

Country Reports

IEA Bioenergy: 09 2018

This report was prepared from the 2018 OECD/IEA World Energy Balances, combined with data and information provided by the IEA Bioenergy Executive Committee and Task members. Reference is also made to Eurostat. All individual country reports were reviewed by the national delegates to the IEA Bioenergy Executive Committee, who have approved the content. General background on the approach and definitions can be found in the central introductory report¹ for all country reports.

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NATIONAL POLICY FRAMEWORK IN NORWAY

As a member country of the European Economic Area, Norway also implemented the EU Renewable Energy Directive 2009/28/EC and produced a National Renewable Action Plan (NREAP). Norway has committed itself to a target of 67.5% share of renewable energy in gross final energy consumption in 2020, with a split in sectors as displayed in the table below.

Table 1: Norway's 2020 renewable energy targets

Sector	Share in gross final consumption per sector
Overall target	67.5%
Heating and cooling	43%
Electricity	114%*
Transport	10%

* Overshoot of renewable power production of 14 %

Source: National Renewable Energy Action Plan of Norway (2012)²

The main incentive for the use of renewable energy is a quota system in terms of quota obligations and a certificate trading system. The Electricity Certificates Act obliges electricity suppliers and certain electricity consumers to annually acquire renewable energy certificates in due proportion to their electricity sales and their consumption by a set date. Furthermore, the act stipulates the conditions under which owners of renewable energy generation plants may acquire electricity certificates.

Furthermore, there is a supply obligation for liquid biofuels for fuels used in road transport. This

¹ Available at <https://www.ieabioenergy.com/iea-publications/country-reports/2018-country-reports/>

² https://ec.europa.eu/energy/sites/ener/files/documents/dir_2009_0028_action_plan_norway_nreap.pdf

obligation has been in operation since 2009, and the obligation has been stronger in recent years. The obligation in 2015 was 5.5%, and in 2017 this obligation was raised to 7%, and the result in 2017 was 16%.

Enova SF, a public enterprise that is owned by the Ministry of Climate and Environment (from 2018), manages the Energy Fund in Norway. The purpose of Enova and the Energy Fund is to contribute to reduced greenhouse gas emissions and strengthened energy security of supply, as well as technology development that also contributes to reduced greenhouse gas emissions in the longer term. In this light Enova offers support to technology development and reduced technology cost/increased performance, and market development. Enova has, for example, supported renewable heat production, both small heating plants and larger district heating plants, by investment aid. Enova also has a support programme directed towards industrial production of biogas. In addition, Enova offers investment aid to households undertaking energy efficiency measures, measures aimed at decreasing energy consumption or conversion from heating sources based on fossil fuels or electricity to a renewable source.

The RCN (Research Council of Norway) ENERGIX-programme provides funding for research on renewable energy, efficient use of energy, energy systems and energy policy. The programme is a key instrument in the implementation of Norway’s national RD&D strategy, Energi21, as well as for achieving other energy policy objectives. The FME Scheme (Centres for Environment-friendly Energy Research - FME) is to establish time-limited research centres, and in 2016 FME Bio4Fuels was established. The level of R&D bioenergy financing from RCN Energy department was in 2016 approximately 10 million euros.

A detailed description of all fiscal and non-fiscal supports for bioenergy development is available at: <http://www.iea.org/policiesandmeasures/renewableenergy/?country=Norway>

TOTAL PRIMARY ENERGY SUPPLY (TPES) AND THE CONTRIBUTION OF BIOENERGY

The total primary energy supply of Norway in 2016 amounted to 1,188 Petajoule (PJ) with an export surplus of electricity of 59 PJ (5% of Norwegian TPES). Fossil fuels include 340 PJ oil products, 232 PJ natural gas and 32 PJ coal products. Renewable energy sources have a share of 51.2% or 583 PJ – 5.4% bioenergy and 45.8% other renewable energy sources.

