WHEN TRUST MATTERS

ENERGY TRANSITION OUTLOOK NORWAY 2025

A national forecast to 2060

FOREWORD

For many decades, Norway's energy system has been characterized by two words: abundance and independence. It is now 50 years since oil exports from Ekofisk started and Norway's offshore adventure began. In power generation, over a century of hydropower development has given Norway a system most countries envy: renewable, flexible, and deeply integrated into society and industry. Yet the coming decades will see Norway's energy story shaped just as much by forces outside Norway's borders as by choices at home.

Europe's energy-security concerns are keeping Norwegian gas in high demand, even as Europe pursues deep decarbonization. Norway will retain a high share of a declining market, but it will be far easier to meet Europe's need for stable gas supply than to become the reliable supplier of green dispatchable electricity. Norway supplies around 30% of Europe's natural gas and will stay an important provider of secure energy to Europe for many years. As European gas demand falls, Norway's export volumes and revenues will decline sharply after 2040, and drop to around 20% of today's levels by 2060.

Domestically, Norway faces a three-faceted dilemma that is becoming increasingly acute: sustaining energy exports, enabling green industrial growth, and delivering rapid emissions cuts. Electricity demand is rising as data centres are built and energy-intensive industries, transport, and petroleum operations electrify. However, new generation capacity and grid reinforcements are not keeping pace. We forecast Norway moving into a power deficit in the early 2030s, relying on net imports even as the debate about price levels and interconnectors intensifies. Wind power is the only technology that can scale fast enough and at acceptable cost to move Norway back into power surplus. At the same time, grid build-out and system resilience, including cyber and physical security, must move from being an afterthought to a central pillar of policy.

In our forecast, we foresee little growth in cross-border exchange of energy beyond hydrocarbons, limited green technology exports, and domestic emission cuts that fall short of Norway's own targets unless policies, permitting, and investment conditions are strengthened.

This year's *Energy Transition Outlook for Norway* does not offer simple answers. Instead, we provide a data-driven forecast to 2060 and a framework for understanding the key choices ahead as Norway shifts from an era of energy abundance and independence to one where the energy sector plays an ever-smaller role in the economy and energy interdependence with Europe becomes an increasingly pressing issue.

I hope you find this report useful, and we welcome your feedback and engagement.

Remi Eriksen

Group President and CEO

DNV

HIGHLIGHTS

1 Norway's energy transition slowed by geopolitics and national priorities

- International supply-chain and policy uncertainties reduce domestic willingness to invest in renewable buildouts and green industries.
- Europe's energy-security concerns sustain strong demand for Norwegian gas, but lock in capital, talent, and political attention to the legacy hydrocarbon sector.
- Domestic welfare, subsidized power prices, and local nature protection priorities outweigh ambitions to develop new electricity production and for large-scale electricity and hydrogen exports.

2 Electricity demand outpaces new supply; wind is the only scalable option

- Short-term electricity demand growth leads to a supply/demand deficit in the early 2030s that challenges Norwegian industry and calls for a strategic debate on power queues, priorities, and security.
- Wind is the only scalable pathway to add new capacity at the necessary pace and acceptable cost. Between 2030 and 2060, onshore capacity almost triples.
- Norway's grid build-out must accelerate to relieve bottlenecks and integrate variable output. Planning must also target improved security and resilience.

3 Norwegian energy exports are pivotal in the near term, but decline sharply by 2040

- Norway currently supplies around 30% of Europe's natural gas and will remain the preferred supplier. However, due to Europe's decarbonization pathway, production of oil and gas is set to almost halve by 2040 and fall to 80% by 2060 with current production and investment plans.
- With rising shares of variable renewables, Norwegian hydropower will help to dampen price volatility and generate valuable export revenue. However, there is far greater potential than current transmission and interconnector plans suggest.
- The limited likelihood of large-scale power or hydrogen build-out signals an end to Norway's role as an energy exporter beyond declining hydrocarbons.

4 Norway is not on track to achieve stated climate targets without extensive use of credits

- Norway aims for 90–95% emissions reduction by 2050. We forecast domestic emissions only falling 75% by then. With domestic emission cuts lagging European peers, excessive use of carbon credits is needed to successfully deliver on *Paris Agreement* commitments.
- Existing and planned policies are insufficient to ensure the necessary step-change in sectors with significant emissions.
- Further cuts in domestic emissions require significant investment in clean technologies – carbon capture and storage (CCS), direct air capture (DAC), offshore wind, hydrogen production, sustainable aviation fuel (SAF), etc. Policies related to behavioural changes will also be required to achieve near net-zero emission targets.

1 Norway's energy transition slowed by geopolitics and national priorities

Heightened geopolitical, supply-chain, and policy uncertainty increases risk and reduces domestic willingness to invest in clean technologies, renewables buildouts, and green industries. Delays and rising costs make it challenging for government and industry to commit to large, long-lived energy assets.

Europe's energy-security concerns sustain strong demand for Norwegian gas, and partly oil. This locks in capital, talent, and political attention to the legacy export sector. While Norwegian gas remains strategically important for Europe, political attention and investment favours extending gas fields and infrastructure with high export revenues over accelerating low-carbon export and industrial value chains which have more limited returns.

Social welfare, electricity price stability, and local nature conservation are now prioritized in Norway to the detriment of an expansion of power and hydrogen exports. Reluctance to accept more onshore wind, grid reinforcements, and extensive offshore wind build-out constrains both export potential and domestic electrification and decarbonization of industry and transport.

Together, these forces leave Norway facing a three-way choice between sustaining energy exports, enabling green industrial growth, and delivering rapid domestic decarbonization. In our current forecast, we see a risk of falling short on all three ambitions.

2 Electricity demand outpaces new supply; wind is the only scalable option

Electricity demand from data centres, energy-intensive industry, oil and gas electrification, and EV charging is growing much faster than new supply. As demand outpaces supply, Norway faces a power deficit from the early 2030s, with annual net imports of up to 5 TWh by 2033. For Norwegian industry, rising data centre demand threatens historically low power prices and calls for a strategic debate on power queues, priorities, and security.

Onshore and offshore wind are the only commercially mature, scalable way to add capacity fast enough and at acceptable cost. Local opposition and complex regulation have so far stalled onshore projects, but we expect moderate build-out from 2030, with capacity almost tripling to 13 GW by 2060. Offshore wind is a promising alternative, but faces cost and auction uncertainty and moderate consortium interest. Even so, we expect sufficient industry appetite and policy support for a moderate build-out, with subsidies gradually reduced until 2040. By then, Norway will again have a power surplus, supported by 6.6 GW of offshore wind, rising to 8.5 GW by 2060.

Grid build-out is slow, but must accelerate with transmission, distribution, and system services reinforcements needed to relieve short-term bottlenecks, integrate variable output, and protect national security interests. The lack of new supply in the short term is likely to cause an increase in price volatility and overall wholesale electricity prices that will only stabilize and decline in the late 2030s.

Electricity supply by technology (TWh/yr)

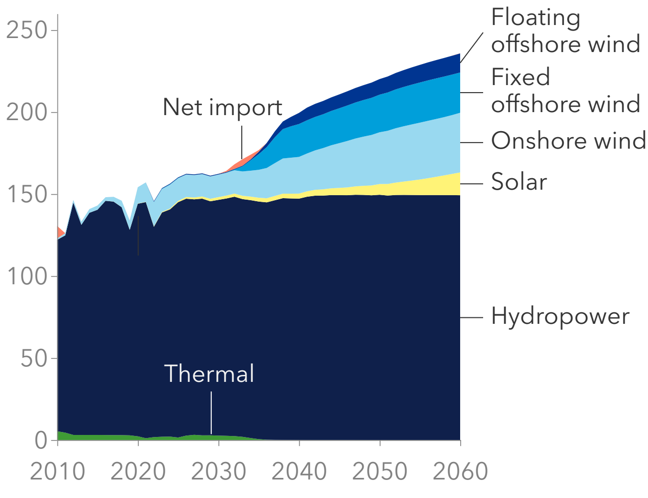


FIGURE 2 | Historical data source: SSB & IEA WEB (2025)

3 Norwegian energy exports are pivotal in the near term, but decline sharply by 2040

Norway currently supplies around 30% of Europe's natural gas – and will remain a strategically important supplier of both oil and gas all the way to 2060 – and new gas developments that can be connected to pipeline export infrastructure are likely to continue. However, with European oil and gas demand projected to fall by about three-quarters towards 2060, Norway's own exports are set to decline by around 80%. Even as Europe continues to rely on Norwegian deliveries for security of supply, the export revenue from oil and gas will shrink sharply in absolute terms.

With increasing shares of variable renewables in both European and Nordic grids, Norwegian hydropower, with its reservoirs and flexibility, becomes even more valuable for balancing and providing flexibility. However, potential is considerably bigger if Norway chooses further domestic transmission and interconnector capacity buildout.

At the same time, domestic frictions, higher costs, and limited willingness to pay for new grid and generation investments reduce the likelihood of large-scale hydrogen or electricity export build-out. Public resistance to onshore wind, auction allocation and further financing of offshore wind, and grid bottlenecks all slow projects. As a result, Norway's role as an energy exporter is likely to ebb away with declining hydrocarbons, with limited electricity exports as a flexibility provider and likely only small amounts of hydrogen or its derivatives.

4 Norway is not on track to achieve stated climate targets without extensive use of credits

Norway aims for a 55% emissions reduction by 2030, 70–75% by 2035, and 90–95% by 2050. We forecast domestic emissions falling 30% by 2030, 45% by 2035, and 75% by 2050, leaving a sizeable gap to current targets. With domestic emission cuts lagging European peers, extensive use of offsets and international credits are required to close the gap. This raises questions about cost, environmental integrity, and the balance between domestic action and imported reductions.

Existing and planned policies are insufficient to deliver the required step-change in manufacturing, oil and gas production, shipping and aviation, and agriculture. Current initiatives (detailed in the government's *Grønn bok*) mainly drive incremental efficiency improvements, while deep cuts demand faster technology turnover, infrastructure build-out, and clearer long-term signals. Uncertainty about future electricity prices, access, and grid build-out postpones and delays decisions. Without stronger and more predictable policies, investment risk remains high and Norway's decarbonization opportunities will be under-realized.

Further cuts in domestic emissions require large-scale investments in clean technologies such as CCS, DAC, offshore wind, hydrogen production, and sustainable aviation fuels. Ambitions must be translated into concrete sector-specific policy packages. Over time, policies that shape behavioural changes will also be needed if Norway is to approach near-net-zero domestic emissions by 2050.

