic system operators.

Imbalances are first regulated using fast frequency reserves. These reserves are activated during approximately one second after a change in frequency. A commercial market for the acquisition of FFR was established by Statnett in 2022. Thereafter, primary regulation is switched to stabilize the frequency change. The primary reserves are traded in a separate 24-hour and weekly market for primary reserves. If the imbalances persist for several minutes, the secondary regulation will take over, freeing up the primary regulation resources for regulating new imbalances. Previously, the Nordic system operators purchased secondary reserves in national weekly markets. In 2022, a joint Nordic market for aFRR was launched. In case of additional needs, tertiary regulation is activated, most often referred to as regulating power. These are manual reserves that have an activation time of up to 15 minutes. Such reserves are acquired in the regulating power market, which is a common balancing market for the Nordic power system.

The system operator ensures that there is sufficient balancing capacity in the Norwegian part of the regulating power market through the Regulating Power Options Market. This is an option market where providers are paid to guarantee that they participate in the regulating power market, regardless of whether the resources are used or not.

The Nordic system operators are working together to develop a new Nordic balancing model. The launch of the Nordic capacity market for aFRR is part of this collaboration. Furthermore, work is being done, among other things, on automating the regulating power market and developing a Nordic capacity market for regulating power.

PRICE FORMATION

System price

Each day, the Nord Pool power exchange calculates the system price for the following day. The system price is theoretical, and is based on the assumption that there is no congestion in the Nordic transmission grid. The system price is the same for the entire Nordic market, and functions as a reference price for price setting in the financial power market in the Nordic region.

Producers submit bids stating how much they are willing to produce at a specified price. The bids reflect the value producers put on their production, closely linked to running costs at power plants. End users submit bids indicating how much they wish to consume at different prices. The price is determined at the level that results in equilibrium between supply and demand in the day-ahead market.

Market-based price formation ensures that the demand for electricity is satisfied at the lowest possible cost to society

In a market equilibrium, the price is determined by the cost of producing the 'last' unit of power (the marginal cost). This ensures that the cheapest energy resources are used, so that the demand for electricity is satisfied at the lowest possible cost to society. Norway's trading capacity with other countries is high, and price levels in Norway are therefore strongly influenced by the cost of producing electricity in thermal power plants, and especially by the prices of coal, natural gas and emission allowances. Renewable production and consumption levels in countries connected to Norway's power supply system also have an influence.

The large proportion of hydropower in the Norwegian and Swedish production mix means that variations in water inflow to hydro reservoirs have a strong effect on price variability in the Nordic region. When inflow is high, so is the supply of power, and prices are pushed downwards. In years when precipitation is low and inflow is lower, prices rise. Similar effects arise when there are windy and less windy periods, since wind power is becoming an increasing part of the nordic energy mix. Market prices are also influenced by temperature fluctuations, since they affect how much energy is needed to heat people's homes.

Area prices/bidding zones

In addition to the system price, Nord Pool sets area prices, which take into account congestion in the grid. Area prices create a balance between the purchase and sales bids from participants in the different bidding zones in the Nordic region. In recent years, Norway has five bidding zones, Sweden four and Denmark two, while Finland constitutes one bidding zone.

The underlying cause of congestion and different power prices in different areas is that the power situation differs from one region to another, and may also vary on an hourly basis and between seasons and years. Some regions may be experiencing a power surplus when others have a power deficit. Power needs to be imported to areas with a deficit and exported from areas with a surplus. Grid congestion arise if there is insufficient grid capacity to import and export power as needed.

When bidding zones are determined, different market areas exist on each side of a bottleneck. This means that the area price is higher in areas with a deficit of power than in those with a surplus. Power flows from low-price areas to high-price areas, thus increasing the power supply where the need is greatest. Furthermore, area prices help the participants determine where it is best to increase or reduce generation and consumption. In areas with a power deficit, generation is increased at the same time as consumption is reduced, which improves access to power and security of supply.

In addition to being a vital tool for short-term balancing, area prices indicate where longer-term measures are needed in the power system. They make producers and consumers aware of where new generation capacity or new major consumers should be sited.

The division into bidding zones does not mean that there will automatically be different area prices. When there are no capacity constraints in the Nordic power grid, area prices will be the same throughout the Nordic region and will correspond to the system price.

THE END-USER MARKET AND ELECTRICITY PRICES

Consumers who purchase power for their own consumption, are called end users. End users in Norway are free to choose their power supplier. Small end users normally purchase electricity from a power supplier, while larger end users, such as large industrial companies, often choose to purchase directly in the wholesale market or enter into a bilateral agreement with an electricity producer.

Competition in the end-user market ensures that end users can choose between different contracts and find one that suits their needs.

Electricity is a homogeneous product; it is not possible to differentiate between different power deliveries. What distinguishes power suppliers from each other is the contracts they offer. Generally, end users can choose between three main types of electricity contracts: fixed-price, standard variable price and spot price (based on market prices, with a mark-up).

In a fixed-price contract, the electricity price is fixed for a certain period, for example a year. The supplier is obliged to deliver electricity at this price, regardless of whether market prices go up or down. Thus, a fixed-price contract is a type of financial contract, where the customer is guaranteed a certain price for the period of the contract. A power supplier sets the fixed price on the basis of expectations about electricity prices, with a mark-up to cover costs. The difference between the fixed price and the market price is the risk premium paid for the guaranteed price.

In a standard variable price contract, the electricity price varies with developments in the power market. This is also a form of financial contract, but with a short price guarantee period. A supplier is required to inform customers of price changes 14 days before they are put into effect.

In a spot-price contract, the price follows the market price determined by Nord Pool. In addition, the customer must pay a mark-up. For households and small businesses, this option is the closest to taking part in the day-ahead market.

All grid companies must ensure that AMS (smart electricity meters) are installed in each individual measuring point. AMS can measure electricity consumption hour by hour. This means that new types of electricity contracts can be developed based on hourly prices, and end users will be able to adjust their consumption better to prices to minimise their electricity bills. The majority of Norwegian electricity customers have now adopted a smart electricity meter. As of the third quarter of 2022, AMS meters with a communication module have been installed in 98.8 per cent of the measuring points in the distribution network. The AMS introduction is therefore considered finalized in Norway. The remaining 1.2% of the metering points are either AMS without a communication module, older meters or unmetered consumption points in the low-voltage network.

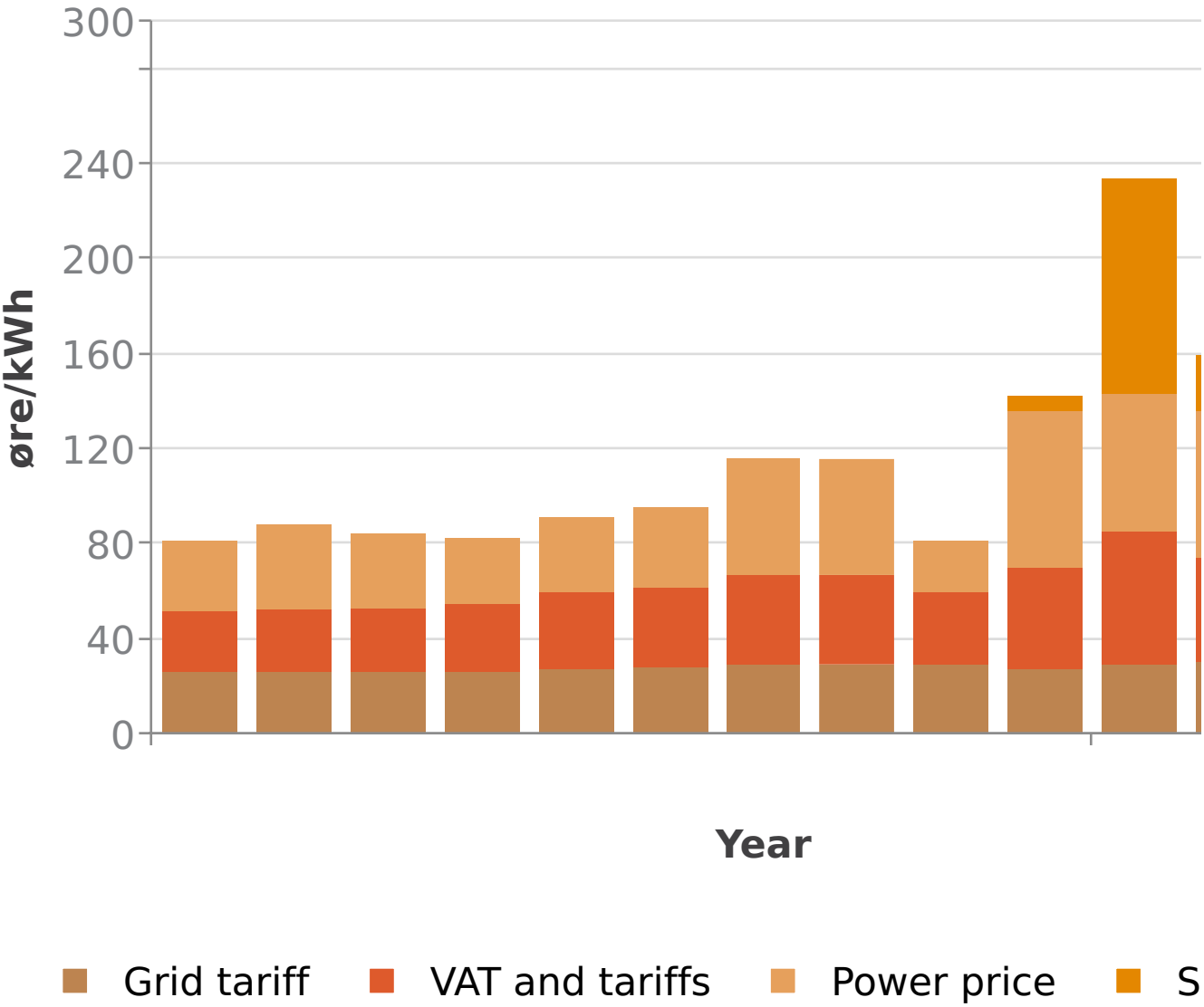
The Norwegian Consumer Council maintains a website, www.strompris.no, where it is possible to compare all the different contracts offered by electricity suppliers. This makes it easy for a consumer to find the most suitable contract.

End-user prices

An end user's total electricity bill consists of charges for several different components of the service: the electricity (power price), connection to and use of the electricity grid (grid tariff), consumption tax on electricity (electricity tax), and value added tax. In addition, there is a fee earmarked for the Energy Fund (Enova), as well as payment for electricity certificates. The power price makes up a varying share of the total end user price, depending on market prices. The electricity tax and the Enova fee are fixed by political decisions, while the price of electricity certificates varies depending on developments in the electricity certificate market. Grid tariffs are fixed by the grid companies, based on a revenue cap and principles for tariffs laid down by the Norwegian Water Resources and Energy Directorate. Grid tariffs are required to reflect the costs of transporting electricity to end users.

End-user prices

Updated: 23.04.2025



FINANCIAL POWER TRADING

Financial power trading includes trading with financial instruments used for risk management and speculation. All contracts are settled financially without any physical power deliveries. Financial products are often called long-term contracts because they apply to periods further ahead in time than those for physical products.

Financial power trading can take place either bilaterally or on a power exchange. In the Nordic countries, financial trading takes place mainly on the Nasdaq OMX Commodities AS (Nasdaq OMX) exchange. Nasdaq OMX has a license from the Financial Supervisory Authority of Norway, which is also the supervisory authority for the marketplace. At Nasdaq OMX, players can hedge prices for purchase and sale of power for up to six years ahead, split by days, weeks, months, quarters and years.

Financial products include future and forward contracts, electricity price area differentials (EPAD) and options.

Nasdaq OMX Clearing AB (Nasdaq Clearing) is the clearing house for the financial contracts on Nasdaq OMX. Nasdaq Clearing has a license from the Swedish Financial Supervisory Authority. Clearing activities make an important contribution to operational efficiency in the Nordic power market. Nasdaq Clearing acts as the counterparty in all financial trading on Nasdaq OMX. Bilateral financial agreements can also be cleared. This eliminates the counterparty risk for the participants.

Financial products

Future and forward contracts are agreements on financial settlement of an agreed power volume, for an agreed time period and at an agreed price. For future contracts, settlement can take place during both the trading and the delivery period, whereas for forward contracts, it always takes place when the contract ends. Future and forward contracts are important instruments for price hedging.

Electricity price area differentials (EPAD) are forward contracts that cover the difference between the area price and system price.

An option involves a right, but not an obligation, to buy or sell a forward contract in the future at an agreed price. NASDAQ OMX only lists European options, which can only be exercised on their expiration, at the end of the contract period.

NORWEGIAN POWER TRADING

Norway has had interconnectors to neighbouring countries since 1960 when the first interconnector to Sweden was built. Norway has since built interconnectors to Denmark, Finland, Russia, the Netherlands, Germany and Great Britain. Norway has been a net electricity exporter in 17 of the past 25 years. Between the mid-1990s and the mid-2000s, there were more years than previously when Norway was a net importer. In the last 10 years, the power balance has improved, and Norway has had an average net export of about 10 TWh per year. Norway experienced large amounts of water in the reservoirs and historically high wind power production in 2020. This resulted in a record high production of electric power, which contributed to Norway having a net export of 20,5 TWh.

