FACTS

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ENERGY AND WATER RESOURCES IN NORWAY

NORWEGIAN MINISTRY
OF PETROLEUM AND ENERGY

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Editor: Inger Østensen
Editing completed: April 2013

Design: iteraGAZZETTE

Cover photo: Front and back: Viddalsdammen
Photo: Aerosport / E-CO Energi

Layout and printing: 07 MEDIA
Circulation: 3000

ISSN: 0809-9464
Publication code: Y-0102/8B

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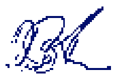
PREFACE
Ola Borten Moe
Minister of Petroleum and Energy



Minister of Petroleum and Energy

Secure access to energy is extremely important for a modern society to function. Norway has large energy resources, both fossil resources such as oil and gas, and renewable resources such as water, wind and bio-energy. This energy wealth has been, and remains, important to social welfare in Norway.

For more than 100 years, we have produced electric energy based on hydropower. The very first hydropower plant was built in 1882 at Senja in Troms County by the Senja Nikkelverk company (nickel works). The power plant on Senja was the first hydropower plant in Europe. Electricity from this power plant was used for lighting, which was typical for the early electricity plants.

The public sector owns about 90 per cent of the production capacity for electric power in Norway, distributed over national, municipal and county authorities. The first municipal electric power plant based on hydropower started operating in Hammerfest in 1891, which earned the city the honour of being the first city in Norway with electric streetlights. Oslo followed close behind, with electric streetlights and electric tram lines in the 1890s.

The Hammeren power station in Maridalen in Oslo was built in 1900, and supplied Oslo's residents with electricity. This is the oldest power station still in daily operation. When Hammeren power station was opened, it was declared "now the city would have power for all time". Today, the annual production from the power station is enough to cover electricity consumption in Oslo for less than one day. This illustrates the enormous increase in the importance of electric power through the 1900s and up to the present.

The objective of this Fact Sheet is to provide a comprehensive presentation of generation, transmission and consumption of energy in Norway. The Fact Sheet reviews energy supply in Norway, and provides an overview of the most important statutes that set the framework for public administration.

Norwegian petroleum activities are described in a separate publication from the Ministry of Petroleum and Energy and the Norwegian Petroleum Directorate

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FRAMEWORK, ORGANISATION AND PLAYERS

Photo: TCN / Ministry of Petroleum and Energy

1.1 Introduction

The Storting (Norwegian parliament) defines the political framework for energy and water resources management in Norway. The Government has the executive authority, and exercises this through various ministries.

- The Ministry of Petroleum and Energy has the overall administrative responsibility.
- The Ministry of the Environment is responsible for the external environment and planning legislation.
- The Ministry of Finance is responsible for power plant taxation, various taxes on energy and the State's expenditures.
- The Ministry of Trade and Industry has ownership responsibility for Statkraft SF.

Ministry of Petroleum and Energy

The Ministry of Petroleum and Energy has the overall responsibility for managing the energy and water resources in Norway. The Ministry's job is to ensure that this management is carried out according to the guidelines provided by the Storting and the Government.

The Ministry's Energy and Water Resources Department has ownership responsibility for the state-owned enterprises Enova SF and Statnett SF.

Norwegian Water Resources and Energy Directorate (NVE)

NVE, which reports to the Ministry of Petroleum and Energy, is responsible for managing domestic energy resources, and is also the national regulatory authority for the electricity sector. NVE is also responsible for managing Norway's water resources and handling the State's administrative functions as regards flood and avalanche/landslide prevention. The NVE is involved in research and development, international development cooperation, and is the national hydrology expert body.

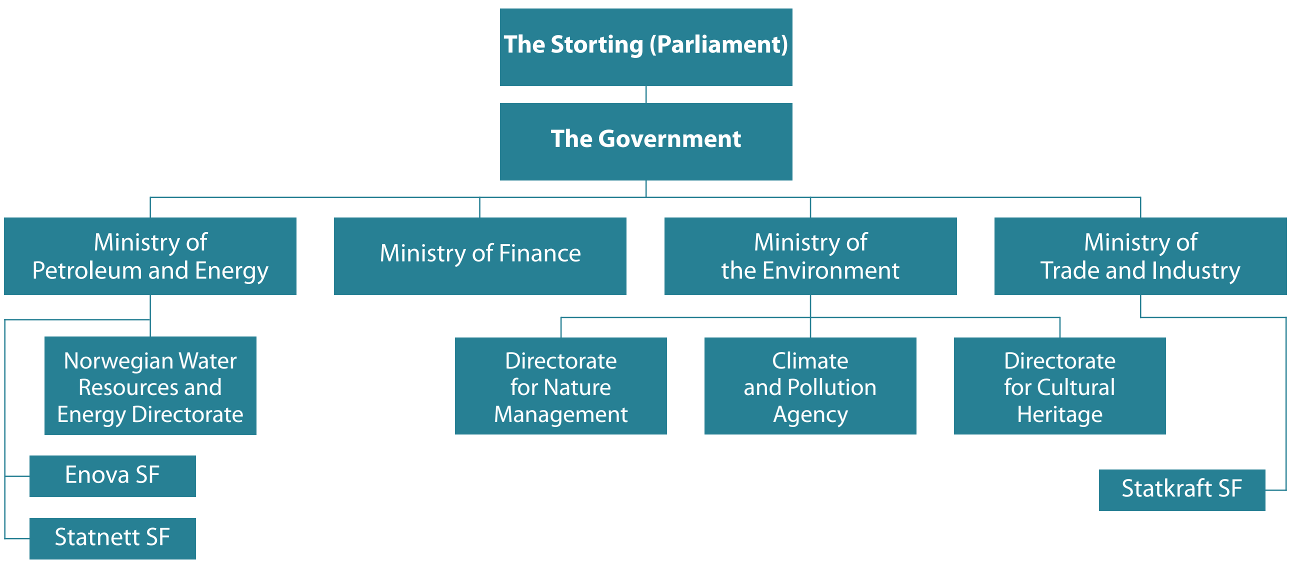
Enova SF

Enova is a state-owned enterprise that manages the assets in the Energy Fund. Enova's objective is to promote environment-friendly conversion of energy consumption and generation, as well as development of energy and climate technology. See a more detailed description of Enova's activities in Chapter 3.

Statnett SF

Statnett is a state-owned enterprise responsible for building and operating the central electricity grid. The enterprise is the transmission system operator (TSO) for and owns more than 90 per cent of the transmission grid. Statnett is the system coordinator for both the short and long term, which entails responsibility for ensuring the instantaneous power balance, as well as facilitating satisfactory quality of supply throughout the country.

Figure 1.1: State organisation of energy and water resources activities.



Source: MPE

Research Council of Norway

The Research Council of Norway reports to the Ministry of Education and Research and its responsibilities include managing the ministries' appropriations for energy research. The Ministry of Petroleum and Energy is by far the largest financing ministry for energy research and development through the Research Council's programmes.

1.2 Legal framework

This chapter provides an overview of legal framework conditions for the energy sector and water resources management. It has been necessary to develop a comprehensive legislative framework that requires public permits (licences) in a number of contexts. Advance public approval in the form of licence obligations ensures an individual assessment of the legality and consequences of specific measures.

Conflicts may arise between various user and environmental interests, in connection with planning, building and operation of a generation or transmission facility for electric energy and district heating, as well as in water resource management. For example, effects may be felt in a number of areas such as biological diversity, landscape and outdoor recreation, fishing, tourism, cultural heritage, local communities and reindeer husbandry. Such interests are often called "public interests" in legislation. Energy and river system measures can also affect private economic interests.

One of the objectives of the regulations in place is to ensure that these different interests are heard and considered, and that the various measures are subject to government control and conditions that safeguard these interests. The legislation is intended to ensure effective management of our resources. Secure supply of energy and a well-functioning power market are key considerations here.

Overview of important legislation

The energy sector and water resource management are subject to comprehensive regulations. The following is a general description of legislation governing this area. A more detailed description of these acts is provided in Appendix 1.

Industrial Licensing Act

The purpose of the Act relating to acquisition of waterfalls, mines, etc. of 14 December 1917 No. 16 (the Industrial Licensing Act) is to ensure that hydropower resources are managed in the best interests of the general public. This will be ensured through public ownership of the hydropower resources at national, county and municipal levels. The Act dictates licence obligations if parties other than the State acquire ownership interests to waterfalls which, in connection with water regulations, could presumably deliver more than 4 000 natural horsepower (NHP). New licences and licences for transfer of existing licences are only granted to public-sector purchasers. This means that licences can only be granted to state-owned enterprises, municipalities and county municipalities. Licences can also be awarded to companies that are partly owned by state-owned enterprises or one or more municipalities or county municipalities, as long as 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.

Watercourse Regulation Act

Even if one has the right of ownership of the waterfall, a separate permit is required under the Act relating to the regulation of watercourses of 14 December 1917 No. 17 (the Watercourse Regulation Act) in order to make use of the water in a regulating reservoir for power generation. Transferring water in a watercourse also requires a licence. The objective of the Watercourse Regulation Act is to safeguard public and private interests in the watercourse. Normally, licences shall only be granted if the damage to these interests is considered to be less than the advantages entailed by the regulation. The Act also gives the licensee the authority to expropriate necessary property and rights in order to carry out the regulation measures.

Water Resources Act

Smaller power plants without regulation and other watercourse measures can trigger a licence obligation under the Act relating to river systems and groundwater of 24 November 2000 No. 82 (Water Resources Act). It follows from the Act that no developer without a licence may initiate watercourse measures that may cause damage or drawbacks for public interests in watercourses or the sea. The objective of the Act is to ensure socio-economically prudent use and management of river systems and groundwater. The consideration for the environment and natural processes in the watercourse, as well as the watercourse's intrinsic value as a landscape component, are among the important factors safeguarded under the Act.

Energy Act

Act relating to the generation, conversion, transmission, trading, distribution and use of energy etc. of 29 June 1990 No. 50 (the Energy Act) sets the framework for organisation of the power supply in Norway.

The Energy Act contains provisions on the obligation to acquire a licence for all technical facilities for generation, transmission and distribution of electric energy, all the way from the power station to the consumer. The Energy Act also requires a licence for trading electric energy, and includes licensing rules for district heating plants. The objective of the Act is to ensure that generation, conversion, transmission, trading, distribution and use of energy take place in a socio-economically efficient manner, including taking into account the affected public and private interests.

Offshore Energy Act

The Act relating to renewable offshore energy production of 4 June 2010 No. 21 (the Offshore Energy Act) relates to renewable energy production and conversion and transmission of electric energy offshore. The purpose of the Act is to facilitate exploitation of offshore renewable energy resources in accordance with socio-economic objectives. The Act shall also ensure that energy facilities are planned, built and managed in a manner taking into account considerations related to energy supply, the environment, safety, commercial and other interests.

The Electricity Certificate Act

The purpose of the Act relating to electricity certificates of 24 June 2011 No. 39 (the Electricity Certificate Act) is to contribute to increased production of electric energy from renewable energy sources. The Act establishes a Norwegian market for electricity certificates which, from 1 January 2012, was linked to the Swedish electricity certificate market. An electricity certificate market is a constructed market in the sense that the demand for electricity certificates arises from a statutory obligation to purchase electricity certificates. More details regarding electricity certificates are provided in Box 1.1.

Box 1.1: Electricity certificates

Electricity certificates is a support scheme aimed at contributing to increased production of renewable electricity in Norway and Sweden. 1 January 2012 was the start-up of the Norwegian-Swedish electricity certificate market. Under the scheme, Norway and Sweden share a common goal of establishing new electricity production based on renewable energy sources equivalent to 26.4 TWh in 2020.

The electricity certificate market is a market-based support scheme. The system functions by granting producers of renewable electricity one certificate per MWh of electricity they produce for 15 years. All renewable production facilities that started construction after 7 September 2009, and hydropower plants with an installed capacity of up to 1 MW that started construction after 1 January 2004, will receive electricity certificates. Facilities that are put into operation after 31 December 2020 will not receive electricity certificates. The electricity certificate scheme is technology-neutral, i.e. all forms of renewable electricity are entitled to electricity certificates, including hydropower, wind power and bioenergy. Norway and Sweden are responsible for financing half of the support scheme each, regardless of where the investments take place. The authorities have therefore obliged all electricity suppliers and certain categories of end-users to purchase electricity certificates for a specific percentage of their electricity consumption. This amounts to 3 per cent in 2012 and will gradually increase to 18.3 per cent in 2020, after which the percentage declines towards 2035 and the scheme will be terminated in 2036. A demand for electricity certificates will arise as a consequence of the mandatory quota obligation imposed by the government, and the electricity certificates will get a price. In other words, the market determines the price for electricity certificates and which projects that shall be developed. Producers of renewable electricity will earn an income from the sale of electricity certificates, in addition to revenues from the sale of electricity. The income from the electricity certificates will contribute to making it profitable to develop new electricity production based on renewable energy sources. The end-users help contribute to this development through the electricity bill. The framework for the scheme is regulated in a dedicated Act relating to electricity certificates.

The Norwegian Water Resources and Energy Directorate (NVE) is the administrative and supervisory authority for the electricity certificate scheme. NVE's responsibilities include approving facilities for electricity certificates. The electricity certificates exist only in an electronic format. Statnett SF is responsible for the electronic registry where the electricity certificates are issued and annulled.

Table 1.1: Norway's ten highest waterfalls (waterfalls steeper than 30 degrees).

Waterfall	County	Fall (m)	Status
Brudesløret* in Geiranger fjord	Møre og Romsdal	300	Undeveloped
Sju søstre* in Geiranger fjord	Møre og Romsdal	300	Undeveloped
Mongefossen in Rauma	Møre og Romsdal	300	Developed
Tyssestrengene in Tysso	Hordaland	300	Developed
Ringedalsfossen in Tysso	Hordaland	300	Developed
Skykkjedalsfossen in Sima	Hordaland	300	Developed
Vettisfossen in Utla	Sogn og Fjordane	275	Protected
Mollisfossen in Reisaelva	Troms	269	Protected
Austerkrokfossen in Fagerbakk watercourse	Nordland	256	Developed
Søre Mardalsfoss in Eira	Møre og Romsdal	250	Developed
The rivers marked with * have extensive seasonal variation in water flow. There is generally always some water in the falls; however, with the exception of periods with significant precipitation, these majestic waterfalls will not be particularly striking.			

Source: NVE

Management of protected areas and Master Plan for Water Resources

Many river systems are permanently protected and cannot be developed for power production. The Storting adopted four protection plans in the period from 1973 to 1993, with supplements in 2005 and 2009. All of these plans are referred to collectively as the Protection Plan for Watercourses. The plan constitutes binding instruction for the public administration not to grant licences for regulation or development of specific river systems for power production purposes. The assessment of which river systems should be protected emphasised conservation of a representative selection of Norwegian natural watercourse landscapes. Distinctive qualities and recreation opportunities in the respective areas were also emphasised. A total of 388 objects with a power potential of 49.5 TWh/year are protected against development for power production. The Water Resources Act made the protection of the watercourses statutory. The Act defines protected river systems, and lays down rules for protection of the protected river systems, also in relation to other types of disruptions than power development. In the supplement to the management plan in 2005, the Storting permitted processing of licence applications for power plants up to 1 MW in protected river systems.

Six of Norway's ten highest waterfalls have been developed, cf. Table 1.1.

The Master Plan for Water Resources, cf. Report No. 60 to the Storting (1991–1992), is a recommendation in the form of a report from the Government to the Storting. The plan indicates a prioritisation of which individual projects can be submitted for licence processing, and the projects are divided into two categories. Category I includes projects that can be submitted for licence processing now. In addition, some projects that are exempt from the plan can also be processed for licensing. Projects in Category II and projects not covered in the plan cannot be submitted for licence processing at this time. The prioritisation of the various projects is assigned according to socio-economic considerations and conflict assessments. This indicates a desire to first develop the river systems that will provide the cheapest power, and which at the same time entail the least disruption of the environment. The fact that a project has been cleared through the Master Plan does not indicate a binding advance commitment for a licence, only that the application can be processed.

The licence authority has turned down applications for projects in Category I. The licence authorities have the legal authority to reject an application that conflicts with the plan. In the Storting's processing of the supplement to the protection plans in 2005, it was determined that hydropower projects with a planned reservoir installation of up to 10 MW or with an annual production of up to 50 GWh would be exempted from processing in the Master Plan. Many of the relevant developments will fall into this category.

Following the processing of the Master Plan in 1993, changes have been made in several of the assumptions. Most of the projects submitted today are technically, environmentally and economically different than what originally emerged in the Master Plan.

Other relevant legislation

In addition to the Water Resources Act, the Watercourse Regulation Act, the Industrial Licensing Act, the Electricity Certificate Act, the Offshore Energy Act and the Energy Act, there are a number of other statutes that are significant for energy and water resources. With the exception of the natural gas legislation, these statutes are administrated by authorities other than the Ministry of Petroleum and Energy and the NVE.

Appendix 1 provides a more detailed description of the following statutes:

- Planning and Building Act (Ministry of the Environment and Ministry of Local Government and Regional Development)
- Nature Diversity Act (Ministry of the Environment)
- Expropriation Act (Ministry of Justice and Public Security)
- Competition Act (Ministry of Government Administration, Reform and Church Affairs)
- Natural Gas Act (Ministry of Petroleum and Energy)
- Consumer Purchases Act (Ministry of Justice and Public Security)
- Pollution Control Act (Ministry of the Environment)
- Neighbouring Properties Act (Ministry of Justice and Public Security)
- Cultural Heritage Act (Ministry of the Environment)
- Outdoor Recreation Act (Ministry of the Environment)
- Reindeer Husbandry Act (Ministry of Agriculture and Food)
- Public Administration Act (Ministry of Justice and Public Security)

Relevant EU legislation

Energy policy is an important area for the EU, which adopts a number of directives and regulations that are incorporated into the EEA Agreement. A short description of this follows below.

The EU's three energy market packages

Work has been ongiong for a number of years to open the EU electricity markets to competition. Council Directive 96/92/EC on common rules for the internal market in electricity (the Electricity Market Directive) was the first step towards an open, common European electricity market. Work has been underway in parallel on a common set of rules for the internal electricity market and a common set of rules for the internal natural gas market.

The second energy market package was adopted on 26 June 2003, and constitutes a significant new step in the direction of a more open energy market. The European Parliament and Council Directive 2003/54/EC (Electricity Market Directive II) includes minimum deadline requirements for opening the market to industrial customers and household customers, as well as minimum requirements for a legal division between transmission functions [1] and activities related to generation and trading. The Directive also contains consumer protection provisions.

The regulation on cross-border exchanges in electricity (European Parliament and Council Directive No. 1228/2003) is part of the second energy market package. The purpose of the regulation is to stimulate cross-border power trade, and thus increase competition in the internal electricity market. The regulation also provides a framework for further harmonisation of the principles on exploitation of the transmission capacity between countries, and provides the legal basis for Commission Regulation (EU) No. 774/2010. The latter introduces a compensation mechanism between system operators (the ITC mechanism) based on the costs associated with transit of electricity.

1 Transmission level is the highest grid level. Transmission in the sense of the Directive is the transmission of electric energy at the central grid level.

The European Parliament and Council Directive 2003/55/EC (the Gas Market Directive II) largely contains the same provisions as Electricity Directive II. The EU subsequently also adopted the European Parliament's and Council Regulation (EU) No. 2005/1771 on access to the natural gas transmission grid.

The second energy market package was incorporated into the EEA Agreement on 2 December 2005. The package has been implemented in the Energy Act and the Natural Gas Act, with underlying regulations.

The EU's third energy market package was adopted on 13 July 2009. The package consists of five legislative acts. Four of the legislative acts are amendments to existing legislative acts (the European Parliament and Council Directive 2009/72/EC (Electricity Market Directive III), the European Parliament and Council Directive 2009/73/EC (Gas Market Directive III), the European Parliament and Council Directive (EU) No. 714/2009 (Cross-Border Exchanges Regulation II), the European Parliament and Council Directive (EU) No. 715/2009 (Gas Transmission Regulation II)). In addition, European Parliament and Council Directive No. 713/2009 lays down completely new rules on the establishment of a new agency for cooperation between national energy regulators (ACER)[2].

The legislative acts in the third package have not yet been incorporated into the EEA Agreement. A new regulation has also been adopted on compensation between transmission system operators and replacing Regulation (EU) No. 774/2010; but it is not part of the actual package.

New elements in the third package, in addition to ACER, include the establishment of two organisations consisting of the states'

Box 1.2: Action plan for renewable energy

Article 4 of the Renewables Directive requires each state to draw up an action plan for how it will achieve its national targets. The Norwegian action plan for renewable energy was submitted to the ESA at the end of June 2012. The action plan lays out how Norway can achieve an overall renewable share of 67.5 per cent, and a renewable share of 10 per cent in the transport sector, by 2020.

The action plan is based on filling in a detailed template prepared by the European Commission which all states are required to use. This makes the action plan a standardised and detailed document that consists of a large number of questions and answers. The purpose of the template is to ensure that the national action plans cover all requirements in the Directive, that they are comparable and that they are in concordance with the reports the member states must submit every other year regarding the implementation status for the Directive.

The action plan consists, in part, of a highly detailed description of the use of policy instruments in all areas with significance for energy use and production in Norway, and, in part, of detailed tables and calculations for developments in energy use, energy production and renewable shares from 2005 leading up to 2020.

The Norwegian target of 67.5 per cent in 2020 will be achieved through existing policy instruments and the policies that the Government has laid out through submission of the Climate Report to the Storting (Report No. 21 to the Storting (2011-2012)). The electricity certificates are the most important single contribution towards achieving the goal. Norway will be credited for half of the overall target for the joint certificate market between Norway and Sweden, regardless of where the production takes place, i.e. 13.2 TWh (26.4 TWh in total). The Norwegian-Swedish electricity certificate scheme is the first example of a joint support scheme between member states under the Renewables Directive. Joint support schemes are regulated in Article 11 of the Directive. Enova's use of policy instruments and the introduction of new construction standards also contribute towards target attainment.

However, the transport target will require additional measures in the years ahead. The measures in the "Klimameldingen" White Paper on Climate Change will form the basis for potential ways of reaching the target, without committing to a specific composition or implementation date. The transport target and policy instruments in this sector fall within the Ministry of Transport and Communications' area of responsibility.

2 Agency for the Cooperation of Energy Regulators.

transmission system operators; Entso for electricity (ENTSO-E) and Entso for gas (ENTSO-G).

A central element in the Electricity Market Directive and Gas Market Directive III is the new, more rigorous requirements for independent national regulatory authorities. The regulator must be independent from both the industry and political authorities. In addition, the regulator has also been assigned an expanded area of responsibility and additional tasks.

The two directives also set new, more stringent requirements for organising grid activities at the transmission level. The directives' main model sets requirements for separate ownership of the transmission system. The consumer rules have also become more extensive.

The Renewables Directive

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 (the Renewables Directive) aims to establish a common framework for the promotion of energy from renewable energy sources, and was incorporated into the EEA Agreement on 19 December 2011. The Directive covers electricity, heating/cooling and transport, and is an expansion of the 2001 Directive, which only covered electricity. Each member state shall contribute to achieve its targets for the proportion of energy from renewable sources in its consumption by 2020, thus contributing to the overall EU target of a renewables proportion of 20 per cent in 2020. Norway's target follows from the EEA Committee decision. In 2020, Norway's proportion of energy from renewable sources shall amount to 67.5 per cent of its gross end consumption of energy. The member states shall draw up action plans for the work on renewable energy, addressing targets for the three sub-sectors (electricity, heating/cooling and transport). The implementation of the Directive has resulted in amendments to regulations pursuant to the Energy Act. See Box 1.2 for a more detailed account of the action plan for renewable energy.

The Energy Performance of Buildings Directive (EPBD)

Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings was incorporated into the EEA Agreement on 23 April 2004. The Directive defines a common method for calculating the energy consumption of buildings, and defines national energy requirements for new and renovated buildings. The Directive includes provisions concerning energy certificates for new and existing buildings, as well as inspections of air-conditioning and boiler systems above a certain capacity. The Directive's requirements for energy labelling of buildings have been implemented through the Energy Labelling Regulations of 18 December 2009 No. 1665. As of 1 July 2010, energy labelling of buildings became mandatory in the event of sale, lease or construction. Non-residential buildings which exceed 1000 m^2 must have an energy certificate which is visible for the building's users.

The CHP Directive

Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market[3] was incorporated into the EEA Agreement on 8 December 2006. The Directive aims to improve energy efficiency and security of supply through promotion of highly efficient combined heat and power generation (cogeneration) where there is a useful heat demand. The Directive has been incorporated into the Energy Act and through the Regulations relating to guarantees of origin for generation of electric energy of 14 December 2007. Commission Decision 2007/74/EC stipulates harmonised reference values for efficiency in the event of separate generation of electricity and heat.

The Ecodesign Directive

Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (such as light bulbs and household appliances) was incorporated into the EEA Agreement on 1 July 2011. The Directive is a revision of the previous Ecodesign Directive from 2005. The Directive has been implemented through the Ecodesign Regulations of 23 February 2011 No. 190. The Regulations are enforced by the NVE. Implementing regulations have been adopted for a number of energy-using products under the 2005 Directive. These are still in force, and have been implemented through the Ecodesign Regulations.

The Energy Labelling Directive

Council Directive 92/75/EEC is a framework directive regarding indication of the consumption of energy and other resources by household appliances through labelling and standardised product information. The detailed provisions for each type of house-

3 Combined heat and power (CHP).

hold appliance have been stipulated in implementing regulations. Norway has implemented these regulations, so the energy labelling scheme currently covers many household appliances.

In the EU, Directive 2010/30/EU of the European Parliament and of the Council has replaced the 1992 framework directive. This has yet to be incorporated into the EEA Agreement.

The Security of Electricity Supply Directive

Directive 2005/89/EC of the European Parliament and of the Council concerning measures to safeguard security of electricity supply and infrastructure investment was incorporated into the EEA Agreement on 8 June 2007. The Directive requires each member state to implement a policy for security of electricity supply. The Directive did not result in any legislative amendments.

The Water Framework Directive

The Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council) aims to promote integrated water resource management with a basis in the ecological status of freshwater and coastal areas. The Directive has been implemented through the Water Regulations.

Standard environmental targets are called "good ecological status", and are to be achieved no later than 15 years after the Directive entered into force. However, the Directive allows for adaptation, both through exemption provisions and through the ability to designate bodies of water as "highly modified" with somewhat lower environmental targets. This includes bodies of water which, due to physical disruptions for the benefit of society, will not be able to reach the standard environmental targets, typically due to hydropower regulations.

The Environmental Liability Directive

Directive 2004/35/EC of the European Parliament and of the Council on environmental liability was incorporated into the EEA Agreement on 5 February 2009. The Directive aims to establish a framework for environmental liability based on the "polluter pays" principle in order to prevent and remedy the effects of environmental damage. Environmental damage covered by the Directive includes damage to protected species and natural habitats, as well as water and land damage. However, it follows from the EEA Joint Committee Decision that the rules regarding damage to protected species and natural habitats do not apply for the EFTA EEA states Norway, Liechtenstein and Iceland. Certain minor amendments to the Water Resources Act and the Watercourse Regulation Act will be implemented as a result of the Directive.

Licence processing

The licensing authority includes the agencies responsible for processing licence applications and granting licences. The licensing authority includes the Storting, the King in Council[4], the Ministry of Petroleum and Energy and the NVE. Below follows a description of the licensing processes pursuant to the Watercourse Regulation Act, the Water Resources Act, as well as electrical installations pursuant to the Energy Act.