Oil, gas, and electricity export (Million Sm³oe/yr)

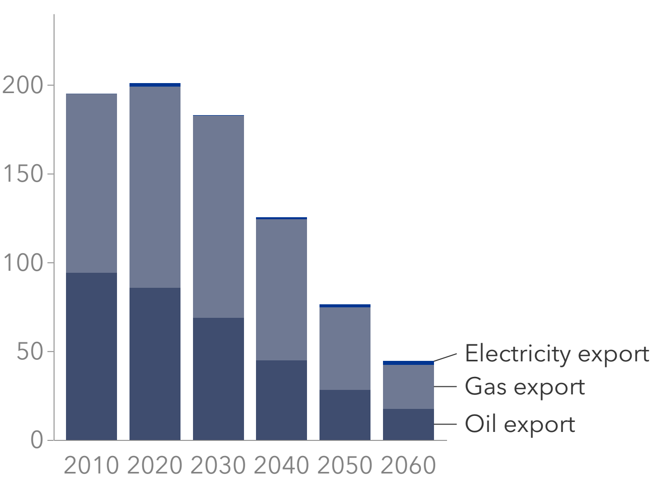


FIGURE 3 | Historical data source: NPD (2025)

GHG emissions by sector (MtCO_2e/yr)

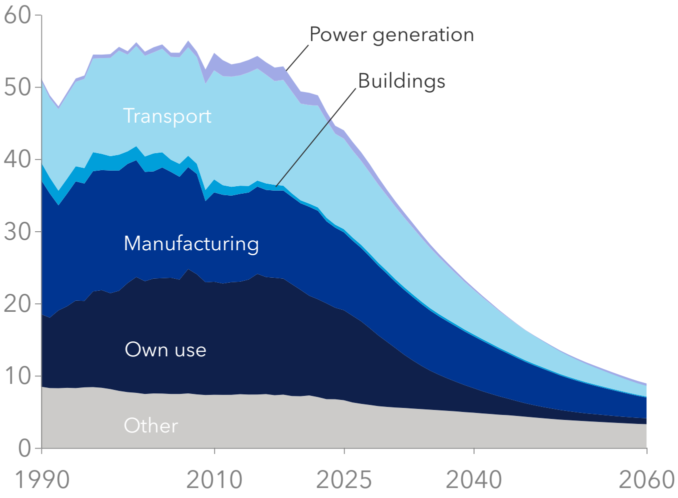


FIGURE 4 | Historical data source: SSB (2025)

CONTENTS

Cover image: Anna Valberg, Unsplash.

1 INTRODUCTION

Norway's energy transition is unfolding in a complex geopolitical environment, reshaping both existing ties and domestic choices. Europe's energy security concerns persist after recent shocks, keeping the reliability of Norwegian natural gas at a premium and raising questions about Norway's long-term commitment to grid stability in the region. In the Nordics, where all countries are now members of NATO, deeper market coupling and interconnectors will matter more as variable renewables increase and coordination on offshore wind areas, grid planning, and balancing services is increasingly regional rather than purely national.

Against this backdrop, Norway faces a domestic trilemma – energy exports vs industrial growth vs climate ambitions – where succeeding in all three objectives simultaneously is becoming increasingly difficult. Electricity demand is set to rise with the growth in data centres and the decarbonization of industry, transport, and petroleum operations, but building new power generation capacity and transmission lines takes time. Wind power is the only option that can scale in the near to medium term, even as onshore projects meet local opposition and offshore cost trajectories remain uncertain. New trade barriers and the reconfiguring of global supply chains combined with internal constraints implies higher risk premiums, longer lead-times, and potentially higher costs. Given these difficulties, is it realistic for Norway to preserve export reliability and industrial competitiveness while staying credibly on a net-zero decarbonization pathway towards 2050? That will depend, as we will explore in this forecast, on strategic choices about permitting, grid build-out, and establishing stable, yet ambitious, investment conditions.

About this report

This *Energy Transition Outlook Norway* (ETO Norway) report covers the energy future of Norway through to 2060. ETO Norway results and report are based on a standalone model derived from DNV's global forecast, the *Energy Transition Outlook 2025* (DNV, 2025a) and the Energy Transition Outlook (ETO) Model. This means the results for Norway are connected to global and regional supply and demand balances to ensure an integrated perspective.

Our analysis produces a single 'best-estimate' forecast of the likely energy future for Norway, taking into account expected developments in policies, economy, technologies, and associated costs, as well as some behavioural adjustments. The forecast also provides a basis for assessing whether Norway is likely to meet its energy and climate-related targets. The report does NOT present what we would like to see happen or what would be necessary to achieve industrial or climate goals.

Our approach

Our model simulates the interactions over time of the consumers of energy (transport, buildings, manufacturing, and so on) and all sources of supply. It encompasses supply and demand of energy globally, and the use and exchange of energy between and within 10 world regions.

To tailor the model forecast specifically for a country, we developed a standalone model for Norway and connected this model to the regionally-based ETO model. In this way, we derive separate forecast results for Norway based on the global ETO results with 10 regions, where the European power system is connected to Norwegian power system.

For additional details on our model, please refer to Chapter 7. There you will find a detailed explanation for our model assumptions of Norway's population and GDP growth trajectory over our forecast period, as shown in the first three rows of the summary table below. Our assumptions on energy technology developments are strongly linked to our assumptions on cost learning rates (CLRs) which describe how the cost of producing a technology decreases as cumulative production increases, typically due to learning-by-doing and efficiency gains.

Our analysis produces a single 'best-estimate' forecast of the likely energy future for Norway, taking into account expected developments in policies, economy, technologies and associated costs.

Forecast summary

	Population (Million)	GDP* (USD billion) GDP/person (USD thousand)	Energy Use (PJ) Energy Use/person (GJ)	CO_2 emissions (Mt) CO_2 emissions/person (tonnes)
2024	5.6	535.0 97.4	1171.0 214.0	45.0 8.0
2040	5.9	662.0 112.8	1150.0 196.0	22.0 3.8
2060	6.3	817.0 129.6	1075.0 170.0	8.0 1.2

*All GDP figures in the report are based on 2017 purchasing power parity in international 2024 USD and therefore not directly translatable to real or nominal GDP.

The analysis covers the period from 1980 to 2060, with changes unfolding on a multi-year scale that is fine-tuned in some cases to reflect hourly dynamics. We continually update our model's structure and the input data. In this report, we do not repeat all details on methodology and assumptions from *Energy Transition Outlook 2025* (DNV, 2025) but refer to that report for further details.

We are also mindful that this analysis has been prepared during the ongoing Russian war on Ukraine and in the context of an economic environment with high interest rates and high uncertainty related to international trade links and patterns. These factors add uncertainty to several parameters of relevance to the energy transition: first and foremost, the historical data in 2022 and 2023 (the COVID-19 'dip') represent an anomaly in several sectors compared with historical trends, but also unprecedented energy prices, EU and Norwegian policy interventions, and behavioural changes.

In addition to incorporating the Norwegian energy trade of oil and gas to the rest of the world, we include import and export of electricity, hydrogen, and ammonia. The power sector is extended to include the power trade between Norway and Europe. This is an important dynamic in Norway's energy system that will prove increasingly important in the future as fossil-fuel exports decline for Norway and demand for electricity and hydrogen imports and exports grow.

External views and insights

Our modelling approach and calibration of the modelling input values are more sensitive when we model a country than with a region or globally. This is especially prevalent when we consider exogenous or outside assumptions such as policies or factors that are country-specific and have a significant effect in forcing the model to select solutions that are not necessarily the cheapest option or 'most likely'. Such factors could be a changing geopolitical landscape, local opposition, energy security, job creation or global and local climate commitments. Therefore, to better understand the most likely development in the near to medium term when these issues have the biggest impact and are also easier to forecast, we have conducted interviews and discussions with politicians, advocacy groups, and business leaders to gain insights on how they view the medium-term future policy landscape unfolding. In addition to external experts, we held internal discussions with our colleagues in different parts of DNV. We are very grateful to everyone involved for taking the time to respond and give feedback on the different topics.

Chapter guide

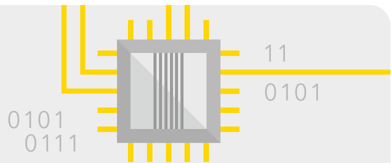
Chapter 2 discusses the policy landscape shaping Norway's transition. Chapter 3 covers the energy needs of the main demand sectors: transport, manufacturing, buildings. Chapter 4 looks at energy supply from all primary sources (fossil, nuclear, and renewables) and through energy carriers like electricity and hydrogen. Chapter 5 describes Norway's role as an energy exporter and its importance for Europe. Chapter 6 quantifies and discusses the emissions in Norway, especially those associated with the energy system whose evolution we forecast. Chapter 7 provides details on our model assumptions and analysis.

> We have conducted interviews and discussions with politicians, advocacy groups, and business leaders to gain insights on how they view the medium-term future policy landscape unfolding.

Our **best estimate**,
not the future we want

A single forecast, not scenarios

Long-term dynamics,
not short-term imbalances



Continued development of proven **technology**, not uncertain breakthroughs

Main **policy** trends included; caution on untested commitments, e.g. NDCs, etc.

Behavioural changes: some assumptions made, e.g. linked to a changing environment

2 POLICY

Norway's energy transition and climate targets are closely tied to EU cooperation. Yet, the EU itself is under pressure. The need to balance climate ambitions with industrial competitiveness and social equity creates friction and uncertainty around the pace of the transition. Still, the direction of EU policy remains consistent: competitiveness and climate action are deeply intertwined, with long-term independence, security, and decarbonization pulling in the same direction – driven by electrification and renewable developments (EEA, 2025). In Norway, diverging views within government slow decision making and create tension around key transition issues, particularly the future of oil and gas and Norway's role in European energy cooperation. At the same time, Norway's strengthened role as a reliable energy supplier to Europe provides short-term stability but arguably weakens the perceived urgency of its own transition efforts.

As this forecast concludes unequivocally: Norway is not on track to fulfil its climate targets, and high earnings from fossil fuel exports reduce the pressure for tackling necessary structural changes such as land-use conflicts and grid constraints. What is needed is action, policy clarity, and continued commitment to EU collaboration to restore momentum and ensure Norway remains a credible and proactive partner in the European energy transition.

Norway's energy transition is shaped by a shifting policy landscape

Norway's energy transition is driven by domestic priorities as well as developments beyond its borders, particularly within the EU. As a member of the European Economic Area (EEA), Norway is legally obliged to implement key EU climate and energy legislation and has long cooperated with the EU on shared transition goals. Central to this cooperation is Norway's participation in the EU's three climate pillars: the EU Emissions Trading System (EU ETS), the Effort Sharing Regulation (ESR), and the LULUCF Regulation. This alignment is not only a legal obligation, but a necessity for maintaining industrial competitiveness and advancing national climate goals.

However, both Norway and the EU are navigating a more turbulent geopolitical landscape. The global energy trilemma – balancing energy security, sustainability, and affordability – has intensified. Russia's invasion of Ukraine, rising trade tensions, and inflationary pressures have shifted political priorities across Europe.