In 2021, exports increased by 3.4 per cent compared to the previous year, to a record high level. This was linked to high power production, relatively high prices in Europe and the fact that more interconnectors were put into operation. Norway exported 25.8 TWh and imported 8.2 TWh in 2021. This gave an export surplus of approximately 17.6 TWh. Never before have there been such high net exports out of the country in the course of one year.

The year 2022 was characterized by a sharp increase in the import of electricity reaching up to 13.2 TWh. One reason for this was an unusually low hydropower production in Norway. At the same time, exports remained at a stable level compared to the previous year at 25.7 TWh, which gave a net export of 12.5 TWh in 2022.

The share of power imports and exports varies both from year to year and between seasons.

Import, eksport og nettoeksport, 2000-2024

Updated: 03.04.2025
Source: NVE

The benefits of power trading

Power trading allows countries to derive mutual benefits from differences between the natural resources available, electricity production systems and consumption patterns. Trade between countries results in lower overall costs than if each country were to provide for its energy supplies alone.

Power trading is organised with the objective of ensuring that power always flows to where its value is greatest, i.e. from low-price areas to high-price areas. Trade between Norway's hydropower-based system and thermal power-based systems in continental Europe illustrates this. The Norwegian power system has a relatively flat daily price profile because it does not cost much to regulate production up and down. In thermal power systems, it is costly to regulate production, and there is wider variation in electricity prices during the course of a day. These differences mean that Norway can import electricity from abroad at night, when the price is lower, and export it during the day, when consumption and prices are higher.

Over the year, Norwegian electricity exports are normally highest in the summer, when reservoir inflow is high and Norwegian consumption is low. Imports are generally highest in winter when inflow is low, consumption is high and Norwegian electricity prices are high. Power trading thus moderates price rises in Norway in winter, and maintains higher summer prices. In the same way, power trading provides access to relatively low-cost power in dry years, and increases the value of Norwegian electricity in years when there is a surplus of power in the domestic market.

SECURITY OF ELECTRICITY SUPPLY

Security of supply means the ability of the power system to provide end users with an uninterrupted supply of electricity and a specified quality of supply, and includes energy security, adequacy and operational security.

Norway enjoys high security of electricity supply

Security of electricity supply is vital for a modern society, and requires a smoothly functioning power market. The market plays a key role in maintaining a constant balance between production and consumption. Both production-side and demand-side flexibility have a positive effect on security of supply, as do hydropower storage reservoirs and foreign trade in power. In addition, there must be a power grid with adequate transmission capacity.

ENERGY SECURITY IN THE POWER SYSTEM

Energy security in the power system

In this context, energy security is defined as the capacity of the power supply system to meet the demand for electricity. Energy shortages or energy insecurity can arise when electricity production is reduced because supplies of primary energy (water, gas, coal, etc.) are in short supply.

Hydropower accounts for most of the Norwegian power supplies, and the resource base for production depends on the precipitation in a given year. This is a significant difference for the rest of Europe where security of supply is mainly secured through thermal power plants, with fuels available in the energy markets.

By using storage reservoirs, flexible hydropower plants can produce electricity even in periods when there is little precipitation and inflow is low. The large storage capacity makes it possible to even out production over years, seasons, weeks and days, within the constraints set by the licence and the watercourse itself.

Norway has half of Europe's reservoir storage capacity, and more than 75 % of Norwegian production capacity is flexible

Norway has a sound power balance and high power trading capacity, and therefore enjoys high energy security in the power system. Nevertheless, low water inflow and events outside Norway can make the situation difficult at times.

Statnett is responsible for developing measures to deal with highly strained power situations energy situations. These are known as 'SAKS' measures, and their purpose is to reduce the likelihood of rationing.

The Energy Act includes rules on electricity rationing, including enforced reductions of supply and requisitioning. Rationing can be introduced if required by extraordinary circumstances. The Norwegian Water Resources and Energy Directorate is the rationing authority and is responsible for planning and administration of any measures needed in connection with electricity rationing. The Directorate has issued regulations relating to rationing.

ADEQUACY

Adequacy

Adequacy is defined as the capacity of the power supply system to meet the instantaneous load, and is measured by the installed production capacity or grid capacity available. Capacity shortages arise in specific hours when consumption is high, in contrast to energy shortages, which may last for several weeks.

Electricity consumption means the amount of electricity used over time; electricity consumption at a specific moment in time is called the load. The power balance shows the relationship between the electricity supply and consumption at a particular moment. Although the load fluctuates with temperature, it has also shown a rising trend in line with the general rise in electricity consumption. In 1990, the maximum load in the Norwegian system was 18.42 GW. On 12 February 2021, a new consumption record was registered, and the load reached 25 230 MW in the morning (09:00–10:00). Thus, the peak load has risen since 1990, and has risen more rapidly than electricity consumption. This trend is expected to continue.

The electricity grid is critical infrastructure, and interruptions in the power supply have serious consequences for end users

Satisfactory security of supply requires a power grid with adequate transmission capacity. To ensure that electricity supplies can be maintained in all circumstances, the grid system must be able to cope with both short- and long-term variability in production and consumption. It must be designed both to handle peaks in electricity consumption, which generally occur on the coldest days in cold years, and to allow for import of sufficient quantities of electricity for extended periods, for example in dry years.

To ensure security of supply, investments in the transmission grid are normally planned on the basis that a failure of one component in the system should not result in the interruption of supplies to end users (this is known as the N-1 criterion). However, this criterion is not a replacement for the cost-benefit analyses that are carried out when specific power lines are being planned. More information on how investments in the grid are planned can be found here.

OPERATIONAL SECURITY

Responsibility for system operation and operational security

Operational security means the capacity of the power supply system to withstand disturbances so that they do not lead to power outages or frequency or voltage deviations.

Operational security is concerned with avoiding interruptions to continuous operation of the power system right down to a time horizon of minutes and seconds. Faults in power lines, substations and control systems can affect operational security and result in service interruptions. There are various reasons why components of the system may fail, but weather-related incidents are an important reason for interruptions. You can read more about this below.

Statnett is Norway's transmission system operator (TSO), and coordinates the operation of the power supply system

Statnett is responsible for coordinating the operation of the power supply system, capacity calculation, dealing with congestion, and facilitating power trade with other countries. As TSO, it must also take steps to ensure that the power market is efficient and that the quality of supply is satisfactory. The continual process of balancing the electricity system is vital for operational reliability. If an imbalance arises, the TSO takes steps to restore the balance, for example by adjusting production or consumption.

Electricity cannot easily be stored, so production must equal consumption at all times. This is called the instantaneous balance in the electricity system. The power market is an essential tool for maintaining the balance between electricity supply and demand. Statnett uses the results of daily price determination in the day-ahead market as the basis for planning and maintaining the instantaneous balance in the following 24-hour period.

The TSO is responsible for maintaining the instantaneous balance between electricity production and consumption at all times

The system frequency is a measure of the instantaneous balance in the power system, and is the same throughout the Nordic synchronous area, which comprises Norway, Sweden, Finland and parts of Denmark. The nominal system frequency is 50 Hertz (Hz), with a normal range of 49.9–50.1 Hz. The common system frequency means that an imbalance anywhere the synchronous area will affect the whole area. In addition, one country's choices as regards grid investments, market solutions and operational security measures will affect the entire synchronous system. This makes it essential for the Nordic countries to cooperate closely.

Frequency quality can be measured using frequency deviations expressed as the number of minutes outside the normal variation range of 49.9–50.1 Hz. Frequency deviations can be caused by faults, imbalances related to changes in flow along interconnectors, or sudden changes in electricity production. To ensure that the instantaneous balance is maintained and prevent sudden changes or faults from causing frequency deviations or even power cuts, the TSO need to have reserves available. Reserves are often provided by flexible hydropower plants, where production can be regulated up or down to stabilise the system. To maintain operational security, TSOs must be able to access sufficient reserves through the balancing markets.

Statnett 50 Hz

Many problems that can arise in the power system as a whole can also affect distribution grids. As people use electricity for more and more purposes, vulnerability to power cuts and problems related to quality of supply are increasing. For example, appliances such as induction hobs that draw more power are becoming increasingly popular, and more electricity produced from intermittent sources is being fed into lower grid levels. These trends are making operation of the distribution grid more challenging.

Investments in the distribution grid and measures to prevent the interruptions are important for security of supply. New technological and market solutions can also make the power supply system more resilient in future. You can read more about technological developments in the power supply system here.

CONTINUITY OF SUPPLY AND INTERRUPTIONS

The continuity of the electricity supply is depends on both the frequency and the duration of interruptions in the supply. In Norway, continuity of supply is stable and very good, and is close to 99.99 % in years without extreme weather events. It has never dropped below 99.96 % in any year since 1996, see the figure below.

Extreme weather events affect continuity of supply. In the figure, this is particularly obvious in 2011, when a winter storm caused a great deal of disruption because the high winds brought trees down on power lines.

Continuity of supply is stable and very good in Norway, and is close to 99.99 % in years without extreme weather events

In 2017, end users experienced an average of 1.6 brief and 1,7 longer power cuts. Longer power cuts are defined as those lasting more than three minutes. Important causes of power cuts are thunderstorms (lightning), wind causing trees or other vegetation to fall over power lines, and snow/ice on power lines. Various steps can be taken to reduce weather-related disruption of this kind. Maintaining a cleared corridor along power lines in forested areas reduces the risk of trees falling over the lines. Using underground cables is another possibility, and this is now the first choice for new power lines in the distribution grid in Norway.

It is not possible to provide 100 % continuity of the electricity supply. This would require an unreasonable level of investment in infrastructure, and for the same reason, no legal requirements have been introduced to provide 100 % continuity. Customers who are dependent on uninterrupted supplies must therefore ensure that they have emergency back-up power such as generators. Thus, society's vulnerability to disruption of the power supply also depends on end user emergency preparedness.

EMERGENCY PREPAREDNESS IN THE POWER SECTOR

Norway has a well-organised emergency preparedness system for power supplies

Emergency preparedness in the power sector has become increasingly important as society grows more and more dependent on electricity. It is important both to take steps to prevent the disruption of supplies and to provide a rapid response if disruption does occur.

Requirements for the emergency preparedness system are set out in the Energy Act and the security and emergency planning regulations. There are rules on the resources that must be available for repairs, security measures, information security, protection of operational control systems and the Power Supply Preparedness Organisation.

The Power Supply Preparedness Organisation is responsible for restoring power supplies in an emergency. It is headed by the Norwegian Water Resources and Energy Directorate and also includes representatives of Statnett, grid companies, major electricity producers and larger district heating companies, and regional representatives of the power supply sector.

Adequate resources for repairs are essential for rapid restoration of power supplies in an emergency

Human life and health and critical infrastructure and services are the priorities when restoring power supplies. Power companies are required to have robust communication systems, for example independent systems that make it possible for them to communicate with each other even if there is no mobile phone signal. Each company has an independent responsibility for maintaining effective security and preparedness systems.

The Norwegian Water Resources and Energy Directorate the supervisory body and is responsible for raising awareness of the need for emergency preparedness in the sector and for offering advice and guidance, exercises/training and information.

REGULATION OF THE ENERGY SECTOR

THE LEGAL FRAMEWORK

This page provides an overview of Norway’s legal framework for the energy sector and water resources management. It has been important to develop a comprehensive legislative framework including requirements to obtain licences for various purposes. Official controls are required as part of the licensing system, and to ensure that the legal position and possible impacts of projects are assessed on a case-by-case basis.