Case processing pursuant to the Watercourse Regulation Act and the Water Resources Act

In the following, a distinction will be made between major and minor development projects. Minor development projects means power plants pursuant to the Water Resources Act with an installed capacity under 10 MW without regulation exceeding the licensing limit in the Watercourse Regulation Act. Major development projects means projects pursuant to the Water Resources Act with installations exceeding 10 MW and projects pursuant to the Watercourse Regulation Act.

The NVE has also prepared guidelines for case processing for a number of different interventions in river systems. For example, this applies to aquaculture facilities, development of minor power plants, upgrades and remodelling of existing power plants, construction in or across river systems, gravel pits and flood protection measures.

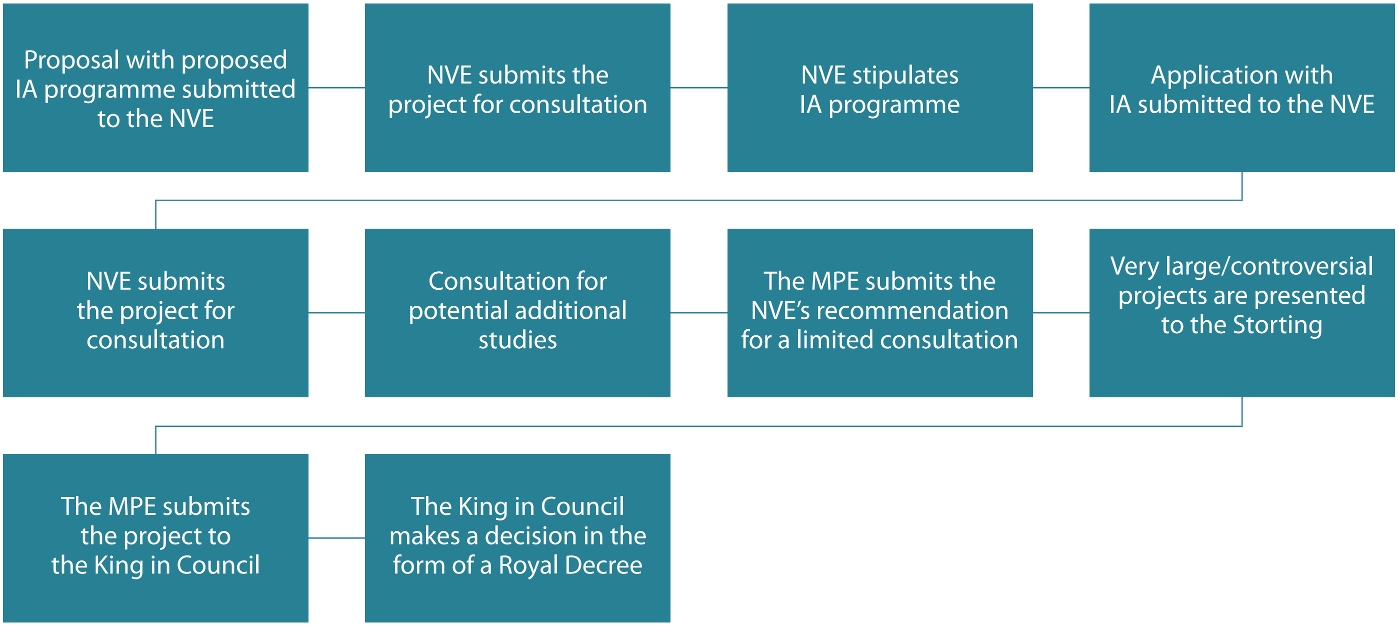
Major development projects

The King in Council has been given licensing authority for projects pursuant to the Watercourse Regulation Act and developments with installations exceeding 10 MW pursuant to the Water Resources Act. Nevertheless, the NVE handles the work during the application phase.

Hydropower plants exceeding 10 MW or with an annual production exceeding 50 GWh are always subject to clarification vis-à-vis the Master Plan for Water Resources. Projects which require processing pursuant to the Master Plan for Water Resources must submit an application to the NVE, which will process it in collaboration with the Directorate for Nature Management.

4 When the Government makes decisions as a plenary body, this takes place as the Council of State, presided over by the King.

Figure 1.2: Procedure for development of major hydropower projects pursuant to the Water Resources Act and water regulations pursuant to the Watercourse Regulation Act.



Source: MPE

When a project has potentially been clarified vis-à-vis the Master Plan for Water Resources, the actual application process will start with a proposal including a proposed impact assessment programme. The proposal will be published for public inspection and submitted for consultation to local authorities and organisations.

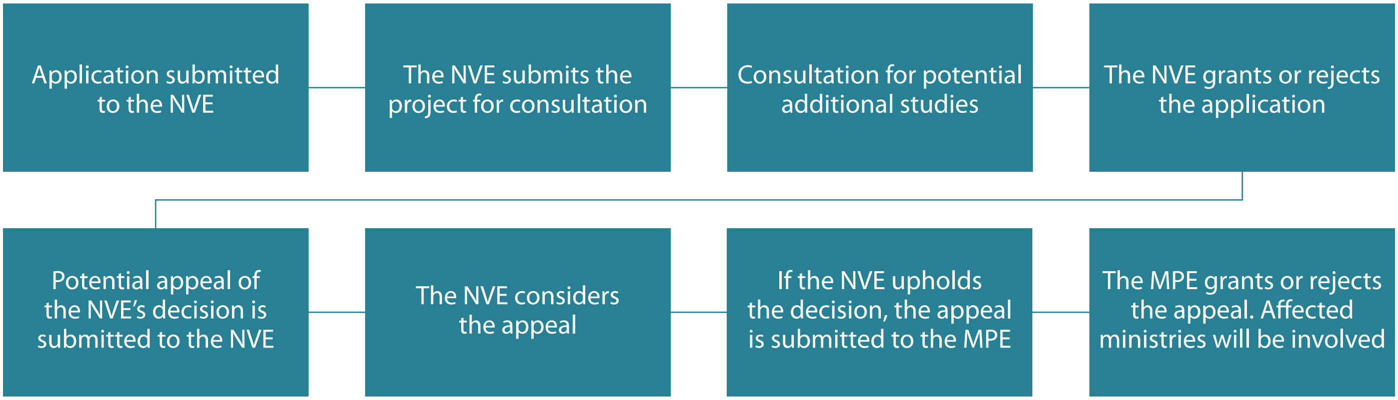
The NVE will then, following consultation with affected municipalities and other authorities, assess whether the measure is subject to impact assessment pursuant to the Planning and Building Act's rules regarding notification and impact assessments (the IA phase). Pursuant to the Regulations relating to impact assessments of 26 June 2009 No. 855 (the IA Regulations), power plants with an annual production exceeding 40 GWh are always subject to an impact assessment. Installations exceeding 30 GWh are subject to an impact assessment if they may have a significant impact on the environment, landscape or society in general. If there is no notification requirement pursuant to the Planning and Building Act, the consequences of the measure must nevertheless be thoroughly described as part of the licence application.

If notification is required pursuant to the Planning and Building Act, the NVE will stipulate the final impact assessment programme after presenting it to the Ministry of the Environment. The consultation bodies will receive the final assessment programme for information purposes.

When complete, the impact assessment will be presented along with the licence application. The application, along with the potential impact assessment, will be submitted to affected authorities, organisations and landowners for consultation and comments. The NVE then makes an overall assessment of the project, and submits its recommendation to the Ministry of Petroleum and Energy.

The Ministry will prepare the project for the King in Council and present a recommendation. The recommendation is drawn up based on the application, the NVE's recommendation, the opinions of affected ministries and local authorities, as well as the Ministry's own assessments. The King in Council then makes a decision regarding development and water regulation in the form of a Royal Decree. Major (more than 20 000 natural horsepower) and/or controversial water regulation and power development projects are first presented to the Storting in the form of a

Figure 1.3: Procedure pursuant to the Water Resources Act for small-scale power (under 10 MW).



Source: MPE

Report to the Storting before the licence is formally awarded by the King in Council. Figure 1.2 illustrates the procedure.

Decisions regarding major development projects cannot be appealed, as the licensing authority rests with the King in Council.

Small hydropower plants

The NVE has been delegated the licensing authority pursuant to the Water Resources Act for power plants with an installed capacity below 10 MW and without water regulation exceeding the licensing limit in the Watercourse Regulation Act. Small hydropower plants are subject to somewhat simpler procedures than major projects, which contributes to faster processing for these projects. As of 1 January 2010, the county authorities have been delegated the authority to make licensing decisions for power plants below 1 MW (mini and micro power plants), with an exception for such plants in protected river systems.

In June 2007, the Ministry published Guidelines for small hydropower plants (Norwegian only) with the aim of facilitating regional planning of such power plants and strengthening the basis for comprehensive, efficient and predictable licence processing.

Power plants between 1 and 10 MW are subject to a study of biodiversity which may be affected by the development. Pursuant to the rules in the Planning and Building Act, the application is announced in the local media, published for public inspection and submitted for consultation with affected authorities, organisations and landowners. Following the consultation, the area will be inspected before a decision is made.

The Ministry is the appeals body for the NVE's decisions. If an NVE licence decision is appealed, an ordinary appeals process will start pursuant to the rules of the Public Administration Act. The Ministry of Petroleum and Energy's appeal decision is final and cannot be appealed to a higher authority. Figure 1.3 illustrates the procedure.

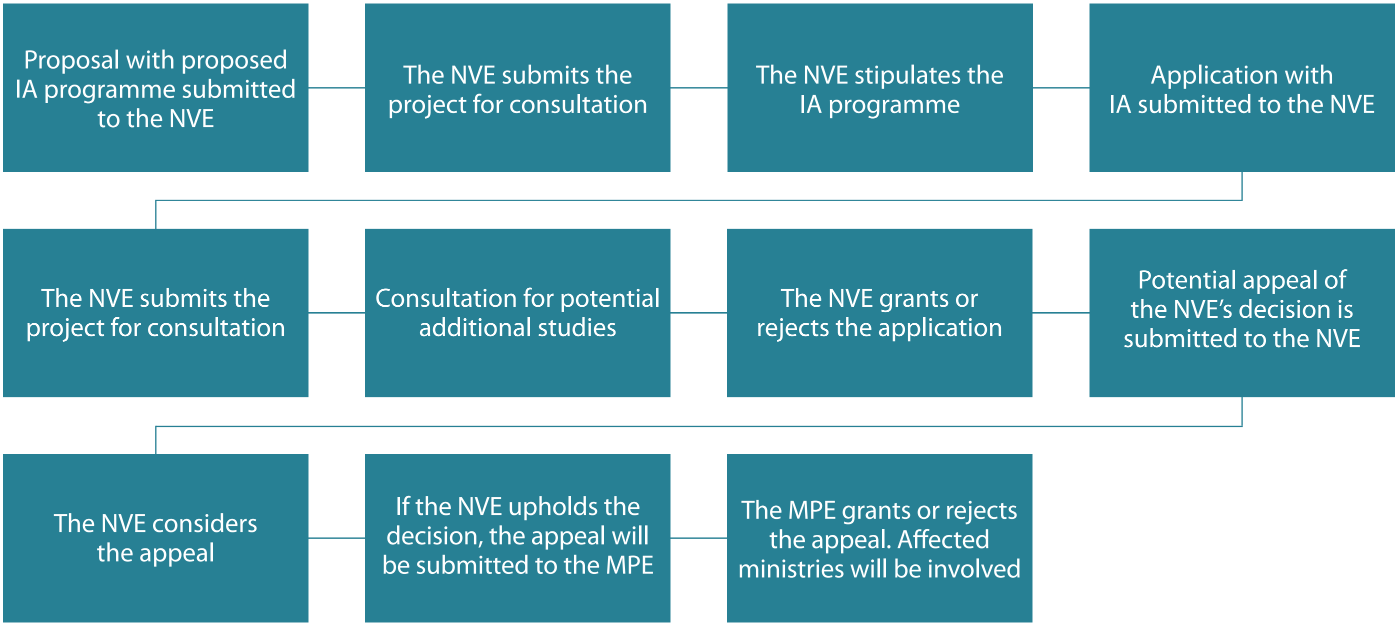
Procedure pursuant to the Energy Act (installation licence)

Installations for production, transformation, transmission and distribution of electric energy cannot be built, owned or operated without a licence pursuant to the Energy Act. This means that, even if a licence for the power plant pursuant to the Water Resources Act has already been granted, the electrical installation is still subject to licensing pursuant to the Energy Act. The authority to make decisions regarding installation licences has been delegated to the NVE. The Ministry of Petroleum and Energy is the appeals body.

Licence applications must be submitted to the NVE. If the application is covered by the Planning and Building Act's rules regarding impact assessments, the impact assessments must be enclosed with the application. The limits on which measures are subject to impact assessment are specified in the IA Regulations.

If the measure is not subject to impact assessment pursuant to the Planning and Building Act, for example minor power lines,

Figure 1.4: Procedure for electrical installations pursuant to the Energy Act.



Source: MPE

the process starts directly with the licence application to the NVE pursuant to the Energy Act. The consequences of the measure must, in such cases, be considered in connection with the application and the NVE's processing of it pursuant to the Energy Act. In connection with processing of licence applications, the NVE will, as a rule of thumb, conduct consultations and present the project to affected stakeholders and may organise public meetings, etc.

If an NVE licence decision is appealed, the Ministry of Petroleum and Energy will start ordinary appeal processing pursuant to the rules in the Public Administration Act. During the appeal processing, the Ministry will carry out an inspection if this is warranted by the case. The Ministry's appeal decision is final and cannot be appealed to a higher authority. Figure 1.4 illustrates the procedure.

Report No. 14 to the Storting (2011-2012) "Building Norway – about grid developments" (the Grid Report) indicated that the authority to make decisions regarding major power lines would be elevated to the King in Council. In this context, major power lines means power lines longer than 20 kilometres with voltage levels starting at 300 kV and upward, and which are covered by the IA Regulations. The NVE will still consider applications as normal, but will not make decisions as the authority of first instance. The NVE will make a recommendation to the Ministry, the Ministry will submit the NVE's recommendation for consultation, and prepare projects for the King in Council, who makes the final decision.

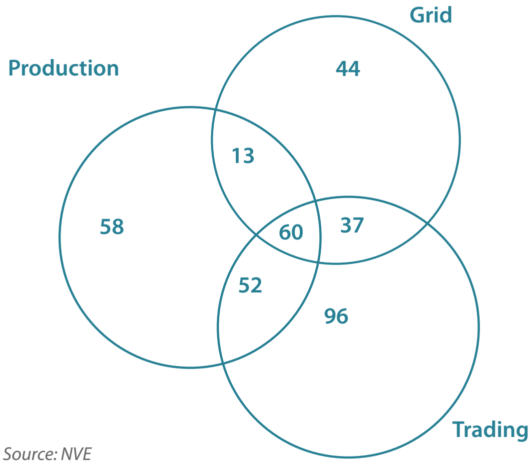
According to the new system, the grid companies' needs analysis and concept choice assessment will be subject to external quality-assurance before the grid companies can submit a proposal regarding these projects. When the quality-assurance is complete, the full documentation must be submitted to the Ministry of Petroleum and Energy. After reviewing the documentation, the Ministry will allow the company to submit a proposal.

Proposed statutory amendments to follow up the Grid Report were submitted for general consultation in the autumn of 2012. The consultation process ended on 5 October 2012. HIT

Processing time for licence applications

Many factors affect the time spent on licence processing, for example the conflict level and complexity of each individual project. Hydropower and energy projects most likely affect com-

Figure 1.5: Licensees by activity, as of 1 January 2011.



Source: NVE

The overlapping circles illustrate to what degree the companies operate different activities. Holding companies without activities subject to licensing are not included in the figure.

merce and industry, local communities, the landscape and other area interests. The licensing authority is responsible for ensuring that the project has been thoroughly studied and described before a decision is made regarding the project, and must, through processing, consider the need for additional studies of various topics, as well as the need for additional statements regarding issues reviewed in the licensing procedure. The processing of licence applications pursuant to the energy and water resources legislation must safeguard the consideration for prudent, comprehensive assessments, as well as efficiency.

1.3 Companies and ownership

The Norwegian power sector is characterised by a large number of stakeholders within different areas of activity. The sector is organised around generation, grid and trading of power. In addition, a considerable number of district heating suppliers have also been established over the last ten years.

Public bodies are considerable owners in the sector; for example, about 90 per cent of Norwegian hydropower production is owned by public entities. The combination of considerable public ownership and a diversity of stakeholders is distinctive for the Norwegian power sector.

Companies within various areas of activity

All producers, grid owners and/or traders of power must have a licence from the NVE. Figure 1.5 shows the number of companies with licence(s) by different activities as of 1 January 2011.

Production companies

Of a total of 183 companies that produce power in Norway, 58 are solely producers.

Table 1.2 provides an overview of the ten largest production companies by MW installed capacity in Norway as of 1 January 2012. They control more than 75 per cent of the country's mean production capacity, and have also installed about 74 per cent of the overall capacity.

Table 1.2: The ten largest production companies by MW installed capacity, as of 1 January 2012.[5]

Production company	Total installed capacity (MW)	Share
Statkraft Energi AS	11 359	36%
E-CO Energi AS	2 754	9%
Norsk Hydro AS	1 801	6%
Agder Energi Produksjon AS	1 756	6%
BKK produksjon AS	1 709	5%
Lyse produksjon AS	1 587	5%
NTE Energi AS	812	3%
Eidsiva Vannkraft AS	787	2%
Statoil	665	2%
Hafslund Produksjon AS	528	2%
Total production capacity	31 712	75%

Source: NVE

5 When the parent company owns more than 50 per cent of the company, the production is distributed according to the company's ownership interests.

Table 1.3: The ten largest grid companies (distribution grids), as of 31 December 2010.

Grid company	Energy delivered in 2010 (GWh)	Number of customers
Hafslund Nett AS	16 754	544 925
Skagerak Nett AS	5 207	182 230
BKK Nett AS	5 229	179 924
Agder Energi Nett AS	4 267	175 278
Eidsiva Nett AS	4 062	140 094
Lyse Elnett AS	4 097	126 703
Fortum Distribution AS	2 567	100 454
Trønderenergi Nett Trondheim AS	2 502	95 455
NTE Nett AS	2 140	81 405
Troms Kraft Nett AS	2 098	67 721

Source: NVE

Table 1.4: The ten largest power traders in 2010.

Trading company	GWh
Statkraft Energi AS	15 658
Norsk Hydro Produksjon AS	11 028
LOS AS	8 802
Fjordkraft AS	8 122
Hafslund Strøm AS	7 999
NorgesEnergi AS	5 104
Ishavskraft AS	3 287
Norske Skogindustrier ASA	3 239
Lyse Handel AS	3 193
Statoil Norge AS	2 963

Source: NVE

Grid companies

A total of 154 companies carry out grid activities at one or more levels (distribution grid, regional grid or main grid). Of these, 44 are pure grid companies, cf. Figure 1.5. Most grid companies are wholly or partially owned by one or more municipalities. Statnett SF, which owns about 90 per cent of the main grid, is owned by the State.

Table 1.3 shows the ten largest grid companies in the distribution grid (including the distribution part of the vertically integrated companies) as of 31 December 2010, by the number of customers and final deliveries.

Trading companies

Trading companies purchase power in the market for re-sale. Table 1.4 shows the ten largest traders of electric energy by deliveries to end-users as of 31 December 2010. Some of the companies in the table also engage in production and/or grid activities. Of the total of 245 companies involved in power trading, 96 have trading as their sole activity. Trading in the financial market is not subject to a trading licence, see Chapter 5 for a more detailed account.

Vertically integrated companies

Vertically integrated companies engage in activities within power production, power transmission and/or power trading.

There are a total of 110 companies involved in both competitive activities (production and/or trading) and grid activities. Of these, 60 companies engage in both production, trading and grid activities. The figures cover vertically integrated companies that are engage in production, transmission and trading activities within the same legal entity, not corporations with separate activities in different subsidiaries.

District heating companies

District heating has been developed or is being planned and developed in most major Norwegian cities. More than 70 com-

Table 1.5: The five largest district heating companies measured by district heating deliveries in 2011.

District heating company	GWh
Hafslund Varme AS	1 371
Statkraft Varme AS	650
Frevar KF	190
BKK Varme AS	187
Fortum Fjernvarme AS	173

Source: Norsk Fjernvarme

panies have been granted licences for district heating. Certain companies operate district heating plants in multiple cities. Table 1.5 shows the five largest district heating companies, measured by district heating deliveries in 2011.

Ownership in the power sector

Municipalities, county authorities and the State own about 90 per cent of Norway's production capacity. The State is the owner through Statkraft, and owns about one-third [6] of the production capacity. Statkraft's organisation as a public enterprise entails that the State must be the sole owner. Many companies have multiple owners and there is a significant level of cross ownership.

One characteristic of the Norwegian hydropower sector has been the right of reversion to the State for licences granted to private players after 1917. The right of reversion entails that the State shall, free of charge, assume ownership of waterfalls and production equipment when the licence period expires. As the time of reversion stated in the licences approaches, private power plants will either be sold to public enterprises or ownership will revert to the State at the time of reversion. The right of reversion to the State has thus caused, and continues to cause, restructuring of the ownership of Norwegian power production. In 2008, amendments were also made to the water resources legislation in order to ensure and strengthen public ownership of national hydropower resources. This means that new licences for the ownership of waterfalls, as well as licences for transferring existing licensed waterfalls, can only be granted to public developers. As a result, new licences will not be subject to the right of reversion. Current temporary licences will run as normal until the time of reversion. We also refer to the section regarding the Industrial Licencing Act in Appendix 1 for a more detailed discussion of this.

The State owns about 90 per cent of the main grid. Private companies, county authorities and municipalities also own parts of the main grid. The State ownership of the main grid is managed through Statnett SF. Municipalities and county authorities own most of the regional grids and distribution grids.

There are private ownership interests within all activity areas: production, grid activity and trading. Foreign ownership interests are relatively limited in the Norwegian power supply, but some foreign companies have been granted trading licences in Norway.

6 The State also owns 34.26 per cent of Norsk Hydro, which owns a capacity of 8.7 TWh/year.

2

ENERGY AND POWER SUPPLY

Photo: E-CO Energi

2.1 Production of electricity

Norwegian electricity production totalled 128 TWh in 2011. Of this, approximately 122 TWh was produced in hydropower plants, 1.3 TWh in windpower plants and 4.8 TWh in gas-fired power plants and other thermal power plants. The average electricity production has been approximately 127 TWh/year over the last ten years.

At the start of 2012, the total installed production capacity in Norway was 31 814 MW. Of this, installed capacity in hydropower plants was 30 172 MW, wind farms 512 MW and gas-fired and other thermal power plants 1130 MW. Norway also has two backup gas-fired power plants with an installed capacity totalling 300 MW. These plants can only be used in special situations and require permits from the Norwegian authorities.

Hydropower

Hydropower is production of electricity based on water. The volume of water and the head determine the potential energy in a waterfall. The head is the difference in height between the water intake and the outlet from the power plant. The water is led from the intake, through pressure shafts, down into the power station. The water reaches the turbine wheel with high pressure. The kinetic energy in the water is transferred through the turbine's drive shaft to a generator that converts it into electric energy. The water is led from the turbine back into the river at the outlet.

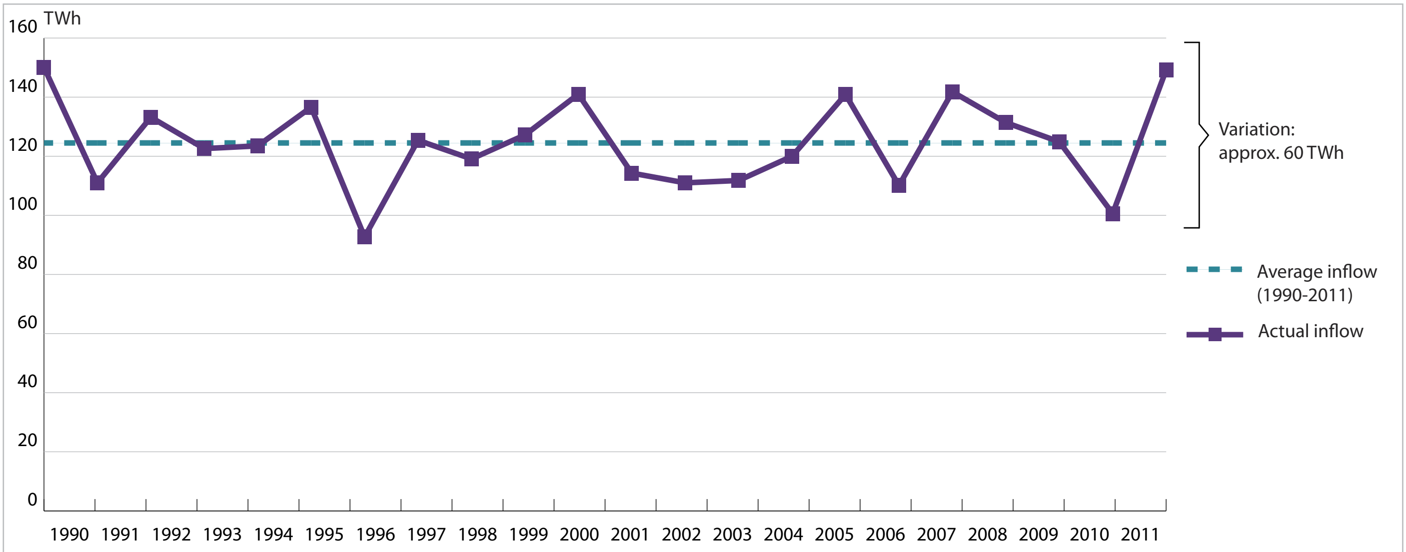
The volume of water that can be led into a hydropower plant depends on the potential inflow available for hydropower production and the regulation reservoir's storage capacity.

The water inflow is the volume of water that can be utilised in the power plant from the drainage basin of a river system. The precipitation, and thus the potential inflow available for hydropower production, varies throughout the country, through seasons and from year to year. The inflow is greatest when the snow is melting during the spring, and normally declines at the end of summer and leading into the autumn. Autumn floods normally provide increased inflow. During the winter months, inflow is normally very low. Over the last 20 years, the annual inflow available to Norwegian hydropower plants has varied by about 60 TWh, where the lowest inflow was registered in 1996 and the highest in 1990, see Figure 2.2.

Figure 2.1: Installed capacity in hydropower plants. As of 1 January.

Source: NVE

Figure 2.2: Annual inflow into the Norwegian hydropower system. 1990 to 2011.



Source: NVE

Capacity and production

As of 1 January 2012, the installed capacity in Norwegian hydropower plants, 30 172 MW, is distributed across 1393 power plants. The ten largest hydropower plants together amount to nearly one quarter of the production capacity. The composition of small and large hydropower plants and the overall installed peak capacity as of 1 January 2012 is listed in Table 2.1.