Within the EU, there are more frequent debates over flexibility in pursuing climate targets as governments seek to protect industrial competitiveness. Although heavy reliance on imports and volatility in fossil-fuel prices remain the primary drivers of high energy costs for EU industries and households (European Commission, 2025a), a convergence of pressures culminated during negotiations on the EU's 2040 climate target. After marathon talks and months past the deadline, a compromise was reached: EU ministers agreed to uphold the Commission's goal of a 90% emissions reduction from 1990 levels, but softened the ambition by introducing flexibility measures. To provide comfort that the target can be reached in a way that preserves competitiveness, social balance, and security, member states can use international carbon credits to meet up to 5% of the target, with the option to expand this to 10% if needed. To secure broader support, they also agreed to postpone the launch of ETS2 for road transport and buildings by one year to address affordability concerns (Council of the EU, 2025).

These compromises reflect a political climate where ambitious climate goals are tempered by other concerns. Progress continues in areas where emission reductions align with economic and security interests – such as renewable energy developments and energy efficiency – but momentum slows where trade-offs are required. This is similar to what we have observed in other regions (DNV, 2025a).

These dynamics directly affect Norway's energy transition and broader industrial development. Uncertainty around the competitiveness of decarbonization has led to delays and cancellations of large-scale investments in electrification and green industrial growth (Guttormsen and Skjelvik, 2023; Sandvik, 2024). At the same time, Norway's role as a key energy supplier to Europe – particularly natural gas – has grown following the EU's ban on Russian energy imports. This has largely shifted the domestic narrative in favour of continued gas development and potentially deprioritized Norway's own transition efforts at both governmental and corporate levels.

While national ambitions remain high, concrete plans for achieving them are increasingly unclear. The government's industrial policy white paper outlines key priorities for industrial competitiveness, including access to clean and affordable power, a competent workforce, and good market access – yet all three face structural challenges (Norwegian Ministry of Trade, Industries and Fisheries, 2025). Little new renewable capacity has been built in recent years due to local opposition, key EU legislation that could support industrial competitiveness remaining unimplemented, and a large share of the skilled workforce remains tied up in legacy oil and gas operations, with major companies scaling back their renewable investments (Holter, et al., 2025).

Challenging domestic political environment

At the same time, the domestic political landscape is evolving. The recent election did not favour a right-wing bloc, led by the Progress Party, which advocates for rolling back major climate-related measures (Naschert, 2025). However, the new government – a coalition of the Labour Party (Ap), Socialist Left Party (SV), Centre Party (Sp), Red Party (Rødt), and the Green Party (MDG) – also represents a wide range of views on energy and climate policy. Internal tensions, particularly around EU-related issues, makes consensus difficult. While the coalition is still in its early stages, this fragmentation risks slowing the implementation of EU directives and weakening Norway's ability to engage effectively in European energy cooperation. It also creates uncertainty around national priorities, with ongoing debates over land use, the future of the oil and gas industry, new power generation, and the role of the state in energy markets dominating the political agenda.

As in many other countries, the political focus has shifted from globalization to protectionism, with domestic concerns increasingly taking precedence. While this may offer short-term political stability, it risks undermining the long-term effectiveness of the energy transition, which depends on early, coordinated investments and stable cross-border collaboration. In a time of rising geopolitical tension and growing security concerns, close collaboration with neighbouring EU countries is more essential than ever.

The coming years will be critical in determining whether Norway's transition ambitions can be translated into coordinated and credible policy actions. Norway has the resources, expertise, and institutional frameworks to lead, but leadership requires clarity of direction, strengthened cooperation with the EU, and renewed commitment to domestic transition planning. Restoring credibility and accelerating implementation will be essential to ensuring Norway remains a serious actor in the energy transition despite a more fragmented and inward-looking global context.

Key developments and dilemmas shaping Norway's transition dynamics

Norway's energy transition is shaped by a set of interlinked developments and dilemmas – some structural, others political – that are slowing progress and creating uncertainty. While the country remains committed to its climate goals, the gap between ambition and implementation is widening.

1. Delayed implementation of EU climate and energy legislation

Norway's alignment with EU climate and energy policy is a cornerstone of its transition strategy. However, the implementation of key legislation is increasingly delayed: as of January 2025, 559 EEA-relevant legal acts remain unimplemented – an increase of 12% from last year (Ministry of Foreign Affairs, 2025). This backlog risks distorting competition in the internal market and weakening Norway's standing with the EU. A government-commissioned review urges faster clarification of EEA relevance and swifter incorporation of EU energy rules (Ministry of Foreign Affairs, 2024).

One of the most nationally debated energy-related packages to come from the EU in recent years, is the *Clean Energy for All Europeans* package (CEP). While CEP was formally adopted in the EU in 2019, it remains only partially so in Norway. Three of its eight legislative acts – including the revised *Renewable Energy Directive* (RED II) – were accepted in June 2025, following EU pressure and the Centre Party's exit from government. The remaining five are postponed until at least 2029, with the Labour Party citing concerns over potential negative impacts on national interests (Ask, 2025). EU-related issues continue to divide the current coalition, with the Centre Party among the most vocal opponents of further implementation.

Meanwhile, the backlog issue underscored by the EU's progress on broader reforms under the *Fit for 55* package, including updates to the RED (RED III) and new legislation such as ETS2, *FuelEU Maritime* and *ReFuelEU Aviation*, and CBAM. In response to the findings from the *Draghi Report*, the EU launched several further initiatives to boost European industrial competitiveness and decarbonization, including the *Net Zero Industry Act* (NZIA). While the Norwegian government has started phasing in ETS2 and signalled intent to adopt several of the new legislations with some delay, there are no plans to incorporate RED III (Ministry of Energy, 2025). Concerns over its implications for municipal authority in permitting of renewables have delayed discussions, despite the Norwegian Association of Local and Regional Authorities (KS) concluding that the self-government remains intact (The Norwegian Association of Local and Regional Authorities, 2024). The NZIA is still under review, awaiting a pending court case on whether the Norwegian Continental Shelf (NCS) falls under the EEA – where the EU and Norway disagree. The results could impact, inter alia, the competitiveness of CO_2 storage projects on the NCS (Ulvin, 2025).

These delays are not without consequence. Many of these directives are foundational to the EU's broader *Green Deal* and industrial strategy. The European Commission has made it clear that Norway must harmonize its legislation to prevent distortions in competitive conditions within the internal market. Relations could also strain if Norway adopts a more insular approach to its power system and reduces interconnections with Europe (Milne, 2024). Moreover, Norway's hesitant adoption of EU legislation risks weakening its industrial competitiveness. The government's own industrial strategy emphasizes the importance of market access and participation in European value chains, yet postponing key EU reforms such as RED III and the NZIA could reduce Norway's position in these markets.

2. Fossil revenues crowding out green investment

Norway's continued role as a major exporter of oil and gas has brought record revenues in recent years, particularly following the EU's ban on Russian energy imports. While this has reinforced Norway's importance for European energy security, it has had a dampening effect on the domestic energy transition. High fossil fuel revenues have reduced the government's and industry's perceived urgency of change and shifted the narrative in favour of continued gas development.

Investment patterns reflect this imbalance. In 2024, oil and gas extraction and pipeline infrastructure accounted for three quarters of total industrial investment – eight times more than investment in electricity generation and grid infrastructure (SSB, 2025a). Green technology projects struggle to compete with the high returns of the fossil sector. Equinor's recent decision to scale back renewable ambitions is a reminder that long-term climate goals do not always align with short-term shareholder expectations (Holter et al., 2025).

This investment landscape also affects Norway's ability to reduce domestic emissions. When the lucrative oil tax package was passed during the pandemic, the industry committed to halving emissions from production by 2030, compared to 2005 levels. According to the 2026 national budget, the sector is currently on track for only a 35% reduction. Several electrification projects on the NCS, seen as key to meeting these targets, are now being shelved (Adomaitis & Buli, 2025). Companies are increasingly opting to pay quota costs rather than invest in electrification, even when profits are strong, signalling a shift from structural decarbonization to short-term compliance.

Beyond emissions, the dominance of the oil and gas sector continues to absorb technical expertise and labour that could otherwise support the build-out of renewable energy, electrification, and grid expansion. This represents a significant opportunity cost for the broader transition, particularly as Norway seeks to scale up new green industries, with access to capital and a skilled workforce highlighted as key to enabling this scale-up in the government's *Green Industrial Initiative* (Norwegian Ministry of Trade, Industry and Fisheries, 2022).

These trends put Norway in the same pattern as other major oil and gas exporters like the US and countries in the Middle East, where the transition is slowing compared to other countries (DNV 2025a). While Norway has become a lifeline for European gas supply, its own decarbonization is falling behind. Without a clearer shift in investment priorities and stronger follow-through on domestic commitments, Norway risks losing momentum and credibility in the global energy transition.

> These trends put Norway in the same pattern as the US and countries in the Middle East, where the transition is slowing compared to other countries.

3. Build-out of new renewable energy is still slow

Despite widespread political and industrial support for expanding renewable energy production, actual development in Norway has stalled. Electricity demand is expected to rise significantly, yet no significant new renewable capacity has been built in recent years. The Norwegian expert committee on electricity prices concluded that a lasting power surplus is the most effective way to ensure low and stable electricity prices (Strømprisutvalget, 2023). Still, nearly all new generation projects face delays or opposition.

A key reason for this stagnation is land use conflicts and local opposition, with municipalities playing a decisive role. Under the *Planning and Building Act*, municipalities have strong authority over land use and zoning, effectively giving them veto power over new projects. This has halted or delayed many developments, particularly onshore wind. While onshore wind remains one of the most cost-effective sources of new power, local resistance – driven by concerns over nature, land use, and reindeer husbandry – has halted most new projects. Although the government reopened the licensing process in 2022, no new onshore wind concessions have been granted, and only two projects have entered production (NVE, 2025a; NVE, 2025b). A proposed pre-production tax on wind power, intended to increase local acceptance by front-loading municipal revenues, may help shift attitudes, but its impact remains to be seen (Fornybar Norge, 2025).

Underlying these tensions is a broader conflict between climate and nature goals – both anchored in international and national commitments. Norway has committed to halting and reversing biodiversity loss through the UN's *Nature Agreement*, while also pursuing legally binding climate targets under the *Paris Agreement* and the *Climate Change Act*. These goals increasingly collide in land-use decisions. The government's nature action plan from 2024 identifies renewable energy and grid infrastructure as "particularly socially beneficial", meant to weigh heavily in such decisions (Ministry of Climate and Environment, 2024). Yet in practice, nature and land-use protection continues to block developments. Without clearer guidance on how to balance nature and climate priorities, renewable build-out will likely remain slow.

A broader ecological perspective is often absent from these land-use debates. Climate change and biodiversity loss are not isolated challenges but deeply interconnected. Emerging scientific evidence suggests that climate change is set to become the leading cause of biodiversity loss, surpassing other pressures like habitat destruction or overexploitation (Ripple et al., 2025). Acknowledging this relationship is critical to ensuring that land-use decisions support both climate and nature objectives, rather than treating them as conflicting priorities.

4. Grid infrastructure still lagging – but not the only bottleneck

Even where renewable energy or green industry projects gain political and local support, grid infrastructure could become the bottleneck. Without sufficient transmission capacity, even mature projects risk delay: not due to a lack of ambition, but because the infrastructure needed to connect them is not ready.

