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International Energy - Norwegian energy in a new geopolitical age

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Introduction

24 February 2022 Russia launched a full-scale military attack on Ukraine. The renewed attack caused upheavals in energy and food supply chains. Europe was hit by skyrocketing energy prices and rapidly rising food prices. Russia's repeated aggression changed the perception of geopolitics in Europe and among NATO allies. Surprisingly quickly the crisis and resultant market volatility created a European resolve not seen since at the hight of the Cold War. The election of a new president in the US, however, has further increased volatility. For Norway, a small nation at the fringes of Europe with an open economy and geopolitically sensitive location this was particularly unwelcome.

Norway is a maritime nation with an extensive coastline dotted with towns and. Nearly half the mainland lies above treeline. Half of the mainland in addition to the Arctic Archipelago of Svalbard is located north of the Arctic Circle.

Today, several hundred thousand Norwegians work in ocean-related industries, including coastal and high sea fisheries, aquaculture, shipping and offshore petroleum production. Industries such as offshore renewable energy and deep-sea mining are about to be developed.

Norway's energy production and consumption

The Norwegian energy sector did not arise out of the seas. Hydro power drove development from the start. Consumers switched directly from lamp oil and firewood to electricity. There has hardly ever been any gas distribution even in urban areas.

Large amounts of snow fall every winter. Water from melting snow and ice run in the mountains into large reservoirs used for hydro power production. These reservoirs, not oil or natural gas, has for more than 100 years formed the backbone of Norwegian energy supply.

Basic hydro power legislation was passed in 1917. The purpose was to secure long-term control over the management and use of resources for energy production purposes laying the ground for today's power system. Norway moved faster and further along the electrification route than most other economies.

Daily electricity production fluctuates between 15.000-23.000 MW. Households consume approx. ¼. Electricity is the only source of lighting and utilities in private homes the primary source of heating. Save for transportation, this is also the situation in the service and hospitality sectors consuming another ¼ of supply. Remaining energy not exported, are consumed by various power-intensive export industries.

Norway is divided into 5 supply regions for which prices are sett individually. There is limited transmission capacity between the two northern most and the three southern regions. Some balancing was and still is obtained by interconnectors with Sweeden having a much more lager north to south transmission grid in place.

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About 98% of Norwegian electricity is renewable and almost exclusively hydro with some onshore wind power. There were 1781 hydro power plants with a total capacity of approx. 157,1TWh in 2024. Electricity is almost entirely generated by hydro power generated by water drawn from 1240 regulated reservoirs. Projects produce 87 TWh representing 75% of hydro power capacity. Reservoirs hold volumes sufficient to provide more than 60% of annual consumption. It is possible to curtail regulated hydro power production almost instantly and without incident, when cheaper electricity is available from other sources. There were 65 onshore wind power projects with 1181 turbines having a 16,9 TWh annual production capacity in 2024.

The Norwegian energy transition

Norwegians have been developing its longer-term strategy for sustainable economic development in a post oil & gas world long before energy policy discussions on climate change or energy security concerns raised post the 2022 Attack on Ukraine. With recent developments energy supply is no longer solely an economic or industrial matter, but one of security, sustainability, and welfare protection.

To meet domestic challenges in reducing emissions and enable the transition government has aimed at increasing hydropower generation authorising an increasing number of small-scale hydropower projects (Nw. små elvekraftverk). Additionally, government has sought to encourage offshore wind power for supply to the grid. The target set for 2040 was for the approval of offshore wind projects with a total generating capacity of 30 GWh. So far it has not been vey successful. Norwegian offshore wind will have to be predominantly build in deep waters which is costly and currently uneconomic. Wind hybrid offtake solutions, meaning connecting to other customers than through the onshore grid has not been permitted.

Norway actively pursues a reduction of dependence fossil fuel. The offshore sector is the most important in terms of the size of emissions. Apart from petroleum production emissions reductions may only be achieved in road transport, costal shipping and the offshore supply. More than 80% of new private cars sold are fully electric, with a small fraction being plug-in hybrids. For years tax incentives and other policy initiatives have strongly favoured electric vehicles. In most cases, reducing the price to half of what an equivalent combustion engine vehicle would cost.

Longer term only reduced emissions from offshore production, scaling down petroleum production, increasing energy efficiency and developing onshore wind may reduce the energy supply squeeze and carbon footprint. For this reason, a new debate on small scale nuclear power has started brewing.

Norwegian electricity generation, supply and interconnectors

The electricity interconnector network and capacity to Europe and the UK has been increased in the last few years. Due to the nature of hydropower system, the interconnectors would enable export of electricity not needed domestically. When established the interconnectors were considered to enhance longer term security of supply. Recent developments, however, have changed the energy landscape profoundly.

The exchange with Sweden is currently balanced. Parts of Norwegian export to Sweden from the northern region (NO 4) does not re-enter Norway in the south (NO 1). Some of the export to Sweden ends up in Denmark. Exchange with Finland is normally balanced but represents modest volumes. Export to Finland could theoretically reach to Estonia, but due to transmission capacity restraints it cannot be much. Export to Denmark, Germany and the UK is larger. Some export to Denmark transits

to the Netherlands and Germany. Norway mostly at night, intermittently imports electricity (believed to be wind based) from Denmark and the Germany, occasionally also the UK. These three countries are, however, substantial net importers of electricity.