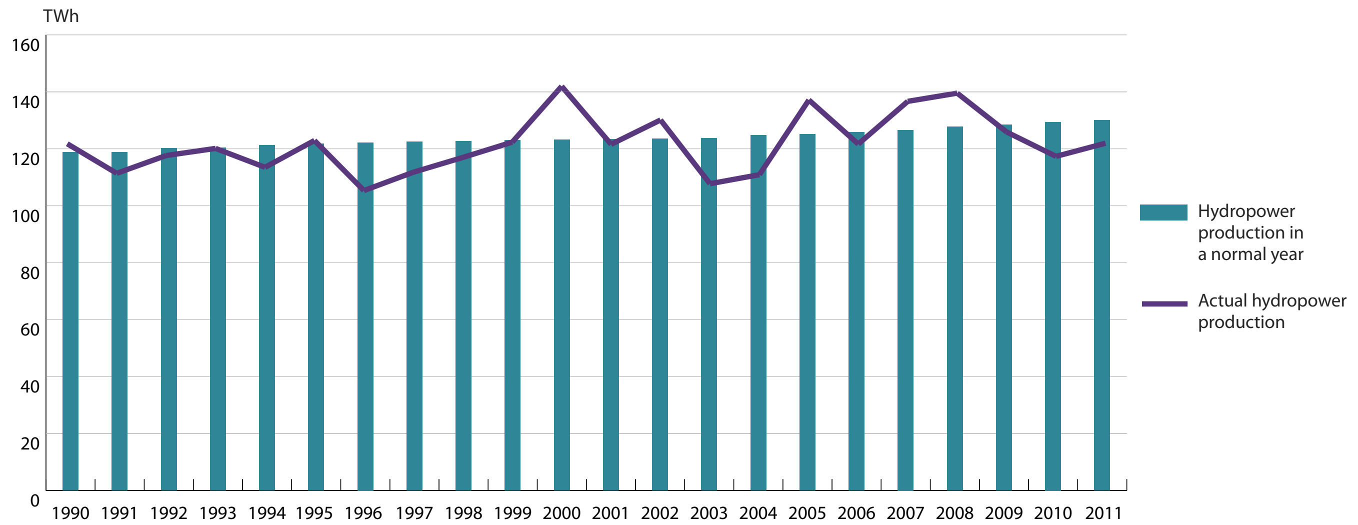
At the start of 2012, Norwegian hydropower production in a normal year was calculated at 130 TWh. This was calculated on the basis of installed capacity and expected annual inflow in a year with normal precipitation. A production record was set in the year 2000 with hydropower production totalling 142 TWh. In 2003, hydropower production amounted to 106 TWh, which was the lowest hydropower production since 1996. Figure 2.3 shows the development in the Norwegian hydropower production in a normal year, as well as the actual hydropower production between 1990 and 2011.

Table 2.1: Operational hydropower stations by size and mean annual production. As of 1 January 2012.

MW	Number	Mean annual production GWh/year
< 1 MW	540	727
1-10 MW	520	7 499
10-49 MW	188	21 681
50-99 MW	67	22 318
100-199 MW	42	26 203
> 200 MW	36	51 581
Total	1 393	130 008

Source: NVE

Figure 2.3: Hydropower production in a normal year and actual hydropower production, 1990 to 2011.



Source: NVE

Different types of hydropower plants

Run-of-river hydropower plants

Inflexible hydropower plants are power plants without storage capacity. Run-of-river hydropower plants and small-scale power plants are typically inflexible.

It is difficult to regulate the flow of water in run-of-river hydropower plants, and the water must mainly be used when it is available. Power production will therefore increase considerably in periods with snow-melting or large amounts of precipitation. The power plant's production will thus vary according to the water inflow.

Power plants with an installed maximum capacity up to 10 MW are called small hydropower plants and are normally divided into the following sub-groups: micro power plants (installed maximum capacity up to 0.1 MW), mini power plants (installed maximum capacity up to 1 MW) and small-scale power plants (installed maximum capacity up to 10 MW). Small hydropower plants are often established in small streams and rivers without regulation reservoirs.

Traditional small hydropower plants do not involve any water regulation measures and are therefore only subject to the Water Resources Act. This may also be the case for larger power plants.

Flexible hydropower plants

Flexible hydropower plants are power plants connected to regulation reservoirs. The water's potential energy can be stored in regulation reservoirs established in lakes or artificial pools if dams are constructed in parts of the river system. The water accumulates during surplus periods with high inflow and low consumption. During deficit periods the reservoir can be tapped and power can be produced from the stored water. Specifically, storing the water in reservoirs makes it possible to retain water during periods of flooding and release water in periods of drought. By storing the water in reservoirs, a greater share of the run-off can be used in power production, and the production can be adapted according to the demand for power.

The reservoir capacity is the amount of power that can be produced by draining a full reservoir. The reservoir regulation is stipulated in a permit which defines the highest and lowest water level, taking into account e.g. topographic and environmental conditions. Dry-year or multi-year regulation is possible through the use of large regulation reservoirs which can store water in years with heavy precipitation for use in years of light precipitation. Storing water over the summer for use during the winter, when the demand for power peaks, is called seasonal regulation. Daily and weekly regulation is called short-term regulation.

Table 2.2 shows the ten largest hydropower plants in Norway as of 1 January 2012.

Pumped-storage power plants

In pumped-storage power plants, water is pumped up to regulation reservoirs with greater head. A financial return can be achieved because the water's potential energy increases proportionally to the head. If power prices are low, it may be profitable for producers to use power to move the water to a higher reservoir in order to use the water for production when prices are high.

Hydropower potential

The hydropower potential is the energy in the Norwegian river systems where development for power purposes is technically and economically viable. The Norwegian Water Resources and Energy Directorate has calculated that the Norwegian hydropower potential is 214 TWh/year as of 1 January 2012, using the 1981-2010 inflow period. Of the total hydropower potential, about 49.5 TWh/year can be found in protected river systems and 0.9 TWh/year can be found in rejected license applications, cf. Figure 2.4. This potential is therefore not available for development. As of today, a hydropower potential of about 33.8 TWh/year has not been protected against hydropower development. The mean annual developed production capacity is 130 TWh, in addition to projects under development totalling 1.1 TWh and licences granted for development of an additional 2.6 TWh. A particularly high number of licences have been granted for small hydropower plants.

Most major remaining projects have been discussed and classified in the Storting White Paper on the Master plan for water resources. The plan provides a prioritised sequence of which individual projects can undergo licence processing, and emphasis has been placed on developing the least controversial and less costly projects first. Reference is made to the detailed discussion in Chapter 1.

Table 2.2: The ten largest hydropower plants in Norway, sorted by max installed capacity. As of 1 January 2012.

Power station	County	Max capacity MW	Mean annual production GWh/year
Kvilldal	Rogaland	1 240	3 583
Tonstad	Vest-Agder	960	4 357
Aurland I	Sogn og Fjordane	840	2 508
Saurdal	Rogaland	640	1 334
Sy-Sima	Hordaland	620	2 158
Lang-Sima	Hordaland	500	1 358
Rana	Nordland	500	2 168
Tokke	Telemark	430	2 328
Tyin	Sogn og Fjordane	374	1 450
Svartisen	Nordland	350	2 430

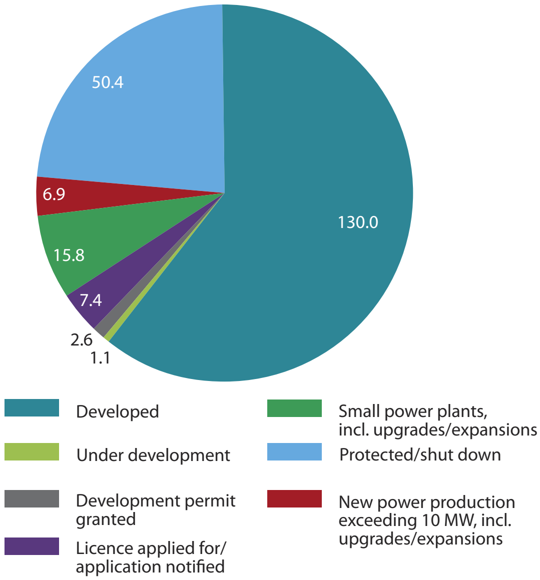
Source: NVE

Part of the hydropower potential can be found in upgrades and expansions of existing hydropower plants. Upgrades of hydropower plants involve modernising existing power plants in order to utilise more of the water's potential energy, using e.g. newer turbine or generator technology. Expansions are larger measures, such as transferring water from other drainage basins.

Wind power

A wind turbine converts the kinetic energy of wind into electric energy. The main components of a modern wind turbine consist of a rotor with three blades driving a generator that supplies electricity. The rotor is attached to the nacelle, which

Figure 2.4: Overview of hydropower potential. As of 1 January 2012. TWh/year.



Source: NVE

is a closed capsule. The nacelle is located at the top of the tower, which in turn is attached to a foundation on the ground, or on the seabed in the case of offshore wind power. Floating offshore wind turbines are under development, but are not yet commercially available.

A modern wind turbine produces electric energy when the wind speed at hub height is between 3-4 and 25 m/s (gentle breeze to storm). At high wind speeds, the wings rotate so that the force on the wind turbine is not too great, and at wind speeds above 25 m/s, the blades are rotated directly into the wind and locked in place. The effect of the wind passing over a surface is proportional to the wind speed in the third power. This means that if the wind speed is doubled, the effect will increase eightfold. The energy production is thus highly dependent on wind conditions. In practice, a wind turbine can utilise up to 40-45 per cent of the kinetic energy in the wind passing the rotor blades.

A wind farm is a collection of more than one wind turbine. It is advantageous to place the turbines in large farms in order to realise an economy of scale in the form of installation of turbines, road construction, grid connection, the number of structures, operations and maintenance.

Wind power is an inflexible energy source that only supplies energy when the wind is blowing. Other, flexible production is therefore necessary to adapt production in line with variations in consumption.

Offshore wind power is a less mature technology and has higher costs compared with onshore wind power, as installation and operation is more complicated and more expensive than on land. Technology development and pilot projects for offshore wind power are underway in Norway.

Wind power development in Norway has, so far, not been commercially profitable, and developments have depended on public funding. Until 31 December 2011, Enova funded wind power development. As of 1 January 2012, this funding was replaced by electricity certificates.

Capacity and production

Norway generally has good wind resources, compared with other countries. The average annual wind speed 50 metres above ground in a well-exposed coastal area in Norway can be 7-9 m/s. A general rule of thumb has been that an average wind speed of 6.5 m/s is needed for an area to be viable for wind power.

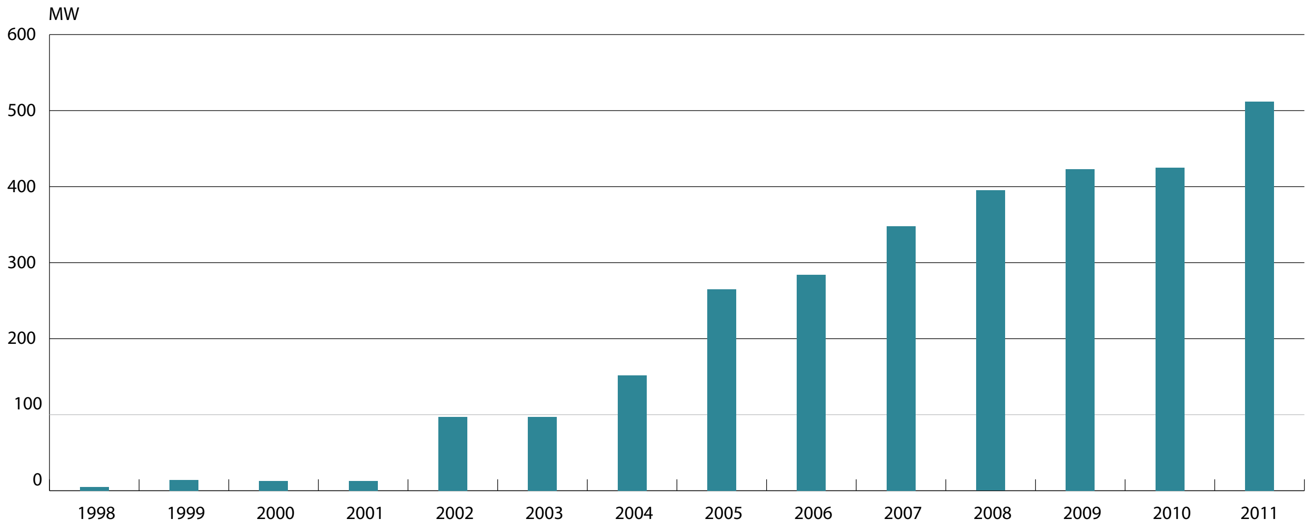
At the start of 2012, Norway had 512 MW of installed wind power, distributed across 242 turbines in 19 registered wind farms, see Figure 2.5. In 2011, the overall production was 1310 GWh. As of 1 January 2012, final permits had also been granted for nine onshore wind farms, one offshore and five demonstration projects which have yet to be developed.

Gas-fired and other thermal power production

Gas-fired power plant is often used as a general term for power plants in which natural gas is used for production of electricity and potentially heat. There are different types of gas-fired power plants.

A power plant where only gas turbines drive the generator is called a gas turbine plant. A gas turbine plant can be started and stopped at short notice, and is therefore suitable for production during hours of high overall demand for power. Electricity production in gas turbines also generates heat.

Figure 2.5: Installed peak wind power capacity. 1998 to 2011.



Source: Statistics Norway/NVE

In combined cycle power plants (Combined Cycle Gas Turbine plants, CCGT plants) and combined heat and power plants (CHPs), the heat is also utilised, which contributes to a significant increase in efficiency, compared with a gas turbine plant. Combined cycle power plants use the heat in the exhaust from the gas turbines to produce additional power using steam turbines. Together, these turbines yield an efficiency of nearly 60 per cent.

Capacity and production

The three largest gas-fired power plants in Norway are Kårstø Power Station, Mongstad Power Station and the power plant on Melkøya.

The natural gas combined cycle power plant (CCGT) at Kårstø was completed in the autumn of 2007. It has an installed capacity of about 420 MW, the equivalent of a maximum annual production of about 3.5 TWh.

In connection with development of the Snøhvit LNG[7] gas field, it was decided that the energy demand would be covered by an integrated combined heat and power plant. The combined heat and power plant on Melkøya was completed in connection with start-up of production on Snøhvit LNG in 2007, and is tailored to the energy needs at the Snøhvit facility. The plant has an installed capacity of 215 MW for electricity production and 167 MW for heat. An annual electricity production of about 1.5 TWh is expected.

The Mongstad Power Station was completed in 2009. The power plant's installed capacity for electricity production is 280 MW. Currently, about half of this production capacity is in use, the equivalent of about 1.1 TWh/year.

Statnett has also built two 150 MW gas-fired backup power plants at Tjeldbergodden and Nyhamna in Møre and Romsdal County. The plants will only be used in the event of highly strained power situations with a risk of rationing. Statnett must apply for a special permit from the NVE each time the facilities may be used.

Other thermal power

The production processes in many industrial enterprises emit heat which can be used for power production. The opportunities and costs involved in such utilisation vary between enterprises, depending on technical aspects of the processes and location.

7 Liquefied natural gas.

During production of heat in district heating plants, part of the heat may be used for power production, so-called co-generation.

In 2011, the overall gas and thermal power production was 4.8 TWh.

Other electricity production

With its extensive coastline, Norway has vast offshore energy resources. There are many technological concepts seeking to utilise energy from the sea: tidal power, osmotic power, as well as tidal barrages and tidal currents. With the exception of tidal barrages, these technologies are still in the development phase. In Norway, solar energy is mainly generated from solar panels mounted on holiday homes in areas not connected to the electrical grid.

2.2 Production of heat

In stationary electricity supply, energy sources such as oil, natural gas and biomass are primarily used to produce thermal energy. Geo-thermal energy, ambient heat and solar energy can also be used to produce thermal energy. The energy can be transported through district heating systems or smaller distribution systems for waterborne heat, or it can be consumed in place. The thermal energy is used to heat buildings and water supplies in commercial buildings, residences and industrial buildings. Industry also uses thermal energy for various processes, and district heating is also, in certain cases, used to melt snow off football pitches, pavements, etc.

The consumption figures for oil, natural gas and bioenergy which are presented in the following sub-chapters reflect energy input. The energy output from these energy sources will depend on the efficiency, which varies with different energy sources and combustion processes.

District heating

The technology of supplying hot water or steam from a central heat source to consumers via insulated pipelines for transporting hot water or steam, is called district heating.

In most cases, district heating plants are constructed as a result of access to a reasonable heat source, such as heat from waste combustion or other heat which would otherwise be wasted. Waste is the most important energy source in district heating production, but bioenergy, heat pumps, electricity, gas and oil are also used.

Capacity and production

Figures for 2010 show that the consumption of district heating totalled 4.3 TWh, cf. Figure 2.6. This was an increase of 30.6 per cent from 2009. Since the year 2000, the consumption of district heating has nearly tripled. District heating accounts for about 3 per cent of energy consumption in the domestic stationary sector. In 2010, 65 per cent of district heating was used within the service sector, while households accounted for about 24 per cent and industry 11 per cent.

District heating has been established or is under development in most major cities in Norway.

Oil for stationary combustion

The use of oil for stationary combustion is distributed across the following products: heating kerosene, light fuel oil, special distillate and heavy oil. Heating kerosene is primarily used in stoves in private residences. Light fuel oil is used in both small systems in private homes and large industrial facilities. The vast majority of the consumption of light fuel oil takes place in plants associated with waterborne heat. Heavy fuel oils are used in large incineration facilities.

Oil products are used less and less frequently to heat buildings, but the consumption varies considerably from year to year due to variations in temperature and energy prices.

Over the last twenty years, the consumption of oil products as a share of stationary energy consumption has declined from about 15 per cent to about 10 per cent. In 2010, the industrial sector's use of oil products for stationary purposes corresponded to 7.5 TWh. Households, the service sector and others used 8.8 TWh of oil products for stationary purposes .[8]

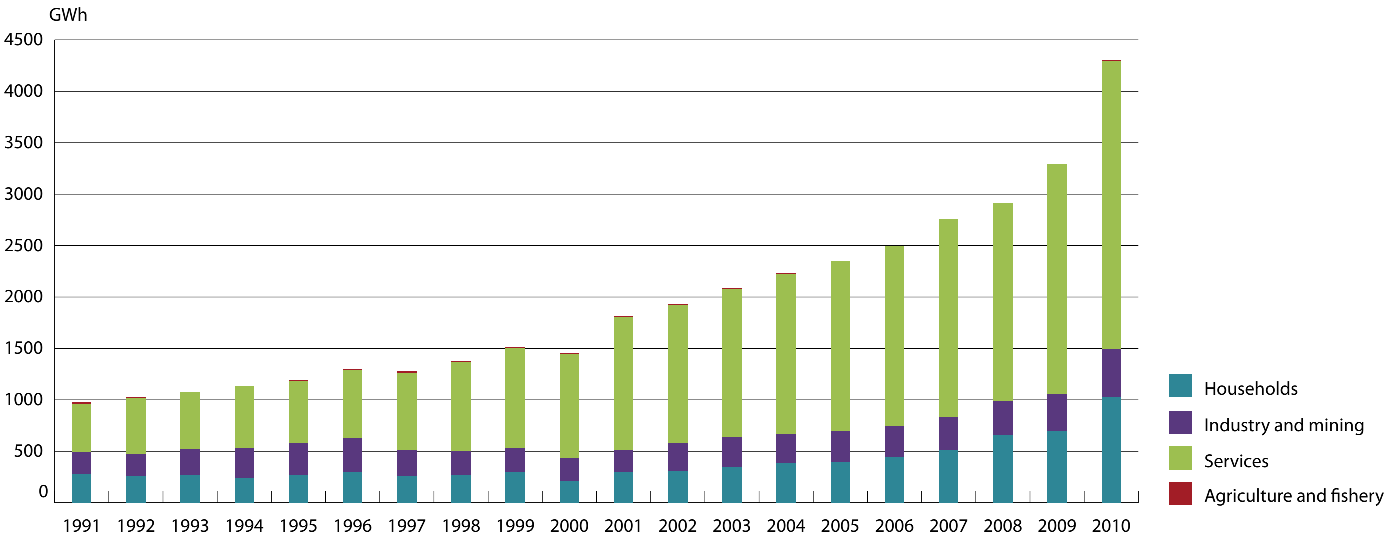
Biomass

Converting biomass through combustion, fermentation or chemical processes yields bioenergy. Biomass includes firewood, paper industry waste[9], bark and other wood waste, as well as waste from households and commercial activities which

8 Includes all petroleum products, including liquefied gas and petroleum coke used for fuel purposes.

9 Paper industry waste is a residual product of cellulose production, consisting of wood pulp and lye.

Figure 2.6: Consumption of district heating in different consumer groups (including district heating delivered to intra-group companies), 1991 to 2010.



Source: Statistics Norway

is used in the production of district heating. Fuels such as gas, oil, pellets and briquettes can be manufactured from biomass.

The use and area of application for biofuels depend on the access to and quality of the fuel and requirements for treatment of emissions. The pulp and paper industry and lumber industries require a lot of heat for various curing/drying processes, which makes it possible to utilise the energy in residual products such as bark and woodchips in large incineration facilities without further processing. Heat from waste incineration can be used to produce district heating and/or electricity. Biofuels used in households and smaller incineration facilities often require somewhat more preparation due to transport, storage and handling.

Wood pellets and briquettes are well-suited for storage, transport and use in automated incineration facilities.

In 2010, the registered use of bioenergy in the stationary sector was about 13.5 TWh. The industrial sector accounted for about one-third of this with 4.8 TWh. The remaining 8.7 TWh was primarily used in households, in addition to biomass used to produce district heating.

Natural gas

Natural gas primarily consists of methane and can be distributed via pipelines, or as CNG[10] or LNG. Natural gas has been adopted in Norway over the last ten years and has primarily replaced heavy fuel oils in industry.

In 2011, domestic use of natural gas[11] amounted to 388 million Sm^3, corresponding to just below 3.9 TWh in energy input. This was 5.4 per cent higher than the previous year. The use of propane and butane is not included. Of the domestic consumption of natural gas in 2011, deliveries via pipelines amounted to 47.9 per cent, while LNG and CNG accounted for 50.9 and 1.5 per cent, respectively.

The industrial sector is the largest consumer of natural gas. The chemical industry used 1 TWh for energy purposes in 2011. The metal industry used 0.8 TWh, while the food, beverages and tobacco industry used natural gas equivalent to 0.5 TWh for energy purposes. Households used natural gas corresponding to 38 GWh in 2011.

10 Compressed natural gas.
11 Net domestic end-user consumption of natural gas (not including natural gas used in the energy sector), excluding natural gas used as raw material. The 2011 figures are preliminary (source: Statistics Norway).

3

ENERGY CONSUMPTION

Photo: istockphoto

3.1 Factors that influence energy consumption

Developments in energy consumption are influenced by general trends in society. Demographic factors such as population development and settlement patterns impact the demand for energy. On the one hand, population growth contributes to increased energy consumption through construction of more homes, schools and commercial buildings which all need heating and lighting. Population growth also results in higher consumption of goods and services produced through the consumption of energy. On the other hand, centralisation of the population from sparsely populated areas to densely populated areas reduces consumption, partly as a result of higher occupant density.

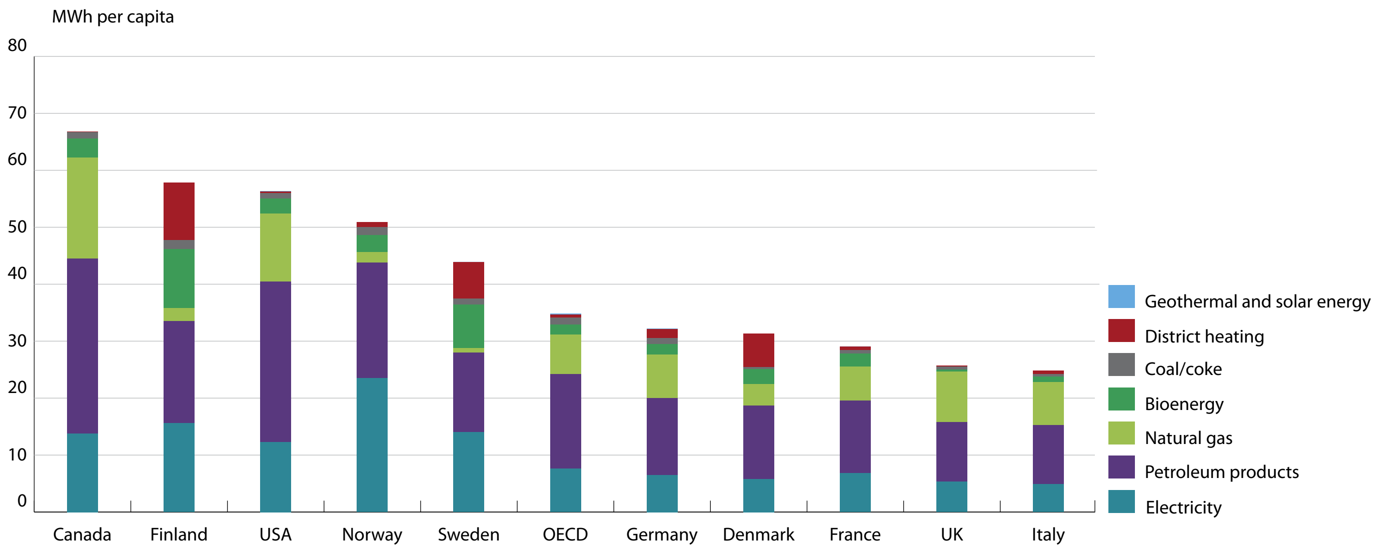
Economic growth entails increased production of goods and services, which in turn leads to increased energy consumption. Energy efficiency and changes in industry structure from energy-intensive industries to less energy-intensive industries contribute to lower energy consumption. Technology developments usually reduce energy consumption as production processes and products become more energy-efficient. Various policy instruments also contribute to curb energy consumption, for example energy consumption taxes, the EU's emissions trading system, regulations relating to technical requirements for new buildings and subsidy schemes for investments in energy efficiency measures.

Energy consumption is also influenced by energy prices. Higher energy prices result in higher production costs for industry and consumption of electricity and other energy carriers in households becomes more expensive. This normally contributes to curb consumption. Temperatures are also a factor in energy consumption trends and result in consumption fluctuations from year to year. This is because a large share of energy consumption goes towards heating, especially in the service industries and households.

3.2 Energy consumption trends

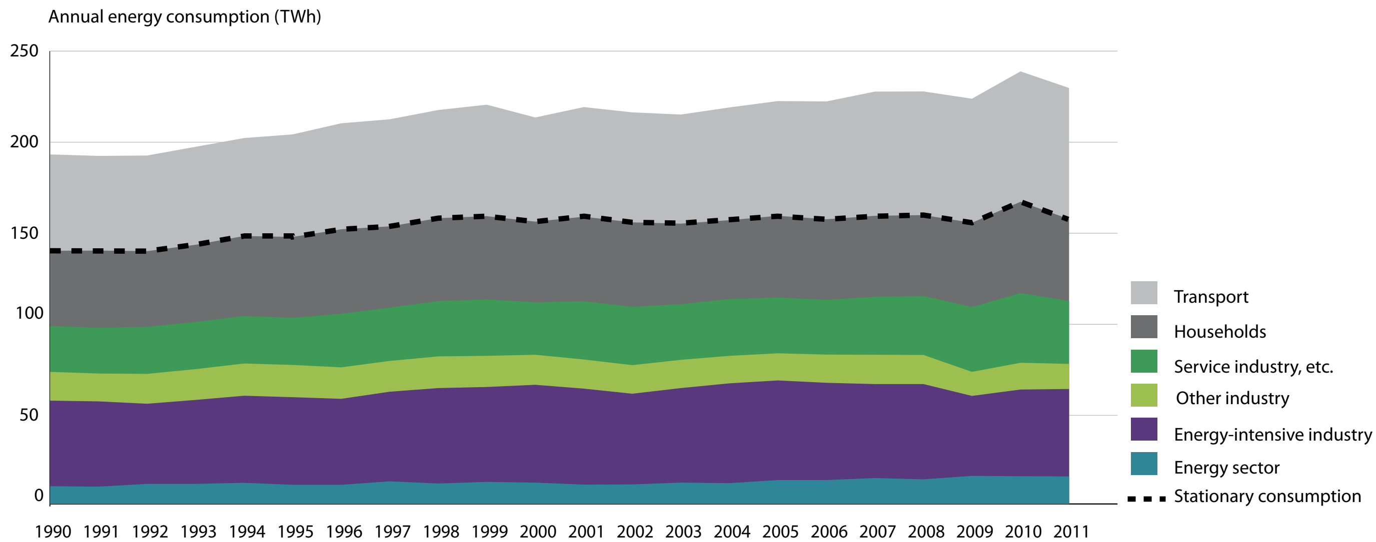
Norwegian energy consumption per capita is somewhat higher than the OECD average, cf. Figure 3.1. Electricity accounts for a significantly higher share of the energy consumption in Norway than in other countries. One important reason for the high percentage of electricity in overall energy consumption is the large energy-intensive industry in Norway. In addition, electri-

Figure 3.1: Energy consumption per capita in OECD countries in 2010.