In March 2025, the Office of the Auditor General issued a critical report on Norway's grid development, highlighting several shortcomings. It concluded that grid capacity has not kept pace with rising demand, pointing to slow progress in both new infrastructure investments and better utilization of the existing grid. The report also criticized the Ministry of Energy for failing to ensure long-term, coordinated planning that supports demand growth while aligning with climate goals (Riksrevisjonen, 2025).

As of November 2025, around 9,000 MW of consumption (more than half from data centres, followed by hydrogen/ammonia) and 8,000 MW of production (mostly hydropower, followed by solar and onshore wind) remain in queue for connection, in addition to 8,200 MW and 7,300 MW already reserved by Statnett (Statnett, 2025a). To address this, Statnett proposes a combination of measures, including better utilization of existing grid and faster deployment of new infrastructure. Their system development plan outlines record-high investments of NOK 150–200bn over the next decade – more than double the previous ten-year period. Further, indicating that not all capacity requests are likely to materialize in new demand or supply, Statnett suggests tightening requirements for project maturity and progress. This ensures only projects with a high likelihood of realization retain their reserved capacity (Statnett, 2025b).

Importantly, grid infrastructure is not always the limiting factor. In many cases, it is the customers' ability to utilize the power that slows progress. A recent DNV study on data centres in Norway found that data centres typically scale incrementally with demand, with average utilization currently around 30% despite full grid connection from the outset (DNV, 2025d). As a result, reserved capacity can remain unused for extended periods. In the past two years, Statnett has released nearly 3,000 MW of reserved capacity due to project immaturity: a reminder that not all capacity requests translate into immediate demand (Sandvik, 2025).

This nuance is often lost in public debate, where grid constraints are blamed for delays even when other factors – such as business case feasibility, finance, or project readiness – are at play. The result is a potentially distorted picture of the grid situation, which risks discouraging industries with urgent electricity demand or new players looking to establish themselves. It may also lead to overinvestment or inefficient prioritization of grid infrastructure.

Importantly, grid infrastructure is not always the limiting factor. In many cases, it is the customers' ability to utilize the power that slows progress.

5. Changes to tax rules and blurred market signals

Stable and predictable policy frameworks are important for attracting investments supporting the energy transition, such as renewable energy and green industry. While Norway continues to score high on indicators such as 'ease of doing business' and 'political stability' (WGI, 2024), recent shifts in taxation and regulation have introduced uncertainty amongst investors. Combined with increasing state involvement in energy markets, this raises questions about how well current frameworks support the transition. To guide efficient investment decisions, it is crucial that market signals remain clear.

One example is the retroactive application of tax changes on certain renewable generation plants. The 2022 ground rent tax on onshore wind led to financial losses and prompted several investors to withdraw from projects. More recently, the proposed reduction in the threshold for small hydropower taxation has raised similar concerns, as it affects the valuation of existing assets (Lund, 2025). Sudden changes in policy frameworks increase the perceived risk, which in turn raises the required rate of return and overall project cost – particularly for capital-intensive renewable projects.

At the same time, Norway's approach to subsidizing the energy system has become more comprehensive. Political pressure to maintain affordable electricity has led to support schemes across the value chain, including household price subsidies through mechanisms like 'norgespris', offering a cap on electricity prices for residences and holiday homes. While this can help reduce national tension around power prices and cross-border electricity trade, its long-term impact on market incentives, energy efficiency, and flexibility remains to be seen. (See Factbox on 'norgespris' on page 44).

FIGURE 2.1

Policy factors included in our Outlook

Policy factors in ETO Norway

Our analysis and input to the ETO Model reflects Norwegian policy. We apply our sector expertise and technical and commercial insight to assess policy developments across energy demand and supply sectors. It is not a given that energy or climate goals will be met at either national, regional, or global levels. As such, our forecast does not assume that Norway will achieve its national target of reducing greenhouse gas emissions by 55% by 2030 compared with 1990 levels or the at least 70-75% reduction promised in the new nationally determined contribution (NDC) for 2035.

Ambitious targets only influence our forecast if they are backed by concrete sectoral policies and measures that shape the energy mix and emissions trajectory. In our global forecast, country-level data on expected policy impacts are weighted and aggregated to produce regional figures for inclusion in our analysis. For Norway, we incorporate existing and expected policies into the forecast.

Our global *Energy Transition Outlook 2025* (DNV, 2025a) provides a detailed overview of the policy framework used in our global forecast. We apply same policy factors (Figure 2.1) in this Norway-specific outlook.

Ambitious targets only influence our forecast if backed by concrete sectoral policies and measures that shape the energy mix and emissions trajectory.

Hafslund Celsio plans to capture 350,000 tonnes of CO_2 annually from their waste-to-energy plant at Klemetsrud in Oslo. Construction will start in 2026, and it will be in operation by the end of 2029.

Specific adjustments to accommodate the Norwegian policy landscape include:

Power

- Fixed and floating offshore wind projects will initially obtain financial support to supply domestic energy demand and establish a domestic pipeline of projects. As cost for offshore wind declines and there is surplus electricity generation in Norway, more electricity can be exported to Europe offering higher profitability, with reducing financial support towards 2040. In addition, we expect there to be mechanisms to redistribute profits from high-margin energy exports, such as hydropower, to further improve the financial viability of offshore wind development towards 2060.
- For domestic political reasons, Norway is unlikely to make large power capacity additions for onshore wind, hydropower, or solar PV for exporting electricity – even if profitable. Thus, we have limited the model for such expansion.

Zero-emission transport

- The support schemes for passenger EVs incorporate the most recent schemes with reduced VAT and registration fees.
- For EVs in the commercial vehicles segment, support schemes will continue as today until EVs account for 90% of new vehicle sales, which will happen in 2040 in our current forecast.
- For biofuels in road transport, we include the government's ambition to increase use through fuel-blending. The fraction of biofuel use for internal combustion engine vehicles increases from 15% today to reach 18% in 2030, and remains at that fraction until 2060, albeit with declining absolute values.
- In aviation, we considered electrification policy on short-haul flights. In international aviation, we expect future alignment with *ReFuelEU* policy to increase SAF use.
- In maritime, the fuel mix will largely follow that of the rest of the world. However, we do not expect nuclear-based shipping in Norway. For short-distance sea travel, electric and hybrid solutions are supported along with limited uptake of hydrogen ferries.

Hydrogen

- Hydrogen production is subsidized to compensate for initial high cost of low-carbon hydrogen. We expect the level of support to be USD 0.25/kgH_2 for natural gas-based (blue) hydrogen and as high as USD 0.4/kgH_2 for grid-connected, electrolysis-based hydrogen (green) until the 2030s when carbon pricing in Europe increases demand for green/ blue hydrogen.

- Taxes and grid tariffs for grid-connected electrolysers are assumed to be a 25% surcharge over the wholesale electricity price. This is the combined result of two factors: active government support, and the fact that some grid-connected electrolysers will be owned by renewable electricity producers who will decide, based on price, whether to sell electricity to the grid or for hydrogen production; if they withhold selling, they do not need to buy electricity.

- Natural gas costs used to produce blue hydrogen will be lower for steam methane reformers than the industrial gas price due to the expectation that many reformers will be supplied directly from gas producers without going through the transmission network and the market. We assume the gas price for methane reformers to be 25% of wholesale price to retail price, on average.

Carbon capture and storage

- We assume the CCS project at Celsio Klemetsrud will be built with phase-in from 2029.

- We expect CCS operations at the Sleipner and Snøhvit fields on the NCS will be phased out. The carbon captured at Sleipner will likely not be replaced by an alternative operation. However, CO_2 will need to be removed at liquefied natural gas (LNG) liquefaction installations, thus continuing CO_2 captured at Snøhvit even if some operations will be phased out in the late 2030s.

- All other CCS will be developed on a commercial basis, taking into account increasing carbon prices and blue hydrogen production support.

Carbon price

- Carbon prices are reflected as costs for fossil-fuel emissions in the power and manufacturing sectors. In these areas, Norway is part of the EU emissions trading scheme (ETS), and we use carbon prices equivalent to rest of Europe (reaching USD 230/tCO_2 in 2060).

- A Norwegian carbon price trajectory reaching USD 230/tCO_2 (NOK 2,400/tCO_2, 2025 NOK) by 2030 is included in 'energy sector own use', such as for oil and gas extraction, with continued increase tracking growth rates for EU carbon prices.

Taxation

- Fossil-fuel tax increases at a quarter of the carbon-price growth rate for the road transport subsector.

- In other areas of the model (e.g. agriculture, household emissions) we do not use carbon price directly, but we do incorporate the added costs of taxes on fuels, energy, and carbon.

3 ENERGY DEMAND

Electricity is emerging as the dominant energy carrier, increasing from 47% of final energy demand in 2024 to 71% in 2060 (Figure 3.2). Fossil fuels are being replaced, remaining only in niche applications. This transition brings efficiency gains that sees final energy demand grow just 3% by 2060, despite rising GDP (53%) and expanding population (15%).

Electrification

Even in Norway, with one of the world's most renewable energy-based power systems, the ongoing transition will further increase the share of electricity in final energy demand in all sectors (Figure 3.1). Reasonably priced and efficient renewables, technological advances, and policy are together driving steady electrification of energy demand. We foresee electricity increasingly replacing coal, oil, and eventually gas in the final energy demand mix, further amplified by new demand for electricity for electrolysis-based hydrogen production.

Bioenergy and Hydrogen

Hard-to-electrify sectors will switch to alternative non-fossil energy carriers. The demand for bioenergy in maritime and aviation will grow eight-fold by 2050, due to policy. Meanwhile, other uses of bioenergy will decline more towards 2050 – with road (-90%), buildings (-50%), and manufacturing (-30%) leading the decline – as electricity and/or hydrogen become preferred energy carriers. Hydrogen and its derivatives will enter the mix with a modest but accelerating growth, representing 0.3% in 2030, 1.3% in 2040, and 5% in 2060 (Figure 3.2).

Fossil fuels

Natural gas demand in end use sectors will remain stable to 2040, at around 100 PJ/yr, from when it will progressively decrease to 65 PJ/yr in 2060. The main demand for natural gas is for non-energy purposes (currently 65%), such as feedstock for ammonia and methanol production that will switch to greener options. Oil demand will decline 75% by 2060. The main driver of this steep decline is the 90% drop in the transport sector. Other sectors will also decline, but at a slower pace.