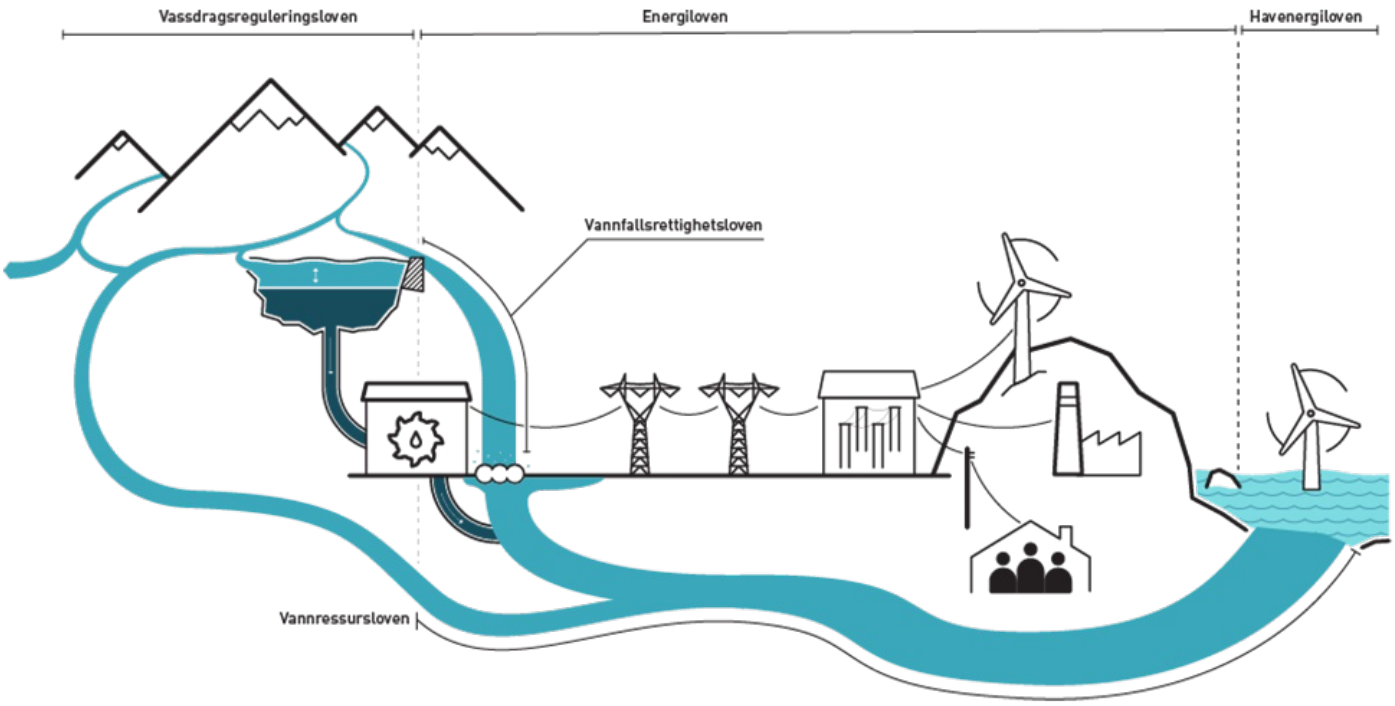
The overall objectives of the legislation

Developing infrastructure for electricity production and transmission or for district heating plants and distribution networks can result in conflicts between user and environmental interests during planning, construction or operation. Conflicts may also arise in connection with water resources management. There may be impacts on biodiversity, landscapes and outdoor recreation, fishing, tourism, the cultural heritage, local communities, reindeer husbandry and so on. In the legislation, these are often referred to generically as “public interests”. Energy and river system projects may also affect private economic interests.

Norway's legislation is intended to ensure that all the different interests are heard and considered, and that projects are subject to government control and conditions that safeguard different interests. Another important objective is to ensure effective management of our resources. Security of energy supply and a well-functioning power market are key considerations here.

Below you will find an overview of Norway's legal framework for the energy sector and water resources management

The legal framework



WATERFALL RIGHTS ACT

Before making use of water for electricity production, a developer must have ownership rights to the waterfall. A non-state developer must hold a licence under the Waterfall Rights Act in order to acquire such rights. The Act does not apply to small-scale power projects or run-of-river hydropower plants under the limit of 4000 natural horse powers. The overall purpose of the Waterfall Rights Act is to ensure that hydropower resources are managed in the country's best interests through public ownership of hydropower resources at national, county and municipal levels.

Under the current rules, licences may only be issued to public bodies, i.e. state-owned enterprises, municipalities and county authorities, and to companies where such bodies hold at least two-thirds of the capital and the votes in the company. This means that private actors may own up to one-third of a company that holds a licence under the Waterfall Rights Act. Licences issued under the Act include conditions on licence fees and obligatory sales of power to the municipalities where waterfalls are situated.

WATERCOURSE REGULATION ACT

To regulate flow in a river or transfer water between river systems for use in power generation above a certain threshold, a licence is required in accordance with the Watercourse Regulation Act. The Act also applies to run-of-river hydropower plants that generate more than 40 GWh per year. Licences set out the highest and lowest permitted water levels in reservoirs. Licences also include rules for reservoir drawdown, which may include provisions on the minimum permitted rate of flow and on the volumes of water that may be released at different times of year. In addition, licences may include conditions relating to licence fees and obligatory sales of power or conditions aiming to compensate or mitigate damage.

WATER RESOURCES ACT

In addition to hydropower projects, many other types of developments may take place in river systems. The Water Resources Act applies to all of these, not just to hydropower developments. Examples include the abstraction of water for fish farms and the extraction of deposits (sand, gravel, etc.). Small-scale power projects smaller than 10 MW are also regulated by the Water Resources Act. Licences may include various conditions to ensure compensation for damage or to mitigate damage. Small-scale developments that are not expected to cause significant damage or nuisance to public interests do not require a licence under this Act.

ENERGY ACT

The purpose of the 1990 Energy Act is to ensure that energy is generated, converted, transmitted, traded, distributed and used rationally and in the best interests of society. This includes taking into consideration any public and private interests that are affected. The Act provides a framework for competition in electricity generation and trading. The development and operation of the grid is a natural monopoly, and the Act provides the legal basis for regulating the grid companies. The Energy Act also regulates marketplaces for trade in electrical energy, cross-border interconnectors, district heating facilities, responsibility for system operation, electricity supply quality, energy planning and contingency planning for power supplies.

Developers must apply for licences under the Energy Act to construct wind and solar farms and high-voltage power lines. Distribution grid companies can obtain general local area licences. This means that they do not need to apply for a licence for each separate installation within an area.

OFFSHORE ENERGY ACT

The Offshore Energy Act provides the legal basis for offshore renewable energy production. The Norwegian state has the right to utilise offshore energy resources. The Act applies to Norway's territorial sea outside the baselines and to the continental shelf, however individual provisions are also applicable to internal waters. A licence is required for electricity generation, conversion and transmission in areas covered by the Act. Licences can only be obtained after the central government authorities have decided to open specific areas for licence applications and held an auction for interested parties/bidders. An area can only be opened after the authorities have carried out a strategic environmental assessment. However, the authorities may exempt pilot projects and similar projects with a limited time frame from these requirements.

ELECTRICITY CERTIFICATE ACT

The 2011 Electricity Certificate Act is intended to promote production of electricity from renewable energy sources up to 2020. It establishes a Norwegian market for electricity certificates, which was linked to the Swedish electricity certificate market from 1 January 2012. The electricity certificate market is a constructed market in the sense that the demand for certificates arises from a statutory obligation to purchase them. Sales of electricity certificates give power producers a supplementary income in addition to that derived from sales of electricity.

OTHER RELEVANT LEGISLATION

Other relevant legislation

Various other acts also have an important bearing on the management of energy and water resources. The Ministry of Energy and the Norwegian Water Resources and Energy Directorate are responsible for the natural gas legislation (Natural Gas Act). The acts listed below are administered by authorities in other sectors.

- Planning and Building Act
- Nature Diversity Act
- Expropriation Act
- Competition Act
- Consumer Purchases Act
- Pollution Control Act
- Neighbouring Properties Act
- Cultural Heritage Act
- Outdoor Recreation Act
- Reindeer Husbandry Act
- Public Administration Act

In addition to legislation administered by the Ministry of Energy, a number of other acts and regulations are important for the management of energy and water resources. The EU Water Framework Directive (2000/60/EC) has been implemented in Norwegian law through the Water Management Regulations, which were adopted under the Pollution Control Act, the Planning and Building Act and the Water Resources Act. The regulations include provisions on river basin management plans, which are intended to maintain and improve the ecological status of rivers and lakes and coastal waters.

Energy production and transmission infrastructure can have impacts on biodiversity, and developments must be assessed according to the principles set out in the Nature Diversity Act. This Act applies to all sectors during the exercise of public authority when the decisions being made may have environmental impacts. The Act is intended to ensure that Norwegian nature is protected through conservation and sustainable use, and that the environment can continue to provide a basis for human activity. The Act includes provisions on priority species, selected habitat types and area-based protection, which must be considered when developing energy production and transmission infrastructure.

The Planning and Building Act applies to a large extent in parallel with the energy and water resources legislation, but there are some important exceptions. Many of the provisions of the Planning and Building Act do not apply to the transmission grid, but an environmental impact assessment (EIA) is required in the usual way. The EIA regulations include specific provisions on projects that require licences. The Technical Regulations for buildings, also adopted under the Planning and Building Act, set out energy requirements for buildings.

A power project developer that does not have the necessary rights to establish and operate installations in a river system may apply for the expropriation of these property rights in accordance with the Expropriation Act. Where appropriate, the provisions of the Cultural Heritage Act, the Pollution Control Act and the Reindeer Husbandry Act must also be taken into consideration during the licensing process for energy projects and other projects in river systems. The Reindeer Husbandry Act is intended to maintain reindeer husbandry as an important basis for Sami culture, in accordance with the Norwegian Constitution and the provisions of international law on indigenous peoples and minorities.

The Public Administration Act sets out general provisions for administrative procedures in the public sector, including how cases should be prepared and how to deal with appeals against individual decisions. These rules apply in addition to the specific rules set out in the legislation on energy and river systems.

LICENSING PROCEDURES

Infrastructure for energy production and transmission must be licensed by the Norwegian authorities

THE LICENSING AUTHORITIES

The licensing authorities are responsible for processing licence applications and issuing licences. They include the Storting (Norwegian parliament), the Norwegian Government (formally the King in Council), the Ministry of Energy, the Norwegian Water Resources and Energy Directorate as well as municipalities. The text below describes licensing procedures for hydropower projects under the Watercourse Regulation Act and the Water Resources Act, and for electrical installations under the Energy Act.

LICENSING PROCEDURES UNDER THE WATER RESOURCES LEGISLATION

There are some differences between the licensing procedures for large- and small-scale hydropower projects. Small-scale projects are defined as power plants that require a licence under the Water Resources Act and have an installed capacity of less than 10 MW, but do not involve regulation of the rate of flow in a river exceeding the limit that triggers licensing requirements under the Watercourse Regulation Act. Large-scale projects are power plants that require a licence under the Water Resources Act and have an installed capacity greater than 10 MW, and projects that regulate the rate of flow in a river and require a licence under the Watercourse Regulation Act.

The Norwegian Water Resources and Energy Directorate has prepared guidelines (in Norwegian only) for the administrative procedures for a number of different types of installations in river systems. These include aquaculture facilities, the construction of small power plants, upgrades and renovation of existing power plants, construction in or across river systems, gravel pits and flood protection measures.

LARGE-SCALE HYDROPOWER PROJECTS

The King in Council formally awards licences for projects dealt with under the Watercourse Regulation Act and for projects with an installed capacity exceeding 10 MW that require a licence under the Water Resources Act. The Norwegian Water Resources and Energy Directorate is responsible for procedures during the application phase.

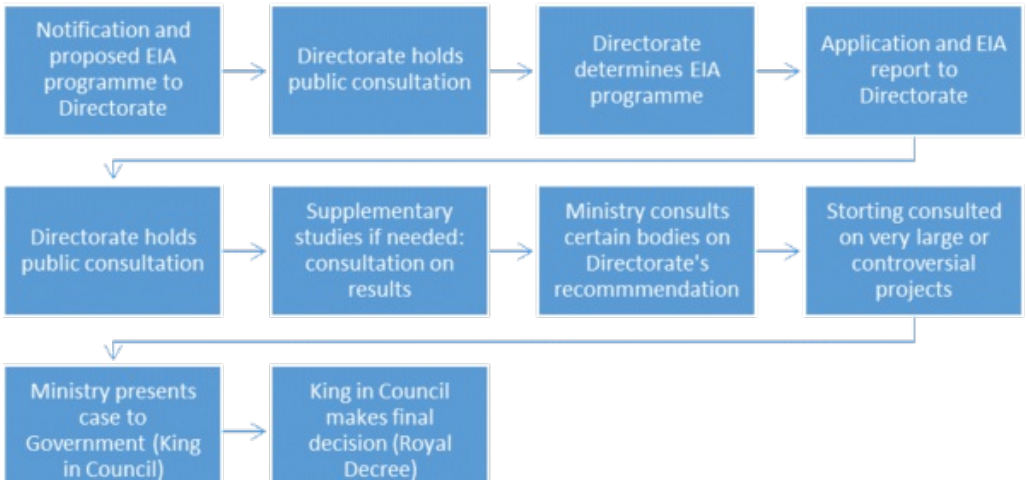
In addition, under Norway’s regulations on environmental impact assessment (EIA), an EIA is mandatory for power plants with an annual production exceeding 40 GWh. For other installations, an EIA is required if the project may have significant effects on the environment and society. Norway has two sets of regulations that implement EU rules on environmental impact assessment. Hydropower projects come under the Regulations relating to environmental impact assessment of projects under sectoral legislation (referred to as the EIA Regulations here).

If a project comes under Appendix II of the EIA Regulations, an EIA is not mandatory and the developer is not required to notify the authorities of the project. As a general rule, the ordinary licensing procedures under the Watercourse Regulation Act and the Water Resources Act are followed in such cases. If an EIA is found to be necessary, it must satisfy the requirements of Appendix IV of the EIA Regulations. The developer may be required to submit supplementary studies if the application does not provide sufficient information. The impacts of a project must be thoroughly described in the application even if no EIA is required under the Regulations.