Source: Energy Balance of OECD countries 2012, IEA/OECD/Paris

Figure 3.2: Energy consumption by consumer groups.



Source: Statistics Norway/NVE

city is used to heat buildings and water to a greater extent than in other countries.

Net domestic energy consumption in Norway in 2011 was about 230 TWh[12]. Overall energy consumption rose until the end of the 1990s, and has subsequently been relatively stable. In recent years, fuel for transport and energy consumption in the energy sector has seen relatively strong growth, while energy consumption in other sectors has generally remained more stable. Figure 3.2 shows energy consumption trends by consumer groups from 1990 to 2011.

Stationary energy consumption

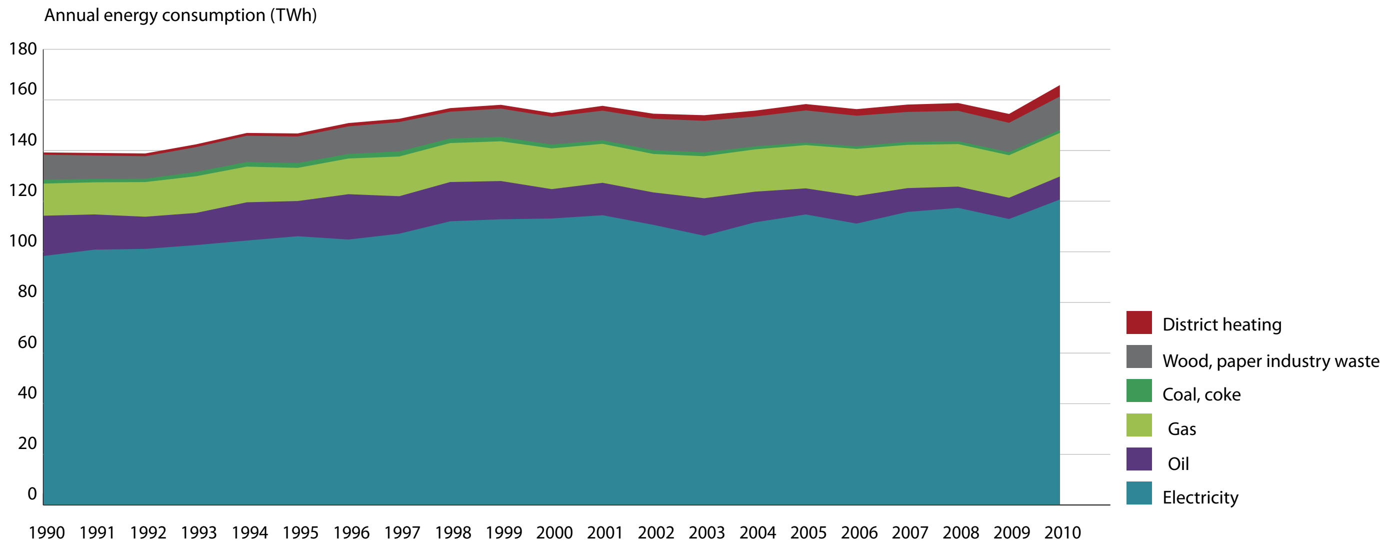
Stationary energy consumption is defined as net domestic energy consumption minus energy used for transport, cf. Figure 3.2. It is common to distinguish between industry, households, service industries and the energy sector. Industry is divided into energy-intensive industry (metal, manufacture of chemical raw materials and pulp and paper) and other industry. The dotted black line in Figure 3.2 shows the development in stationary energy consumption by different consumer groups in the period 1990 to 2011. From 1990 to 1998, stationary energy consumption increased by 10 per cent. Consumption has since remained relatively stable. In 2011, stationary energy consumption in Norway amounted to slightly more than 150 TWh.

Buildings in Norway include primary residences and holiday homes, as well as commercial buildings in the service industry, general industry, primary industries and construction sector. Energy consumption in buildings is used for lighting, heating rooms and water, and powers electrical equipment. In 2011, more than 50 per cent of the stationary energy was used in buildings. As seen in Figure 3.2, energy consumption in households and service industries was high in 2010. This was a result of 2010 being an unusually cold year in Norway.

In 2011, slightly less than 40 per cent of the stationary energy was used for industrial processes. It is common to differentiate between processes in energy-intensive industry and in other industry. Other industry consists of many smaller enterprises,

12 Net domestic energy consumption includes domestic end-user consumption of energy and energy consumed in the onshore energy sector. Energy consumed in the onshore energy sector includes electricity generation, district heating generation, onshore petroleum facilities, refineries and platforms supplied with electricity from shore. Energy goods used as raw materials for production of new energy goods (transformation) are not included. The figures for 2011 are provisional. Transport is the responsibility of the Ministry of Transport and Communications.

Figure 3.3: Stationary energy consumption by energy carrier, 1990 to 2010.



Source: Statistics Norway

where there is uncertainty as to the amount of energy consumed in industrial processes and how much is consumed in industrial buildings. From 2008 to 2009, energy consumption in industry fell by about 18 per cent as a result of the economic downturn following the financial crisis. Energy-intensive industry in particular had lower energy consumption in 2009, while these figures rose again in 2010.

Energy consumed in the onshore energy sector includes electricity generation, district heating generation, the onshore petroleum facilities, refineries and platforms supplied with electricity from shore. The energy sector has experienced the greatest growth in consumption with an increase of more than 50 per cent since the early 1990s. The increased use of energy in the energy sector is connected e.g. to higher natural gas exports. In 2011, 10 per cent of the stationary energy was used to produce energy goods onshore, most of it in the petroleum sector.

Stationary energy consumption by energy carrier

Electricity accounts for the largest share of stationary energy consumption, around 70 per cent. Figure 3.3 shows stationary energy consumption trends from 1990 to 2010 by energy carriers. The percentage of oil products used in stationary energy consumption has declined since the 1990s[13]. The consumption of coal and coke has gradually declined in recent years, while consumption of biomass, gas and district heating has increased.

3.3 Change in the consumption and production of energy

Many countries are working to change their consumption and production of energy (energy change or energy diversification). What this work entails might vary based on the inherent characteristics of the energy supply in the respective countries. Many European countries are working to limit the use of electricity based on coal as it implies high CO_2 emissions, and some countries are working to phase out nuclear power. In Norway, electricity production is based on hydropower, and the challenges are related to the system's vulnerability to fluctuations in water inflow. In addition, we have to a large extent based our heating of buildings on electricity, which makes us particularly vulnerable

13 Energy use for tools and construction machines such as tractors, excavators, industrial forklifts and private lawnmowers is considered stationary energy consumption in the energy balance, but this is not included here. Energy used as raw material, for transport purposes and fishing vessels, military aircrafts and vehicles is not considered stationary energy consumption and is not included.

during cold winters. An important part of our energy change is therefore to limit the use of electricity and fossil energy sources, both in new applications, existing buildings and the industry.

In Norway, the rationale for energy diversification is the need to regard the security of supply, greenhouse gas emissions and the fact that renewable energy production and transport of electricity entail interventions in the landscape. The work is directed towards:

- More use of other energy carriers than electricity and fossil fuels for heating
- Energy efficiency
- Renewable energy production based on other sources than hydropower or fossil fuels.

Energy diversification is often a result of technological development. In addition, Norwegian authorities have a number of policy instruments available in order to influence the consumption of energy and stimulate to increased energy efficiency. The policy instruments include regulatory measures such as technical construction standards, economic measures such as taxes and support schemes, information and advisory services, as well as voluntary agreements between the authorities and market actors or industries. Laws and regulations place limitations on the solutions that can be used, while information and advice make it easier for actors to find and consider various solutions.

Box 3.1: Energy efficiency

Energy efficiency is a measure of the ratio of output in the form of comfort, or production, compared to the input of energy. Energy efficiency has increased if a given number of square metres in a residence can be heated by using a lower energy input. Another example of increased energy efficiency is that a given number of tonnes of paper can be produced by using a lower energy input. However, if the residence area or production capacity increases, the energy consumption may increase. Hence energy efficiency is not the same as energy saving. Energy saving is associated with actions that causes a reduction in the consumption of energy as a consequence of a reduction in output. Typical energy saving initiatives are lowering the room temperature or turning off the lights.

Energy indicators such as energy consumption per unit of GDP are often used to measure the efficiency of the energy consumption. A simple indicator illustrates how energy-intensive an economy, industry or process is. However, a change in the energy intensity of a country is not necessarily equal to an improvement in energy efficiency. The reason is that changes in the energy consumption over time are driven by other factors than merely energy efficiency, such as temperature, behaviour and structural changes in the economy. To establish how much energy efficiency affects the energy consumption, it is necessary to isolate the other effects. According to Statistics Norway (Bøeng et al. (2011)), energy efficiency reduced Norwegian energy use by 18 per cent from 1990 to 2009.

Taxes stimulate energy change by making it more expensive to use energy, while support schemes make it cheaper to carry out projects. EU directives and decrees also affect goals and policy instruments available to the Government.

Enova SF and management of the Energy Fund

The Energy Fund is a policy instrument to promote an environmentally friendly change in the consumption and production of energy, and the development of energy and climate technologies. The Energy Fund is a government fund established to ensure a long-term, predictable and stable source of finance for the strategy on energy efficiency and the promotion of renewable energy. The state enterprise Enova manages the Energy Fund. The Ministry of Petroleum and Energy (hereinafter "the Ministry") governs Enova's management of the fund through a 4-year agreement between the Ministry and Enova. The Energy Fund is financed by means of a levy on the electricity grid tariff, as well as through allocations from the state budget. The Energy Fund also generates interest rates which are included in the Energy Fund's budget.

Objectives for Enova's activities

Enova's task to manage the assets in the Energy Fund is specified in a 4-year agreement between the Ministry and Enova. The

Agreement defines the objectives of the enterprise, the assigned tasks, requirements to systems and requirements for reporting. The current Agreement covers the period 1 January 2012 to 31 December 2015.

The enterprise shall contribute to an environmentally friendly change in the consumption and production of energy, both in the short and long run, and the development of energy and climate technologies. The main objectives stated in the Agreement indicates the areas in which Enova shall operate within.

Enova's management of the assets from the Energy Fund shall contribute to:

a. Development and introduction of new energy and climate technologies in the market.
b. More efficient and flexible use of energy.
c. Increased use of other energy carriers than electricity, natural gas and oil for heating purposes.
d. Increased use of new energy resources, including energy recovery and bioenergy.
e. More well-functioning markets for efficient energy, environmentally- and climate-friendly solutions.
f. Increased knowledge among the general public about the possibilities to use energy-efficient, environmentally- and climate-friendly solutions.

The Agreement stipulates an overall energy target expressed in TWh that Enova must meet within the expiry of the agreement period. The funds managed by Enova shall, in the period leading up to 2015, contribute to combined energy and climate results that correspond to at least 6 1/4 TWh. Furthermore, it is stipulated that for the work related to energy and climate technology, the efforts shall contribute to a reduction in greenhouse gas emissions and support the development of energy diversification in the long run, through the development and market introduction of new technologies and new solutions which can contribute to this. Enova's efforts shall be directed towards the development of new technology and support for technologies and solutions close to market introduction.

Enova's programme areas

Enova's market approach varies according to the barriers that must be addressed and the conditions characteristic to the respective markets. A brief description of the programme areas is provided below.

Renewable heat production

Enova's management of the assets in the Energy Fund shall contribute to increased use of other energy carriers than electricity, natural gas and oil for heating. There are support programmes aimed at small heating plants and larger district heating plants. Enova also has a support programme directed towards industrial production of biogas.

Buildings

Enova offers investment aid to measures aimed at reducing the energy consumption and for conversion to heat production based on renewable energy sources in existing buildings and plants. Enova also has an initiative in place for anyone who wants to build or rehabilitate buildings to a higher standard than what is required by the Technical regulation for buildings, and it is currently aimed at low-energy buildings and passive houses. Enova offers aid to projects in the pre-engineering phase of passive house projects as well.

Scheme on support for alternative, renewable heating and electricity savings in private households

Enova has, since 2006, managed a support programme aimed at promoting increased dissemination of mature technologies for environmentally friendly heating and electricity saving which are currently not widely spread in the market.

Industry

Enova offers investment aid to energy efficiency measures, conversion to the use of renewable energy sources and energy recovery in the industry. Such measures are also eligible for pre-engineering funding. Aid is also granted for introduction of energy management in the industry.

Demonstration activities of new energy and climate technologies

Enova offers investment aid to full-scale demonstration projects involving new energy and climate technology under real-life operating conditions. Enova has a distinct responsibility for an initiative directed towards new energy and climate technologies in the industry.

Enova's advisory and information work

Enova offers a number of information and advisory activities targeting businesses, municipalities, households, children and young people. These include measures such as "Ask Enova ",

Table 3.1: Enova's allocated funds, contractual energy result, projects initiated, finally reported and realised energy result by areas, 2001 to 2011.[14]

Area	Allocated (NOK million)	Contracted GWh/year	Initiated GWh/year	Finally reported GWh/year	Realised GWh/year
Industry	1 342	4 633	2 228	928	795
Buildings	1 859	3 292	1 155	952	488
Wind power	2 523	2 095	987	483	625
Heating	2 908	5 416	2 362	1 210	805
Biorefining	38	906	40	318	548
New technology	441	145	39	39	–
Households	451	72	22	12	–
Total	9 562	16 559	6 833	3 942	3 261

Source: Enova

"Enova recommends", "the Rainmakers" and courses for municipalities. Enova also participates in joint projects such as the "Low Energy programme".

Results of Enova's work, 2001 to 2011

Enova reports results from the allocation of aid to projects in the form of contracted energy results, reported energy results or realised energy results. Many of the projects are of a size which entails that they are carried out over several years.

From 2001 to 2011, Enova has contracted projects that are expected to yield 16.6 TWh/year, either in energy efficiency, conversion from fossil fuels and electricity and energy production (energy result). A total of NOK 9.6 billion has been granted in investment aid to these projects. About 43 per cent, or about 7.2 TWh/year, has been completed and a final report has been delivered, cf. Table 3.1. A project for which a final report has been submitted is a reported project, for instance where the plant has been completed, while realised results represent the actual measured results from completed projects.

Other policy instruments that affect energy consumption

The carbon tax, the emissions trading system and the consumer tax

Energy consumption is also influenced by energy prices and taxes. Norway has several energy-related taxes.

Fuel oil, kerosene and natural gas are subject to a carbon tax. Mineral oil (fuel oil, kerosene, etc.) is subject to a carbon tax of about NOK 220/tonne CO_2 for light oil and about NOK 185/tonne for heavy oil. The tax amounts to NOK 0.59 per litre of oil. There is also a carbon tax on the use of natural gas and LPG[15], with the same taxation as for light oil. Other taxes include a base tax on fuel oil and a sulphur tax.

The European CO_2 Emissions Trading Scheme (ETS) which Norway is a part of influences power prices in Norway. As

14 All figures corrected for cancelled projects.
15 Liquefied petroleum gas.

the Norwegian and Nordic power markets are connected to the European power market, price increases in the European market will influence Norwegian prices.

The consumption tax on electricity applies to electricity delivered to consumers and is collected by the grid companies. In 2012, the consumption tax was NOK 0.1139/kWh. Industry is exempt from this tax. Confer proposition to the Storting 1 LS (2012-2013) Taxes, fees and import tax for a further description of energy taxes.

Programme for increased energy efficiency in power-intensive industry (the PFE scheme)

In 2004, a programme was established to increase energy efficiency in the pulp and paper industry. The participating enterprises are exempt from electricity tax in return for meeting the programme's conditions. The terms include introducing an energy plan and implementing the identified measures. The programme extends for five years per renewal. The Norwegian Water Resources and Energy Directorate (NVE) is the supervisory authority for the scheme.

The Technical regulation for buildings

The Technical regulation for buildings (TEK10) under the Planning and Building Act sets energy requirements for buildings.

Figure 3.4: Energy label for energy-using products.

Source: NVE

The energy efficiency requirements can be met either by implementing specific measures described in the regulations (the measure model), or by meeting the framework conditions for total net energy need (the framework requirements model). For energy supply, the requirement is that at least 60 per cent of the net heating need can be covered by energy supplies other than directly used electricity or fossil fuels in buildings exceeding 500 m2. In buildings smaller than 500 m2, the same requirement applies for 40 per cent of the heating need. There is also a ban on installation of oil boilers for base load.

Regulations resulting from EU directives and decrees

Norway is a member of the EU's internal market through the EEA agreement. On this basis, the Energy Labelling Directive, the Ecodesign Directive and the Energy Performance of Buildings Directive have been implemented in Norwegian legislation. Below is a brief description of the effect of these directives on energy consumption. See also Chapter 1 for a general description of the EU energy directives.

Energy labelling of household appliances

The framework directive relating to energy labelling of household appliances sets information requirements for manufacturers and suppliers. Products subject to the directive must have an energy label to help consumers choose the most energy-efficient products. The products are rated on a scale of seven levels (A+++ - D, A++ - E, A+ - F or A - G) displayed on an information label on the product. Figure 3.4 shows a picture of an energy label for washing machines.

The EU works continuously to prepare product-specific regulations under the directive, specifying the requirements for each individual product. Today, the energy labelling regulations cover dishwashers, refrigerators, freezers, refrigerator-freezers, air conditioning units, washing machines, tumble dryers, combined washing machine and tumble dryers, lighting and electric ovens. All these appliances have been specified as household appliances.

Ecodesign

The Ecodesign Directive sets requirements for environmentally friendly design of energy-related products for sale in the EEA. The directive is aimed at manufacturers/importers and covers the household sector, the service sector and the industry (except means of transport). If certain requirements related to environmentally friendly design are met, the products can be affixed with the CE marking, which is the entry permit to the EEA. The ecodesign requirements are intended to remove the least energy-efficient products from the market and reduce environmental impact from energy-related products throughout all life stages.

In the same way as under the Energy Labelling Directive, the EU continuously prepares product-specific regulations under the Ecodesign Directive. The regulations that have been prepared and introduced in Norway so far cover simple set top boxes, energy losses of electric and electronic devices in standby and off-mode, domestic lighting, fluorescent lamps for office and street lighting, external power supplies, electric motors, refrigerators and freezers for household use, circulation pumps and televisions.

Energy performance certification of buildings

The Energy Performance of Buildings Directive contains provisions relating to minimum requirements for energy performance in buildings, requirements for energy certification of buildings and requirements relating to inspection of boilers using fossil fuels and of air conditioning systems. To implement these provisions in Norway, a requirement was introduced on 1 July 2010 to the effect that all residential and commercial buildings now built, sold or let out must have an energy certificate. The energy certification scheme aims to put energy on the agenda in the market for residences and other buildings, as well as in the planning of new buildings, and to stimulate implementation of energy efficiency measures. Inspection of heating, ventilation and air conditioning systems also became mandatory to stimulate sound operation and inspection routines. The energy certificate can be acquired free of charge online[16].

The heating grade of the energy label in the energy performance certificate shows the extent to which the building can be heated (rooms and hot water) by energy carriers other than fossil fuels and electricity.

The energy grade of the energy label ranges from A (very energy-efficient) to G (low energy efficiency). The rating gives an overall assessment of the building's energy need, i.e. the number of kWh required by the building per square metre for normal use. The rating process applies standard values for factors such as number of residents, indoor temperatures and air quality. The energy grade is based on a calculation of delivered energy, and is independent of actual measured energy consumption. Buildings that are in accordance with the Technical regulation for buildings of 2007 will normally be rated C or D, while older buildings built in accordance with less strict technical regulations will have lower ratings. Low energy buildings and passive houses with efficient heating systems can achieve the ratings A or B.

16 Reference is made to www.energimerking.no

Box 3.2: Household energy consumption trends - historical perspective

This text has been prepared by Statistics Norway.

The incandescent light bulb was invented in the late 1870s, and lighting was the first electrical application of interest in Norway. Until the first power plants were built in the late 1800s, kerosene lamps were the dominant source of lighting in Norway. At the beginning of the 1900s, only 10 per cent of Norwegian population had electric lighting at home.

As lighting was the first, and most important electrical application in Norway, the number of lamps was counted in the first electricity statistics. In 1911, there were about 805 000 incandescent lamps in Norway, distributed among industrial and commercial enterprises and 2.4 million citizens.

In 1923, the number of incandescent lamps had risen to 5 million.

In time, electricity was used in an increasing number of contexts. The kitchen was an important workplace. Electricity simplified the work and improved family hygiene. Close connections were established between housewife organisations, manufacturers of electrical appliances and power plants. Hot plates, heaters and irons were the most common electrical appliances in Norwegian homes in the 1920s and 1930s. Housework became significantly easier with electrical appliances. It was said that "with an electric iron, you can iron as much in one hour as you could in one day".

In 1945, one fifth of the Norwegian population did not have any access to electricity. The differences between regions were significant. Nearly all households in Oslo, Akershus and Bergen, had electricity. In Nordland and Troms, only 42 per cent of the population had access to electricity, while only one in five in Finnmark had access to electricity after the Second World War. In addition, there was not sufficient power to meet consumer demand during the post war period. In 1960, almost all Norwegians had access to electricity, except for Finnmark where 10 per cent were still without electricity.

Table 3.2: Percentage of households with various electrical appliances. 1974-2009.

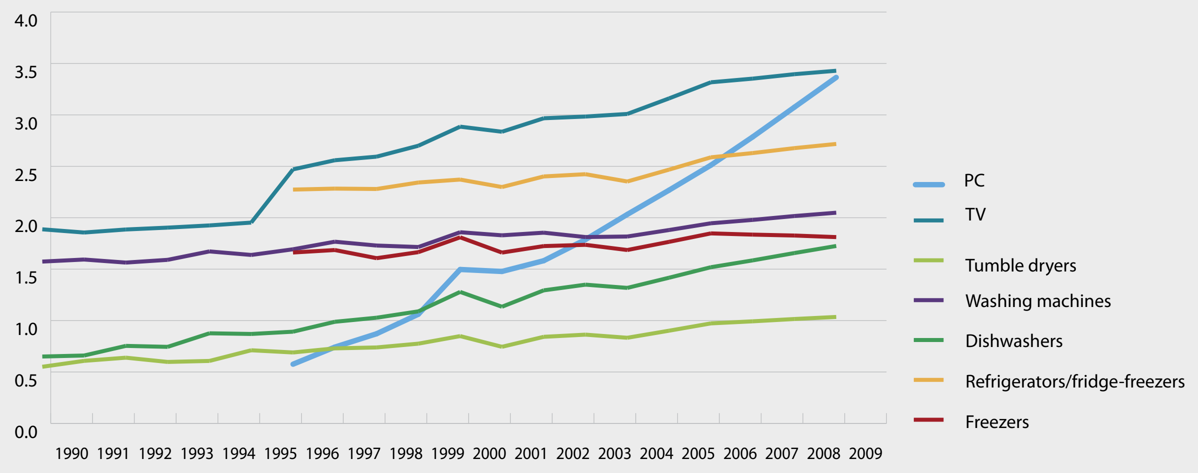
	1974-1976	1980-1982	1983-1985	1986-1988	1989-1991	1997-1999	2000-2002	2003-2005	2005-2007	2007-2009
Freezer compartment, freezer (separate)	67	75	76	92	92	91	92	91	93	92
Dishwasher	6	17	20	32	37	59	61	66	72	75
Washing machine	74	79	83	87	89	88	89	88	90	89
Tumble dryer, drying cabinet				26	32	39	40	42	45	45
TV	24	72	81	93	95	95	95	95	96	95
VCR			9	23	37	68	71	72	74	78
Camcorder					5	23	24	26	31	31
Home PC					10	53	59	71	78	84

Source: The Consumer Survey, Statistics Norway

Fully automatic washing machines came on the market in the late 1930s, but neither washing machines nor refrigerators became common until the late 1940s. There was a consumer boom in household appliances starting from the 1950s. The electrical refrigerator, the washing machine and the vacuum cleaner all became common. In 1967, three quarters of the population had refrigerators, while from the 1980s almost all households had refrigerators. Before refrigerators became common, outbuildings, larders and cold cellars were used to store food.

In time, electric shavers, record players, tape recorders and TVs also became more common. In 1975, one in four had a TV while about 95 per cent had a TV from 1990. A large percentage of the TVs were produced by Norwegian companies such as Tandberg, Radionette and Luma. In the early 1970s, the colour TV was launched. Since 1990, home PCs have seen the most rapid rise in household penetration. In 2008, 84 per cent of households had a PC, compared with 10 per cent in 1990. Table 3.5 shows the percentage of households with different types of electrical appliances. However, many households have more than one of each appliance. This applies in particular to TVs and PCs, of which there are often more than one per household. Based on the information about the number of electrical appliances per household, and the number of households, the total number of different appliances has been calculated, as shown in Figure 3.5. According to a report on power consumption of appliances (Xrgia 2011), the annual power consumption of a TV averages about 260 kWh per year. With a total number of 3.4 million TVs, about 890 GWh, or slightly less than 1 TWh is consumed by TVs annually (if all are used an equal amount of time). In 2009, there were about an equal number of PCs and TVs in Norwegian homes, but PCs use less electricity on average, especially laptops. The total consumption for PCs will therefore be somewhat lower.

Figure 3.5: Total inventory of electrical appliances in Norwegian households. 1990-2009. Million[17].