Electricity demand increases in all sectors

Share of electricity by sector

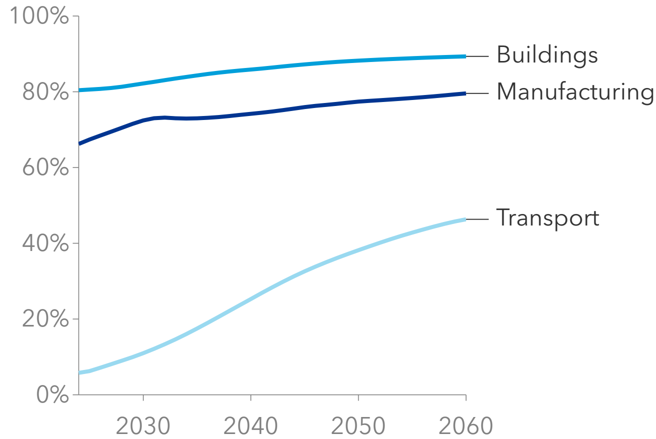


FIGURE 3.1 | Historical data source: SSB & IEA WEB (2025)

Fossil fuels replaced by greener energy

Final energy demand by carrier (PJ/yr)

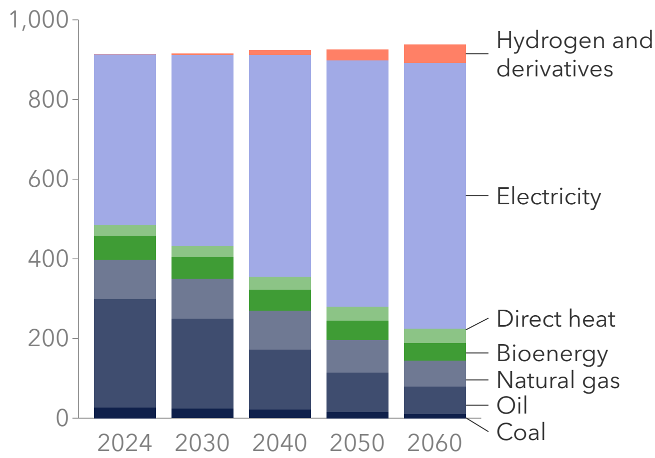


FIGURE 3.2 | Historical data source: SSB & IEA WEB (2025)

Energy demand by sector

While the final energy demand remains stable over time, there are clear sectoral differences (Figure 3.3). We forecast the buildings sector to increase 120 PJ/yr, with more than 80% of that growth coming from data centres. That is partially offset by falling demand for space heating, driven mainly by efficiency gains from heat pumps. Electrification is also the main cause for the 65 PJ/yr drop in energy demand for the transport sector (EVs account for 96% of that drop). The energy demand of manufacturing and other energy uses stays quite stable over the forecast period. The use of fossil fuels for non-energy purposes, e.g. in asphalt or for chemical purposes, will decline by 21 PJ/yr by 2060. This decline is mainly in the demand for natural gas in the production of ammonia and methanol as feedstock (not as energy carriers) as well as in plastics production, starting in 2040.

Stable total energy demand

Final energy demand by sector (PJ/yr)

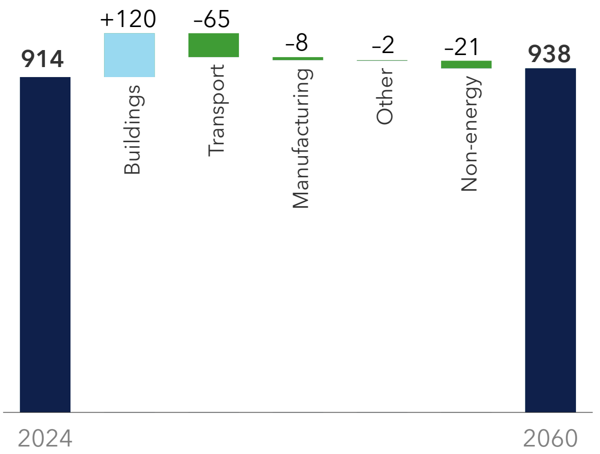


FIGURE 3.3 | Historical data source: SSB & IEA WEB (2025)

Road efficiencies eaten up by data centres

Final energy demand by sector (PJ/yr)

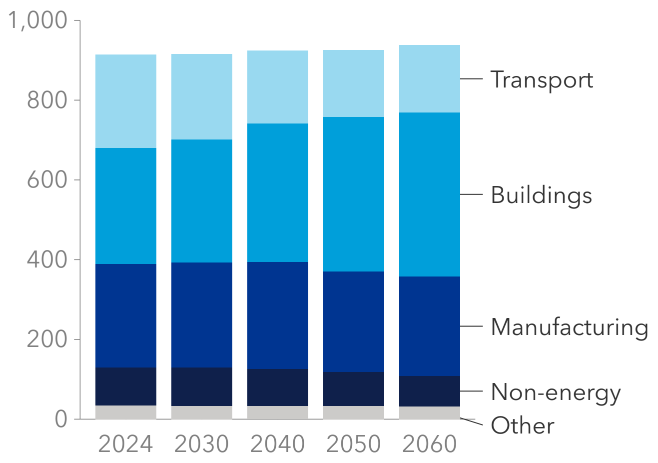


FIGURE 3.4 | Historical data source: SSB & IEA WEB (2025)

Transport

We expect the transport sector to undergo the most radical electrification, rising from 6% electricity today to 46% in 2060, largely in road transport. Road transport currently pollutes more than all the other transport segments combined; by 2050, both maritime and aviation will emit more than the road segment. While these sectors will also decarbonize, their transition depends primarily on switching to alternative and currently more expensive fuels. Consequently, progress in maritime and aviation is largely driven by national and EU regulations.

Buildings

A significant share of future energy demand growth will come from data centres. Space heating is the only end-use category with a declining trend, driven by energy efficiency and stricter building codes. Public interest in energy efficiency has been increasing over the last couple of years, but larger private energy investments are hindered by high upfront investments and long and uncertain payback periods. Norway is not on track to meet its target of reducing electricity use in buildings by 10 TWh by 2030.

Manufacturing

The energy demand will remain stable, dominated by the production of base materials, such as aluminium. Norwegian manufacturing relies heavily on low-cost, clean electricity, which makes up 66% of its energy mix and is projected to reach 80% by 2060. Further decarbonization through hydrogen and CCS will grow slowly, requiring both financial support and long-term clarity around carbon pricing and market demand. We forecast a limited growth of new energy-intensive industries in Norway.

3.1 Transport

Transport in Norway – road, aviation, maritime, and rail – accounted for 26% of final energy demand in 2024. Of this, more than half was from the road sector, a quarter from domestic maritime transport, a sixth from aviation (both domestic and international), and just 1–2% from rail (Figure 3.5). The road sector will see high efficiency gains from switching to electricity, almost halving its energy demand by 2050. At the same time, a reduced need for maritime transport in the offshore industry will offset increased demand for aviation transport. By 2050, road will remain the largest source of transport energy demand, but its dominance will have reduced markedly relative to both aviation and maritime. Overall, we project total energy demand will decline to 170 PJ/yr in the 2050s, down 34% from its 2014 peak.

Transport accounted for half the fossil energy in 2024. with 85% of its total energy consumption derived from fossil fuels. We forecast a significant decarbonization of this sector, cutting its fossil energy demand from 200 PJ/yr in 2024 to 30 PJ/yr in 2060 (Figure 3.3). Road transport electrification is again the largest contributor – replacing almost 100 PJ/yr of fossil energy – taking road from being the biggest polluter to a smaller emitter than both aviation and maritime. The maritime sector is also decarbonizing quickly through a wide selection of low-GHG fuels, cutting the demand for fossil energy in half by 2045. The aviation sector will decarbonize the slowest, halving its fossil energy demand by 2054. That is a significant achievement for this segment, but aviation will be responsible for an increasing share of Norway's emissions.

Rail

The Norwegian rail subsector consists of all tracked transportation, including urban rail transport such as subways and trams. It accounts for only 1-2% of the national transport energy demand (Figure 3.2) and will continue to do so. That demand is already 83% electric, a share that will continue to increase. We forecast that all diesel trains will be replaced by electricity – in some cases from batteries – in regular operation by 2060. Some diesel trains will be kept as a backup option for security concerns.

The national priorities are to reverse the degradation of the ageing infrastructure and enhance it where railways are the optimal solution to meet a transport need (Samferdselsdepartementet, 2024). The latter, in particular, includes increasing the capacity in and around major cities. The plans do not include building high speed trains between these cities. Furthermore, the long-debated Nord-Norgebanen from Fauske to Tromsø does not align with either the overall transport strategy nor the climate strategy. Consequently, the rail sector will improve its ability to transport daily commuters, but most likely not challenge the position of aviation for domestic long-distance travel in Norway.

Transport will use less energy in total

Transport sector energy demand (PJ/yr)

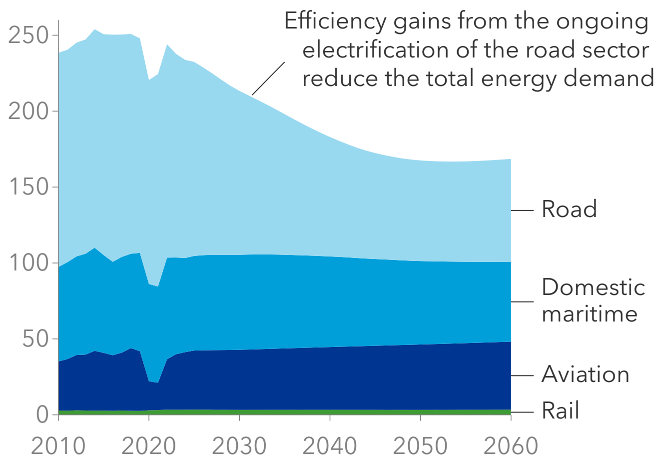


FIGURE 3.5 | Historical data source: SSB (2025), IEA (2025)

All transport sectors will use less fossil energy

Transport sector fossil energy demand (PJ/yr)

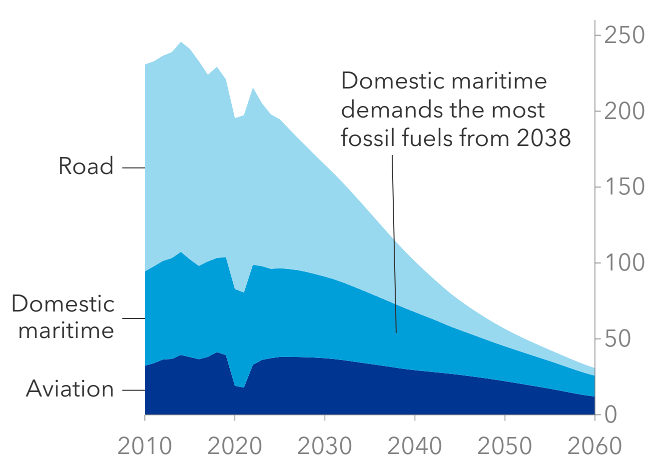


FIGURE 3.6 | Rail is less than 1 PJ/yr in 2010 and decreases. Historical data source: SSB (2025), IEA WEB (2025)

Aviation

Aviation will remain a key mode of transport, both domestically and internationally. It is not easily replaced by either cars or trains. The number of trips per person will grow 10% by 2050, from 5.0 to 5.5 trips per year. When including the population growth, the total number of trips will grow by 10% to 30 million per year by 2034, another 10% by 2046, and yet another 10% by 2060. This growth exceeds the expected efficiency gains from improved aircraft, making the overall energy demand increase 18% from 38 PJ/yr today to 45 PJ/yr in 2060 (Figure 3.7).