If a project comes under Appendix I of the EIA Regulations, so that an EIA is mandatory, the Directorate will determine the final impact assessment programme after submitting it to the Ministry of Climate and Environment. The notification is made available for public inspection and local authorities and organisations are consulted on its contents. They also receive a copy of the final assessment programme for information purposes. Once an EIA is completed, the report is submitted together with the licence application.

Authorities, organisations and landowners that will be affected by the project are consulted on the application, and the EIA if one has been carried out. The Directorate makes an overall assessment of the project and submits a recommendation to the Ministry of Energy. The Ministry prepares the case for the Government (King in Council) and presents its recommendation. This is based on the application, the Directorate's recommendations, the views of affected ministries and local authorities and the Ministry's own assessments. The King in Council then makes a formal decision on the project in the form of a Royal Decree. If a project is particularly large (more than 20 000 natural horsepower) or controversial, the Storting is consulted and given an opportunity to debate the matter before a licence is formally awarded by the King in Council. The figure below illustrates the procedures.

Decisions to grant licences for major development projects cannot be appealed, as the licensing authority rests with the King in Council. Decisions to refuse licences are made by the Ministry of Energy and can be appealed to the King in Council.



Procedures for large-scale hydropower projects under the Water Resources Act and for river regulation projects under the Watercourse Regulation Act. (Directorate = Norwegian Water Resources and Energy Directorate; Ministry = Ministry of Energy).

SMALL-SCALE HYDROPOWER PROJECTS

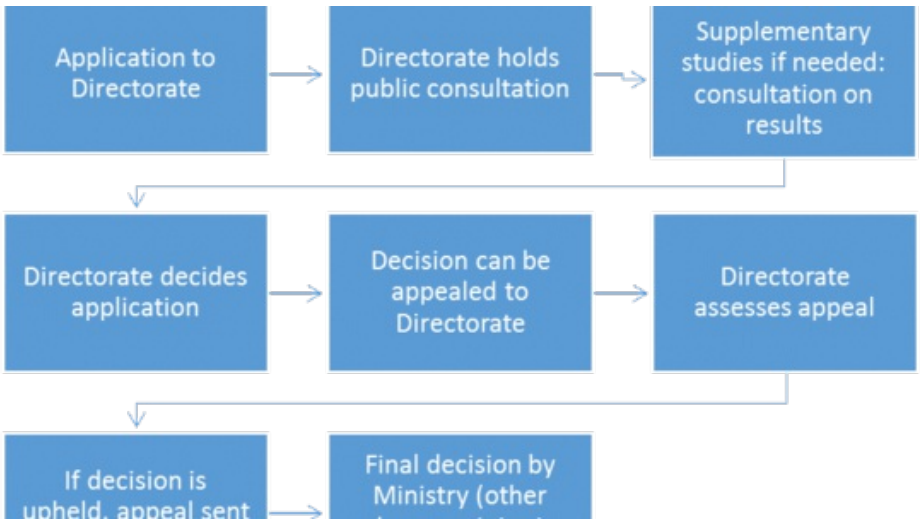
Licensing authority for small-scale hydropower projects has been delegated to the Directorate. Small-scale projects are defined as power plants that require a licence under the Water Resources Act and have an installed capacity of less than 10 MW, but do not involve regulation of the rate of flow in a river exceeding the limit that triggers licensing requirements under the Watercourse Regulation Act. The procedures are simpler than those for large-scale projects, which also means that they can be processed more quickly.

In June 2007, the Ministry published guidelines for small hydropower plants. They describe how to draw up regional plans for small hydropower plants and how to ensure comprehensive assessment of applications and make licensing procedures more efficient and predictable.

For power plants of between 1 and 10 MW, a study of biodiversity that may be affected by the development is required. Pursuant to the rules of the Planning and Building Act, public notice of the application is given in the local media, it is made available public inspection, and authorities, organisations and landowners that will be affected are consulted. After this, an on-site inspection of the area is held before a decision is made.

Decisions by the Directorate may be appealed. If the Directorate upholds its decision, the appeal is sent to the Ministry, which deals with it under the normal rules of the Public Administration Act. The Ministry's decision is final and cannot be appealed. The figure illustrates the procedures.

The municipalities are the licensing authority for power plants below 1 MW (mini and micro power plants), with the exception of projects in protected river systems. All applications for such power plants are therefore first sent to the Directorate to decide how the specific application is to be processed.



Procedures pursuant to the Water Resources Act for small-scale power projects (under 10 MW). (Directorate = Norwegian Water Resources and Energy. Ministry = Ministry of Energy)

LICENSING PROCEDURES UNDER THE ENERGY ACT

Licensing authority

The Energy Act requires anyone who builds, owns or operates an installation for the production, transformation, transmission or distribution of electrical energy to hold a licence. This means that in addition to holding a licence for building a power plant, the developer must also hold a licence for the electric components in the facility under the Energy Act.

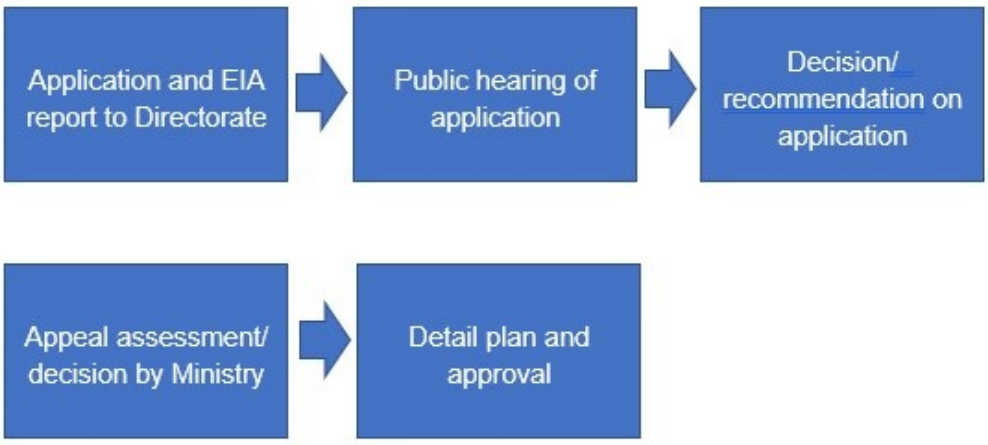
The Norwegian Water Resources and Energy Directorate is the licensing authority for electrical installations, except for new major power lines longer than 20 kilometres carrying a voltage of 300 kV or more, where the Government (King in Council) has the licensing authority. Before the King in Council makes a final decision, the Directorate will make a recommendation to The Ministry. Decisions made by the King in Council cannot be appealed. The Directorate's decisions may be appealed to the Ministry of Energy.

The Licensing Process

For smaller and simpler cases, The Directorate can put the licensing case on a "fast track". Fast track implies a quick process for handling well-prepared applications for projects that entail a minor or insignificant impact to public and private interests. For fast-track processing, the applicant must meet several requirements. These include consultations with relevant authorities and affected landowners and interest holders. The applicant must also complete an evaluation demonstrating that the potential damages are small, and a clarification with the owner adjacent grid infrastructure that the necessary capacity is available.

An applicant, for projects concerning 132 kV electrical power lines which is shorter than 15 km, does not have to send a notification before the application. See the figure above. The Directorate holds consultations and makes information available to stakeholders, and may also organise public meetings as part of the licensing procedure. The Directorate's licensing decisions can be appealed. If the Directorate upholds its decision, the appeal is sent to the Ministry of Energy, which handle the case in according to the Public Administration Act. If necessary, and a part of the process, the Ministry may inspect the site before it makes a decision. The Ministry's decision is final and cannot be appealed. Before the applicant can start the construction work, the Directorate shall approve a detailed plan for both the construction- and the operation phase.

All licence applications under the Energy Act require an environmental impact assessment (EIA) according to the EIA regulations. Projects that do not require a notification must still perform an EIA prior to the submission of the licence application. The EIA must be submitted together with the licence application.

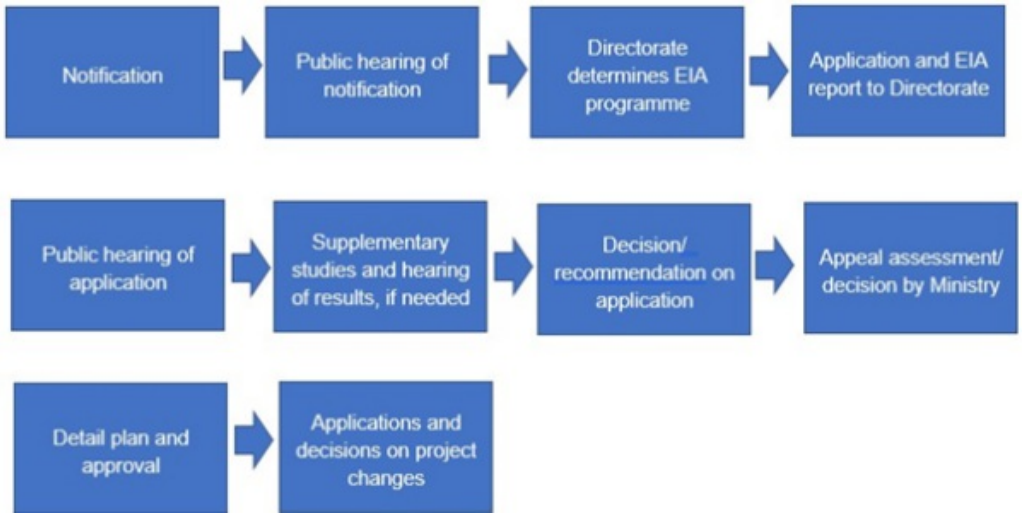


Simple licensing process that starts with an application.

LICENCE CASE THAT DEMANDS NOTIFICATION ACCORDING TO THE EIA-REGULATION

New power lines longer than 15 km and carrying a voltage of 132 kV or more are required to send the government a notification together with a proposed programme for the EIA prior to the application stage. The notification of the project shall describe the visual impact of the grid infrastructure, the affected area and the consequences regarding the environment and society. The notification document shall also describe relevant and realistic alternatives, and how these alternatives shall be considered in the EIA. The applicant needs to present a proposal for programme of the EIA that describes the possible investigations and possible methodology. These documents will be part of a public hearing by the Directorate. Based on the proposal for the EIA-programme and the received testimonies of the hearing, the Directorate will decide on a final programme for the EIA. Then the process of the EIA can start and finally a submission of the licence application.

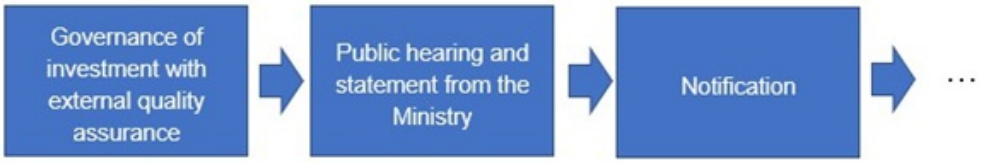
The Directorate will perform a public hearing of the application, inspect the area and hold public meetings. If Directorate's decision is appealed, the appeal will be handled by the Ministry, as described above. After a licence has been awarded, the Directorate must approve a detailed plan before any construction can start.



Source: Ministry of Energy

NEW MAJOR POWER LINES AND GOVERNANCE OF INVESTMENT PROJECTS

Major power line projects are also subject to Norway's rules for governance of investment projects. These rules were established in 2013. This involves a needs analysis and choice of concept, and external quality assurance to determine whether a project is viable. Full documentation of this procedure must be submitted to the Ministry, which decides whether a proposal can be submitted and the procedures described above can be started.



Source: Ministry of Energy

PROCESSING TIME

Many factors affect the time spent on processing licence applications, for example the conflict level and complexity of the individual project. Hydropower and energy projects generally have impacts on commerce and industry, local communities, the environment and other user interests. The licensing authorities are responsible for ensuring that a project has been thoroughly assessed and described before a decision is made. They must also consider the need for additional studies of various topics and supplementary statements on issues raised during the licensing procedures. It is important to ensure that licence applications are properly and thoroughly assessed, and that procedures are as efficient as possible.

REGULATION OF GRID OPERATIONS

The electricity grid is a natural monopoly, and is therefore subject to monopoly control.

REGULATION OF GRID OPERATIONS

Electricity production and trading, are exposed to competition, and the Norwegian Energy Act is based on the principle that power trading should be market-based. Electricity transmission and distribution, on the other hand, is a natural monopoly. The fixed costs of grid development are high, and it is not rational to construct several competing grids. The grid operations are therefore not subject to competition; instead they are subject to monopoly control.

The overall purpose of the monopoly control is to ensure that operation, utilisation and development of the grid is rational and in the best interests of society

The authorities have established extensive control of monopoly operations to prevent the grid companies from exploiting their position. A licence under the Energy Act is required in order to construct, own and operate grid assets. Grid operations are regulated using a combination of direct regulation (specific requirements and obligations in licences) and incentive-based regulation in the form of a revenue cap. The overall purpose is to ensure that the operation, utilisation and development of the grid is rational and in the best interests of society.

The purpose of direct regulation is to ensure the necessary level of investment in the grid as well as satisfactory maintenance and operation. Further, the direct regulation shall ensure that all who require it are given access to the grid, that there is sufficient grid capacity and a satisfactory quality of supply, and that the security of supply is maintained in demanding situations.