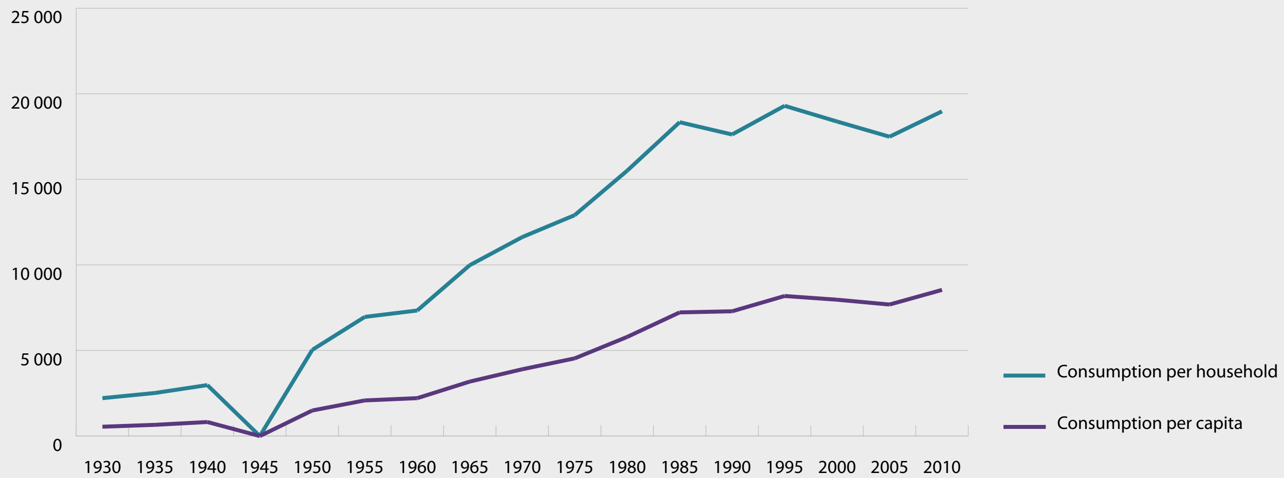


Source: Calculated on the basis of data from the consumer survey and household statistics, Statistics Norway

The development of electric power which facilitated the consumer boom in electrical appliances and heating ovens in the 1950s is reflected in the rapid increase in electricity consumption per capita in the 1900s. While each person used about 600 kWh of electricity on average in the 1930s, this number had risen to 2000 kWh in the 1960s and about 7000-8000 kWh per capita from the 1990s and later. Norwegian households are now on average among the largest electricity consumers in the world. However, we do not use more energy overall than other countries with a similar climate, but the energy consumption mix is different, with a very high percentage of electricity.

17 Data for refrigerators/fridge-freezers not available before 1996.

Figure 3.6: Electricity consumption in households 1930-2010. KWh per capita and per household.



Source: Annual electricity statistics and population statistics, Statistics Norway

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The Directorate of Electricity 1923. Electricity statistics

Xrgia (2001). Main survey of electricity consumption in households;

http://www.nve.no/PageFiles/15092/Hovedrapport_Elbrukende_apparter.pdf

The Norwegian Museum of and Science Technology

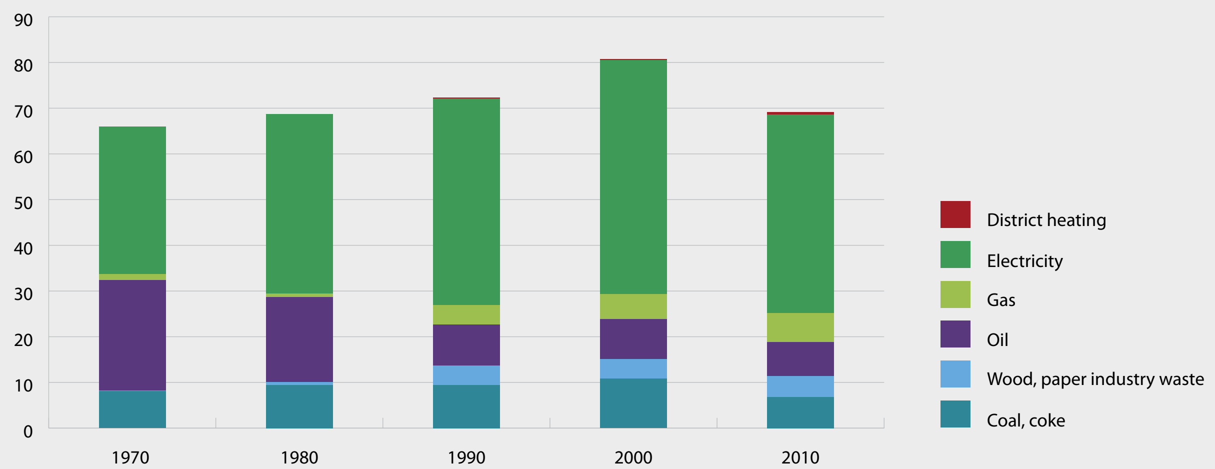
Box 3.3: Energy consumption in industry and energy industries since 1970.[18]

This text has been prepared by Statistics Norway.

Industry is often divided into the categories energy-intensive industry (metal, chemical raw materials production and pulp and paper) and other industry. Figure 3.7 shows that the industry used a total of 69 TWh of energy in 2010, corresponding to 31 per cent of the total domestic end-use. 53 TWh was consumed in the energy-intensive industry and pulp and paper industry. The preliminary figures for 2011 show almost unchanged energy consumption in the industry. In total, consumption was 69 TWh, 54 TWh in the energy-intensive industry. In 1970, industry was responsible for almost half of the total domestic end-use of energy. After an increase throughout the 1990s, industrial energy consumption has declined during the past decade. This development can be seen in the context of energy efficiency measures and closure of several plants in the energy-intensive industry.

Electricity has been the most important energy good in the industry throughout the period, and amounted to 43 TWh in 2010, corresponding to 63 per cent of the total energy consumption. Oil products, along with electricity, were the dominant energy goods in the 1970s, but the percentage of oil has fallen from 37 per cent of the total energy consumption to currently 11 per cent. Instead, we see increased use of gas and biomass.

Figure 3.7: Energy consumption in industry by energy goods 1970-2010. TWh.



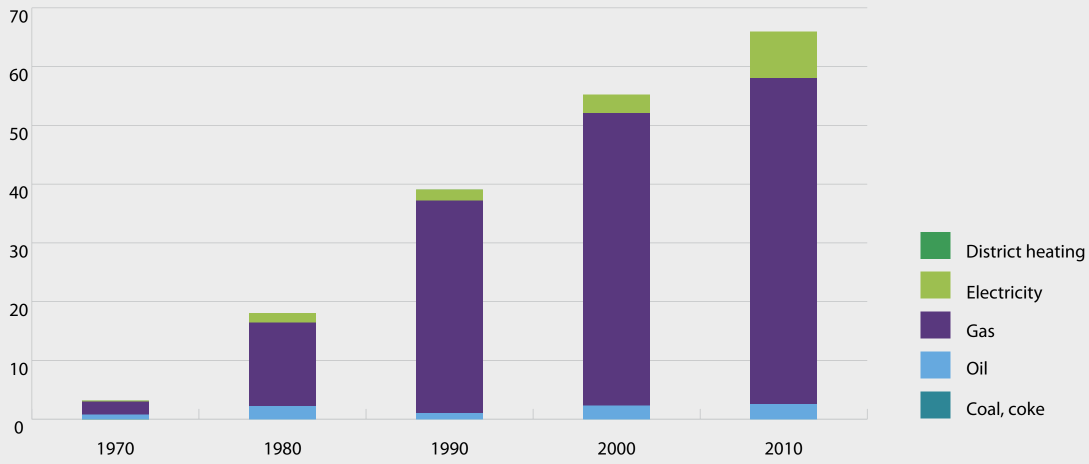
Source: The Energy Balance, Statistics Norway

Energy use in industry and the energy industries is related to industrial processes and mainly driven by how much the businesses produce. While energy consumption in industry has risen by 5 per cent since 1970, the production measured in fixed NOK has increased by 150 per cent. New technology and efficiency measures may explain why the energy consumption has increased less than production. In addition, the industry mix has changed over time. The engineering industry and food industry account for an increasing share of the production value, while using a small percentage of the total energy.

The energy industries include producers (including refineries), distributors and sellers of oil, gas, district heating and electricity. The consumption in the energy industries is not considered part of the total domestic energy end-use, but is covered under consumption in energy-producing industries in the energy balance.

18 Energy used as raw material is not included in the figures in this chapter. Energy used as raw material amounted to about 23 TWh in 2010 and was mainly used in industry.

Figure 3.8: Energy consumption in the energy industries by energy goods 1970-2010. TWh.



Source: The Energy Balance, Statistics Norway

Figure 3.8 shows that the energy industries used a total of 64 TWh of energy in 2010. Energy use in connection with oil and gas production accounted for 55 TWh of this, of which 5 TWh was flaring of natural gas. Oil refineries used 8 TWh and the rest of the consumption is divided among the other energy industries. Preliminary figures for 2011 show minor changes in energy use from 2010, with a total of 65 TWh.

The low consumption in 1970 is explained by the fact that Norway did not start producing oil and gas until 1971. Oil refineries, coal mining and coke plants were the energy consumers in 1970.

Oil and gas production has seen a considerable growth in energy consumption over the last 30 years, and gas amounted to 84 per cent of total consumption in 2010. Today, platforms on the Norwegian shelf are mainly powered by gas turbines, with a few exceptions where the platforms are supplied with electricity from shore. The production of oil and gas is power-intensive. Considerable amounts of energy are required to pump oil and gas from the ground and to process and compress the products.

While the physical oil production peaked in 2000 and has fallen every year since, gas production has continued to rise. In total, the energy consumption per physically produced oil and gas unit has increased from 2000 to 2010. This can be partly explained by the increased share of gas production in the period. Moreover, gas is more energy-intensive to produce and transport to the destination than oil. The phase of the field is also important. It is more energy-intensive to produce oil and gas from a field in the start-up phase and late phase, than in the so-called plateau phase.

4

THE TRANSMISSION GRID

Photo: Hilde Totland Harket

4.1 The power grid is critical infrastructure

Generation, transportation and trading are the three fundamental functions of the power supply. A reliable supply of electricity is absolutely essential in modern society. In business and industry, public service and households, reliable access to electricity is considered a matter of course. Almost all important public services and functions are critically dependent on a well-functioning power system with a reliable supply of electricity. The power grid maintains one of the basic functions of the power supply, and constitutes key infrastructure in any modern society.

The function of the power grid is to transport electricity from producers to consumers, in the volumes and at the time requested by consumers. Electricity must be generated the same second as it is consumed. Consequently, a vital feature of the power system is that there must be a balance between total generation and total consumption of power at all times, a so-called instantaneous balance. This sets very high demands for grid capacity.

4.2 Description of the power grid

The distribution grid consists of the local power grids that normally supply power to end users, such as households, services and industry. The distribution grid has a normal voltage of up to 22 kV, but the voltage is reduced to 230 V for delivery to the general electricity consumer. The distribution grid over 1 kV constitutes just under 100 000 km.

The regional grid is the link between the transmission grid and the distribution grid. The regional grid covers about 19 000 km.

The transmission grid comprises the highways of the power system that link producers and consumers in a nationwide system. The transmission grid also includes the international interconnectors, which make it physically possible to export and transport power as needed, cf. Chapter 5. The transmission grid has high capacity. The voltage level is normally 300 to 420 kV, but some power lines are 132 kV in certain parts of the country. The transmission grid constitutes about 11 000 km.

The use of earth and subsea cables varies in the three grids. The transmission grid consists of three per cent cables, the regional grid of eight per cent and the high-voltage distribution grid of 39 per cent.

Large power generation plants can be connected to the transmission grid, while smaller generation units can be connected to either the regional grid (small wind farms or small-scale power plants) or the distribution grid (minor small-scale power plants). Minor consumers are connected to the distribution grid while major consumers, such as power-intensive industry, can be directly connected to the regional or transmission grids.

Transportation of electricity entails that some energy is lost along the way. The grid loss percentage is lower for high-voltage transportation than for lower voltages. This is part of the reason why transportation over large distances, which is the transmission grid's primary task, takes place with high voltage. The total electric energy lost in the Norwegian power grid is normally approx. 10 TWh/year. This constitutes about eight per cent of the normal annual production.

4.3 The power grid is a natural monopoly

Building power grids is expensive. The average costs per transported unit decline with increased use of the grid until it approaches maximum capacity. This means that it is not profitable for society to build parallel power lines when there is sufficient transport capacity in the existing lines. Parallel lines can also lead to inappropriate land use and could disfigure the landscape unnecessarily. These conditions make the power grid a natural monopoly. There is therefore no competition within grid operations.

One consequence of the grid companies' natural monopoly is that users are tied to their local grid company. The authorities have established extensive monopoly supervision to prevent the grid companies from exploiting this position and to regulate the grid companies' activities. The goal is to ensure that the users do not pay too much for the grid, while also making sure that grid investments are sufficient to ensure capacity and quality. The grid regulation is a combination of direct and indirect policy instruments. The Energy Act and associated regulations stipulate the framework for the grid activities. Direct regulations set explicit obligations or orders for grid activities, e.g. as regards quality of deliveries and reliability. Indirect regulation of grid activity is based on economic incentives, cf. Chapter 5.

Monitoring activity is also key. The NVE conducts inspections and monitors grid activities, and can issue administrative orders for compliance with regulations and licencing terms. Grid services must be offered at non-discriminatory and objective point tariffs and conditions, ensuring that all customers have access to the power market, cf. Chapter 5.

Grid companies engaged in operations other than grid activities must keep separate accounts for their monopoly operations. The monopoly supervision aims to ensure that costs related to generation and sale of electricity are not charged to the grid activities.

4.4 Statnett SF

Statnett is the transmission system operator in Norway. As the transmission system operator, Statnett will ensure a balance between generation and consumption of electricity at all times. The enterprise is responsible for prudent socioeconomic operation and development of the transmission grid. Statnett is subject to the NVE's monopoly supervision.

Statnett is responsible for continuously assessing and developing necessary policy instruments to ensure instantaneous balance in severe power situations. These policy instruments include agreements on energy options in consumption and use of reserve power plants. Statnett is also responsible for continuously assessing whether new policy instruments are necessary to ensure the instantaneous balance in a better manner than what is the case today.

Furthermore, Statnett has a key role in development and operation of cross border interconnectors. This includes extensive cooperation with transmission system operators and regulators in other European countries. The transmission system operators cooperate through the European Network of Transmission System Operators for Electricity, ENTSO-E.

Nord Pool Spot AS organises the physical power trading on the Nordic power exchange. Nord Pool Spot is owned by the Nordic transmission system operators, who have the largest ownership interests, as well as the transmission system operators in Estonia and Lithuania. The Latvian system operator will become an owner when the Latvian power market opens.

5

THE POWER MARKET

Photo: Scandinavian Stockphoto

5.1 Introduction

Norway is part of a joint Nordic power market with Sweden, Denmark and Finland, which is in turn integrated in the European power market through interconnectors to Germany, the Netherlands, Estonia, Poland and Russia.

The Energy Act, which provides the overall framework for the organisation of the power supply in Norway, uses the principle of market-based power sales as a basis. Corresponding legislation also exists in Sweden, Denmark and Finland, as well as in most other EU countries.

A precondition for a well-functioning power market, and thus power system, is a connected and well-developed power grid with access for all players. There is no competition within grid operations as in the rest of the power market, because grid operations are considered a natural monopoly. The grid companies are regulated by the authorities, for example through revenue ceiling regulation and rules for stipulating tariffs for electricity transportation. All consumers and producers connected to the electricity grid pay tariffs to their local grid company for transportation of electricity.

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. For example, a consumer who switches on the power has no way of knowing who produced the power he/she is using or how far it was transported through the grid. The grid companies keep account of how much power each producer delivers and how much each consumer uses, and this forms the basis for settlement. Producers are paid for the volume of power they deliver and end users pay for their consumption.

Statnett is the transmission system operator in Norway, and is responsible for the overall physical coordination and management of the country's power system, cf. the description of Statnett in Chapter 4.4.

5.2 Organisation of the power market

The power market is an important tool for ensuring efficient economic utilisation of the power system. The market-based organisation has contributed to sound utilisation of the system. Electricity is different from other goods as it cannot be stored easily. There must therefore always be an exact balance between generation and consumption. Power prices providing a planned balance between overall generation and consumption for the hours of the next day are determined each day in the market-based power sales. Thus, the market, with all its players, helps ensure safe and efficient operation of the power system.

All producers who supply power to the grid and all consumers who utilise power from the grid are players in the power market. Power suppliers who trade power on behalf of small and medium-sized end users, households and small-scale businesses and industry also participate.

It is common to divide the physical power market into two parts: a wholesale market where trade takes place bilaterally between two players or in a marketplace (exchange) and the retail market. See Box 5.1 for more detailed information about the financial markets.

Large power volumes are bought and sold in the wholesale market, and the players are power producers, power suppliers, brokers, energy companies and major consumers. In the Nordic region, these players trade on the physical power exchange Nord Pool Spot or bilaterally. In 2010, 74 per cent of the Nordic power generation was traded through Nord Pool Spot. In the retail market, each consumer enters into a power purchase contract with an independently selected power supplier. In Norway, the retail market consists of about one-third household customers, one-third industry and one-third medium-sized consumers, such as hotels and shops.

The market price of power, which is determined each day at the Nord Pool Spot power exchange, is a result of supply and demand. Variations in precipitation and temperature result in considerable fluctuations in power prices; over 24 hours, and through seasons and years. The prices also depend on transportation conditions, between areas and the Nordic countries and between the Nordic countries and the rest of Europe. Since there are periodic capacity limitations in the grid, power prices may vary between the different areas.

The power exchanges and the transmission system operators in Europe are currently working on a project to introduce market coupling of the power markets in north-western Europe, starting in 2013. The project will be implemented in stages where north-

Box 5.1: The financial power trading

The financial energy trading includes trading with financial instruments used for risk management, price hedging and speculation. All contracts in the financial power exchange are settled financially without involvement of physical power deliveries. Financial products are often called long-term contracts because they last for more than one day.

Financial energy trading can take place both bilaterally and on the power exchanges. For exchange trading, the day-ahead market at the physical power exchange forms the basis for the financial power market. In the Nordic countries, financial trading takes place on the NASDAQ OMX Commodities AS (NASDAQ OMX) exchange. NASDAQ OMX has a licence from the Financial Supervisory Authority of Norway, which also conducts audits. At NASDAQ OMX, players can hedge prices for purchase and sale of power for up to six years in the future, distributed in days, weeks, months, quarters and years.

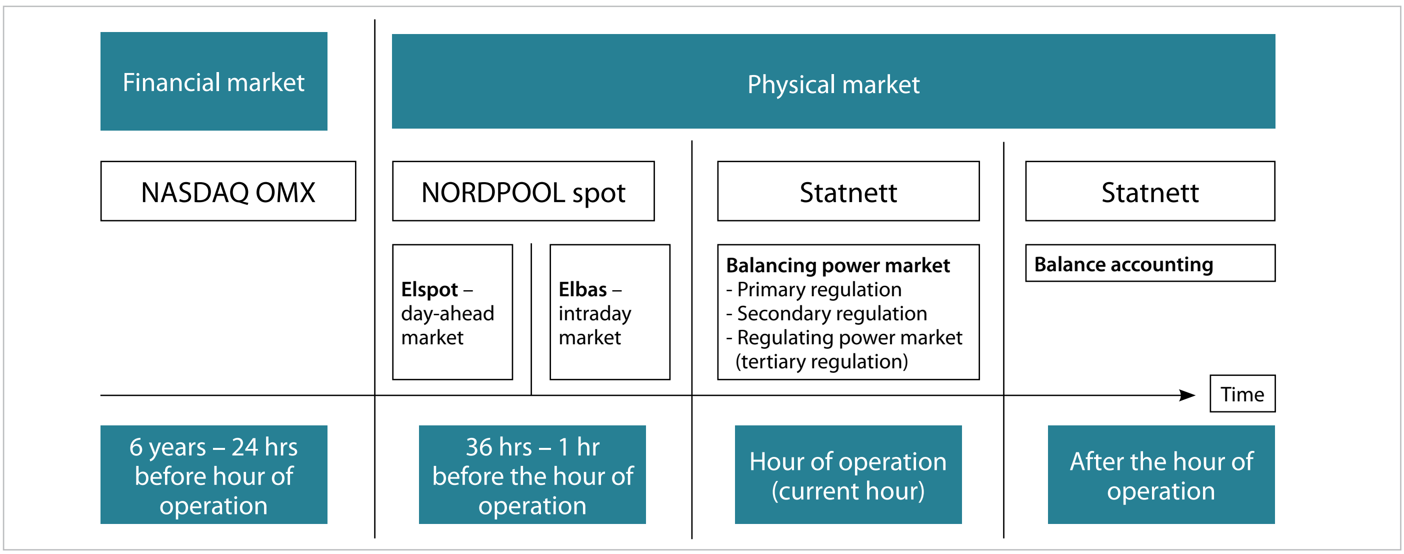
The system price determined at Nord Pool Spot is used as the reference price in the financial contracts at NASDAQ OMX. The financial products include future and forward contracts, Contracts for Difference and options.

Future and forward contracts are agreements on a financial settlement of an agreed power volume for an agreed time period at an agreed price. For future contracts, the settlement takes place in both the trading and delivery period, while settlements are only made in the delivery period for forward contracts. The future and forward contracts only hedge against fluctuations in the system price. Contracts for Difference (CfDs) are forward contracts that cover the difference between the area price and system price. Options involve the right to buy or sell a forward contract in the future at an agreed price. NASDAQ OMX only lists European options.

western Europe will be a pilot for the rest of Europe. The market coupling will help ensure that the power flows in line with the prices, thus better utilising existing grids and generation.

5.3 How the power market works

Figure 5.1: The different power marketplaces.



Source: MPE

Operation of the power market is briefly described in Figure 5.1. In the physical Nordic power market there are three markets where players can submit bids and where prices are determined:

- Elspot – Day-Ahead market
- Elbas – continuous intraday market
- Regulating power market – balancing market

Elspot and Elbas are operated by Nord Pool Spot and Statnett operates the regulating power market.

The day-ahead market is the primary market for power trading in the Nordic region, where the majority of the volumes on Nord Pool Spot are traded. Elspot is a market for contracts with delivery of physical power hour-by-hour the next day. In Elbas, the intraday market, hourly contracts are continuously traded in the period between clearance in the Elspot market and up to one hour before the hour of operation.

If there is a balance between access and consumption of electricity, the frequency of the voltage in the Nordic power system is about 50 hertz. To maintain this balance during the actual hour of operation, several markets have been established to be able to quickly obtain sufficient regulating services based on transparent and non-discriminatory terms. Statnett is responsible for these markets. Statnett also makes decisions on minimum delivery of frequency-controlled reserves from the power plants. The immediate reaction to a change in generation or consumption is automatically and instantaneously detected by the power system itself. The change in generation or consumption leads to a minor change in the frequency and the frequency-controlled reserves are automatically activated in the power plants (primary regulation). A Nordic market system with secondary reserves handles unstable frequencies when there is no accordance between generation and consumption and the primary reserves are not sufficient. The secondary regulation has a near instantaneous effect and is activated between the primary reserves and the regulating power market (tertiary regulation). The Nordic regulating power market is regulated manually. Power producers who can regulate their own generation up or down at 15-minutes' notice, as well as major power consumers that can disconnect their own consumption on short notice, are active players in this market.

Since 1997, Statnett has been responsible for settling the imbalances in the Norwegian power market, so-called balance settlement. The balance settlement will ensure that all supply and consumption of electricity is correctly settled, to achieve financial balance in the power market.

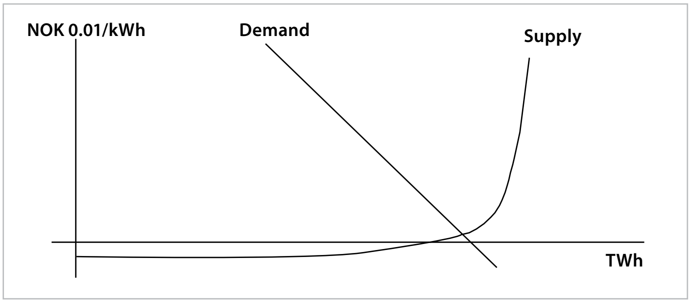
5.4 About price formation

Price formation

Each day, the Nord Pool Spot power exchange calculates the system power price for each hour of the upcoming day. The system price is the same for the entire Nordic market and reflects the overall generation and consumption conditions. The price of power in Norway is mainly determined by the supply and demand in the Nordic market, but also by power market developments in countries outside the Nordic region.

Figure 5.2 shows a simplified outline of supply and demand for power in the Nordic market. The intersection between the supply curve and demand curve illustrates the market equilibrium. The system price which arises here is the power price which ensures balance between supply and demand of power in the relevant hour. All factors that have an effect on the demand and/or supply of power will influence the price formation.

Figure 5.2: Principle drawing of price formation in the power market: Supply and demand at different power prices.



The rising supply curve in Figure 5.2 shows how much the power producers in the market are willing to produce at different power prices. In principle, the curve shows the marginal production costs for power in each plant, in ascending order. Hydropower, nuclear power and wind power have the lowest marginal costs in the Nordic region, and can therefore be offered at the lowest power price. Technologies such as biopower, gas and coal-based power have higher marginal costs and are therefore located further to the right on the supply curve.

The high level of hydropower in the Norwegian power system means that the precipitation volume and inflow to reservoirs set the framework for the overall generation potential and are decisive for the power price and its fluctuations through the seasons and years. During periods with considerable precipitation, the power supply increases in the Norwegian market, and the power price usually declines.

Norway is part of the Nordic and European power markets. Power generation in Europe is dominated by combined heat and power plants, such as nuclear power, coal-based power and gas. Coal and gas have relatively high production costs. Production costs primarily depend on the price development of the input factors coal and gas, as well as the price of carbon quotas. As coal-fired power and gas power often constitute the marginal production both in the Nordic region and on the Continent, this also has an impact on power prices in Norway.

The sinking curve in Figure 5.2 shows the demand for power in the Nordic market at different prices. The demand for power is equal to the consumption of power, which e.g. depends on temperature and weather conditions. During periods with low temperature, consumer load increases and, in isolation, this leads to higher power prices.

The general activity level in the economy also impacts the power demand. Power consumption increases during periods of economic growth because power is an important input factor in the production of several goods and services. In Norway, where power-intensive industry represents a considerable percentage of electricity consumption, the global power price of power intensive goods is, among other factors, significant for the domestic power demand. Economic prosperity in Europe typically leads to increased power consumption and higher power prices in Norway, both through increased prices of Norwegian industrial products, increased gas, coal and quota prices and through increased direct demand for power in Europe.

Area prices

The system price for power provides a balance between the total supply and demand in the entire Nordic market, but does not take into account any capacity limitations in the grid (bottlenecks). Nord Pool Spot therefore stipulates area prices in addition to the system price which takes into account bottlenecks in the grid and create a balance between the purchase and sales reports from the players within the different bidding areas in the Nordic region. In recent years, Norway has been divided into five bidding areas, Sweden has been divided into four areas, Denmark into two areas, while Finland consists of one. In Norway, the division into bidding areas can be changed if there are any fundamental changes in the grid or in the geographical distribution of generation or consumption.

The underlying cause of bottlenecks and different power prices between areas is that we have different regional power situations, which can also vary on an hourly basis and between seasons and years. Some regions may experience a power surplus, while others experience a power deficit. Power must be imported in areas with a deficit, while power needs to be exported in surplus areas. If the grid capacity to import and export this power is insufficient, bottlenecks occur between the areas.

A market area is defined on each side of the bottleneck when determining bidding areas. This may result in the deficit areas having an area price that is higher than the price in surplus areas. The power flows from low-price areas to high-price areas and this helps increase the power supply where the need is greatest. Furthermore, area prices help the players determine where it is most beneficial to increase or reduce generation and consumption. In areas with scarcity of power, 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 creating balance in the short term, the area price system helps highlight the need for more long-term measures in the power system. The area prices help producers and consumers identify where to place new generation or new major consumption.

Division into bidding areas does not mean that different area prices will automatically arise. This will only be the case during periods where the grid capacity actually restricts the flow between the areas. When there are no limitations in the capacity of the Nordic power grid, area prices will be the same throughout the Nordic region and will correspond to the system price.

End user price

Consumers who purchase power for their own consumption are considered end users. End users in Norway can freely choose their power supplier.