The energy carriers used in aviation will diversify from its currently fossil-dominated mix. We forecast that Norway will reach the *RefuelEU* mandate of minimum 6% sustainable aviation fuels (SAF) in 2030, as the production capacities within EU are projected to be sufficient to meet this requirement (EASA, 2025). Beyond that, the EU mandate requiring a minimum of 70% SAF by 2050 is considered overly optimistic in terms of possible fuel production. We forecast that 51% of the energy mix will still be fossil in 2050 (Figure 3.7), including fuel used by aircrafts refuelling abroad before landing in Norway.

The national plan is to implement zero- and low-carbon aviation in commercial flights in Norway as soon as the technology allows for it, without jeopardizing the availability of transport services (Samferdelsdepartementet, 2024). The first available alternative to fossil jet fuel, albeit at a higher price, has been SAF made from biomass (bioSAF). Norway has had a blending mandate of minimum 0.5% bioSAF since 2020, following which bioSAF has been providing 1–2% of the domestic demand since 2022 (SSB, 2025b). From 2026, this blending mandate is increased to 2%, identical to *RefuelEU Aviation*, which Norway is working to enter into national law (Klima- og miljødepartementet, 2025b). BioSAF will drive most of the decarbonization until mid-century but will be limited long-term by global access to sustainable biomass yield. Over time, synthetic fuels made by renewable electricity (eSAF) will be used alongside bioSAF, though this technology is still in an early stage and production will be limited by access to biogenic CO_2 and low-cost electricity.

Alternative propulsion technologies based on electricity and hydrogen are currently in the test stage. We forecast that 10% of domestic aviation energy demand will be met by electric propulsion by 2040. Norway is an ideal test ground for electric planes. The mountains and fjords separating the decentralized population makes high-speed trains and roads unproportionally expensive. Therefore, there will continue to be numerous flights shorter than 200 km, including the route Bergen-Stavanger where electric test flights have already been completed. In addition, the electricity is mainly generated by renewable sources (Section 4.3). Finally, based on the history of EV subsidies, there is an ability to pay for subsidized electric aviation. Since domestic aviation stands for two fifths of the total aviation energy demand, its decarbonization will be a key milestone in reaching national emission targets.

Norway, the ideal test for electric aviation

Aviation energy demand by carrier (PJ/yr)

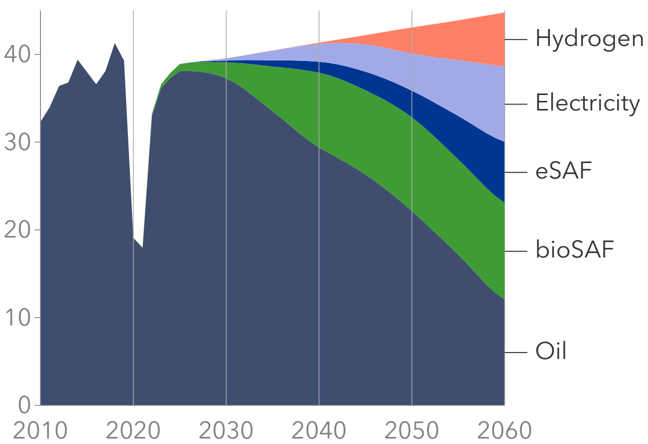


FIGURE 3.7 | Historical data source: SSB (2025)

Road

The road sector currently demands 130 PJ/yr (Figure 3.8), corresponding to half of the national energy demand for transport. By the early 2050s, the road sector energy demand will be cut in half, reaching 66 PJ/yr. The dwindling energy demand is not caused by reduced road transport activity, which we project to grow by 15%, but by the improved energy efficiency on the road as internal combustion engine vehicles (ICEVs) are replaced by EVs. The same kind of efficiency gains will not occur in the other transport sectors. Once most vehicles have become electric, there will be no further efficiency gains, and growing transport demand will lead to an increasing energy demand.

The most important aspect of the future energy transition in the road sector is the transition from ICEVs to zero-emission vehicles (ZEVs). Norway has been world-leading in electrifying passenger-vehicle transport, driven by various financial subsidies and other benefits. The goal was that all passenger-vehicle sales should be ZEV in 2025. With an EV share of 93% in the first 3 quarters of 2025 (Figure 3.9) – 95% if including plug-in hybrid electric vehicles (PHEV) – the government has declared that the goal is practically achieved (Finansdepartementet, 2025). Therefore, they have suggested a national budget where the VAT subsidy on EVs will decrease by up to NOK 50,000 in 2026 and an additional NOK 75,000 in 2027. This is now up for negotiation with several parties in parliament. This EV subsidy will eventually be rolled back, whether it is over two years or longer. If it is fully rolled back by 2030, we forecast that the market share of EVs will take a small hit and revert to 91%, before dominating the market completely.

The share of EVs on the road naturally lags their market share. Only in 2032 will 50% of passenger vehicles in use be EVs (Figure 3.9). In 2038, this on-the-road share will reach 75%. While the market share is already high, it is the number of vehicles in use that ultimately determines emissions. The incentives to buy EVs could be followed by turnover incentives with a focus on scrappage to speed up the transition. The government forecasts that if all future sales are EVs, all passenger vehicles in use may be ZEVs in the early 2040s, and thus they need no further turnover incentives (Klima- og miljødepartementet, 2025a). With the rollback of EV subsidies, we forecast that only 81% of passenger vehicles in use will be ZEVs in 2040.

In the commercial sector, we see that the transition to EVs is progressing more slowly (Figure 3.10). The market share of EVs will not reach 50% before 2031, and EVs will not be the most common commercial vehicle in use until 2041. This subsector is more varied than passenger-vehicles – ranging from light vans to heavy road transport in size and from local city buses to long-distance transport in range – and so is its progress. The initial target that 100% of light commercial vehicles and vans sold in 2025 should be ZEV has not been reached, (Samferdselsdepartementet, 2017) – the current share stands at 42%. The deadline has, therefore, been

Electrification brings large efficiency gains

Road sector energy demand by carrier (PJ/yr)

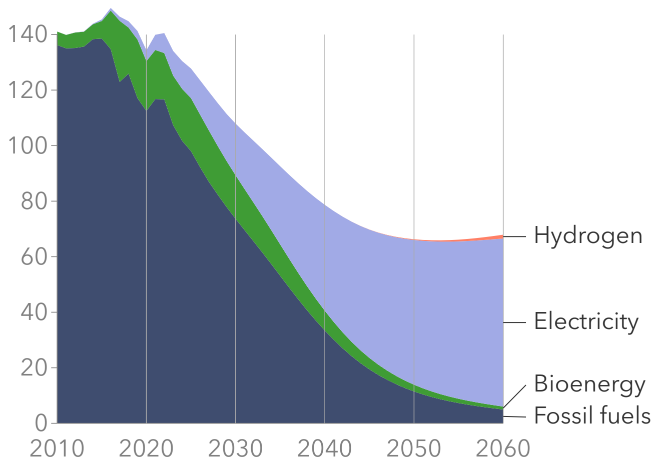


FIGURE 3.8 | Fossil fuels include up to 0.7% natural gas. Historical data source: IEA WEB (2025), SSB (2025)

EVs dominate passenger-vehicle market

Share of EVs in passenger vehicles

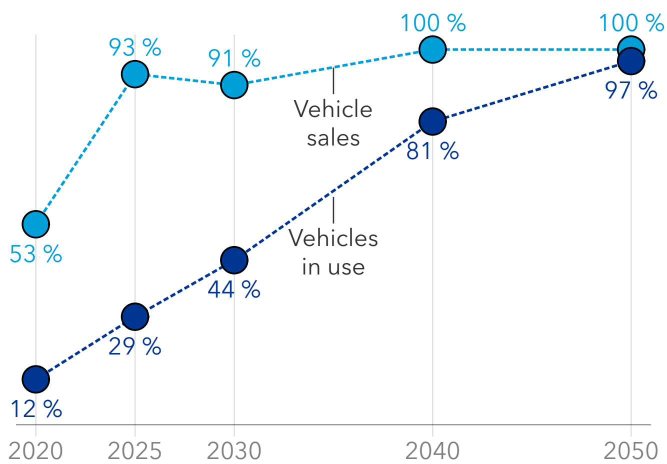


FIGURE 3.9 | Historical data includes September 2025. PHEV not included. Historical data source: SSB (2025)

postponed till 2029. The progress is stronger in city buses – 90% of new registrations in 2025 until August were ZEVs – supported by their short-distance operations and public sector ownership. Long-distance buses are further behind at 34%, and long-haul heavy road transport has the lowest EV market share (still at 13% in 2025).

EV transition lags in commercial market
Share of EVs in commercial vehicles

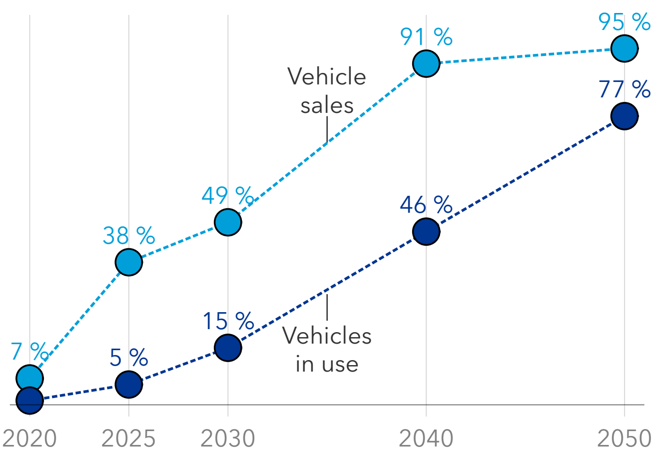


FIGURE 3.10 | Historical data includes September 2025. PHEV not included. Historical data source: SSB (2025)

We forecast that 5% of commercial vehicles will still not be EVs in 2060 – 2% will run on hydrogen, but the remainder are ICEVs. Heavy long-distance transport will lag the most in terms of electrification. That is natural as these sub-segments have the highest energy storage demand, and their charging infrastructure is currently limited. To alleviate this problem, it helps that the national transport plan shifts its focus to these segments contributing a NOK 3.7bn prioritization to invest in charging infrastructure for heavier vehicles (Samferdselsdepartementet, 2024). Nevertheless, the governmental ambition for 100% of new heavy vehicles in 2030 to be ZEV or use biofuel seems unrealistic (Klima- og miljødepartementet, 2025a).