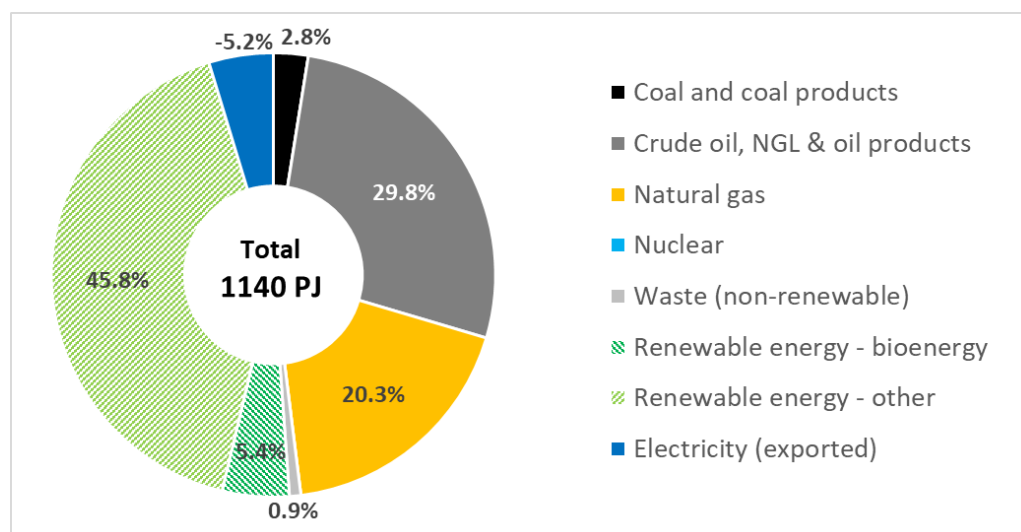


Figure 1: Total primary energy supply in Norway in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Compared to 5 years earlier (2011) the share of fossil fuels was relatively stable, with slight decreases in oil products and coal and a slight increase of natural gas. In the same period exported electricity increased from 1% to more than 5% of TPES. Energy supply of renewable energy increased from 504 to 583 PJ, with most growth in 'other' renewable energy forms (non-bioenergy).

Almost 90% of the total primary energy supply of renewable energy sources is covered by hydropower (515 PJ), followed by bioenergy (61 PJ) and wind energy (8 PJ). The role of solar or geothermal energy is not significant.

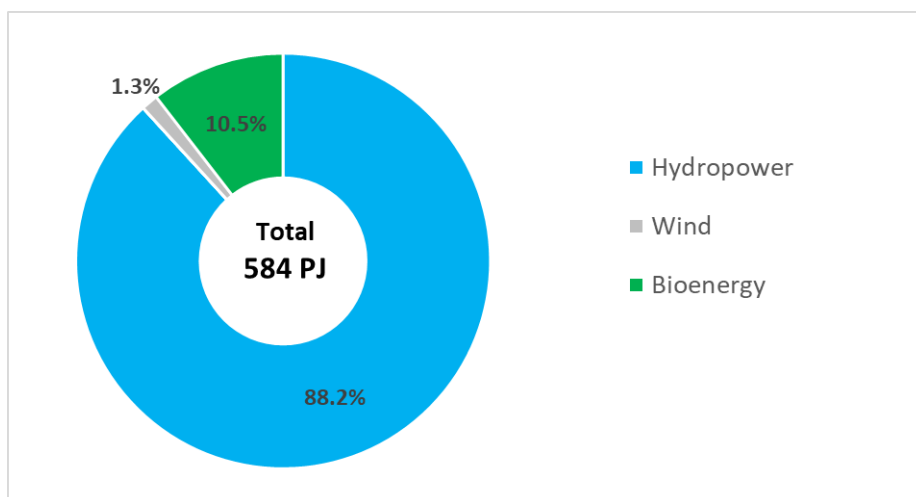


Figure 2: Total primary energy supply of Renewable Energy Sources in Norway in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Most bioenergy in Norway is from solid biomass (37 PJ), of which around 20 PJ is used in the residential sector. There are also significant volumes of biodiesel (13 PJ) and renewable MSW (8 PJ). Biogas, biogasoline and other liquid biofuels reach lower shares (around 1 PJ).