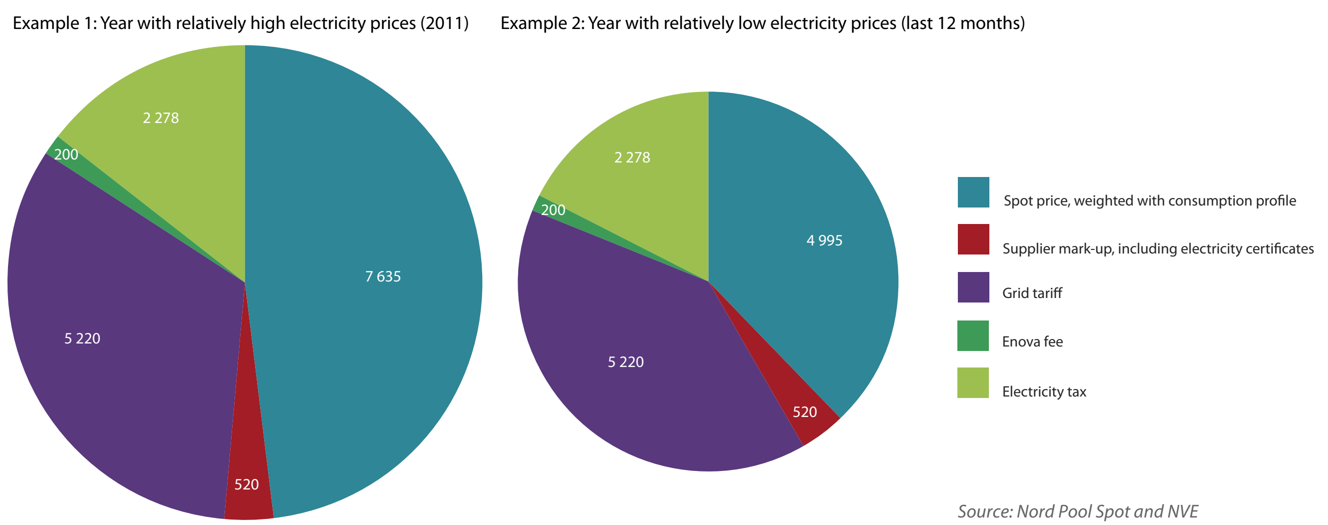
Small end users normally purchase power from a power supplier, while larger end users, such as large industrial companies, often choose to purchase power directly in the wholesale market.

An end user's total electricity bill consists of multiple components for which payment is required: the raw material electricity (power price), connection to and use of the power grid (grid tariff), consumption tax for electricity (electricity tax), and value added tax. There is also a fee earmarked for the Energy Fund (Enova), as well as payment for electricity certificates.

End users pay a grid tariff to their local grid company. Together with the grid tariff, they also pay an electricity tax which was set at 11.39 øre/kWh[19] in 2012. The grid companies also invoice the Enova fee, which is 1 øre/kWh for households and holiday homes. The power supplier is responsible for invoicing payment for electricity certificates. Those end users who have chosen to purchase power from the same company or group responsible for grid operations in the area normally only receive one bill which specifies which amount is the power price and grid tariff, etc. End users who have chosen another company as their power supplier normally receive two bills; one from their local grid company and one from the power supplier. Household customers and other end users can choose between different power purchase contracts. In the retail market, most power suppliers offer a number of power supply contracts ranging from fixed price contracts, variable contracts and spot price contracts.

Figure 5.3 shows an example of an electricity bill for a representative household during a year with relatively high electricity prices and a year with relatively low electricity prices. It is assumed that the household has a spot price contract with their power supplier and an annual consumption of 20 000 kWh. The household's total electricity expenses, including the grid tariff and taxes, amount to about NOK 20 000 during the year with high prices and NOK 16 500 in the year with low prices. [18]

Figure 5.3: Examples of annual electricity expenses in NOK for a household.[20]



Source: Nord Pool Spot and NVE

19 The electricity fee does not apply in Finnmark County and certain municipalities in northern Troms County.

20 The spot price in the high price year is the Nordic system price in 2011. The spot price in the low price year is the Nordic system price for the last 12 months (November 2011 – October 2012). The grid tariff is equal to the domestic average for 2012

5.5 Power trading between countries

Power has been traded between Norway and the neighbouring countries ever since the first international interconnector was established between Norway and Sweden in 1960. Sweden is still the country with which we have the largest trading capacity. Norway currently also has transmission interconnectors to Denmark, Finland, the Netherlands and Russia (see capacity map in Appendix 4). The total trading capacity between Norway and other countries is currently about 5400 MW.[21] Construction of a new 700 MW transmission interconnector to Denmark is ongoing and Statnett is also planning other international interconnectors.

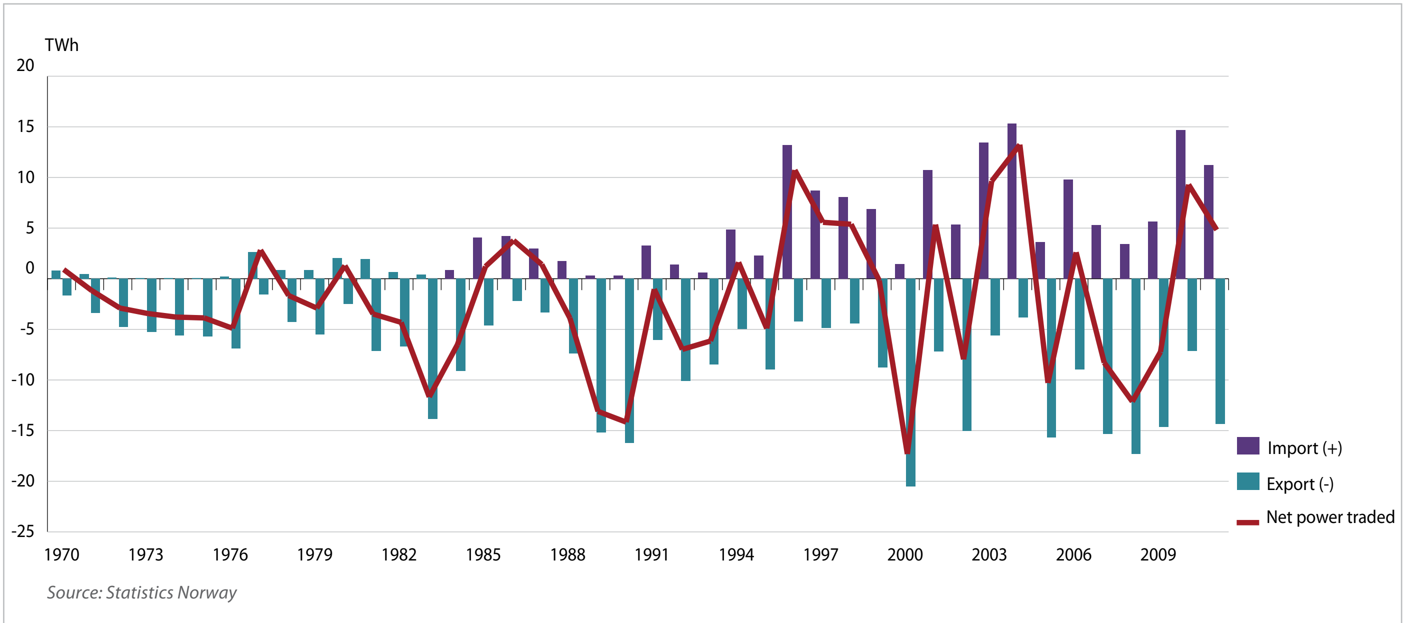
The power exchanged between Norway and other countries is determined by the generation and consumption conditions in each country, in addition to the capacity of the transmission interconnector.

Power trading is organised with the objective of power always flowing to where its value is greatest, i.e. from low-price areas to high-price areas. For example, this means that Norway imports power from the Netherlands during hours when Norwegian power prices are higher than in the Netherlands and, conversely, we export power to the Netherlands when Norwegian prices are lower than in the Netherlands. Figure 5.4 shows that Norway has been a net exporter of power for most years, but that we have been a net importer in certain years, such as in 2010. The power normally flows in both directions over the course of a year/month/week/day.

Power trading between Norway and other countries provides mutual benefits for use of production systems with different properties:

Power production in most countries with which Norway has a connection is largely based on thermal power. Energy sources used for thermal power generation, such as coal, natural gas, oil and uranium, are purchased in the market. However, this is not the case for hydropower generation, where reservoir levels restrict production and cause system vulnerability in the event of inflow fluctuations. In combined heat and power plants it is

Figure 5.4: Annual import and export of power and net power traded, 1970 to 2011.



21 For comparison, the total production capacity in Norway is about 31 000 MW.

time-consuming and costly to regulate generation levels in existing plants and/or to build new combined heat and power plants to cover short-lived consumption peaks. However, hydropower plants are able to rapidly adjust generation according to consumption fluctuations and in the event of unforeseen short-term changes in power supply, at a low cost. Power trading is therefore important to Norway because it reduces the vulnerability to inflow fluctuations and utilises hydropower's inherent regulation abilities.

5.6 Pricing of grid services

Revenue cap regulation

Grid companies are monopoly companies which primarily receive their income from tariffs for transportation of electricity. To prevent grid companies from earning unreasonable monopoly profits, the authorities regulate the grid companies' income. The NVE determines a revenue cap for each grid company every year. Together with certain other costs (property tax payments, costs from overlying grid, etc.), the revenue ceiling constitutes the company's maximum permitted revenue. The grid company must set the tariffs so the grid operations' actual income over time does not exceed the permitted income. The revenue cap regulation is designed to provide the grid companies with incentives for being cost-efficient, thus ensuring customers do not pay too much for the grid. The NVE will determine the revenue ceiling so the grid company's income over time covers the costs of operation and depreciation of the grid, as well as a reasonable return on invested capital, given efficient grid operation, utilisation and development.

The revenue cap regulation will also incentivise grid companies to maintain supply reliability in the grid at an optimal level. The KILE scheme (quality-adjusted revenue cap for energy not supplied) reduces the grid companies' permitted income in the event of power supply interruptions. End users experiencing power cuts lasting more than 12 hours may claim compensation from the grid company.

Tariffs for electricity transmission

The grid customers pay so-called point tariffs for transportation of electricity. This means that they only pay a grid tariff to their local grid company to gain access to the entire power market. Consumers pay to extract power from their connection point to the grid, while power producers pay to supply power to their connection point.

Grid companies are responsible for setting the tariffs. Over time, the grid companies' total tariff revenues should be below the total revenue ceiling set by the NVE, and the tariffs should comply with provisions in the Energy Act and associated regulations. General tariff requirements include objective and non-discriminatory tariffs, and that the formulation and differentiation of tariffs should be done on the basis of relevant grid conditions. To the extent possible, the tariffs should also be designed to provide long-term signals on efficient utilisation and development of the grid.

The grid tariff for consumption should help cover costs that arise at the relevant grid level and in overlying grids. Consumers directly connected to the main grid, for example power-intensive industry, pay a grid tariff solely based on the costs at this level, while consumers in the distribution grid help cover costs in all three grid levels. Consumers connected to the distribution grid thus normally have higher tariffs than consumers connected to the regional and main grids.

The grid tariff for consumption also varies between the different grid companies. One reason for this is that grid companies face several conditions that impact the costs of supplying power to customers. Difficult natural transportation conditions and scattered settlement can contribute to high transportation costs. There is also some variation on how efficiently each grid company operates the grid.

The grant scheme for smoothing of tarrifs[22] contributes to reduce differences in grid tariffs between consumers connected to different grid companies. The subsidies go to the grid companies with the highest transportation costs in the country and are used as a direct reduction of their customers' grid tariff.

22 The grant scheme was about NOK 120 million in 2012, and included 31 grid companies with about 103 000 customers.

6

THE ENVIRONMENT

Photo: Arne Trond Hamarsland/NVE

6.1 Local environmental impacts

Development of renewable energy and associated grids has an impact on the Norwegian natural environment. In addition to natural environment conflicts, energy projects can conflict with various industry and recreational interests. The negative effects will be most significant for the local environment, but can also impact species and nature types of national and international value.

Hydropower development, as well as other types of intervention in water resources can impact nature in different ways. Examples of impact include redirecting water or creating water reservoirs. Measures in water resources can have a negative impact on fish, plants, insects, bird life, nature types and landscape connected to the water and nearby areas. This may also impact the experience value of recreation, hunting and outdoor activities. The consequences of upgrading and expanding existing hydropower plants are normally smaller than for projects in watercourses that are currently relatively or completely unaffected by intervention.

The visual effects of wind power and its impact on the landscape are of key importance. Noise can be a challenge for the local environment, both for people and wildlife.

When developing power lines, land take is the greatest challenge. Some power lines are planned in or near pristine landscapes with considerable biological diversity. The challenges in the local and regional distribution grid are to a larger extent related to consequences for bird life.

Conflicts of interests and disruptions to the natural environment in connection with generation and transport of energy are often unavoidable. Negative consequences must be weighed against considerations such as security of supply and value creation. The challenge is striking the right balance and minimising negative consequences.

An application for a licence to develop a plant for generation and transmission of power undergoes extensive processing. Among other factors, negative consequences are explored in detail. If the advantages of a measure do not exceed the drawbacks, the licence application will be rejected. The authorities can also stipulate requirements for mitigating measures to reduce any damage caused by the development. The licence processing system is described in more detail in Chapter 1.

The authorities can stipulate requirements for a number of mitigating measures in connection with hydropower development. These include minimum water discharge, habitat improvements and weirs if the regulation results in damage to fishing interests or other flora and fauna in and surrounding the watercourse. Other types of watercourse interventions than power development can trigger a licence obligation in accordance with the water resources legislation, for example excavation of earth or rock material or flood control facilities.

There are fewer possibilities for mitigating measures for wind power. Surveys indicate that the effect on bird life can be limited with appropriate positioning. In areas with favourable wind conditions, the concrete position, both of the entire wind farm and each wind turbine, is thus vital in order to limit environmental drawbacks. Other relevant remedial actions include marking turbines and barring of access during nesting periods.

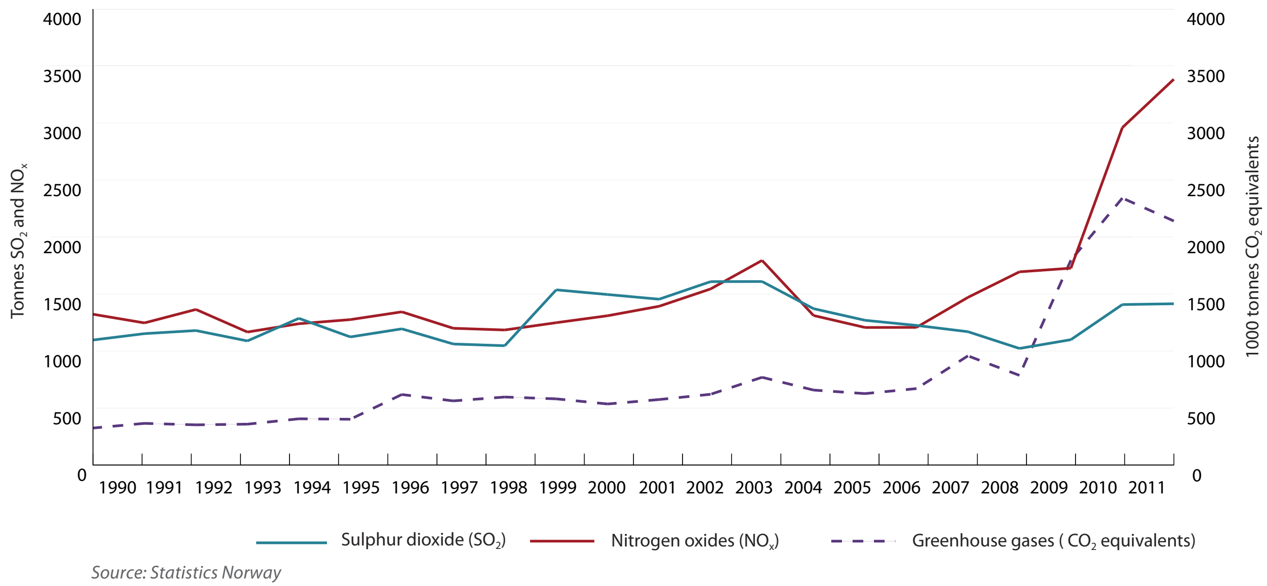
Routing power lines outside conflict areas is the most important remedial action for power lines. Other remedial actions include camouflage, pylon design, consideration for bird life and use of underground or subsea cables. Use of underground cables on lower voltage levels is increasing, but is gradually more restrictive for increased voltage levels.

6.2 Emissions to air

Norway is different from other countries in that most of the domestic stationary energy consumption is covered by electricity, primarily based on hydropower. Norway has the world's largest hydropower generation per capita. Hydropower is a renewable energy source and hydropower generation does not result in emissions to air.

Emission of CO_2 equivalents, NO_x and SO_2 from domestic energy generation is shown in Figure 6.1.

Figure 6.1: Emissions from domestic energy generation, 1990 to 2011[23]. CO_2 equivalents in 1000 tonnes. NO_x and SO_2 in tonnes.



Source: Statistics Norway

Greenhouse gas emissions from domestic energy generation increased sharply in 2009 due to a high activity level at the gas-fired power station at Kårstø. Emissions increased further in 2010 and 2011 after the new combined heat and power heating plant at Mongstad came on stream.

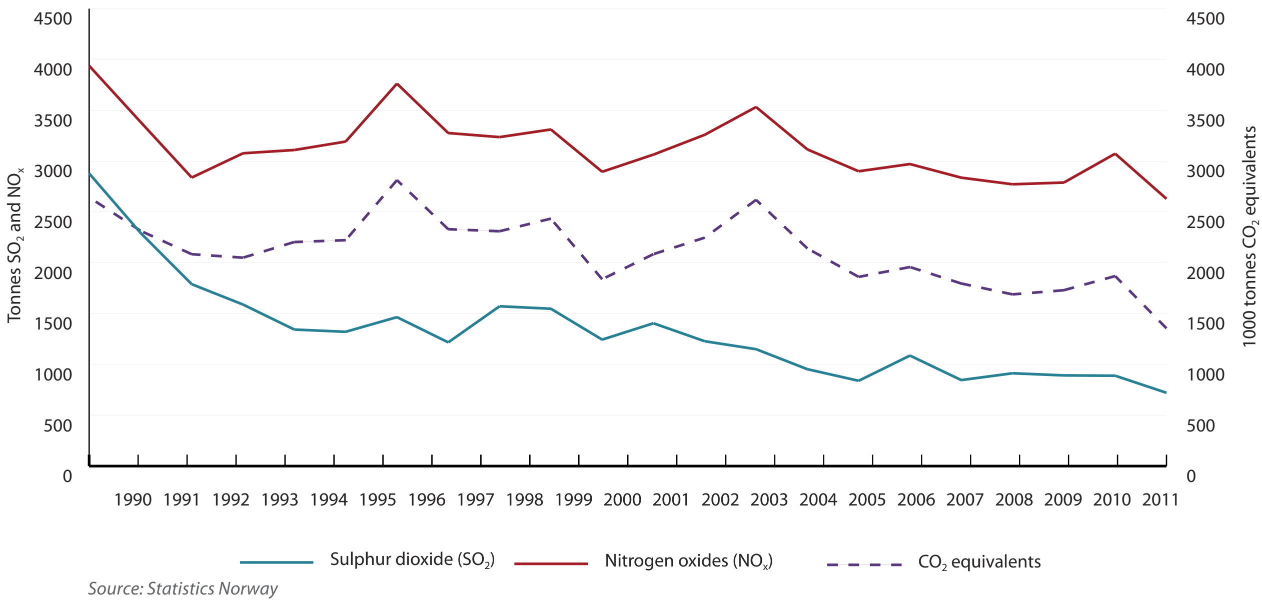
Box 6.1: CCS

Power generation based on fossil energy is a significant source of global greenhouse gas emissions. Development of technology for capture and storage of CO_2 from coal and gas-fired power stations could be an important measure to help reduce greenhouse gas emissions. CO_2 capture is when the CO_2 is removed from the exhaust gas or the fossil fuel, and is then stored in a geological formation. Norway has several years of experience with CO_2storage. On the Sleipner gas field in the North Sea, one million tonnes of CO_2 per year have been removed from the produced natural gas and stored in the Utsira formation at 1000 metres below sea level since 1996. In connection with the LNG production based on gas from the Snøhvit field, CO_2 is separated from the natural gas in the facility on Melkøya and returned to the field to be injected in a deeper formation.

CCS from power generation is costly and energy-intensive. The CO_2 Technology Centre Mongstad opened in 2012. The Centre will contribute to technology development to facilitate increased application of CO_2 capture facilities. Through the Technology Centre, we will gain practical experience with capture technologies related to design, full-scale CCS, and operation of large CO_2 capture facilities. At the same time, planning and preparation of full-scale CCS is taking place at the combined heat and power plant at Mongstad.

23 Preliminary figures for 2011.

Figure 6.2: Emissions from heating of buildings, 1990 to 2011[24]. CO_2 equivalents in 1000 tonnes. NO_x and SO_2 in tonnes.



Source: Statistics Norway

Emissions to air from heating and domestic energy supply constitute low percentages of the total Norwegian emissions to air due to the high percentage of hydropower in the Norwegian energy system. In 2010, heating represented 3.5 per cent of total greenhouse gas emissions, 4.6 per cent of SO_2 emissions and 1.7 per cent of NO_x emissions for domestic energy generation. Figure 6.2 shows the development in emissions from heating.

The major decline in SO_2 emissions from heating is a result of measures limiting the sulphur content in heating oils. This has been accompanied by a decline in the use of heating oils. The sharp decline in emissions in 2011 must be seen in context with the fact that the year was milder than normal, and one of the warmest years on record in Norway. This, together with low electricity prices, made it more economical to use electricity instead of oil for heating. By comparison, 2010 was a relatively cold year with a relatively high level of emissions.

Emissions from domestic stationary combustion come from a number of different sources. Among other pollutants, oil heating creates emissions of CO_2, NO_x and particulate matter (PM). Combustion of biomass creates emissions of polycyclic aromatic hydrocarbons (PAH), NO_x, PM and carbon monoxide (CO). Wood-burning is an important source of particulate matter (PM10) emissions in cities and communities.

24 Preliminary figures for 2011.

7

RESEARCH, TECHNOLOGY AND EXPERTISE

Photo: Øyvind Hagen/Statoil

7.1 The Ministry of Petroleum and Energy's use of policy instruments within energy research

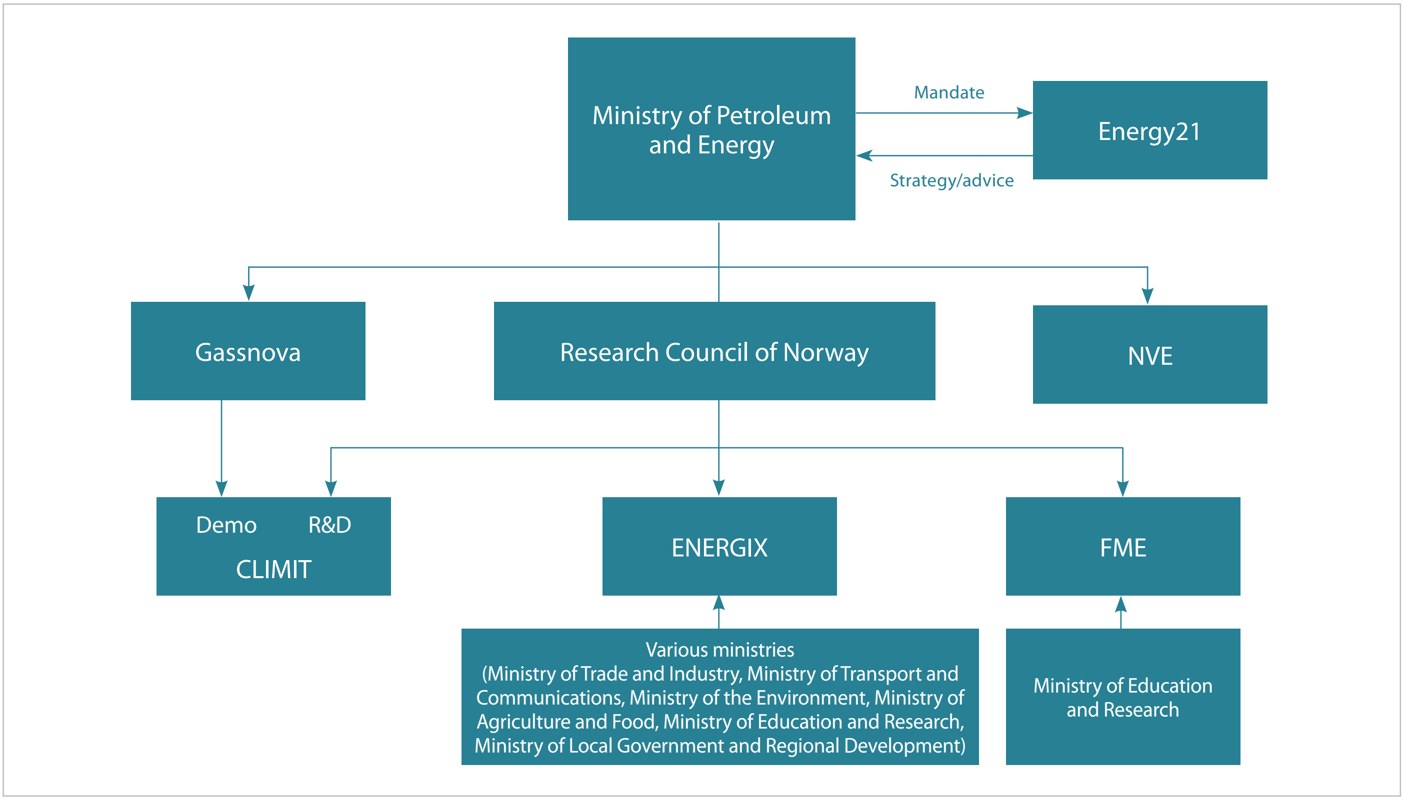
The Ministry of Petroleum and Energy (MPE) focuses its research efforts in areas where Norwegian research communities possess special expertise and hold a unique position, where Norwegian businesses and other user environments have special expertise to apply in research results, where Norwegian energy resources put us in a unique position in the long term and where there are special Norwegian research needs. The Energy21 strategy provides input for the Ministry's distribution of research grants.

The Research Council of Norway manages most of the public research funds for energy research. The funds cover basic research, industrial research and social research. The basic, strategic research will lay the foundation for more commercial projects in cooperation with business and industry, as well as other users. The industrial research is managed by the users to ensure the results can be utilised if they are technically successful. Here users are responsible for the majority of project financing. The social research is directed at energy policy and international agreements.

The Norwegian Water Resources and Energy Directorate (NVE) is also responsible for a portion of the research activities within the energy sector. This primarily relates to administrative energy and water resources research.

In addition to the national research activities, Norway and Norwegian research communities participate actively in a number of international energy research collaborations.

Figure 7.1: Organisation of the energy research.



Source: MPE

Figure 7.1 provides an overview of the organisation of the energy research under the MPE.

7.2 Energy21

Energy21 was established by the Ministry of Petroleum and Energy in 2008 and is the national strategy for research, development and commercialisation of new climate-friendly energy technology. The strategy targets increased value creation and effective resource utilisation in the energy sector through efforts in R&D and new technology. It will contribute to coordinated, effective and targeted research and technology initiatives, where increased involvement in the energy industry is key. Through Energy21 we have goals and ambitions for Norwegian efforts in research and development of technologies for renewable energy, energy-efficiency measures and CCS. The Ministry has established a board for Energy21 which will follow up the strategy work and provide advice for the allocation of research grants.