Blending mandates for biofuel in diesel and gasoline represent the less prominent counterpart to EVs in the energy transition in the road sector. Since 2008, increasing shares of biofuels have been fuelling cars on Norwegian roads (Figure 3.8) and from 2027, the blending mandate increases to 21% (Klima- og Miljødepartementet, 2025b). So far it has replaced 200 PJ of fossil energy, twice the oil demand of the road sector in 2024. However, as the transition away from ICEVs continues, the role of biofuels will gradually diminish. Since 2022, electricity has been replacing a larger portion of fossil energy per year. Nevertheless, if the blending mandates are increased further, biofuels can play a key role in decarbonizing heavy road transport.

Maritime

The maritime sector is an important part of the Norwegian economy. Today, domestic maritime transport within the Norwegian exclusive economic zone (EEZ) stands at 62 PJ/yr or 27% of national transport energy demand – this number is calculated based on activity data from AIS using DNV's MASTER model and is higher than the corresponding national statistics of sold fuels due to bunkering abroad (DNV, 2025b). Of this, approximately 20% are used by fishing vessels, 20% by offshore vessels, and 27% by passenger vessels and ferries. The demand for domestic navigation will, unlike the other transport sectors, start to decrease in the 2030s. The drop is mainly happening for offshore vessels, due to a falling oil and gas production (see Sections 4.1 and 4.2 for more details). Consequently, the energy demand will drop to 55 PJ/yr in 2050.

Most of the seaborne transport in the Norwegian EEZ will continue to decarbonize faster than global shipping (DNV, 2025a). 50% of the energy demand will come from non-fossil sources in 2046. Natural gas and biofuels already have a share of 10%, which will continue to grow (Figure 3.11). In 2026, two ferries running on pure hydrogen will start operation, following in the wake of several electric ferries already in operation. The access to shore and charging power may be a limiting factor, but we forecast 5% electricity in the mix in 2040. Furthermore, we forecast the growth of ammonia and e-methanol in Norway to be about five years ahead of the global average.

Maritime sector will use many low-GHG fuels

Maritime energy demand by carrier (PJ/yr)

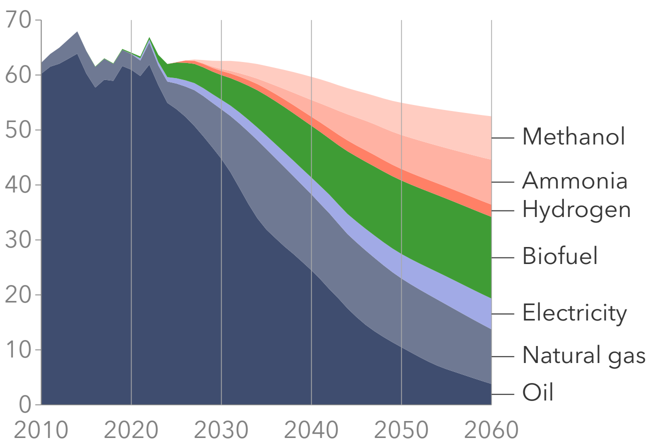


FIGURE 3.11 | Historical data has been adjusted relative to AIS activity data. Historical data source: SSB (2025)

Decarbonization of the maritime sector is driven by domestic, regional, and, eventually, global legislation. Since 2025, all new ferry tenders are required to be zero-emission, with only narrowly justified exemptions permitted (Samferdselsdepartementet, 2024). Going forward, Norway plans to align with FuelEU Maritime, targeting a 2% well-to-wake GHG intensity reduction by 2025, 6% by 2030, and 80% by 2050, but it remains to be entered into the EEA agreement (Sjøfartsdirektoratet, 2025). The cost of non-compliance with these targets will be high. For now, this only applies to ships above 5000 GT, but it may be extended to ships above 400 GT in 2027, which in time will have a bigger impact on domestic navigation (Miljødirektoratet, 2025). We expect that these targets will be accompanied by legislation with global coverage. This has been delayed as the International Maritime Organization in October 2025 postponed their decision on adopting the *Net-Zero Framework* for one year.

Fishing vessels represent a category that will decarbonize much slower than other vessels. We forecast that fishing vessels will trail the rest of the maritime sector by about 20 years because emissions from fishing vessels are not covered by the existing *FuelEU Maritime* regulations. If fishing vessels have a competitive disadvantage from buying more expensive low-GHG fuels in Norway alone, they will likely bunker elsewhere. That is already happening to some extent, causing carbon leakage. The Norwegian government has proposed to raise CO_2 compensation for the fishing fleet, starting next year, to counter this leakage and to incentivize efficiency and technology adoption. However, fishing vessels must also follow regulations regarding their shape, size, and security measures, which can hinder innovation and modifications on these vessels (Miljødirektoratet, 2025). Fishing vessels represent about 20% of the current maritime energy demand, or almost 1 MtCO_2 of emissions. While only 2-3% of the national emissions today, 1 MtCO_2 would correspond to 5% of the forecasted emissions in 2040 and 10% in 2050 (see Chapter 6 for more details).

Fishing vessels represent about 20% of the current maritime energy demand, or almost 1 MtCO_2 of emissions. That would correspond to 10% of the national emissions in 2050.

3.2. Buildings

Today, the buildings sector makes up 32% of Norway's energy demand, making it the largest demand sector. We forecast a 41% increase in buildings energy demand, from 81 TWh in 2024 to 114 TWh in 2060. Over 80% of this growth will come from energy demand for AI and data centres which increase 18-fold by 2060. The remaining moderate increase in energy demand is driven by an increase in population, GDP per capita, and floor area, and is heavily tempered by increased energy efficiency, stricter regulations, stricter building codes, and further electrification.

Shifting end-uses in a changing building sector

We divide buildings energy demand into five different end uses: space heating, water heating, space cooling, cooking, and appliances and lighting. We also include data centres in this demand sector, which are responsible for the largest absolute increase in demand, rising from 1.6 TWh today to 29 TWh by 2060 (Figure 3.12). This growing demand raises questions about rising electricity prices and future grid capacity. You can read more about energy demand from AI and data centres in the Factbox at the end of this section.

Space cooling, appliances and lighting, water heating, and cooking also show upward trends. We expect space cooling, which is currently the smallest end use, to grow steeply towards 2060 due to climate change. As cooling degree days increase and air conditioning becomes more common, energy demand for space cooling will increase from 0.16 TWh to 3 TWh by 2060. Appliances and lighting, which encompass everything from reading lights, phone chargers, and computers to refrigerators, washing machines, and dryers, will increase by 26% compared to today's levels, though there will be some increases in energy efficiency which dampen this growth. Energy demand for water heating will increase by 15% by 2060 and cooking 26%, compared to today's levels.

Data centres drive future electricity demand

Buildings energy demand by sector (TWh/yr)

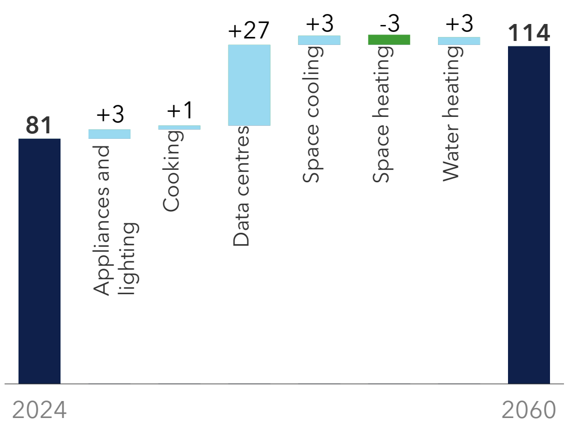


FIGURE 3.12 | Numbers may not sum due to rounding.

While we project most end uses will grow steadily, space heating stands out as the only category with a declining trend. Today, space heating accounts for the largest share of buildings energy demand at 56%, but this will fall to 37% by 2060 driven by energy efficiency improvements and stricter building codes. More energy efficient technologies, such as heat pumps, will also contribute to reducing this energy consumption.

Today, Norway is the country with the highest share of household heat pumps in Europe (Søreide, 2025), at over 1 million units (Energikommisjonen, 2023). We forecast a continued modest uptake of heat pumps, to 2 million units by 2060. The uptake of heat pumps could, however, be hampered by norgespris, which you can read more about in the norgespris Factbox in Chapter 4. Conventional electric heating accounts for most of the remainder of space heating demand, while oil has been fully phased out. Bioenergy – mainly wood burning, which remains an important source of heating, especially on cold days – currently accounts for 12% of space heating demand, but is expected to decline to 5% of the space heating demand mix by 2060. In contrast, direct heating will play an increasingly important role in the future of space heating, rising from 6 TWh today to 8 TWh by 2060.

A highly electrified sector with untapped efficiency potential

The Norwegian buildings sector is already highly electrified, with electricity making up 80% of buildings energy demand (Figure 3.13). This will continue to rise to 89% as bioenergy continues to fall away. Oil and natural gas will be virtually non-existent in 2060.

The government has set a target to reduce electricity use in buildings by 10 TWh by 2030 compared to 2015 levels (Regjeringen, 2024a). Yet progress has been slow, and Norway is not on track to reach this goal with the upward electricity trend we are seeing. Achieving this target will require stronger policy interventions and broader uptake of efficiency measures. An analysis by SINTEF shows that

NOK 4-5bn in subsidies per year could trigger investments that would help achieve the goal of reducing electricity consumption in the building stock by 10 TWh (NVE, 2024c).

While new buildings are subject to stricter energy performance requirements, the older building stock remains a challenge. Despite the available mature technology and significant knowledge, there are still many older buildings that could be far more energy efficient through re-insulation and other upgrades to the building envelope. Although energy grading shows a marked increase in A-C ratings since 2015, a large share of the building stock still falls short of current TEK17 standards, representing significant untapped potential for reduced energy use (ENOVA, 2025).

The revised EU *Energy Performance of Buildings Directive* (EPBD), once adapted and implemented in Norway through the EEA agreement, will introduce minimum energy performance standards for existing residential and commercial buildings by 2030-2035. While the adaptation of the directive allows for national modifications, such a directive will help raise the baseline for buildings performance.

This regulatory shift is a major step for the building sector, but it also presents financial challenges – particularly for private households. Clear political guidelines will be necessary to ensure that renovation requirements remain within an acceptable financial burden. Importantly, the directive focuses on primary energy demand, meaning that transitioning from direct electric heating to heat pumps may be sufficient to meet the new standards without requiring structural upgrades to the building envelope.

Electricity dominates building energy demand

Buildings energy demand by carrier (TWh/yr)

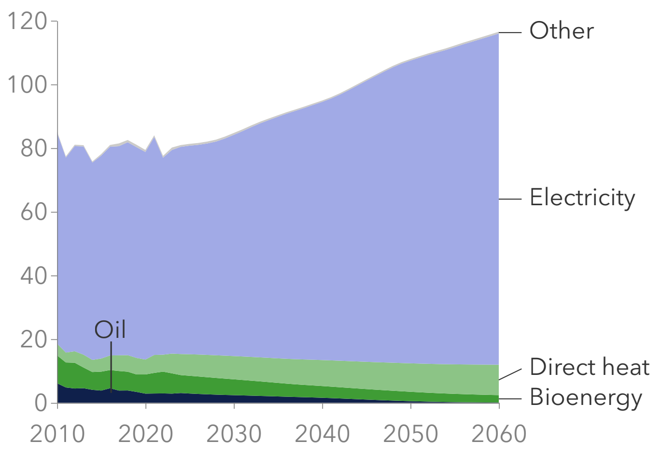


FIGURE 3.13 | Other category includes natural gas, solar thermal, hydrogen, and self-generating electricity.