Within the regulatory framework, the grid companies have considerable freedom to decide how to meet the requirements. The revenue cap regulation is intended to give the grid companies incentives to find cost-effective ways of meeting the requirements. This is important because a regulated monopoly whose costs are automatically covered will not necessarily have incentives to operate cost-effectively.

The Norwegian Energy Regulatory Authority (NVE-RME) sets an annual revenue cap for each grid company. The cap is set at a level that permits grid companies to earn revenues that over time cover the costs of grid operation and depreciation of the grid, and at the same time gives a reasonable return on invested capital, given efficient grid operation, utilisation and development. The design of the revenue cap regulation is intended to provide the grid companies with an acceptable financial framework, and simultaneously ensure that the grid tariffs are set at reasonable levels.

Grid companies earn most of their revenue from the grid tariffs. The grid companies are obliged to set the tariffs such that net earnings from grid operations over time do not exceed the permitted level.

The revenue cap regulation also gives grid companies incentives to maintain an optimal level of reliability of supply. In the event of power supply interruptions, grid companies' permitted revenues are reduced by means of a quality-adjusted revenue cap for energy not supplied (known as the CENS/KILE scheme). Further, end users who experience power outages that last for more than 12 hours may claim compensation from the grid company.

In addition to the revenue cap and direct regulation, inspection and enforcement is of key importance. NVE-RME is the supervisory authority of grid operations, and may issue orders for compliance with regulations and licensing terms.

GRID TARIFFS

Grid customers pay point tariffs for the transmission and distribution of electricity. This means that the grid tariff is dependent on the location of the connection point. The tariffs are intended to cover a share of the costs that accrue at the relevant grid level as well as higher grid levels.

Customers pay a tariff to their local grid company and gain access to the entire power market

For consumers, this implies that the grid level to which one is connected affects the size of the tariff. Consumers connected directly to the transmission grid, pay a tariff based on the costs of operating the transmission grid. Therefore, they are charged less than customers connected to lower grid levels, who pay a share of the costs at the lower level as well as the transmission grid.

Electricity producers pay a fixed charge that does not depend on the grid level to which they are connected. In 2023 the transmission charge is capped at 1.2 EUR/MWh.

Distribution tariffs vary from one grid company to another. This is partly because the grid companies' conditions vary and influence the cost of distributing electricity to the customer. Difficult natural conditions and a scattered settlement pattern can often result in high transmission costs. There is also some variation in the efficiency of grid operations between companies.

Grid companies are responsible for setting their own tariffs, but the national authorities set the general principles for the tariff design. Over time, the grid companies' total tariff revenues must be within the permitted level set by NVE-RME. Grid tariffs must be objective and non-discriminatory, and they must be designed and differentiated based on relevant grid conditions. To the extent possible, tariffs should also be designed to provide long-term signals encouraging efficient utilisation and development of the grid.

Energy component

One fundamental principle of designing optimal tariffs is that grid users should pay a price that is equal to the short-term marginal cost incurred through their use of the grid. As electricity is transmitted through the grid, a proportion of it is lost. The size of the transmission losses depends on the total load on the grid. The marginal loss can be positive or negative, depending on whether changes in electricity fed into or tapped from the grid increase or decrease the energy loss.

The tariff energy component for customers connected to the transmission and regional distribusion grid, and for producers who feed electricity into the distribution grid, must be set on the basis of the marginal cost of transmission losses. The size of the energy component is the same for electricity fed into and tapped from the same connection point, but with the opposite sign. The energy component for customers who are supplied with electricity from the local distribution grid may also be used to cover a share of the fixed costs of grid operation. In practice, the energy component for the local distribution grid is therefore set higher than marginal cost of network losses. From 1 July 2026 the income from the energy component cannot exceed 50 percent of the grid company's total income from each customer group.

The energy component for the transmission grid is set using the marginal loss rates for each connection point multiplied by the area price set in the day-ahead market. The energy component shall be time-differentiated, with one daytime rate and one rate for nighttime and weekends. The marginal loss rates are limited by the TSO to +/- 15 % of the electricity price. The same limits are also used in calculating the energy component for customers of some regional distribution grids, and for feeding electricity into the distribution grid. Marginal loss rates are calculated and published in advance for one week at a time.

There is no requirement to calculate loss rates for each connection point in the distribution grid when calculating the energy component of the tariff. The loss rate is generally determined as the marginal loss in the nearest connection point with a higher grid level plus the average marginal loss for the area. The energy component is determined in advance, often for a year at a time.

Fixed component and capacity charge

Due to the cost structure of grid operations – high fixed costs and low costs associated with day-to-day use of the grid – revenue from the energy component, which is calculated on the basis of the marginal losses, is not sufficient to cover the fixed costs of grid operation. The grid companies can therefore use other tariff components to cover these costs and provide a fair return on grid investments.

All customers who are connected to the distribution grid pay a fixed charge. This component covers customer-specific costs in addition to a share of other fixed costs related to grid operation. The grid companies can divide customers into different categories which are offered different tariffs on the basis of relevant grid conditions.

The fixed component must be differentiated according to power, that is how much capacity a customer demands in the grid. Customers who need a high capacity pay a higher fixed fee than those who need less capacity. Most grid companies have a tiered fixed component, where customers are differentiated according to their peak load hours each month. Customers therefore have the opportunity to influence the level of their fixed fee by smoothing their electricity consumption.

Tariffs for business customers with an annual consumption above 100,000 kWh may also contain a capacity charge. Grid companies use different methods for determining the capacity used as a basis in the tariff. Some companies use the peak load in the course of each month, while others use the average of several measurements during the same period.

Investment contribution

In addition to the tariff components discussed above, a grid company may, subject to certain rules, require an investment contribution from new customers to cover the costs of their connection to the grid or from existing customers who demand reinforced or increased grid capacity. The purpose of the investment contribution is to make customers aware of the costs of expanding and upgrading the grid. Customers can weigh the need of grid access or reinforcement against the costs involved. In addition, the investment contribution is intended to separate the investment costs between the customer who triggers the investment, and the other grid customers. As a general rule, grid investments triggered by a particular customer's needs are to be paid by that customer.

TAXATION OF THE POWER SECTOR

The taxation system ensures that municipalities, counties and the state all receive revenue from the operation of power plants.

TAXATION OF HYDROPOWER

The profits of electricity production are taxed as **general income**, in the same way as the profits of other businesses. The tax rate for general income is 22 per cent in 2023. In addition, a **tax on resource rent** is levied on hydropower plants with generators rated at least 10 MVA. Hydropower production can often results in profits exceeding normal returns to capital. Through the tax, a proportion of the profits is returned to society as a whole. The effective rate of the resource rent tax is 45 per cent in 2023.

The resource rent tax returns a share of the profits from hydropower production to society as a whole.

The resource rent tax is designed as a neutral tax, so that projects that are profitable before resource rent tax, are also profitable after resource rent tax. Hydropower plants with generators below 10 MVA are exempted from resource rent tax. The resource rent tax is calculated based on standardised market value of the power generated (actual power generated multiplied by spot market prices), less operating expenses, licence fees, property tax. As of 2021 the resource rent tax is designed as a cash flow tax, with immediate recognition of expenditures of investments. Investments prior to 2021 are still subject to deduction through depreciation and uplift (return on investment). The uplift is used to compensate for investments prior to 2021 that are depreciated and will not be deducted immediately.

The resource rent can be positive, negative or zero. The resource rent is coordinated for companies who own several hydropower plants, which means that any negative resource rent in one hydropower plant is subtracted from positive resource rent from another hydropower plant. The resource rent tax is unlike other taxes in that tax value is paid out to companies if the resource rent is negative.

Corporate tax is calculated before resource rent tax on hydropower, and resource rent-related corporate tax is deducted from the basis for resource rent tax. An effective resource rent tax rate of 45 per cent means that the formal resource rent tax rate is 57.7 per cent.

A **natural resource tax** of NOK 0.013 per kWh, paid to the municipalities and counties, is also levied on power plants rated at more than 10 MVA. Natural resource tax is deductible against the assessed tax on general income.

In addition, power producers normally pay **property tax** to the municipalities where their plants are situated. The property tax base is calculated according to specific rules for hydropower plants. The taxable value of a hydropower plant larger than 10 MVA is based on the plant's market value by estimation of an indefinite net present value calculation. However, the property tax base must be between a minimum of NOK 0.95 per kWh and a maximum of NOK 2.74 per kWh of the average production over a seven-year period at the plant in question. If a hydropower plant has been in operation for less than seven years, the period during which it has been operating is used as a basis. The property tax is deductible when calculating the economic rent. For hydropower plants smaller than 10 MVA, the property tax is calculated on the basis of the value of the investments.

Hydropower companies must also pay a licence fee and meet requirements for obligatory sales of power to the municipalities where their plants are situated, for more details see below.

LICENCE FEES

Owners of large hydropower plants are required to pay a licence fee to the state and to the municipalities affected by the hydropower developments. The size of the fee depends on the theoretical capacity of the power plant and is calculated independently of the actual production capacity. The theoretical capacity is expressed in natural horsepower and calculated from the rate of flow after regulation and the head of water. The normal fee rates are NOK 24 per natural horsepower to the municipality and NOK 8 to the state for new licences but vary considerably for older licences. The fee rates are normally adjusted at regular intervals. In 2022, the municipalities and the state received about NOK 900 million in licence fees.

OBLIGATORY SALES OF POWER

Owners of large hydropower plants are required to deliver power corresponding to up to 10 per cent of the theoretical capacity to the municipalities affected by the hydropower developments. The purpose of this arrangement is to ensure that municipalities where there are large-scale hydropower developments obtain electricity for general consumption at a reasonable price. If a municipality is entitled to more electricity than is used for general consumption, the county is entitled to buy the surplus. The parties are free to agree on the price of power sold through these arrangements. Unless otherwise agreed, the price is as a general principle based on production costs. For licences awarded after 10 April 1959, the Ministry of Energy calculates a price based on the average production costs for a representative selection of power plants. In 2023, this price is NOK 0.1177 per kWh.

Counties and municipalities receive about 8.8 TWh of electricity through these arrangements every year, about one-third of which currently goes to the counties. The difference between the price of electricity sold through these arrangements and the normal market price is a source of revenue for the municipalities and counties.

TAXATION OF ONSHORE WIND ENERGY

The profits of electricity production are taxed as **general income**, in the same way as the profits of other businesses. The tax rate for general income is 22 per cent in 2023. A linear five-year depreciation rules were introduced in 2015. The rule applied to fixed assets acquired up to the end of the approval period for plants under the electricity certificate scheme, i.e. up to and including 31. December 2021.

Wind farms can be subjected to property tax by the municipality. Valuation of wind farms are set equal to technical value, equivalent to replacement costs less deduction of wear and tear and untimeliness. The wind farms can also be valued by return value if this reflects the valuation better. A production fee on onshore wind power was introduced as of July 1st 2022. As of 2023 this fee is NOK 0,02 per kWh. The fee is fiscal and paid directly to the state, but the income is redirected back to the municipalities through NVE.

PROPERTY TAX OF ELECTRICITY GRID

Valuation of grid assets is based on the legislation on municipal property tax. This means that the objective sales value must be used, and the valuation must be carried out by the municipalities. The valuation is based on the replacement value of the assets.

THE EEA AGREEMENT AND NORWAY'S COOPERATION WITH THE EU ON ENERGY

Norway has a close cooperation with the EU on energy. Norway is a key energy partner for the EU and a major supplier of oil, gas and electricity. Through the EEA Agreement, Norway is part of the EU’s internal energy market.

THE EEA AGREEMENT

The EU’s energy policy framework aims to ensure a sustainable, competitive, and secure energy supply. Since the EEA Agreement came into force in 1994, the EU’s regulatory framework for the internal energy market has evolved, becoming more comprehensive over time.

The framework directly affects Norwegian stakeholders through the EEA Agreement and indirectly impacts the European energy market – Norway's primary export market for oil, gas, and electricity. Stable and predictable conditions are crucial for Norwegian energy producers. Therefore, monitoring the development of new directives, regulations, and decisions related to energy within the EU is of great importance for Norway.

The initial legislative packages from the EU concerning electricity and natural gas regulation primarily focused on opening national markets and applying competition policies to the energy sector. When negotiating the EEA Agreement in the early 1990s, nine legal acts (regulations and directives) related to energy were incorporated into the agreement. Article 24 of the EEA Agreement, located in the section on free movement of goods, specifically mentions energy. Directives and regulations related to energy are included in Annex IV of the EEA Agreement.

EU energy policy extends beyond the scope covered by the EEA Agreement. The Lisbon Treaty of 2009 introduced a dedicated provision on energy (Article 194). This article outlines objectives related to the functioning of the energy market, energy security, energy efficiency, renewable energy, and infrastructure. It also emphasizes that member states have the right to determine the national management of their energy resources and the national energy mix independently.