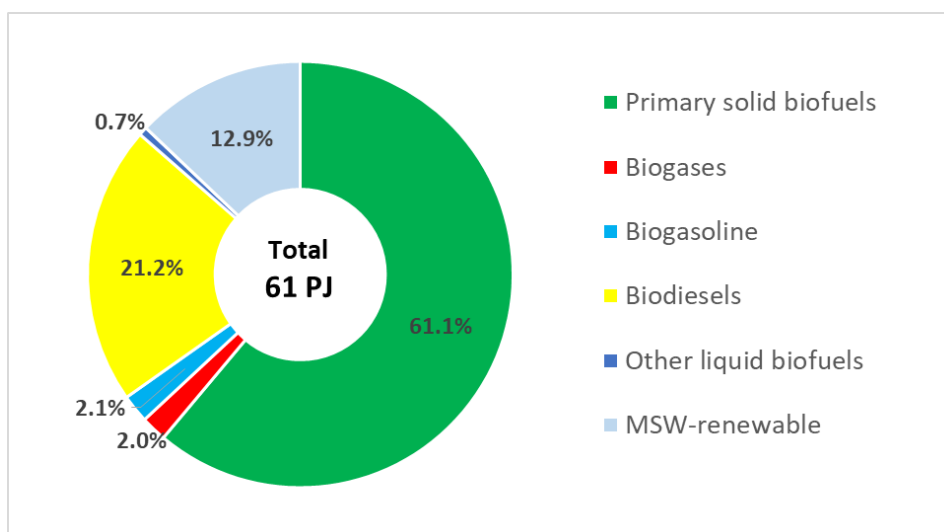


Figure 3: Total primary energy supply from bioenergy in Norway in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Bioenergy consumption in Norway fluctuated between 4 and 6% of TPES in the past decades. Between 2010 and 2014 there was a clear decreasing trend of solid biomass from over 50 PJ to 35 PJ. This is due to closures in the pulp and paper industry, and a reduction in the use of firewood used for heating in the private households due to mild winters. Solid biomass consumption stabilized in the last few years. Renewable MSW stabilized at 7-8 PJ since 2012. Liquid biofuels have been introduced between 2005 and 2010, and stabilized between 2010 and 2015 around 5-6 PJ. In 2016 there was an upward step, with more than a doubling from 2015 to 2016 (to 15 PJ).

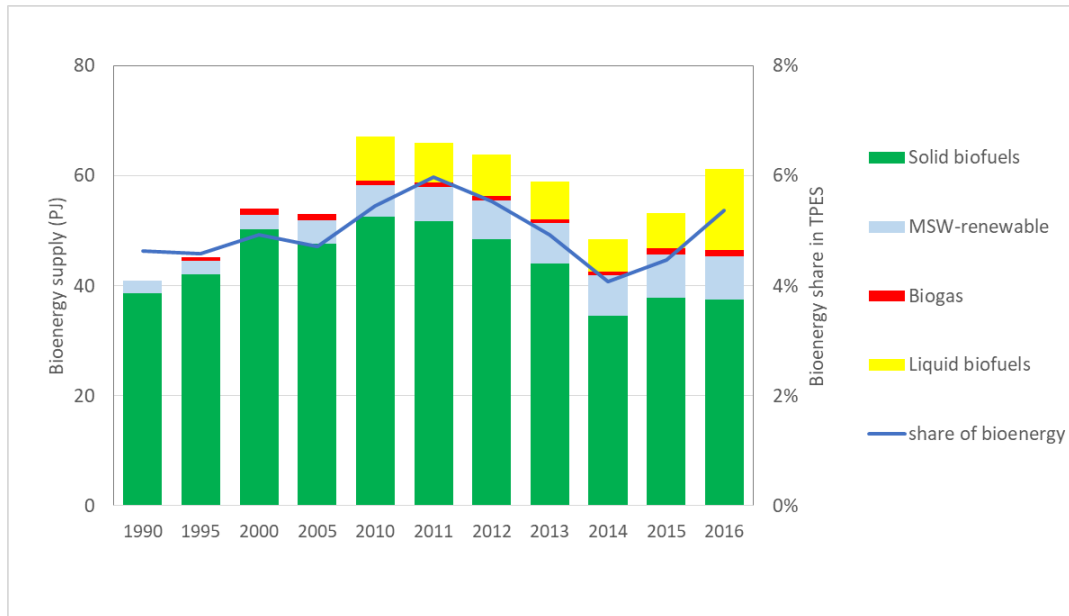


Figure 4: Development of total primary energy supply from bioenergy in Norway 1990 – 2016 (Source: World Energy Balances © OECD/IEA 2018)

Table 2 expresses the 2016 TPES figures per capita, considering Norway’s population of 5.24 million people. Compared to the other 22 member countries of IEA Bioenergy (expressed per capita), Norway ranks in the top 5 for liquid biofuels, in the top 10 for renewable MSW, halfway for solid biofuels and in the lower end for biogas.

Table 2: Total primary energy supply per capita in 2016

	GJ/capita
Total energy	217.6
Bioenergy	11.7
Solid biofuels	7.1
Renewable MSW	1.5
Biogas	0.2
Liquid biofuels	2.8

Source: World Energy Balances © OECD/IEA 2018

Role of bioenergy in different sectors

Norway has an extremely high share of renewable electricity (98% of it is related to hydropower), with a very small part through electricity from biomass.

The share of biofuels for transport was around 7% in 2016. Mind that there is also a considerable share of renewable electricity in the Norwegian transport system, predominantly through rail, but recently also through the introduction of electric cars.