The strategy presents six prioritised focus areas and a set of recommendations for the implementation of the focus areas. The six technology and topic areas in which Energy21 recommends strengthened efforts are:

- Solar cells – strengthened industrial development
- Offshore wind – industrial development and resource utilisation
- Regulating power – increased resource utilisation
- CCS[25] – value creation and fair value hedging
- Flexible energy systems – SmartGrids
- Energy utilisation – conversion of low-temperature heat to electricity

7.3 Research programmes

ENERGIX

ENERGIX is the name of the Research Council of Norway's successor to the R&D programme RENERGI – Clean Energy for the Future. The programme was launched in 2013 and will run for ten years.

The programme funds research and development projects within renewable energy, effective energy use, energy systems and energy policy. This is an important policy instrument in the implementation of the R&D strategy Energy21 and other energy policy objectives. The programme covers research and development within technology, natural science, social science and humanistic science.

ENERGIX is directed at realising the Government's current energy and climate policy, but also helps support other important policy areas such as transport and industrial development. The programme is targeted towards Norwegian research and expertise institutions as well as companies that can contribute to long-term expertise development to further develop the energy industry and related industries, for example the energy processing industry and the supplier industry.

The main objective of ENERGIX is to support a long-term and sustainable restructuring of the energy system in order to accommodate increased access to new renewable energy, increased energy-efficiency and flexibility and closer integration with Europe. At the same time, it is important that environmental concerns are safeguarded. ENERGIX will generate new knowledge and cutting- edge solutions that are directed at the following five primary targets:

- Ensure national energy security of supply
- Sustainable utilisation and consumption of national renewable energy resources
- Reduction of national and global greenhouse gas emissions
- Development of national trade and industry
- Develop national research communities

Centres for Environmentally-friendly Energy Research

In 2009, eight Norwegian research groups were declared Centres for Environmentally-friendly Energy Research (FME). These were within the areas of carbon capture and storage (two centres), offshore wind power (two centres), energy-efficiency in buildings, solar cells, bioenergy and environmentally-friendly phase-in of new renewable energy in the hydropower system. At the research centres, research communities can join forces on technology efforts within certain topics. The research centres contribute to broad-based and binding cooperation between leading research institutions and innovative companies in Norway and a close cooperation with international players.

25 Carbon capture and storage.

In 2011, another three centres were declared FME, of which two receive funding from the Ministry of Petroleum and Energy's budget. These are research centres within social science-related energy and climate research. The purpose of the centres is to contribute to a better foundation for public and private decision-makers in the interface between climate, energy and industry and to increase the knowledge basis for national and international energy policy.

The FME centres are established for up to eight years, but will be assessed after five years of activity. The Research Council of Norway handles this activity.

CLIMIT

CLIMIT is a national programme for research, development and demonstration of technologies for capture and storage of carbon from fossil-based power production and industry. The programme covers the entire chain, from long-term, expertise-building basic research to projects that demonstrate CCS technologies. The initiatives should be directed at technology development, but emphasis is also placed on establishing possibilities for future industrialisation and value creation in Norwegian industry.

CLIMIT is a collaboration between Gassnova SF and the Research Council of Norway, where the Research Council is responsible for the research aspect, and Gassnova is responsible for the prototype and demonstration aspect. Decisions regarding project funding are made by a separate programme board for CLIMIT.

Projects funded by CLIMIT are particularly directed at improving or developing technologies with a potential for significant improvement in the effectiveness and profitability of carbon capture, as well as developing robust methods for carbon storage. Funding is also granted for projects related to carbon transport.

Administrative research and development

The administrative energy and water resources research is headed by the NVE. The objective is for research activities to support the NVE's tasks and contribute to gaining new knowledge which strengthens the NVE's administrative expertise. The activity includes issues within the energy and water resources area, hydrology, landslide processes and licence processing. The activity supplements the Research Council of Norway's activities and is coordinated with them. The NVE also cooperates closely with Energy Norway, the Directorate for Nature Management and Enova SF.

7.4 International R&D cooperation

Participation in international R&D cooperation within energy is highly prioritised and is an important supplement to the national research. Cooperation across borders is vital, not only to maintain a high expertise level in Norwegian research communities, but also to establish contacts and alliances with other countries. International projects help build expertise and accelerate academic and financial solutions to key research tasks. At the same time, international cooperation is a way for Norway to showcase its good technology and knowledge suppliers.

The EU's Seventh Framework Programme for Research

Norway participates through the EEA agreement as a complete member of the EU's Seventh Framework Programme for Research (2007-2013). The Framework Programme has an overall budget of EUR 50.5 billion. One of the prioritised topics is "Energy", with an overall budget of EUR 2.3 billion. The energy programme's instruments range from funding for thematic networks and coordination activities to funding for R&D and demo projects. The goal of the programme is to contribute to a sustainable, innovative and competitive European energy sector by supporting development and demonstration of new technologies for renewable energy, efficient energy systems and carbon capture and storage. The Research Council of Norway coordinates the Norwegian activities.

The International Energy Agency

The International Energy Agency has established a number of collaboration projects within research, development and market introduction of energy and petroleum technologies (Implementing Agreements). Norway is a member of 24 such programmes, within end user technologies, renewable energy technologies, petroleum technology and information exchange. The Research Council of Norway coordinates the Norwegian activities.

Energy Research

Nordic Energy Research is an institution under the Nordic Council of Ministers. Nordic Energy Research will contribute to increased expertise, innovation and industrial development through a joint strategy for research and development in those parts of the energy sector that are of Nordic interest. The activity is governed by a strategy and action plan for the period 2011-2014. Nordic Energy Research funds basic research projects within integration of the energy market, renewable energy, energy efficiency, the hydrogen society and consequences of climate change on the energy sector.

Other international R&D cooperation

- Norway also participates in bilateral and multinational R&D cooperation. For example:
- Carbon Sequestration Leadership Forum (CSLF) will promote cooperation on research and further development of technologies relating to capture, transport, storage and use of CO_2.
- International Partnership for the Hydrogen Economy (IPHE) will contribute to coordination and implementation of international R&D and demonstration projects relating to hydrogen as an energy carrier and fuel cells.

7.5 Norwegian hydropower expertise

Norway is the world's sixth largest hydropower producer and the largest hydropower producer in Europe. Norway has been a hydropower producer for more than 100 years. Through the development of a number of large and medium-sized projects, we have acquired expertise which covers all aspects of a hydropower project; this applies to everything from planning, engineering and construction to supply and installation of equipment. Everything is done with a focus on finding both efficient and environmentally-friendly solutions. The authorities and power companies have developed expertise in regulating and managing the hydropower resources, and Norway is a world-leader in efficient power market operations.

Norway has already developed most of the available hydropower potential, and Norwegian industrial and consulting companies have therefore increasingly focused on projects abroad. In addition to turbines and electromechanical products, Norway also delivers consultancy services within planning, design and other engineering services. There is also an increasing demand for Norwegian expertise within system operations and facilitation for a power market. Furthermore, there is an increasing interest in investing in hydropower projects abroad. Relevant examples are SN Power's extensive activities in South America and Asia, as well as Statkraft's increased investment in central and southeast Europe.

The International Centre for Hydropower (ICH) was established about 15 years ago as a step towards sharing the unique Norwegian hydropower expertise. ICH is an organisation where power companies, the supply industry, consulting companies and the authorities work in collaboration. The activity is directed at all areas within hydropower generation and electricity supply, including financing and the environment.[26]

Norwegian Renewable Energy Partners (INTPOW) is an association which was established in cooperation between the authorities and the energy industry in 2009. INTPOW works to promote value creation and employment in the Norwegian-based energy industry through cooperation between the authorities and industry, to make it even more effective internationally. INTPOW focuses its efforts on renewable energy sources such as hydropower, wind and solar power, as well as power ICT. In 2013, INTPOW will continue to prioritise initiatives directed at markets in southeast Europe (hydropower), the UK (wind power), Germany (wind power) and southern Europe (solar energy).[27]

26 Read more at www.ich.no
27 Read more about INTPOW at www.intpow.no

APPENDICES

Photo: Hilde Totland Harket

APPENDIX 1

The Ministry of Petroleum and Energy's legislation within the energy sector and water resources administration

The following provides a detailed description of each act which the Ministry of Petroleum and Energy is responsible for within the energy sector and water resources administration.

1.1 The Industrial Licensing Act

In order to use water for generation of electricity, one needs a waterfall where the potential energy in the water can be utilised. The owner of the waterfall owns the land. Acquisition of ownership rights of the waterfall by anyone other than the State requires a licence in accordance with the Industrial Licensing Act if, when harnessed, it can be expected to produce more than 4 000 natural horsepower. This limit is so high that small hydropower stations without regulation plants are not included under the Act. Acquisition of other rights than property rights can only take place in pursuance with Chapter 1, cf. Section 4. The other rights discussed in Chapter 1 are regulated in Section 4. Section 4 states that the Ministry can make a licence decision following an application for use of waterfalls that have already been developed for up to 30 years at a time. Total use of developed waterfalls and power plants for a period of up to 15 years is regulated in Section 5 and separate regulations relating to lease of hydropower generation of 25 June 2010, no. 939. When the Act was passed in 1917, the State's and general public's interests were safeguarded. This was ensured through, among other things, rules relating to right of pre-emption, time-limited licences and reversion to the State when the licence expires. Reversion entails that the State will take over the waterfall and generation equipment when the licence expires at no cost. Right of pre-emption entails that the State, or the county authority on behalf of the State, can enter into the purchase agreement with the original buyer's rights and obligations according to the agreement.

ESA instituted legal proceedings against Norway for the EFTA Court in 2006. The ruling from the EFTA Court from 2007 stated that the previous system conflicted with the EEA agreement. However, it was stated that public ownership of the hydropower resources could be an independent goal, but that the legislation needed to be consistent with this goal. The EFTA Court noted four aspects that needed correction in the applicable system.

In the spring of 2008, the government submitted Proposition to the Odelsting no. 61 (2007-2008), which followed up the ruling from the EFTA Court. The amendments entered into force on 25 September 2008. The amendments entailed establishing by law that the country's hydropower resources belong to and should be managed to the best of the general public. This is ensured through an ownership structure based on public ownership at State, county authority and municipal levels. Amendments related to the four aspects noted by the EFTA Court involved the following:

- New licences for acquisition of waterfall rights can only be granted to public owners.
- Acquisition of reverted waterfalls and power plants is limited to public players.
- No longer access to renewed licences for private players in the event of reverse repurchase/lease after expected reversion.
- Sale of more than one-third of publicly owned waterfalls and power plants to private players is prohibited.

It was proposed that the scheme allowing private owners to own up to one-third in public companies be continued. Applicable time-limited licences with reversion run normally until the time of reversion. The last major reversion will take place in 2057. The reversal scheme was established by law. This means that private power plants owners subject to terms and conditions relating to reversion and time limitations can sell or merge the power plant with public owners, so long as the private ownership interest in the joint company does not exceed one-third, and the organisation is such that there is obviously actual public ownership. In the event of reversal, the public ownership is forced, because reversal must take place before the time of reversion.

The Industrial Licensing Act contains mandatory basic terms relating to licence fees and obligatory sales to the municipalities where the waterfalls are located. The obligatory sales term entails that the municipality, and the county authority on its behalf, will have a right to use 10 per cent of the produced power at cost. It is also possible to require terms and conditions out of consideration to, for example, the environment and local community.

1.2 The Watercourse Regulation Act

In order to regulate production in hydropower plants throughout the year according to varying needs, it will be important and often decisive from an economic standpoint, that it is possible to use a regulation reservoir to store the water supply, cf. Chapter 2.1.2. A separate permit pursuant to the Watercourse Regulation Act is required in order to utilise the water in a regulation reservoir, when this is to be used for power generation.

The Watercourse Regulation Act covers regulation measures which balance the rate of flow in watercourses over the year. The Act primarily allows for ordering licensees to follow the same terms and conditions which follow from the Industrial Licencing Act, but special terms may also be set in order to reduce harm to the watercourse as a result of the regulation. Separate terms may be stipulated for the establishment of e.g. fish funds if the regulation harms the fish population in a watercourse. Rules of manoeuvring have also been stipulated and contain provisions concerning minimum release of water and rules as to what volumes of water can be released at different times throughout the year. The maximum and minimum allowed regulated water level is stipulated pursuant to this Act. Awarded regulation licences can be revised after 30 or 50 years, depending on when the licence was awarded. The NVE will decide whether to initiate a revision following a request for revision of the terms from non-State authorities (primarily the municipality) or others who represent public interest. The ability to revise primarily opens up opportunities for stipulating new terms to rectify environmental damage which has been caused by the regulation measures.

The Watercourse Regulation Act has separate provisions regarding expropriation for regulation purposes.

Regulation licences can also require obligatory sales and payment of an annual licence fee to the State and the municipality(ies) in which the regulated watercourse is located. The size of the fee is calculated according to the volume of the power increase as a result of the regulation, and is intended to act as compensation for inflicted disadvantages. Furthermore, the establishment of a business development fund for the municipality is commonly stipulated. The objective of the fund is partially as compensation for inflicted disadvantages, and partially to provide the municipality with a share of the value creation. Business development funds can also be stipulated pursuant to the Industrial Licencing Act.

1.3 The Water Resources Act

Even if a power developer already owns the waterfall rights, and does not want to regulate the watercourse, any measures in the watercourse which are necessary in order to utilise the power will normally require a special permit according to the Water Resources Act.

The Water Resources Act is a general statute which covers all types of measures in watercourses. The Act came into force on 1 January 2001, and replaced most of the Watercourses Act of 1940. The purpose of the Act is to ensure socially responsible use and administration of watercourses and ground water. The Act balances consideration for the resources, as well as the users, and is more resource-oriented than the previous Watercourses Act.

The licence obligation pursuant to the Water Resources Act covers all types of watercourse measures which can be expected to entail substantial harm or disadvantage to the general public interest. The main criterion for awarding a permit for implementing measures is that the advantages of the measure exceed the damage and disadvantages for the general public and private interests that are affected in the watercourse or drainage basin.

Multiple terms can also be stipulated with the objective of compensating for and alleviating the damage caused by the measure in the watercourse. If there is a licence obligation pursuant to both the Watercourse Regulation Act and Water Resources Act, the Watercourse Regulation Act will supersede the Water Resources Act, thus eliminating the need for a permit pursuant to the Water Resources Act.

Previously, licences were generally only needed for hydropower development. These provisions have been interpreted more widely in recent years, so that other projects that could involve damage or nuisance to the general public interest have also become subject to the licensing process. For example, this includes major water supply and drainage measures, as well as tapping water for aquaculture facilities.

Certain micro and mini power plants could have such negligible impact that they may be exempt from licencing. The impact is often difficult to assess without special watercourse expertise. A developer should therefore have its licence obligation assessed by the NVE before implementing the measure.

As a point of departure, the water resources are renewable, but parts of the ecosystem along and in watercourses are non-renewable natural resources. The Act emphasises preserving natural resources. It has general rules for conduct in watercourses and stipulates ordinary requirements and restriction as regards use, planning and implementation of measures in watercourses. Most requirements follow from the ordinary provisions, and have been stipulated out of consideration for circumstances in the watercourse.

The Water Resources Act is primarily intended to promote the considerations for sustainable development and safeguarding biodiversity, as well as the natural processes in the watercourses. The key concern is the inherent value of the watercourse, both as a landscape feature and as a habitat for plants and animals.

The sustainable development principle underpins several provisions of the Act, for example rules concerning preservation of riparian vegetation and minimum water flow. Both of these provisions aim to facilitate biological productivity and diversity in watercourses.

The penal provisions in the Water Resources Act have been significantly reinforced in comparison with previous rules, and penal provisions concerning environmental crime in river systems have been made more stringent.

Groundwater

Before the Water Resources Act entered into force, there were no legal rules concerning groundwater abstraction. Groundwater must be protected against pollution and overconsumption, and we must ensure a fair distribution of this scarce resource. The Pollution Control Act largely concerns the qualitative influence, while the Water Resources Act primarily regulates quantitative issues.

The Act continues the main rule concerning the landowner's right of disposal in river systems. Nevertheless, the Act stipulates certain general disposal restrictions as regards utilisation of groundwater, e.g. to ensure that an abstraction is limited to what the groundwater reservoir can withstand. Rules have also been stipulated concerning the licence obligation for abstraction and influence of groundwater.

Special provisions concerning measures in protected river systems

The objective of river system protection through protection plans has been to prevent the loss of conservation values in the river systems as a result of hydropower developments. Even if a river system is protected against hydropower developments, other types of disturbances could have a negative impact on the same conservation values. In order to not reduce the conservation values, the Water Resources Act stipulates certain special provisions for the management of protected river systems which also apply for measures in watercourses apart from hydropower developments. The most important provision is the legal establishment of the principle that all decisions pursuant to the Water Resources Act must put clear emphasis on the river system's conservation values. Among other things, this will result in more stringent licence processing in protected river systems than compared with other types of river systems.

Secure river systems

The Water Resources Act contains rules intended to prevent both harm resulting from river system measures, as well as harm caused by the river system.

There are a large number of dams in Norway. A potential dam failure could have major consequences. The large dams in Norway have a high level of structural safety and are followed up by owners and the NVE through inspections. The Regulations relating to the safety of hydrological structures (the Dam Safety Regulations of 18 December 2009, No. 1600) has been stipulated pursuant to the Water Resources Act.

The NVE also has administrative responsibility for preventing floods and landslides. The Water Resources Act contains legal authorisations for preventing loss of life and material assets due to floods, erosion and river-related landslides. The NVE can order the owner of watercourse installations to carry out measures to limit harm, or implement measures itself if there is a high risk of serious damage.

1.4 The Energy Act

The Energy Act provides the framework for organising the Norwegian power supply. The Energy Act made Norway the first country in the world to allow customers to freely choose their supplier of electricity. Through various licencing schemes, the Act regulates e.g.: construction and operation of electrical installations, district heating plants, power trades and monopoly supervision, foreign power trades, metering, settlement and invoicing, the marketplace for physical power trades, system responsibility, rationing, quality of supply, energy planning and power supply preparedness.

Below you can find a review of the content listed by licence type and main topics in the Act.

Local area licence

A local area licence is required in order to construct, own and operate power lines and electrical installations for distribution of electricity with voltages of 22 kV or less. Local area licences are awarded by the NVE. Those who have a local area licence do not need to apply for a licence pursuant to the Energy Act for each individual installation. This scheme is a simplification of the more extensive case processing required for installation licences. One of the conditions for the local area licence is that the grid companies are obliged to deliver electric energy to customers within the licence's geographical area.

Installation licence

In order to construct, own and operate power plants, transformer stations and power lines which are not covered by the local area licencing as mentioned above, a separate installation licence is required for each individual installation. The scheme covers all electrical installations which exceed the licencing limit, e.g. gas-fired power plants, wind farms and electrical installations associated with hydropower plants.

This licencing scheme aims to ensure a uniform practice for construction and operation of electrical installations. High-voltage power lines and transformer stations often entail substantial disruptions. In line with the purpose provision of the Energy Act, the licence processing emphasises e.g. socio-economical considerations, as well as the consideration for general public and private interests as regards, for example, landscape disruptions and the environment.

The licences may stipulate various conditions. The conditions are specified in Section 3-5 of the Energy Act, as well as in the Act's regulations. They include e.g. conditions entailing that the installation must result in a rational supply of energy, provisions concerning the time of start-up, construction, technical operations, conditions regarding utilisation of the individual plant, conditions with a view toward avoiding or limiting harm to natural resources and cultural heritage sites, the licensee's organisation and expertise, as well as additional conditions as required in each individual instance.

Trading licence

Entities that sell electric energy or which may be in some form of monopoly situation must have a trading licence. Only the State can trade electric energy without a licence. Trading licences are awarded by the NVE.

The largest group covered by the licencing scheme consists of entities that handle retail sales of self-produced or purchased power over their own grid to end-users in ordinary supply within a specific area, as well as others who own distribution or transmission grids. Pure trading companies that purchase power from producers or over the power exchange for resale are also covered. Entities in which the activity subject to licencing is of a limited scope can be awarded trading licences with simplified conditions. Power brokers that solely handle brokerage, i.e. that do not assume any responsibility for the economic aspects of a contract, do not need a trading licence.

The trading licence scheme is an important precondition for market-based power trade. The scheme aims to safeguard the interests of the customers by contributing to an economically rational trade of electric energy, as well as supervising the grid function as a natural monopoly.

The trading licence provides a legal basis for supervision of grid activities, which are a natural monopoly. The grid companies cannot demand higher prices than what is necessary, over time, to cover the costs or operation and depreciation of the grid, in addition to reasonable return on invested capital through efficient operations. Vertically integrated companies that have trading licences must keep separate accounts for the grid activities and the competitive activities (trade and production). This in necessary in order to enable the NVE, which is responsible for monopoly supervision, to assess whether the price for transmission of power is fair. Another condition requires the licensee to provide market access to anyone who requests grid services through non-discriminatory and objective point tariffs and conditions. Since the amendment of the Act in 2006, vertically integrated enterprises which have assumed system responsibility or which have more than 100 000 grid customers are required to have distinct corporate and functional divisions. Through regulations, the NVE has stipulated more detailed rules regarding the revenue ceiling, tariffs, metering and settlement of power trades. Reference is made to Chapter 5 for a more detailed discussion of monopoly supervision.

Marketplace licence

Organisation and operation of a marketplace for physical trading of electric energy requires a marketplace licence. The marketplace plays a key role in the market-based trade of electric energy. The marketplace licence enables the energy authorities to stipulate conditions and carry out supervision in order to safeguard considerations concerning e.g. pricing, the marketplace's obligations vis-à-vis the system coordinator, transparency, requirements for the trading players, neutral conduct and non-discrimination, etc. Reference is made to the detailed discussion of power trades in Chapter 5.

Licence for international power trades

A licence is required for facilitating international power trades pursuant to the Energy Act. Such licences are awarded by the Ministry of Petroleum and Energy. The system is intended to ensure the safest and most efficient international power exchanges as possible. Statnett SF and Nord Pool Spot AS have licences for facilitating international power trades. Reference is made to the detailed discussion of international power trading in Chapter 5.4.

District heating plants

A licence pursuant to the Energy Act is required for district heating plants whose output exceeds 10 MW. It is also possible to apply for a licence for smaller plants. District heating licences are awarded by the NVE.

If a district heating plant has a licence, the municipality may order mandatory connection through provisions stipulated for legally binding plans pursuant to the Planning and Building Act. The duty to connect may cover new buildings and buildings undergoing general renovation. The municipalities can also use these provisions to stipulate which buildings are to be covered by the duty to connect and which will not. The municipalities can also grant exemptions from the duty to connect.

The Energy Act also regulates the price for delivering district heating. The district heating price shall not exceed the price for electric heating in the supply area in question. Customers covered by the mandatory connection can appeal to the NVE as regards prices and other delivery conditions.

System responsibility, rationing and quality of supply

The system responsibility entails responsibility for ensuring continuous balance between the overall production and overall consumption of power. The system coordinator shall facilitate satisfactory quality of supply throughout the country. The NVE has been delegated the authority to designate the system coordinator and stipulate conditions for it. Statnett SF is the system coordinator. The Ministry has stipulated more detailed rules regarding system responsibility through the Regulations relating to the Energy Act. The NVE has stipulated separate Regulations relating to system responsibility in the power system. Reference is also made to the description of Statnett SF in Chapter 4.4.

The Energy Act also contains a provision concerning rationing of electric energy, including enforced reductions in supply and requisitioning. Rationing may be implemented when this is warranted by extraordinary circumstances. Pursuant to the provision, the NVE has been designated as the rationing authority, and is responsible for planning and administrative implementation of measures in connection with power rationing. The NVE has adopted separate Regulations relating to rationing.

Regulations relating to quality of supply have also been adopted pursuant to the Act.

Energy planning

The Energy Act has a separate chapter on energy planning. According to the Energy Act, energy planning aims to ensure that different solutions for the development of a rational public energy supply system are considered. Anyone who holds licences pursuant to the Act for electrical installations and district heating plants is obligated to participate in energy planning. The NVE has stipulated separate Regulations of 16 December 2002 No. 1607 relating to energy studies. The Regulations regulate both power system studies for the regional and main grids as well as local energy studies.

The NVE submitted new draft Regulations relating to energy planning for consultation in June 2012. The NVE aims for the new Regulations to enter into force on 1 January 2013. The new proposed Regulations primarily entail material changes for provisions which cover power system studies. No material changes are proposed in the provisions for local energy studies.

According to the Regulations, all grid companies shall prepare a local energy study for each municipality within their grid areas. This must be updated every two years, or more frequently if this is deemed necessary. A local energy study must e.g. describe the municipality's current energy system and energy composition, expected stationary energy demand in the municipality, as well as the most relevant energy solutions for areas in the municipality in which significant changes in energy demand are expected. The grid companies must also hold a public meeting with the municipality and interested energy players every two years, in which the energy study is presented and discussed.

The power system studies describe the current power grid, consumption and production data, current and future transmission conditions, as well as expected measures. The power system studies aim to ensure systematic, robust and transparent assessment of alternative measures in the grid. Eighteen study areas have been established; one for the main grid and 17 regional areas. Statnett has been designated as responsible for studies in the main grid, while 17 different parties have been designated as responsible for regional studies. The new proposed Regulations will safeguard the recommendations set for power system studies in Report No. 14 to the Storting (2011 -2012) "Building Norway – about grid developments" (the Grid Report). The Grid Report emphasises strengthening participation for various stakeholders in the processes surrounding power system studies. The Grid Report also describes how the power system studies will ensure coordinated grid development across all grid levels and grid owners, as well as ensure that the need for measures is identified and elucidated early.

Power supply preparedness

Proposition No. 112 L to the Storting (2010-2011) regarding amendments to the Energy Act and certain other acts was adopted by the Storting on 9 January 2012. The amendment act includes e.g. amendment and clarification of the preparedness chapter in the Energy Act. The part of the amendment act which concerns preparedness is scheduled to come into force on 1 January 2013.

Pursuant to the amendment act, the preparedness rules in the Energy Act apply in extraordinary situations during times of peace which may harm or prevent production, transformation, transmission, trading and distribution of electric energy or remote heating, in addition to times of war. As the preparedness authority, the NVE is authorised to implement preparedness measures vis-à-vis those who own or operate installations and systems which are critical for the supply of electric energy or district heating. These players are also assigned an independent duty to ensure effective security and preparedness, as well as implement measures to prevent, handle and mitigate the effects of extraordinary situations.

The Power Supply Preparedness Organisation (KBO) consists of the entities that own or operate installations or other equipment with material significance for the operation of restoration of or security of production, transformation, transmission, trading or distribution of electric energy or district heating. As a main rule, entities with licences pursuant to the Energy Act must be part of KBO, but others may be included through stipulation in regulations or individual decisions.

KBO can be assigned tasks and obligations in extraordinary situations which may harm or prevent production, transformation, transmission, trading or distribution of electric energy or district heating. In preparedness and war situations, the NVE can assign responsibility for power supply to KBO. The KBO entities must also ensure that the activities are designed in such a way and with the resources necessary for handling the responsibility and tasks described in the preparedness chapter of the Energy Act.

The new Regulations relating to preventive security and preparedness in the energy supply were submitted by the NVE for consultation in June 2012. The proposed regulations gather regulatory rules regarding preparedness in the energy supply in a single location.