In 2015, the European Union's Energy Union was launched by the European Commission. It can be described as a political framework for the goals and measures in the EU's energy policy. The legal acts were framed as parts of the Clean Energy Package and adopted in 2018-2019. The Energy Union focuses on five areas, also known as dimensions: energy security, the internal energy market, demand-side management, decarbonization, and research, innovation, and development. Since then, regulations have been modified in the "Fit for 55" package and some internal energy market modifications.

The EU has set goals for emission reductions, increased use of renewable energy, and energy efficiency by 2030. In 2021, the EU legally committed to cutting at least 55% of its net greenhouse gas emissions by 2030 compared to 1990 levels. Later that year, the European Commission proposed a series of laws to help the EU achieve this target. This package is known as “Fit for 55.” Several measures in the package relate to the energy sector. For instance, the EU aims to increase the share of renewable energy by 2030 and ensure that most of the EU’s energy consumption is renewable by 2050. After Russia’s attack on Ukraine in February 2022, new initiatives were proposed to promote the green transition and reduce the EU member states’ dependence on gas imports, under the name REPowerEU.

Under the EEA Agreement, directives and regulations must be incorporated through separate decisions in the EEA Committee to apply to the EFTA countries. In this context, specific EFTA adaptations may be necessary.

Currently, Annex IV of the EEA Agreement covers over 80 legal acts related to energy. Several legal acts are still being considered for inclusion in the EEA Agreement. EU energy regulations are continually updated in response to the energy situation and policy objectives. Therefore, closely monitoring the regulatory developments in the EU is of importance and in the interest of EEA EFTA states.

As part of the EEA Agreement, Norway has implemented three of the EU’s energy market packages. The third package, introduced in 2009, further develops the internal market for electricity and gas. It was incorporated into the EEA Agreement in 2017. Subsequently, the regulatory framework was modified through the Clean Energy Package, adopted by the EU in 2018 and 2019. This package comprises eight different legal acts, including a revised Renewable Energy Directive and changes to the Energy Performance of Buildings Directive and the Energy Efficiency Directive. In 2020, the new Commission proposed the “Fit for 55” package with important revisions in the Clean Energy Package from 2018-2019.

The legal acts concerning the electricity market were replaced by a new Electricity Directive, a new Electricity Regulation, and a new ACER Regulation. As of February 2024, this regulatory framework has not yet been incorporated into the EFTA Agreement. These energy market revisions must also be submitted to the Norwegian Parliament (Stortinget) for consideration.

The EEA Agreement has provided Norwegian stakeholders with opportunities to participate in various research and cooperation programs. Norway is involved in energy programs such as Intelligent Energy Europe (IEE) and the Competitiveness and Innovation Framework Programme (CIP). Additionally, Norway has engaged in research-based collaboration through Horizon Europe.

Under the EEA Agreement, Norway has the right to participate in the decision-making process at an early stage. Our experts are involved in discussions on new regulations and initiatives within expert groups under the European Commission. The Norwegian Energy Regulatory Authority also participates in the Agency for the Cooperation of Energy Regulators (ACER). The early involvement in decision shaping is crucial for the EEA EFTA experts and government representatives.

When incorporating EU directives and regulations into the EEA Agreement, there is some flexibility for EEA adaptations to individual legal acts. For instance, when the EU's Third Energy Package was integrated into the EEA Agreement, several such adaptations were made. It is common for proposals regarding necessary EEA adaptations to be developed in collaboration among the three EEA member states Norway, Iceland, and Liechtenstein, and discussed with the EU.

HOW DO WE HANDLE EEA MATTERS IN NORWAY?

The EEA Agreement extends the Single Market of the European Union to three of the four EFTA member states – Iceland, Liechtenstein and Norway. The fourth member of EFTA, Switzerland, is not a party to the EEA Agreement.

The EFTA Secretariat reviews regulatory proposals adopted by the EU on a weekly basis. Proposals that fall within the scope of the EEA Agreement are sent to the EFTA member states for assessment.

In Norway, the Government's Guidelines for Impact Assessments outline the framework for further processing of regulatory proposals from the European Commission. If a proposal is deemed to have significant implications for Norway, the relevant ministry must send it out for public consultation. An EEA memorandum is prepared for all legal acts under consideration for incorporation into the EEA Agreement. The relevant ministry evaluates whether the act is relevant to the EEA. Affected ministries must be involved. Important matters related to the EEA must also be discussed within the government. If a regulatory proposal is expected to have substantial benefits or costs, a socioeconomic analysis is conducted.

After the European Commission's proposal has been adopted by the European Council and the European Parliament, collaboration with other EFTA countries and the EU is necessary to reach consensus on an EEA Joint Committee decision. If the decision is applicable to Norway, it may be relevant to request specific adaptations to EU regulations. Both the EFTA countries and the EU must agree to such adaptations, as stipulated in Article 93 of the EEA Agreement. Once an EEA Joint Committee decision is made, EU regulations become part of the cooperation under the EEA Agreement and are binding for EEA EFTA states.

According to Article 26, paragraph 2 of the Norwegian Constitution, the parliament must give consent for international agreements of particular importance, as well as agreements requiring legislative changes or other decisions by the parliament. A decision by the EEA Joint Committee to incorporate legal acts (both directives and regulations) into the EEA Agreement may fall into this category, necessitating constitutional reservations. In such cases, a consent proposal must be submitted to parliament before the decision takes effect, as outlined in Article 103 of the EEA Agreement.

In such cases, a consent proposal must be prepared and submitted to parliament. During the process, it may also be relevant to keep the parliament informed about work related to EU regulations intended for incorporation into the EEA Agreement, through the parliament's European Consultative Committee.

Once the EEA Joint Committee decision comes into effect, Norwegian law must be aligned with both EU regulations and the EEA Joint Committee decision. Necessary changes to existing regulations must be identified, and a consultation memorandum must be drafted. Then, regulations and possible legislative amendments must be adopted.

ELECTRICITY CERTIFICATES

The joint Norwegian-Swedish electricity certificate scheme is a support scheme for renewable electricity production in both countries. The electricity certificate scheme started up in 2012, and will be terminated in 2035. The deadline for commissioning new production facilities covered by the electricity certificate scheme expired in December 2021.

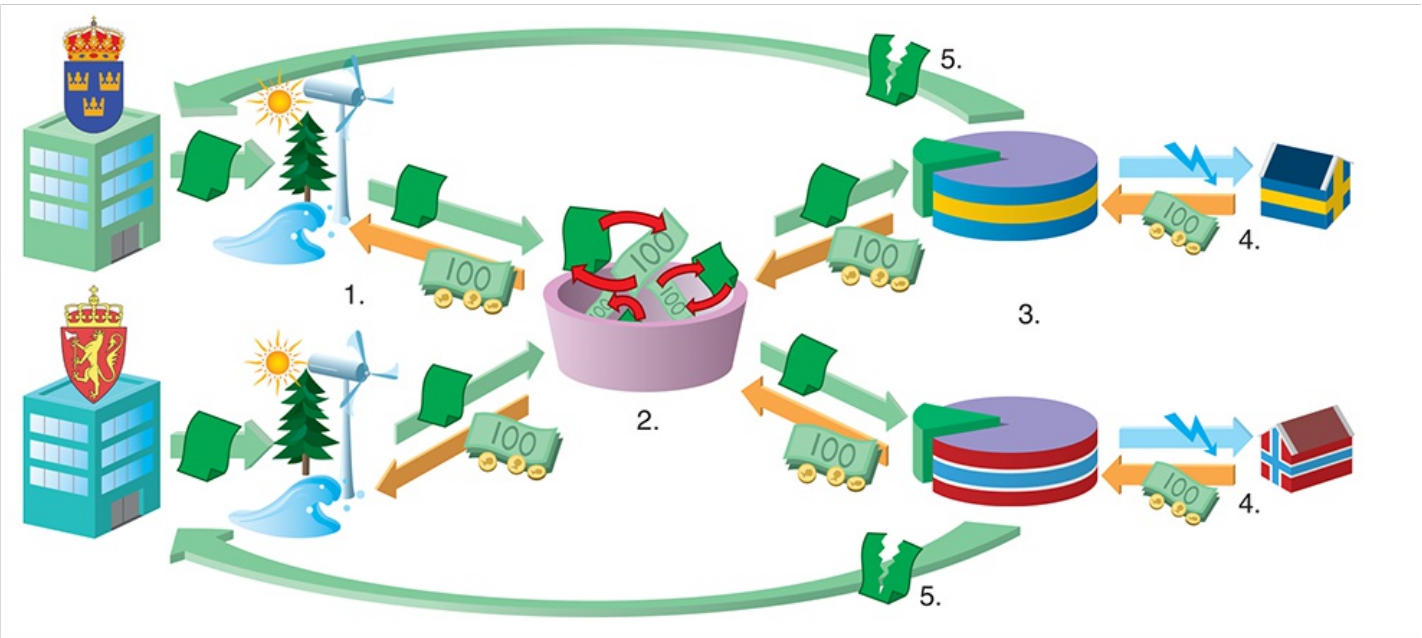
The electricity certificate market

The electricity certificate scheme started up in 2012. Norway and Sweden had a common goal of increasing electricity production based on renewable energy sources by 28.4 TWh by 2020. This goal was reached in 2019.

The electricity certificate scheme will be terminated in Norway in 2035. Power producers receive one electricity certificate for every MWh they produce, for a maximum of 15 years. The deadline for commissioning new production facilities covered by the electricity certificate scheme expired in December 2021. This means that no more production facilities will be approved for the electricity certificate scheme.

The electricity certificate market

Source: Norwegian Water Resources and Energy Directorate



This is how the electricity certificate market works

1. The power producers receive one electricity certificate for every MWh they produce, over a maximum of 15 years.
2. The electricity certificates are sold in a market where supply and demand determine the price. In this way, the producer gets and extra income in addition to the power price.
3. The demand for electricity certificates arises from the fact that power suppliers and certain electricity customers are required by law to purchase electricity certificates corresponding to a certain proportion of calculation-relevant electricity consumption.
4. The electricity customer pays for the development of renewable power production because the electricity certificate costs are included in the electricity bill.
5. Every year, the electricity certificate holder must cancel electricity certificates in order to fulfill his electricity certificate obligation.

The electricity certificate scheme is a market-based support scheme. In this system, producers of renewable electricity receive one certificate per MWh of electricity they produce for a period of up to 15 years. The electricity certificate scheme is technology-neutral, meaning that all forms of renewable electricity production qualify for electricity certificates, including hydropower, wind power and bioenergy.

The Norwegian Electricity Certificate Act

The purpose of the Electricity Certificate Act is to promote increased production of electricity from renewable sources.

An electricity certificate is confirmation issued by the state that one megawatt hour (MWh) of electricity has been generated from renewable sources in accordance with the legislation. The owners of production plants are entitled to receive electricity certificates for their production provided that they generate electricity from renewable sources (a technology-neutral requirement), are approved by the Norwegian Water Resources and Energy Directorate, and comply with metering and reporting requirements. Both an increase in production as a result of the expansion of existing production plants and production from new plants may qualify for electricity certificates.

Renewable production facilities that started construction after 7 September 2009, and hydropower plants where construction started after 1 January 2004, are qualified to receive electricity certificates. Facilities that permanently increase their production as a result of construction begun after 7 September 2009 are also entitled to electricity certificates for the increase in production. Norwegian facilities must be in operation by 31 December 2021 to be entitled to receive electricity certificates.

Electricity suppliers and some categories of end users have an obligation to purchase electricity certificates corresponding to a proportion of their consumption (quota obligation). Producers that are qualified to receive electricity certificates must apply to the Norwegian Water Resources and Energy Directorate, which is the administrative and supervisory authority, for approval of their facilities. In addition, the company or an account manager authorised by the company must apply to have an account opened in the electronic registry.

Statnett maintains the Norwegian registry, and is responsible for issuing and cancelling electricity certificates. Certificates are issued retrospectively on the basis of actual metered production. Statnett registers certificates in the appropriate electronic account. The scheme will be terminated on 1 April 2036, when electricity certificates for 2035 are cancelled.

Further rules for the electricity certificate scheme in Norway are set out in the Regulations relating to electricity certificates.

All electricity suppliers and certain categories of end-users are required to purchase electricity certificates for a specific percentage of their electricity consumption (their quota). This percentage was gradually increased each year until 2020. The percentage will be gradually reduced until 2035.

The quota obligations imposed by the Norwegian and Swedish governments create a demand for electricity certificates, so that they acquire a value. Thus, the authorities decide how many certificates must be purchased, but the market determines their price. Producers of renewable electricity gain an income from the sale of electricity certificates, in addition to their earnings from electricity sales. The income from the electricity certificates is intended to make the development of new electricity production based on renewable energy sources more profitable. End-users contribute to this through their electricity bills. In Norway, the framework for the scheme is governed by the Electricity Certificate Act.

The electricity certificate market is based on a bilateral agreement between Norway and Sweden. The two countries are making use of a cooperation mechanism under the EU Renewable Energy Directive (2009/28/EC). .The establishment of the joint Norwegian-Swedish market was contingent on the possibility of meeting a quota obligation in Sweden by purchasing Norwegian electricity certificates, and vice versa.