Overall, the direct share of biomass for heating in the different sectors is around 21%. In the residential sector biomass represents about 53% of fuel/heat consumption. Heat output generated and sold by CHP plants and heat plants represents around 13% of fuel/heat provided, of which on average 44% is produced from biomass.

Table 3: Role of bioenergy and renewable energy in electricity production, transport energy consumption and fuel/heat consumption in 2016

Sector	Share of bioenergy	Share of renewable energy	Overall production/consumption
Electricity production	0.16%	97.8% (96.2% hydro)	149 TWh (535 PJ)
Transport energy (final consumption)	7.2%	8.9%	201 PJ
Overall fuel and heat consumption³	Direct biomass: 20.9% Biobased heat: 5.6%	26.5%	153 PJ

Source: World Energy Balances © OECD/IEA 2018

According to Eurostat⁴, the following renewable energy shares in gross final energy consumption were reached in Norway in 2016:

- Overall share: 69.4%
- In heating and cooling: 31.7%
- In electricity: 104.7%
- In transport: 17.0% (8.8% in 2015)

Both the overall share and the individual sectors have exceeded the renewable energy targets for 2020 (see Table 1). Mind that some of these figures can differ from the IEA derived data because of different accounting rules. This is particularly the case for transport biofuels, e.g. where cellulose or residue based biofuels are double-counted towards the target.

³ This includes final consumption of fuels and heat in industry, the residential sector, commercial and public services and agriculture/forestry. Transport fuels are excluded. Energy used for transformation and for own use of energy producing industries is also excluded.

⁴ http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_335a&lang=en

RESEARCH FOCUS RELATED TO BIOENERGY

Bioenergy R&D, R&D on biomass and waste to fuels for transport and heating, has for the last years developed positively with more integration between disciplines and technologies. The level of financing through the Research Council (RCN) and Enova supporting research, innovation, piloting and demonstrations are substantial.

The R&D focus has been more on fuels for transport the last years with strong interdisciplinary collaboration between universities and institutes in close connection with industry. Bio4Fuels, which started in 2017, is a key initiative to coordinate such a development. The overall aims for the R&D is to demonstrate lab- and pilot scale technology which can reduce processing costs and increase product yields, and to document overall value chain sustainability. In Norway, with rather cold winters, a well-functioning heating sector is important and R&D focus the last years have been (1) to increase profitability and sustainability in waste-to-energy (WtE) plants, and (2) product development of small scale heating to reduce emissions and increase flexibility to serve both modern and traditional housings.

The metallurgical industry in Norway would like to utilize large amounts of biocarbon as substitute for fossil reductants in their reduction processes. R&D cooperation between industry and institutes is developing well, also looking at possibilities to establish Norwegian value chains. This is also the case the case for so called black pellets production.

A modern household WtE sector is developing, and especially with more organic waste to biogas. Still there is potential to develop biogas from industrial organic waste. Deliveries of biomass from forests might be doubled in sustainable ways, and with decline in paper industry, there is already biomass available to develop new biorefining for fuels and chemical markets. Research on sustainability and climate effects is going on to document profitable ways to do this.

RECENT MAJOR BIOENERGY DEVELOPMENTS

From 2010 to 2014 there was a reduction in the use of bioenergy –particularly solid biomass – in Norway. This is due to closures in the pulp and paper industry, and reduction in the use of firewood used for heating in the private households due to milder winters. Since 2014 the use of bioenergy has increased. The supply obligation for renewable fuels in road transport has increased the use of liquid biofuels strongly in recent years. Only a small part of these liquid biofuels are produced in Norway.

LINKS TO SOURCES OF INFORMATION

The following websites provide useful information and data on national Norwegian bioenergy policy, production and consumption:

Statistical data on renewable energy, provided by Statistics Norway: <https://www.ssb.no/en/energi-og-industri/statistikker/energibalanse>

Relevant ministries in Norway are:

- Norges vassdrags- og energidirektorat (NVE) – Norwegian Water Resource and Energy Directorate: <http://www.nve.no/>
- Olje- og energidepartementet (OED) – Ministry of Petroleum and Energy: <https://www.regjeringen.no/no/dep/oed/id750/>

Energy Facts Norway, website by the Ministry of Petroleum and Energy: <https://energifaktanorge.no/en/>

Other relevant organisations:

- Statnett – Norwegian transmission system operator: <http://www.statnett.no/>
- Enova SF was established in 2001 in order to drive forward the changeover to more environmentally friendly consumption and generation of energy in Norway: <http://www.enova.no/>
- RCN - Research Council of Norway- www.rcn.no/energix