1.5 The Offshore Energy Act

The Act relating to offshore renewable energy production of 4 June 2010 No. 21 (the Offshore Energy Act) regulates renewable energy production, as well as offshore transformation and transmission of electric energy. The Act establishes that the right to utilise offshore energy resources belongs to the State. The Act applies within Norwegian territorial waters outside the baselines and on the continental shelf, but provisions of the Act can also be applied in coastal waters. A licence is required in order to establish installations for production, transformation or transmission of power under the scope of the Act. The main rule for establishing offshore power production installations is that this can initially be applied for following an impact assessment by the State, with subsequent decision by the King in Council regarding opening of areas for licence applications. However, exceptions from this main rule can be made for temporary pilot projects or similar projects. Licences for installations within the baselines can also be processed pursuant to the Energy Act.

1.6 The Electricity Certificate Act

An electricity certificate is a confirmation issued by the State proving that one megawatt hour of renewable energy has been produced pursuant to the Electricity Certificate Act. The electricity certificate system is intended to promote investments in renewable energy. The electricity customers finance the scheme through their electricity bills. The electricity certificate market is a statutory market in that the market would not have established itself naturally, but that the need and demand has been created through the Electricity Certificate Act.

The electrical certificate market is based on an international agreement with Sweden. Through this shared electrical certificate market, Norway and Sweden are utilising a cooperation mechanism under the Renewables Directive, cf. the discussion regarding the Directive in Chapter 1. The goal is for the shared electrical certificate market to provide 26.4 TWh in new electricity production based on renewable energy sources in Norway and Sweden by 2020. One assumption for the establishment of the shared market was that electricity certificate obligations in Sweden can be fulfilled using Norwegian electrical certificates and vice versa.

The owner of a production facility is entitled to electricity certificates if specific conditions in Chapter 1 of the Electricity Certificate Act have been fulfilled. The production facility must produce electric energy based on renewable energy sources (technology-neutral requirements), be approved by the NVE and satisfy requirements for metering and reporting. Both expansion of existing facilities and new facilities may satisfy the conditions for receiving electrical certificates. Production facilities which become operational after 31 December 2020 will not qualify for electrical certificates. Those subject to the electricity certificate obligation are primarily suppliers of electric energy to end-users. But, in certain cases, end-users themselves may themselves be subject to an electricity certificate obligation.

Producers entitled to electrical certificates must apply for approval of the facility to the NVE, which administers the electrical certificate scheme in Norway. In addition, the producer, or a registrar authorised by the producer, must apply for an account in the electronic electricity certificate registry.

Statnett SF is responsible for the electricity certificate registry. This means e.g. that Statnett SF has established and operates the electricity certificate registry. Statnett SF is responsible for registration and cancellation of electricity certificates in the registry. The electricity certificates are issued after production has taken place on the basis of actual metering data. Electricity certificates are issued by Statnett SF registering the electricity certificate in the certificate account of the entity entitled to electricity certificates. The scheme will be terminated on 1 April 2036 through the cancellation of electricity certificates for the year 2035.

The electricity certificate scheme presumes that the certificates are traded, thus enabling the entities entitled to electricity certificates to capitalise the value represented by the certificates. Those subject to an electricity certificate obligation will have access to the electricity certificates that are necessary in order to fulfil their electricity certificate obligation.

The Electricity Certificate Act is supplemented by the Regulations relating to electricity certificates of 16 December 2011 No. 1398.

1.7 Other legislation

The following will provide a detailed description of other legislation with significance for the energy and water resources area. The Natural Gas Act is the only one of these acts which is administered by the Ministry of Petroleum and Energy/NVE.

The Planning and Building Act

The Act relating to planning and processing of building applications of 27 June 2008 No. 71 (the Planning and Building Act primarily applies in parallel with the energy and water resources legislation, but important exemptions have been made.

The new planning section of the Planning and Building Act entered into force on 1 July 2009. The Act introduced certain new provisions which apply for energy measures. Only the chapters of the Act which concern impact assessments and the requirement for basic map data and localised information apply for main and regional grid facilities. These measures are also exempt from the Act. As regards facilities for production of electric energy, the Act states that there is no obligation to prepare a regulation plan. In order to ensure that these production facilities can be established in instances where the municipality does not facilitate the measure through adoption of a regulation plan, plan amendment or dispensation, a provision has been included which allows the Ministry of the Environment to decide that a final permit may be granted the status of a State regulation plan. The Ministry of the Environment's authority in this regard has been delegated to the Ministry of Petroleum and Energy by Royal Decree.

The new Regulations relating to impact assessments (the IA Regulations) entered into force on 1 July 2009. The Regulations stipulate the specific limits on which measures require an impact assessment and detailed rules regarding implementation of impact assessments. In brief, the provisions entail that major measures always require an impact assessment, while minor measures may be subject to an impact assessment pursuant to specific conditions.

As a point of departure, the building application provisions in the Planning and Building Act do not apply for measures pursuant to the energy and water resources legislation. This is stated in the Regulations relating to processing and oversight of building applications, which was stipulated pursuant to the Planning and Building Act.

The Nature Diversity Act

Act of 19 June 2009 No. 100 Relating to the Management of Biological, Geological and Landscape Diversity (Nature Diversity Act) repealed the Nature Conservation Act and resulted in amendments to certain other acts. The purpose of the Nature Diversity Act is to ensure that nature, with its biological, geological and landscape diversity and ecological processes, is preserved through sustainable use and conservation, in addition to providing a basis for human activity, culture, health and well-being, now and in the future, and as a basis for Sami culture.

In addition to rules regarding various forms of nature conservation, the Act also includes provisions regarding sustainable use of nature. The environmental law principles in the Nature Diversity Act apply in all sectors when the State exercises its authority and makes decisions which affect nature. Licences for wind power, hydropower and power from other renewable energy sources may affect biological, geological and landscape diversity and must thus be considered in line with these provisions. The principles in Sections 8 through 12 shall be act as guidelines in the exercise of discretionary judgment. The decision must account for how the principles have been considered and weighted.

The Expropriation Act

When an energy facility is to be built, the developer must acquire the necessary land and permits for the facilities. This can either takes place through amicable agreements or through expropriation. When the developer applies for a permit, this is usually accompanied by an application for an expropriation permit in the event that such amicable agreements are not secured with the affected landowners and licensees.

Rules relating to expropriation and advance possession are founded in the Act relating to expropriation of real property of 23 October 1959, No. 3 (the Expropriation Act). Consent can only be granted for expropriation if it is likely that the measure will, without doubt, result in greater advantages than disadvantages.

If the developer cannot achieve amicable agreements with affected landowners and licensees, expropriation is implemented through a subsequent discretionary judgement case before the courts, in order to stipulate possible compensation for the expropriation measure. If the construction work needs to start before such a discretionary judgement has been rendered, the developer can apply for advance possession.

Competition legislation

The Act of 5 March 2004 No. 12 relating to competition between undertakings and control of concentrations (the Competition Act) provides a framework for the parts of the power market which are subject to competition, and applies in this area alongside the Energy Act.

The purpose of the Act is to further competition and thereby contribute to the efficient utilization of society's resources. When applying the Act, special consideration shall be given to the interests of consumers.

The Act prohibits collaboration that restricts competition and abuse of a dominant position. The Act also allows the competition authorities to issue considerable fines in the event of breach of the Act's prohibitions, and introduces the opportunity to reduce fines for undertakings which assist the competition authorities in clearing up infringements. There is also a general duty to report mergers and acquisitions. The Norwegian Competition Authority handles competition issues in the power market.

The Natural Gas Act

The implementation of Directive 98/30/EC (the Gas Market Directive) in Norwegian law necessitated the establishment of a legal framework for such activities in Norway. The Act relating to common rules for the internal market in natural gas of 28 June 2002 No. 61 (the Natural Gas Act) covers transmission, distribution, supply and storage of natural gas.

Chapter 2 of the Natural Gas Regulations of 14 November 2003 No. 1342 contain more detailed rules regarding permits for certain types of downstream natural gas infrastructure. Facilities for transmission of natural gas, including transmission pipelines, LNG plants and associated facilities, which will primarily supply natural gas to natural gas enterprises in another region cannot be constructed or operated without a permit from the Ministry. Smaller LNG plants, smaller plants for transmission of natural gas or facilities for distribution of natural gas do not require a permit. The authority to make decisions pursuant to the Natural Gas Regulations has been delegated to the NVE.

On 26 June 2003, the EU adopted Gas Market Directive II (Directive No. 2003/55/EC). In turn, this Directive has been replaced by Directive 2009/73/EF (Gas Market Directive III) in the EU, which was adopted on 13 July 2009. Gas Market Directive III has not yet been incorporated into the EEA Agreement. The Directive will require certain amendments to the natural gas legislation. Reference is made to the discussion concerning the Third Internal Energy Market Legislative Package in Chapter 1.

Within the framework of Gas Market Directive II it is possible to take into account special conditions in countries where the gas markets are underdeveloped. The implementation of this Directive in Norway has taken into consideration the fact that the Norwegian downstream gas market is considered an emergent market in line with Article 28, No. 2 of the Directive. This entails an exemption from all but the most important of the Directive's provisions until 2014. Gas Market Directive III also allows for exemptions from key Directive provisions in emergent markets.

The Consumer Purchase Act

The Act of 21 June 2002 No. 34 relating to consumer purchases (the Consumer Purchase Act) covers transmission and supply of electric energy. As a point of departure, the consumer has the same protections in the event of supply of electric energy as with other services which fall under the Consumer Purchase Act. This entails that the consumer, according to specific conditions, e.g. can exercise a right of retention, demand price reductions and reimbursement as a result of breach of contract on the part of grid companies. Application of the rules in the Consumer Purchase Act has been adapted to the special circumstances which are in effect during supply of electric energy. Among other things, this applies to the issue of the grid companies' liability in the event of deficient supply of electric energy. There are also clear guidelines for the grid companies right to shut down facilities in the event of the consumer's default on payments, in addition to the statutory establishment of the activities of the Electricity Appeal Board[29] .

The Pollution Control Act

The Act of 13 March 1981 No. 6 relating to protection against pollution and concerning waste (the Pollution Control Act) covers most sources of pollution within the energy and water resources sector.

The Pollution Control Act stipulates that pollution is prohibited unless a permit has been issued. Such permits are awarded for certain activities and on certain conditions pursuant to Section 11 of the Act or various regulations concerning polluting activities.

The main rule is that polluting activities are subject to individual permits from the pollution authorities.

The Pollution Control Act is administered by the Ministry of the Environment. Applications for emission or discharge permits fro industrial activities, etc., must be submitted to the Climate and Pollution Agency (Klif) or the County Governor's department for environmental protection for enterprises which are subject to the County Governors' pollution authority.

Energy and water resource measures may require permits pursuant to the Pollution Control Act. This applies to e.g. gas-fired power plants and hydropower plants. Major hydropower plants and regulations will have their pollution effects assessed in the licence processing pursuant to the Watercourse Regulation Act, and pollution permits are included in the licence awarded pursuant to the Watercourse Regulation Act. Routines have been developed for coordinating permits for smaller developments. For example, the Water Resources Act allows for licences pursuant to the Water Resources Act to replace permits pursuant to the Pollution Control Act and vice versa.

The Neighbouring Properties Act

The Act of 16 June 1961 No. 15 relating to the legal relationship between neighbouring properties (the Neighbouring Properties Act) regulates the legal relationship between neighbours, not only the relationship between adjacent properties. The Act applies as long as "special legal considerations" do not indicate otherwise. The Neighbouring Properties Act is primarily applicable for measures which affect neighbours in river systems.

The Cultural Heritage Act

The Act relating to cultural heritage of 9 June 1978 No. 50 (the Cultural Heritage Act) has significance for measures pursuant to the energy and water resources legislation. The Ministry of the Environment is the highest administrative authority and has delegated its authority to the Directorate for Cultural Heritage, the county authorities, as well as the Sami Parliament of Norway as regards Sami cultural heritage. Archaeological and architectural monuments and sites will be considered in the licence processing, and may e.g. lead to a licence requirement for certain measures or contribute to rejection of a licence application. River system licences set conditions concerning safeguarding of automatically protected monuments and sites, and licences pursuant to the Energy Act safeguard the consideration for cultural heritage through an environment, transport and construction plan.

The Outdoor Recreation Act

The Act relating to outdoor recreation of 28 June 1957 No. 16 (the Outdoor Recreation Act) regulates the right of access (allemannsretten) to properties owned by others. The Water Resources Act stipulates that the actual right of access in river systems is regulated by the Water Resources Act, but that other activities (bathing, landing and mooring boats) are regulated by the Outdoor Recreation Act. The highest administrative authority is the Ministry of the Environment, with the Norwegian Directorate for Nature Management as its underlying agency.

The Reindeer Husbandry Act

According to Section 22 of the Act relating to reindeer husbandry of 15 June 2007, No. 40, the closure of migration routes is prohibited. This includes not only complete blockage of routes, but also restrictions of and construction near routes, as well as any disturbances resulting from construction of the measure which can be included under the provision if this prevents herding the reindeer along the migration route. This must be assessed in each individual case. The Ministry of Agriculture and Food can grant consent for re-routing migration routes and opening new migration routes. However, migration routes may be affected and potentially closed in connection with more extensive measures when the preconditions for expropriation are satisfied.

If the reindeer cannot be practically herded past an energy facility or underneath a power line which crosses a migration path, the developer may be obliged to compensate for any damage, or potentially implement mitigating measures out of consideration to the reindeer husbandry, as determined by the licensing authority following prior consultations with the Sami Parliament and the affected reindeer migration district.

The Public Administration Act

The Act relating to procedure in cases concerning the public administration of 2 October 1967 No. 10 (the Public Administration Act), establishes a framework for how the authorities' processing should take place. The Act contains general rules regarding the processing of decisions, etc., and supplements the special processing rules in the special acts, for instance in the Energy Act.

Other statutes

Other statutes which may affect energy and water resource measures include the Act relating to wildlife and wildlife habitats of 29 May 1981 No. 38, the Act relating to salmonids and fresh-water fish, etc., of 15 May 1992 No. 47 and the Act relating to aquaculture, etc., of 14 June 1985 No. 68.

APPENDIX 2

Definition of energy terms, conversion factors and theoretical energy content of various fuel sources

Power units

Power is energy per unit of time.
The basic unit of power is watt (W), and the following units are used:

1 W	watt	= 1	J/s	
1 kW	kilowatt	= 10^3	W	= 1000 W
1 MW	megawatt	= 10^3	kW	= 1000 kW
Natural horsepower		= 13.33 x Q x H Q = regulated stream flow in a medium, expressed in m^3 per second H = waterfall height in metres		

Energy units

Energy is defined as the capacity to carry out work.
The basic unit of energy is joule (J).

1 MJ	megajoule	= 10^6	J	= 1 million J
1 GJ	gigajoule	= 10^9	J	= 1 billion J
1 TJ	terajoule	= 10^{12}	J	= 1 trillion J
1 PJ	petajoule	= 10^{15}	J	= 1 000 trillion J
1 EJ	exajoule	= 10^{18}	J	= 1 million trillion J

The following units are also used for electric energy

1	kWh	kilowatt hour	= 10^3	Wh	= 1 000 Wh
1	MWh	megawatt hour	= 10^3	kWh	= 1 000 kWh
1	GWh	gigawatt hour	= 10^6	kWh	= 1 million kWh
1	TWh	terawatt hour	= 10^9	kWh	= 1 billion kWh

PJ is obtained by multiplying TWh by 3.6.

1 MWh is close to the amount of electric energy needed to heat a detached house for a week during the winter.

1 TWh approximately corresponds to one year's consumption of energy in a town with a population of about 50 000.

Conversion factors and average theoretical energy content of various fuel sources

	MJ	kWh	Toe	Sm^3 natural gas	Barrel of crude	Favn of firewood
1 MJ, megajoule	1	0.278	0.0000236	0.025	0.000176	0.0000781
1 kWh, kilowatt hour	3.6	1	0.000085	0.09	0.000635	0.00028
1 toe, tonne of oil equivalent	42300	11750	1	1190	7.49	3.31
1 Sm^3 natural gas	40	11.11	0.00084	1	0.00629	0.00279
1 barrel of crude (159 litres)	5650	1569	0.134	159	1	0.44
1 favn of firewood* (2.4 m^3)	12800	3556	0.302	359	2.25	1

* Depends on the fuel's moisture content.

APPENDIX 3

Electricity – key figures for 2011 (TWh)

	TWh	Change from 2010
Mean annual production capacity for Norwegian hydropower*	130	0.6
Production	128.1	4.5
– Hydropower	122.1	4.9
– Thermal power	4.8	-0.8
– Wind power	1.3	0.4
Net export	3.1	10.6
– Import	11.3	-3.4
– Export	14.3	7.2
Net domestic end-user consumption**	105.4	-8.1

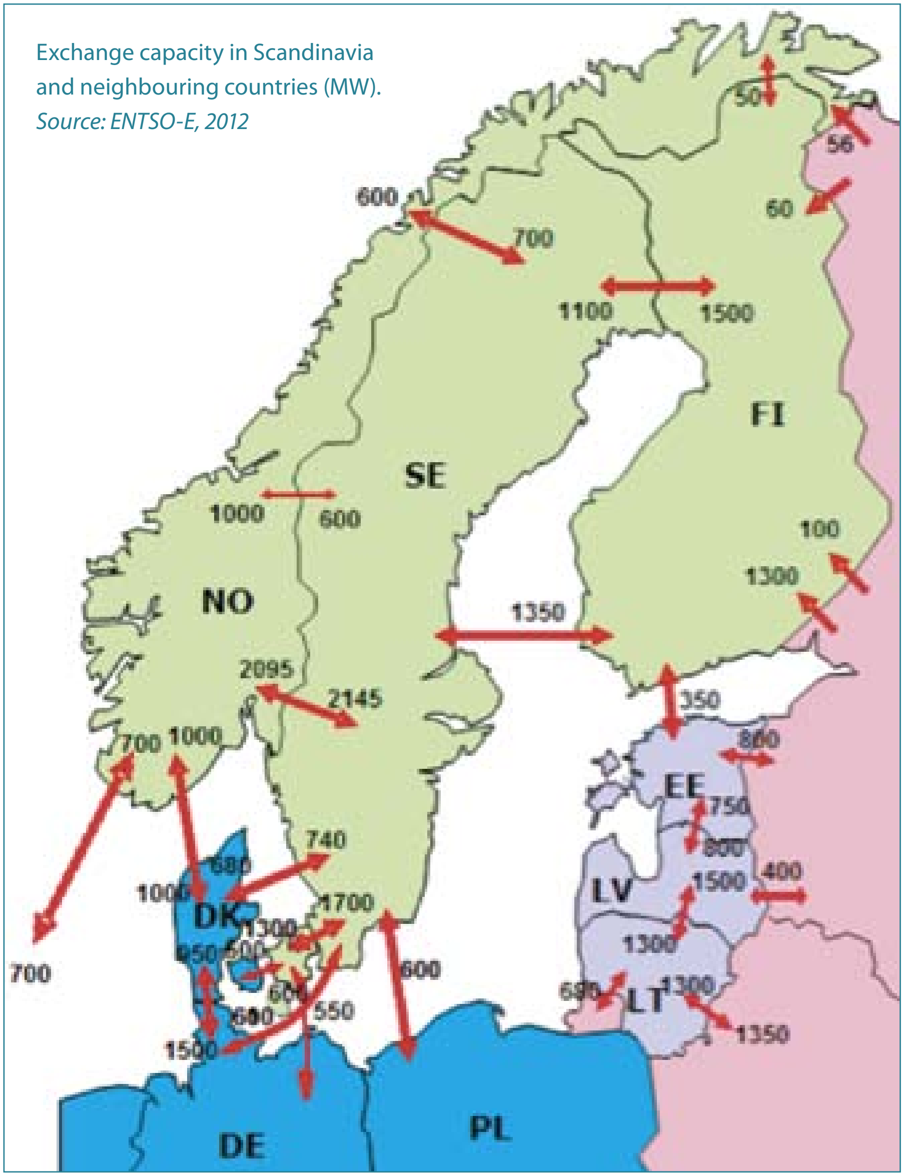
Source: Statistics Norway

* Inflow series 1981–2010

** Preliminary figures

APPENDIX 4

Transmission capacity in Scandinavia



Exchange capacity in Scandinavia and neighbouring countries (MW).
Source: ENTSO-E, 2012

APPENDIX 5
Definitions

Term/expression	Definition
Operational time	$\text{Operational time (h)} = \frac{\text{Energy produced over a year (MWh)}}{\text{Installed turbine capacity (MW)}}$
Effect balance	Difference between supply and consumption of power at a given time.
Bottleneck	Transmission restrictions between geographic areas.
Installed (production) capacity	The power (MW) a power plant can supply.
(Domestic) power balance	Difference between production and overall consumption of power over a year.
Hydropower production in a normal year	Calculated, average annual production capacity in a hydropower plant. The 1981-2010 inflow series is currently used as a basis for the calculation. Production per station is normally listed in GWh. Each power plant's volume of water forms the basis for production simulations for the individual power plant.
Natural horsepower	Natural horsepower is used in energy legislation as a unit of power in hydropower plants.
Drainage basin	The geographic area which collects precipitation running into a river system.
Grid loss	Energy loss in the grid during transmission of electricity.
Area price	Electricity price established in an individual bidding area on Nord Pool Spot. The area prices consider bottlenecks in the grid and provide balance between supply and demand within each bidding area.
Bidding area	A defined market area for buying and selling power. Norway is currently divided into 5 bidding areas.
Regulating power	Reserves in the power system which can be used in the event of faults or imbalances in the operating hour to achieve secure operation.
End-user	Anyone who purchases power for personal consumption.
Stationary energy consumption	Net domestic energy consumption minus the use of energy for transport purposes.
System price	Joint Nordic electricity price set on Nord Pool Spot. The price balances overall supply and demand in Scandinavia, but does not consider potential bottlenecks in the grid.
Water inflow	The volume of water which flows into the reservoirs from a river system's entire drainage basin.
Hydropower potential	The energy in Norwegian river systems which can be developed for power purposes within technical and economical constraints.
River system	A continuous system of rivers from source to sea, including any lakes, snowfields and glaciers.

APPENDIX 6

Report No. 14 to the Storting (2011-2012)

Building Norway – about grid developments

On 2 March 2012, the Government presented Report No. 14 to the Storting, “We are building Norway – developing the power grid”. In the white paper, the Government presented the policy for developments and reinvestments in the transmission grid in the years to come.

The paramount objective is for planning and development of the grid to take place in a manner which is rational for society at large, cf. the Energy Act. The Government has listed the following goals which have consequences for modernisation and development of the power grid:

- Secure access to electricity throughout the country.
- High production of renewable electricity.
- Facilitate industrial and commercial development that requires increased power supply, such as power to petroleum and industrial activities.
- Adequate transmission capacity between regions, thus avoiding significant long-term differences in electricity prices between areas.
- A climate-friendly energy system which takes into consideration nature diversity, as well as local communities and other general public interests.

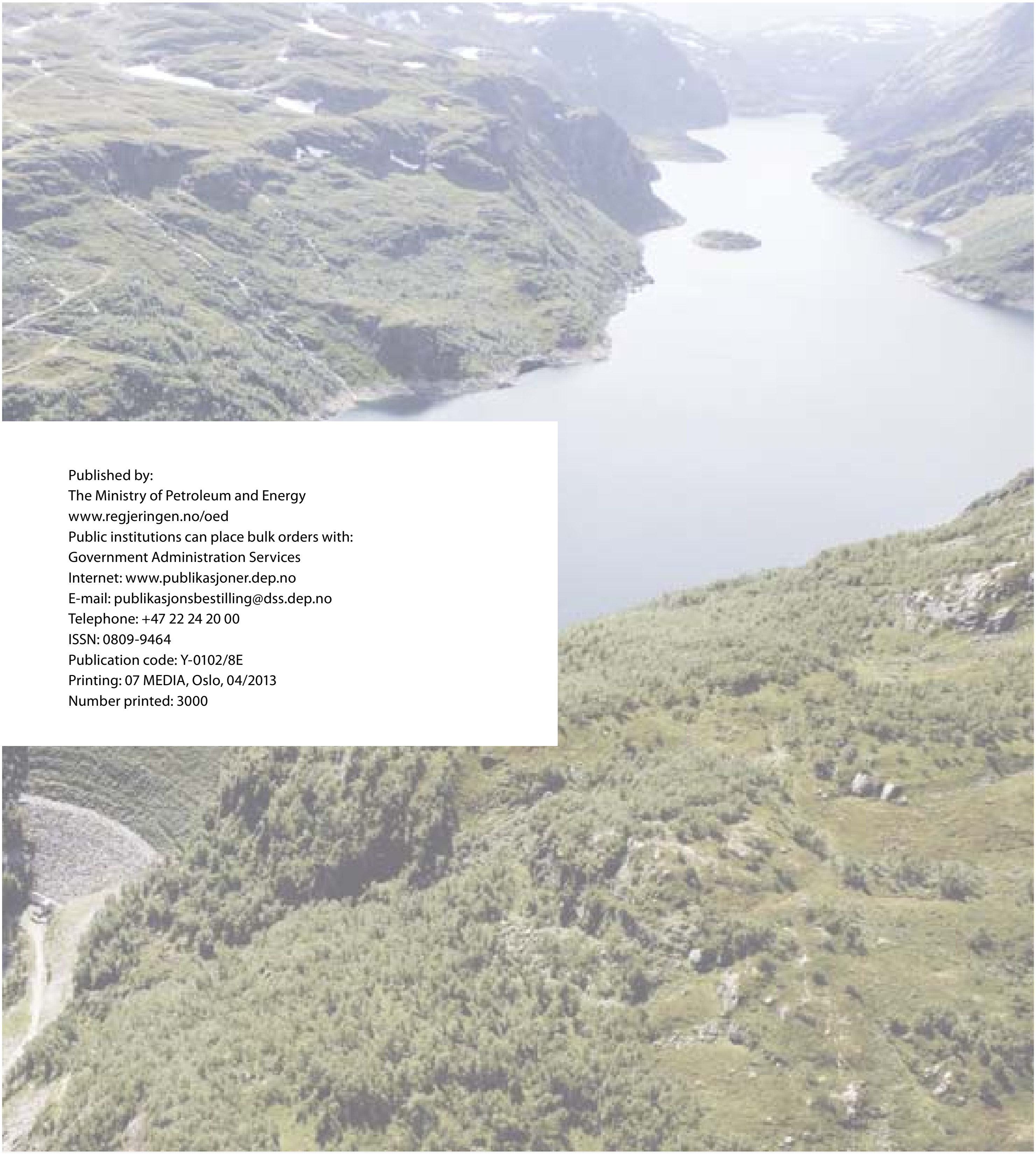
The white paper also proposes changes to planning and licence processing for major power lines in order to increase efficiency, strengthen early involvement of relevant parties and clarify political choices.


DET KONGELIGE
OLJE- OG ENERGIDEPARTEMENT

Meld. St. 14

(2011–2012)
Melding til Stortinget

Vi bygger Norge
– om utbygging av strømnettet



Published by:
The Ministry of Petroleum and Energy
www.regjeringen.no/oed
Public institutions can place bulk orders with:
Government Administration Services
Internet: www.publikasjoner.dep.no
E-mail: publikasjonsbestilling@dss.dep.no
Telephone: +47 22 24 20 00
ISSN: 0809-9464
Publication code: Y-0102/8E
Printing: 07 MEDIA, Oslo, 04/2013
Number printed: 3000