ABOUT THE NORWEGIAN ENERGY SECTOR

MAIN ELEMENTS OF NORWEGIAN ENERGY POLICY

The aim of Norwegian energy policy is to provide a suitable framework for maintaining an efficient, climate-friendly and reliable energy supply system.

Norway has competitive advantages in its abundant renewable energy resources and a well-functioning energy sector. Our energy policy is intended to encourage modernisation of the energy supply system and adapt policy instruments and the regulatory framework to rapidly changing markets.

The question of how to develop an energy supply system that is sustainable in the long term is a key policy issue in many countries. Security of energy supply, climate change, environmental considerations and value creation must all be taken properly into account in energy policy development. It is vital to find solutions that create the maximum value for society at the lowest possible cost.

Fire prioriterte hovedområder for norsk energipolitikk

1. Improving security of supply
2. Profitable development of renewable energy
3. More efficient and climate-friendly energy use
4. Value creation based on Norway's renewable energy resources

Improving security of supply

A smoothly functioning power market is of crucial importance for security of electricity supply. In Norway, security of supply is closely linked to the capacity of the supply system to ensure an uninterrupted supply of electricity to end users. The power supply system must be able to deal with variations in electricity consumption through the day, through the year and between years. We depend on a robust power grid. All important societal functions, business and industry and consumers are dependent on reliable power supplies. It is therefore vital to maintain and expand the grid to meet the challenges of the future. Major investments are currently being made in the power grid, and will improve security of supply.

Both production-side and demand-side flexibility have a positive effect on security of supply. Price signals play a decisive role in determining which elements of short-term flexibility are actually used. Operation of the power supply system and power trading should as far as possible be market-based. Effective markets send the right price signals to producers and consumers, and promote sound use of resources, innovation and security of supply.

Security of energy supply is vital in modern society. Norway has abundant energy supplies, but also needs to find good ways of responding to the growing demand for power. Regulation by the authorities is intended to facilitate the development of new, effective solutions that will ensure security of energy supply in the future.

Profitable development of renewable energy

One goal of Norwegian energy policy is to facilitate profitable production of renewable energy in Norway. Renewable production should be developed on the basis of profitability, allowing Norway's renewable energy resources to be used in a way that creates the maximum value for society at the lowest possible cost.

Norway produces a large amount of flexible hydropower, which will continue to be the backbone of its energy supply system. Hydropower production is also important in the context of climate change in Europe, and hydropower production makes it possible to maintain security of supply in the Norwegian and Nordic electricity systems.

More efficient and climate-friendly energy use

Norway already derives a large share of its energy supplies from renewable sources. The electricity generation sector is virtually emission-free. However, fossil energy use in transport, manufacturing and oil and gas production still results in greenhouse gas emissions. Our energy policy is intended to facilitate more efficient and climate-friendly energy use.

Value creation based on Norway's renewable energy resources

Renewable energy is an important sector in Norway. The industry employed about 20 000 people in 2021 throughout the country, including employment in grid operations. Renewable energy supplies are essential for the development and growth of other industries. Hydropower has been the basis for Norway's industrial development and prosperity for more than 100 years. The renewable energy industry will continue to play a key role as the transition to more climate-friendly energy use continues in Norway and the rest of Europe.

Norway’s energy policy is intended to provide a framework that enables the country to further develop its renewable energy resources and make use of its competitive advantages. This includes ensuring that there are well-functioning markets, so that profitable renewable resources can be used efficiently and provide a good basis for business development and value creation. Flexible hydropower production, the widespread use of electricity for many purposes and Norway’s pioneering role in market reform in the power sector are competitive advantages in a European energy market that is undergoing transformation.

The availability of abundant supplies of renewable electricity was the basis for Norway’s large energy-intensive sector. This is a good starting point for developing new markets for energy services, new technology and new energy-intensive products. Norway must continue to use its power, and to use it as efficiently as possible.

OWNERSHIP IN THE ENERGY SECTOR

Municipal, county and central authorities own about 80% of Norway’s electricity production capacity.

Norwegian municipalities and counties have large investments in the power sector. Together with central authorities, they own about 80% of Norway’s electricity production capacity. About 35% of the production capacity is owned by the state through Statkraft SF, which answers to the Ministry of Trade, Industry and Fisheries. Statkraft is organised as a state-owned enterprise, and the Norwegian state must therefore be the sole owner. Many other companies have several owners, and there is a significant level of cross-ownership in the electricity sector.

Grid operations and production

The state owns the transmission grid. State ownership of the grid is managed through Statnett SF.

About 85 companies carry out grid activities at one or more levels, but not all of them are connected to customers. Most grid companies are wholly or partly owned by one or more municipalities.

In all, there are 420 electricity production companies in Norway, and 305 of them are solely producers. The ten largest companies account for about 75% of total production capacity in the Norwegian hydropower system.

One characteristic of the Norwegian hydropower sector has been the right of reversion to the state for licences granted to private companies after 1917. The right of reversion means that the state assumes ownership of waterfalls and any hydropower installations free of charge when a licence expires. As the date of reversion stated in the licences approaches, private power plants will either be sold to publicly-owned companies or ownership will revert to the state on the specified date. This system has resulted in gradual restructuring of the ownership of Norwegian power production and is continuing to do so.

In 2008, the water resources legislation was amended to strengthen public ownership of Norway's hydropower resources. New licences for the ownership of waterfalls and licences to transfer already licensed waterfalls may now only be granted to public developers such as state-owned enterprises, municipalities and county authorities. Licences may also be awarded to companies that are partly owned by state-owned enterprises or one or more municipalities or county authorities, provided that the public sector holds at least two-thirds of the capital and the votes in the company, and the organisation clearly indicates genuine public ownership. In other words, private actors may own up to one-third of a company. Private actors may also own power production facilities that do not require a licence under the Industrial Licensing Act, such as wind and solar power installations and some small-scale hydropower installations.

There are private ownership interests in all parts of the power sector: production, grid operations and trading. Foreign ownership interests are relatively limited, but increasing. Some foreign companies have been granted trading licences in Norway and there is a growing number of foreign stakeholders that have invested in Norwegian wind and small-scale power production.

ENERGY USE IN NORWAY

FACTORS THAT INFLUENCE ENERGY USE

There are various factors that influence energy use in Norway. Variations in energy use from year to year are often related to fluctuations in weather conditions and in the prices of energy and energy-intensive goods and services. Longer-term trends are related to population growth and other demographic factors, and to the rate of economic growth and structural changes in the economy.

POPULATION

Population growth influences energy use both directly and indirectly. As the population rises, so will total household demand for energy services – for transport, heating and electrical equipment. A larger population means a larger labour force and higher production of goods and services. This creates a growing demand for offices, shops, supermarkets, cafés and production plants, which in turn increases energy demand. More people also need more schools, child daycare centres and health services, all of which use energy for heating and to run equipment.

Population structure and population distribution also influence energy use. Urbanisation is expected to continue, with more and more people living in towns. Urbanisation tends to mean that more people live in flats, where each person generally has less living space and therefore uses less energy for heating. Centralisation also reduces energy needs for transport, because travel distances are shorter and people can use public transport more extensively or walk or cycle to their destinations. Compact towns generally have a less energy-intensive industrial structure and more service industries.

ECONOMIC GROWTH

Economic growth results in greater demand for goods and services. This in turn increases energy demand, both for the production of goods and services and for transport of people and goods. Although economic growth, population trends and energy demand have become less closely linked in recent years, the level of activity in the Norwegian economy will continue to have a strong influence on trends in energy demand.

INDUSTRIAL STRUCTURE

The Norwegian economy consists of a large number of sectors and industries, and their energy use varies considerably. For example, manufacturing industries are generally more energy-intensive than service industries. Changes in industrial structure therefore influence energy use in Norway. Energy use will therefore rise more slowly than would be expected if more energy-intensive industries were growing.

TECHNOLOGICAL ADVANCES

The effects of technological advances on energy use are complex. New technology is often more efficient, which tends to moderate any increase in energy use; on the other hand, energy use may increase as new machinery and equipment is introduced. For the economy as a whole, technological advances act as a stimulus for growth. Technological developments are the most important driver of growth in productivity, which in turn is a key driver of economic growth, which brings with it more energy use. Technological advances also shift production towards capital-intensive industries, and these are generally also relatively energy-intensive. Thus, the overall effect of technological advances is to increase energy use, even if the energy is used more efficiently.

ENERGY PRICES

Energy prices influence both the energy mix and overall energy use. If the price of one energy carrier rises, this may both reduce its consumption and increase demand for other energy carriers. In the short term, however, the technology available limits how much consumption can be reduced and whether it is possible to switch to another energy carrier. Relatively large price changes that are maintained over time are needed to make it financially worthwhile to reduce energy use or switch energy carriers. People do not immediately replace inefficient fridges or install heat pumps when electricity prices rise.

In isolation, rising energy costs tend to result in lower demand and lower production of goods and services. Energy-intensive sectors become less profitable, and less energy-intensive sectors such as services become relatively more profitable. In the long term, higher energy prices may therefore result in a less energy-intensive industrial structure and reduce overall energy demand.

ENERGY USE BY SECTOR

A large proportion of the energy used in Norway comes from electricity. Much of it is used in energy-intensive industries. Electricity is also a common source for heating buildings and tap water.

In 2022, the net domestic consumption of energy in Norway was 219 TWh. Electricity covers a large proportion of the consumption. Norway has a significant energy-intensive industry that uses a lot of electricity. Electricity is also common for heating buildings and tap water buildings.

In the transport sector energy use is mainly based on fossil fuels. However, the use of electricity is increasing, and significant growth is expected in the coming years due to the electrification of vehicles and ferries. Read more about factors that influence energy use here.

In the mainland economy electricity is the dominant energy carrier, followed by fossil fuels. This is especially true in the industrial sector (excluding the oil and gas sector), households, and service industries.

MANUFACTURING

In 2022 the energy use in the industry was 75 TWh, excluding the oil and gas sector. Norway has much power-intensive industry, largely due to a long history of having access to power at competitive prices. The industrial sector is characterized by many large actors with high energy use. The dominant industries are chemicals, metal, and wood processing.

Energy use in the sector covers cooling and heating, industrial processes, and operation of electrical equipment. The high proportion of electricity use is largely due to aluminium production. This process is energy-intensive and uses almost exclusively electricity as energy source. Production of other metals, chemical raw materials, and cement involves a greater share of fossil fuels. The wood processing industry uses some biomass in addition to electricity.

HOUSEHOLD AND SERVICE INDUSTRIES

In 2022 the consumption in households was 45 TWh. Electricity is the dominant source of energy, followed by biofuels and district heating. Due to a ban on oil heating introduced in 2020, fossil energy sources such as oil and paraffin are no longer used for heating in households. More than 75 percent of the energy consumtion in households is used for heating rooms and tap water.

In Norway, electricity covers much of the heating of buildings. In other European countries, energy sources such as bioenergy, district heating, and fossil fuels are more common. The high share of electricity used for heating means that the annual electricity consumption in Norway fluctuates with the weather and outdoor temperature. Electricity use is typically high in the winter and lower in the summer. The correlation between outdoor temperature and electricity use is stronger in Norway than in other European countries.

While energy use in buildings is largely influenced by the outdoor temperature, energy consumption in the industrial sector is relatively even throughout the year. In areas with many homes and little industry, the overall use of electricity varies more than in industrial areas. In the Oslo area, which has less industry than other parts of the country, the electricity consumption is therefore particularly high in winter and low in summer.

Despite a population increase in Norway of 20 percent from 2000 to 2021, the use of energy in households has increased relatively little. A moderate growth from 2020 to 2021 can be explained by improved energy effenciency in buildings, electrical appliances and other technical solutions. Additionally, many households have installed heat pumps, mainly air-to-air pumps. According to The Norwegian Water Resources and Energy Directorate, in 2021 18.8 TWh of heat was produced from heat pumps consuming 8.1 TWh of electricity.

In 2022, the service sector, including the military sector, consumed 34 TWh of energy. Around 22 TWh came from electricity. In service industries, energy use covers activities such as nursing homes, hospitals, schools, cultural centres and hotels. The two dominant types in terms of energy use are office and retail buildings.

About half of the energy used in service industries goes to lighting, fans, pumps, and other electrical devices. Room heating constitutes 40 percent, while a small portion is used for heating tap water. The use of fossil fuels in service industries is mainly in the military sector.

Read more about energy use in buildings here.

TRANSPORT

In 2022, the transport sector consumed 56 TWh of energy. This includes all domestic transport. Road transport accounts for 70 percent of the energy use. Coastal transport accounts for 20 percent, aviation 7 percent, and rail transport 3 percent. Fossil fuels are the dominant energy source in the sector. The use of electricity is increasing. In the coming years, significant growth in electricity consumption is expected due to the electrification of vehicles and ferries.

In 1990, the total energy use in the transport sector was about 40 TWh. Between 1990 and 2022, energy use in road transport increased by just over 40 percent. In the maritime sector, there has been a slight increase over the same period. Aviation has had a steady consumption since the turn of the millennium, except for 2020 and 2021 due to the coronavirus pandemic.