In combination with the European gas supply crisis, lower reservoirs levels, inadequate electricity transmission capacity, the electrification of offshore petroleum production and the rapid growth in electric vehicle numbers have contributed to the explosive increase in Norwegian electricity prices.

European and UK energy supply shortages, gas and electricity price volatility has had serious knock-on effect on Norwegian electricity prices. Due to Norwegian grid capacity constraints the impact has been more dramatic in the east (NO1), south (NO2) and west (NO5) than in the central (NO3) and northern regions (NO4). This is because Norwegian supply to the NCS to larger continental and UK markets are supplied from the grid in the south (NO 2 and NO5). The result has been that prices in the north (NO3 and NO4) at times are only 1/100 of the prices paid in the three southern regions. When water levels in reservoirs in dry years falls to critical low levels as it did in 2023, it amplifies the negative impact. With current demand rationing or controlled outages might in the short term be a needed in consecutive dry years unless exports are not curtailed. Understandably this has created tensions on many levels.

There is a growing popular movement calling for more radical government price-interventions. Political parties across the spectrum, as well as industry associations and labour organisations are calling for rapid increases in domestic production. Some are pushing for improved grid capacity between the north and the south. Several far right- and far left political parties are demanding that government curtail electricity export. So far, the renewal of the agreement governing two minor interconnectors with Denmark is put on hold. Environmentalists also want a reduction in hydropower supply to offshore petroleum production. The same parties would also like to see an end date to all Norwegian petroleum production.

Norwegian energy production and export

In 2024 the total Norwegian energy production was 2.530 TWh. Domestic consumption was 217 TWh of which electricity represented 137 TWh. Total energy export was 2.346 TWh of which approx. 20 TWh was electricity. The remaining 2.326 TWh equivalent is oil and natural gas.

The history of Norwegian the petroleum industry is relatively brief and, in my view, much misunderstood. Production started in 1971. All petroleum produced is depleted from deposits located within the 200 nm Exclusive Economic Zone. Norway is not endowed with vast resources compared to peers it has only had a different governance and resource management approach. The 1917 legislation and the UK licensing system inspired the Norwegian legal and concessionary regime.

Crude production these days are about 1.9 mmboe/d of crude oil and condensates, of which about 1,7 mmboe/d is landed in Europa. Crude oil is mostly loaded offshore and all exported. Some liquids are laded by pipeline to terminals in Norway and Teesside, the UK. Seven large diameter natural gas submarine export pipelines, all comprised by Gassled now owned by the Norwegian state, have their ultimate landing terminals in Europe. One of the pipelines, Europipe II has a branch (Baltic-pipe) crossing Denmark with its ultimate landing terminal in Poland. Two pipeline systems; Vesterled an extension of the original Frigg Norwegian Pipeline has landfall in St. Fergus, Scotland. Langeled has its landfall in Bacton, England. They supplied the UK 25,76 Bcm in 2023.

Norway was Europe's second largest suppliers of natural gas until 2022. From 2022 production and export has increased by about 9-10 %. Gassled, the state-owned pipeline system operator is

operating close to peak capacity. In 2024 total gas production was 122 Bcm/y and export 117 Bcm/y. Gas volumes not exported are almost exclusively used for petroleum production.

The reasons, for the relative high export is firstly the general ban on flaring introduced in 1972, later augmented with a prohibition of venting, penalised by an ever-increasing CO_2 emissions tax. Secondly, the mid-1990is drive in electrification of offshore production. Approx. 45% of NCS production is now supplied with electricity. Emissions have in the last 15 years been reduced by 50%.

Hywind Tampen supplies the Tampen Area with offshore wind power. Wind power for petroleum production purposes is regulated by the petroleum regime and is subject to petroleum special tax. Offshore wind power for supply to the grid is not.

Offshore electrification has resulted in CO_2 emission cuts by 5 million tons annually. The aim is to reduce emission from 2005 levels in 2030 by 50%. Increased domestic consumption combined with these initiatives and increased capacity in interconnectors with Continental Europe and the UK have resulted in supply squeezed and price hikes. At times Norwegians have experienced to levels 10 times historic prices.

The Norwegian Petroleum fund

Norway's income from natural gas sales is a hot topic. Some think the Norwegian Petroleum Fund is a result of Norway taking advantage of customers in recent times. The high prices seen particularly in 2023 are predominantly consequences of customers insisting on short term contracts. Cheap Russian gas was used to pressure Norwegian prices. The very high prices since 2022 have resulted in an additional income of approx. 100 BUSD.

The creation of the Petroleum Fund was proposed in 1983 by a government appointed commission It was established in 1991. The first deposit was only made in May 1996. It was 1.6 BNOK. All investments by the Petroleum Fund are made outside Norway. A mere 60% of the fund is invested in listed stock. The remaining predominantly in real estate and bonds. The management rule (3%- rule) was introduced in 2001. The limit represents the expected long-term return on capital. At the end of 2024 the Fund amounted to 19.742 BNOK. Only BNOK 5.100 are net cash inflows (SDFI revenue and taxes) from government. BNOK 11.094 are returns on investments. BNOK 3,548 were currency gains.