In recent years road transport has been marked by a transition from fossil fuels to electricity. Economic incentives for electric vehicles, improved charging infrastructure, and more electric car models available are all strong drivers for this development. Since electric motors utilize energy nearly three times more efficiently than combustion engines, the transition to electricity leads to a decrease in the total energy use in road transport.

Electrification is also ongoing in coastal transport and the fishing sector. Several new ferries with electric propulsion are being ordered, while hybrid solutions are installed in older ships. Charging infrastructure is also being established in ports, including onshore power for larger ships. For long-distance ships the development towards zero emissions is slow. Yet, hydrogen and ammonia are identified as important future energy carriers for phasing out fossil fuels in this segment.

ENERGY USE IN BUILDINGS

Buildings account for about 40% of energy use in Norway. Efficient energy use in buildings is therefore essential for the Norwegian energy system. Norway uses various policy measures to ensure efficient energy use, including regulatory measures, labelling schemes and information.

TECHNICAL REGULATIONS ON BUILDINGS

Building standards have a long history in Norway, and the first energy requirements for buildings were introduced as far back as 1949. The Ministry of Local Government and Regional Development is responsible for determining the requirements of the Technical Regulations on buildings.

The Technical Regulations apply to new buildings and when large-scale renovation and alterations are carried out on existing buildings. The regulations set minimum standards that must meet for the construction to be legal. These minimum standards include requirements relating to energy use in buildings. New buildings correspond to only about 1-2 % of the building stock per year. However, buildings have a long lifespan, and the energy requirements will therefore influence energy use for many years to come. Norwegian energy requirements have been revised and made stricter a number of times, most recently from 1 January 2016.

Building standards have a long history in Norway, and the first energy requirements for buildings were introduced as far back as 1949.

PHASING OUT OIL-FIRED HEATING

Historically, oil-fired heating has been used in both residential and other buildings, while fuelwood has mainly been used in private homes. In recent years, there has been a switch from fossil energy sources to electricity, district heating and heat pumps for heating purposes in buildings. This energy switch is a result of high taxes on emissions and support schemes in combination with the prospect of a ban on oil-fired heating. The ban was introduced in 2020.

Traditionally, oil-fired heating and fuelwood have been a widespread local energy solutions and have functioned well together with the electricity system. To ensure the smooth functioning of the energy supply system as a whole, it will be useful to find new heating solutions that do not strain the electricity system in winter.

DISTRICT HEATING

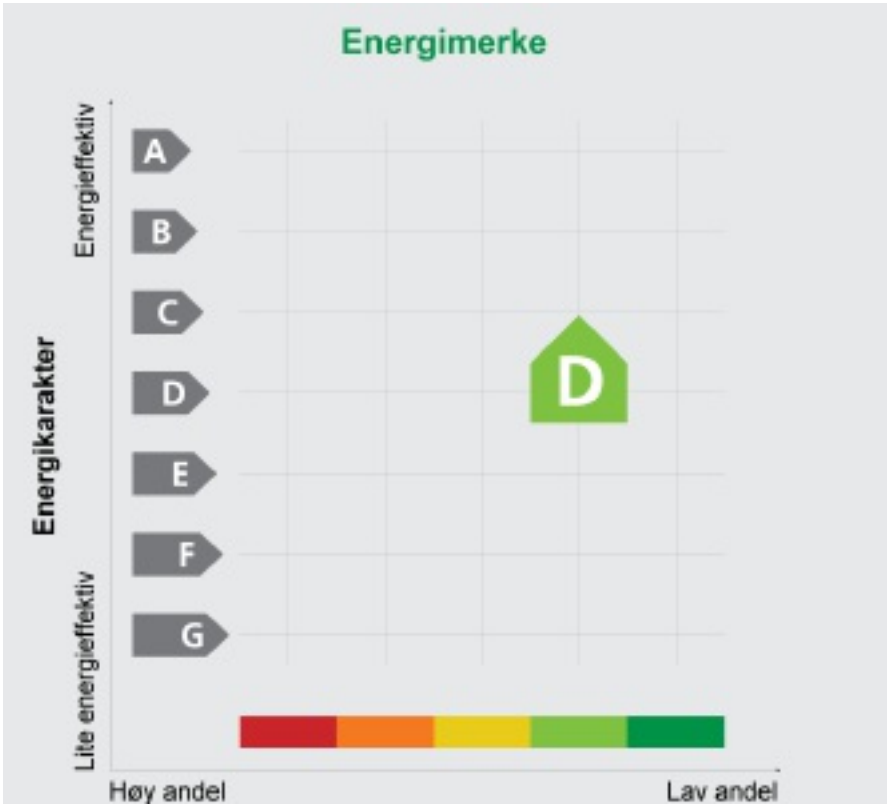
Mandatory connection to district heating

A sufficiently large number of customers is required for a district heating system to be developed for an area, since the cost per customer drops as capacity is more fully used. In, Norway, a municipality is entitled to require new buildings to be connected to a district heating system when a district heating license has been issued.

Ministry of Local Government and Regional Development and the Ministry of Energy has published guidelines explaining how municipalities can use requirements for mandatory connection to a local district heating system for new buildings. They emphasize that the municipalities can modify the requirements to suit local conditions, for example by specifying which types of buildings are to be connected or defining the geographical areas where the requirements apply. The district heating companies are responsible for providing municipalities with the information they need in order to make good decisions on mandatory connection. This is to make sure that the municipal planning process is as effective as possible.

ENERGY PERFORMANCE CERTIFICATES FOR BUILDINGS

Since 1 July 2010, it has been mandatory in Norway to hold an energy performance certificate for any building that is constructed, sold or rented out. The energy performance certificates are intended to improve knowledge and awareness of energy use in buildings. Inspection of large heating, ventilation and air conditioning systems has also been made mandatory to encourage sound operation and inspection routines. Owners of private homes may choose to use a free online system for obtaining energy certificates for buildings, while commercial buildings and new buildings must be certified by an expert.



The letter assigned to the building shows the energy efficiency rating, and the colour shows the heating rating (according to the energy source(s) used)

The heating rating (the colour scale) on the energy performance certificate indicates the extent to which the building can be heated (rooms and hot water) by energy carriers other than fossil fuels and electricity.

The energy efficiency ratings on the certificate are between A (high energy efficiency) and G (low energy efficiency). The rating gives an overall assessment of the building's energy performance, i.e. energy in kWh required per square meter. The rating process applies standard values for factors such as number of residents, indoor temperature, and air quality. The energy rating is based on an estimate of delivered energy and is independent of actual measured energy use. Buildings that meet the requirements of the 2010 Technical Regulations will normally be rated C, while older buildings built in accordance with less strict regulations will have lower ratings. Low energy buildings and passive houses with efficient heating systems can achieve the rating A or B.

ECODESIGN AND ENERGY LABELLING

Ecodesign and energy labelling establish minimum requirements for energy efficiency and eco-friendly design. NVE is market surveillance authority for eco-design and energy labeling related to energy efficiency.

More information on ecodesign and energy labelling can be found here.

LABELLING SCHEMES AND STANDARDS

Ecodesign and energy labelling establish minimum requirements for energy efficiency and eco-friendly design. NVE is market surveillance authority for eco-design and energy labeling related to energy efficiency. You can find more information about the regulations on NVE's website.

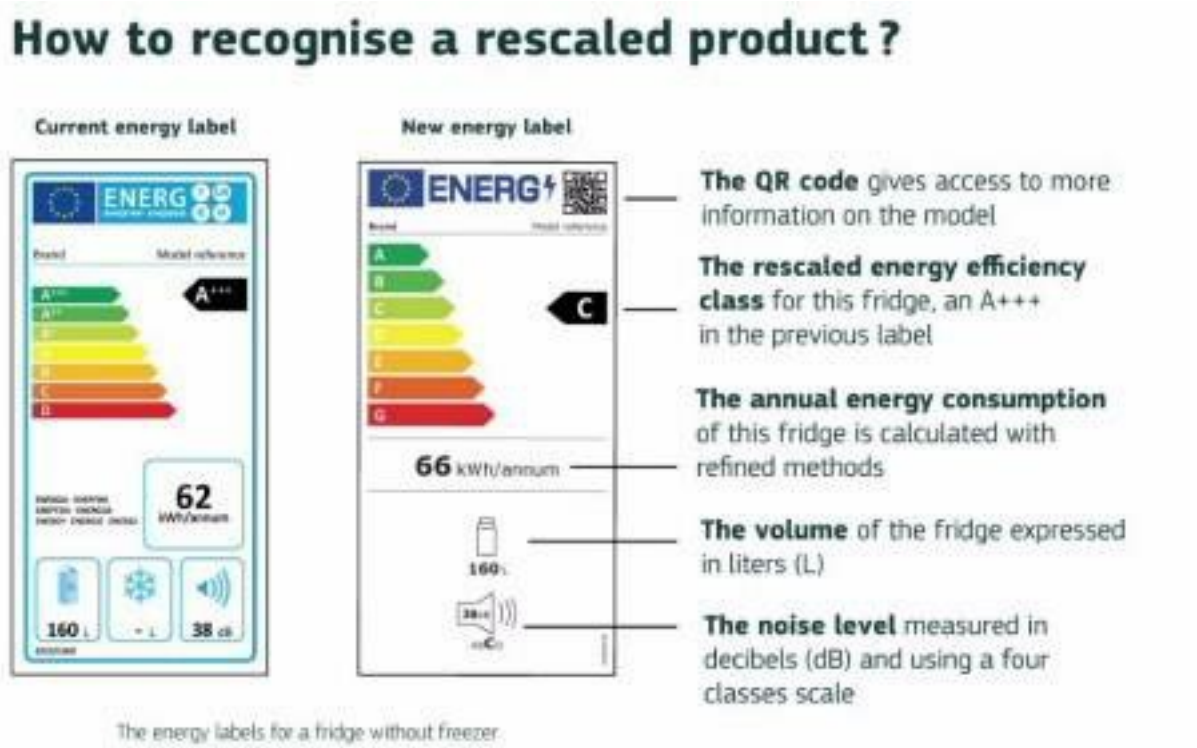
ENERGY LABELLING OF PRODUCTS

The purpose of energy labeling is to provide consumers with easily recognizable and comparable information, which provides a basis for choosing the most energy-efficient products. The products are graded according to how energy efficient they are, based on a scale, where A is the best and G gives the worst grade. Energy labeling regulation imposes information requirements on manufacturers and suppliers, while retailers (shops) are required to place the energy labeling clearly visible.

In 2017, the EU decided to update the energy label. The purpose of the change is to make it as easy as possible to understand the energy label arrangement. This includes, among other things, a new grading scale that goes from A to G without further division. This means that the grades A+ to A+++ will disappear gradually.

Comparison of new and old energy label

Rescaling of labels started in 2021 for the following selection of product groups: Fridges and freezers, Dishwashers, Washing machines and washer-dryers, Electronic displays including televisions & Lighting



The energy labels for a fridge without freezer

ECODESIGN

The Ecodesign Directive sets requirements for improving the energy efficiency and environmental performance of energy-related products for placing/or putting into service on the EU internal market. The directive is aimed at manufacturers/importers and covers the household sector, the service sector and the industry. If products meet specified ecodesign requirements, they qualify for CE marking, and may be sold throughout the internal market. Ecodesign requirements are intended to remove the least energy-efficient products from the market and reduce the environmental impact of energy-related products at all stages of their life cycle.

The EU is drawing up product-specific rules under the Ecodesign Directive on an ongoing basis, in the same way as for products covered by the Energy Labelling Directive. The EU has signaled that ecodesign will be a tool to achieve circular economy. Future requirements could be related to a products use of resources, how easy the product is to repair or recycle. Several products covered by eco-design requirements are also covered by energy label requirements.

GUARANTEES OF ORIGIN

Guarantees of origin are certificates to show an end customer that an amount of electricity is produced from a specific source. Guarantees of origin were first introduced in the 2001 Renewable Energy Directive (2001/77/EC), which entitled all producers of renewable electricity to obtain guarantees of origin. These provisions were retained in the 2009 directive (2009/28/EC), and extended to heating and cooling produced from renewable sources.

A guarantee of origin is a confirmation that one megawatt hour (MWh) of electricity has been produced from a specified energy source.

Guarantees of origin are tradable. In Norway, production plants are accredited for the guarantee of origin scheme for a five-year period, after which they must obtain new accreditation. Guarantees of origin are issued by individual countries, but many of the EU and EFTA states, including Norway, have joined forces to ensure that there is an international standardised system for recording trading in guarantees of origin. In Europe this is coordinated by AiB. Statnett is responsible for the Norwegian registry, and the Norwegian Water Resources and Energy Directorate is the supervisory authority for the scheme. Guarantees of origin can be used for marketing purposes, but are not a form of support that can be expected to trigger the development of new production capacity. Some countries, including Norway, have made arrangements for using guarantees of origin in electricity disclosure (sometimes known as 'electricity labelling'). Requirements for electricity suppliers to provide information on the origin of the electricity they sell, i.e. the fuel mix used in production, follow from the Internal Energy Market Directive. However, EU legislation does not require companies to use guarantees of origin for this purpose – another option that is available is to use production statistics for this purpose.