High electricity prices have increased public awareness and encouraged behavioural changes. Many households have adopted low-cost measures such as lowering indoor temperatures.

Energy awareness grows amid budget cuts

Interest in energy efficiency has grown significantly in recent years, reflected in a steady increase in disbursed Enova subsidies for energy measures in private households over the past decade (Klimastiftelsen, 2025). In 2025, the two most popular energy measures are upgrades of the building body and installations of price- and power-controlled energy storage systems (Klimastiftelsen, 2025), and we see a shift from passive energy efficiency improvements to active operational energy performance. Yet the adoption of smart controls, load flexibility requirements, and renovation-trigger mechanisms remain slow relative to policy ambitions.

Despite growing public engagement, financial support is lagging. While NOK 1.1bn was previously allocated annually for energy efficiency measures through Enova and Husbanken, the proposed 2026 budget reduces this to NOK 900m (CICERO, 2025) – well below SINTEF's estimate on subsidies needed to trigger a reduction in electricity demand by 2030.

High electricity prices have increased public awareness and encouraged behavioural changes. Many households have adopted low-cost measures such as lowering indoor temperatures or load management strategies such as shifting consumption away from peak hours. However, energy investments remain limited due to high upfront costs and long payback periods (NVE, 2024d). Starting in autumn 2025, Enova will require households to apply for support before starting a project, ensuring approved funding upfront and thus reducing financial uncertainty.

Meanwhile, the introduction of the norgespris electricity pricing model – which flattens price signals throughout the day – may reduce incentives for load shifting. This could increase grid stress and drive the need for further infrastructure investments. For more on the implications of norgespris, see the Factbox in Chapter 4.

Data centre and AI energy demand

While traditional data centres have been around for many years, the development of AI data centres – with their higher needs for computing power, liquid cooling, and energy – has led to rapid growth in their demand for electricity. As of October 2025, 84 data centres have been registered in Norway, but how many of these are dedicated to AI purposes is not disclosed publicly (NKOM, 2025).

The electricity demand from data centres in Norway allocated to AI services is increasing, but the pace and magnitude of the growth is uncertain. Several AI data centre projects have been announced during the last years, including Stargate, where Aker, Nscale, and OpenAI will collaborate on one of Europe's largest AI data centre projects, located in Narvik (Nscale, 2025). In addition, several big data centre operators are planning for high-performance computing infrastructure that can facilitate AI applications. Government initiatives, such as funding for AI research centres through the Norwegian Research Council (Forskningsrådet, 2025), and the launch of the supercomputer Olivia, further support this momentum (Regjeringen, 2025).

As of early October 2025, Statnett has reserved 3.2 GW for data centres towards 2035, with additional 4.3 GW in the queue for capacity. Combined, this corresponds to 44% of the capacity queue and reservations in the transmission grid (Statnett, 2025a). There is uncertainty related to how much of this will be allocated specifically to AI, as this depends on how many projects will be realized and to what extent these will attract AI customers. Projects may also be postponed or cancelled.

Several factors make Norway an attractive location to build data centres. It has renewable energy with lower electricity prices than rest of Europe, good access to international and transatlantic fibre connections, a robust electric grid as well as a temperate climate that reduces the amount of energy needed for cooling. In terms of information security, Norway is seen as a safe country to store data and run AI models due to its location in Europe and the many international agreements it is a party to. That being said, the development of AI data centres poses challenges; AI data centres have a high power load and variable load profiles, often changing rapidly, leading to the need for a robust electrical grid – though the flexibility some data centres have in performing tasks at off-peak hours could reduce this burden on the grid. Data centres also tend to be built in clusters, putting strain on local power grids. Any delays in permitting and network connection could have a significant impact on installed capacity, and thus energy demand. Current experiences from the data centre industry also indicate a low utilization factor of the capacity that is currently installed, reflecting a phased buildout, and thereby uncertain development of energy demand.

Globally, we have determined the overall market size and related energy demand for general purpose data centres based on the rate and depth of digital diffusion in each of our world regions, which broadly correlates with increases in GDP per capita. For AI, we have implemented an additional logic where our hypothesis is that demand is driven by AI's capacity to augment and replace human labour (Epoch AI, 2025), see ETO (2025a) for further details. This drives data centre and AI uptake in Europe which is similar to other studies (Correa, 2025; RoE, 2025) reaching an electricity demand of 250 TWh in 2040.

For the reasons described above, we have assumed Norway will capture an outsized share of the data centre demand in Europe, serving both Norwegian demand as well as European customers. This means that in Norway, we expect energy demand for data centres to increase nearly 18-fold, from 1.6 TWh in 2024 to around 29 TWh in 2060. For the intermediate demand, this means tripling from today to 2030, reaching 6 TWh, 5% of European data centre energy demand. While today general-purpose data centres dominate, at 80% of energy demand, AI is rising rapidly, surpassing demand for general purpose data centres in 2029 and growing to represent 72% of energy demand in 2060 in Norway.

AI energy demand grows 18-fold by 2060

Data centre energy demand (TWh/yr)

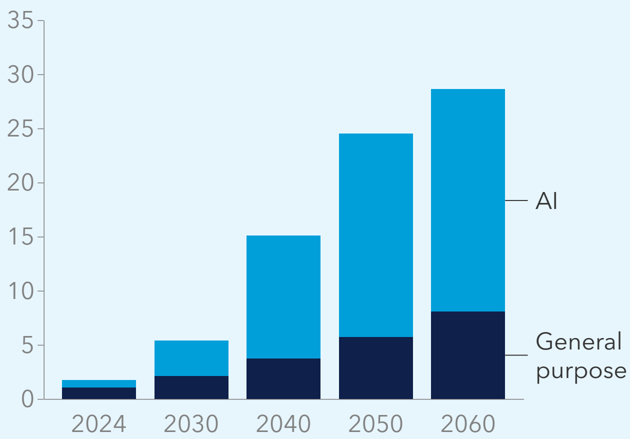


FIGURE 3.14 |

3.3. Manufacturing

Norwegian manufacturing has long benefited from access to stable, low-emission electricity, which has shaped its energy profile and competitiveness. In 2023, electricity accounted for 66% of the sector's energy mix, and this is expected to rise to almost 80% by 2060. However, the transition to a low-carbon manufacturing sector is now entering a more complex phase where global market dynamics, investment uncertainty, and infrastructure coordination are more decisive than domestic energy prices or grid access alone.

No revolution in sight for energy demand

Total energy demand in manufacturing has been stable for the past 15 years. Despite a small increase to 2030, we expect no major deviation from that trend. Demand will likely stay in the range of 250-270 PJ/yr to 2060. The sector remains diverse, with base materials (including aluminium, chemicals, and cement) accounting for over 70% of energy use.

We expect hydrogen to grow slowly, from barely 1% of the energy mix in 2040 to 5% by 2060, replacing fossil fuels in high-temperature processes. CCS will also play a role, though its deployment remains limited by cost and infrastructure. Unlike electrification, these two solutions require strong support, as well as long-term clarity around energy availability, carbon pricing, and market demand for low-carbon products.

Electricity penetration: Norway vs Europe

Norway's manufacturing sector stands out in Europe for its high electricity penetration, forecasted to reach almost 80% by 2060 (Figure 3.16). In contrast, Spain, Germany, and the UK, although electrifying at faster pace, will still show significantly lower electricity penetration to 2050. This gap highlights Norway's structural advantage in low-carbon competitiveness, as electrification reduces reliance on fossil fuels and aligns with EU climate targets.

Industrial electricity prices remain among the lowest in Europe, thanks to abundant hydropower and long-term contracts. Even with expected grid reinforcements and rising demand, we project Norway's average industrial price to stay well below the European average through 2060. This structural advantage supports electrification and competitiveness for energy-intensive sectors.

However, it also underscores the need for robust grid capacity and stable pricing to maintain this lead. In the long term, without sufficient transmission upgrades, Norway risks losing its competitive edge despite its renewable power base.

Strategic challenges

In the short term, while grid access and electricity prices are often cited as barriers, our analysis suggests these are not the primary constraints. Norway still offers some of the lowest electricity prices in Europe, and long-term contracts are available. The real challenge lies in the timing mismatch between industrial investment decisions

Base materials dominate energy demand

Manufacturing energy demand (PJ/yr)

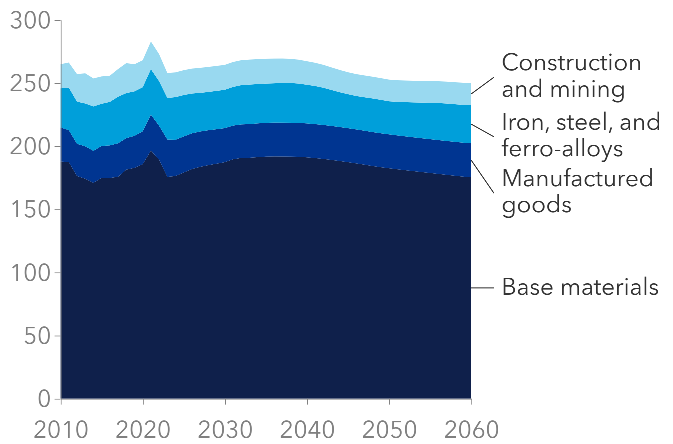


FIGURE 3.15 | Historical data source: IEA WEB (2025)

High electrification of Norwegian industries

Share of electricity in manufacturing

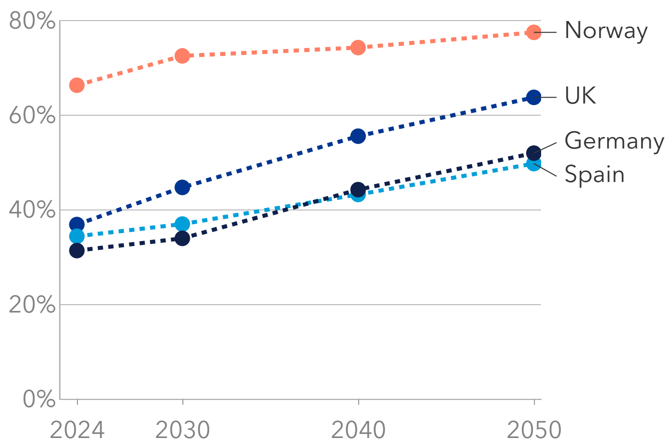


FIGURE 3.16 |

and infrastructure readiness. Grid operators cannot deliver capacity 'overnight' when industrial actors delay commitments.

However, competition for electricity access is real and intensifying. We forecast Norway will face a supply crunch in the coming years, driven by rising demand from transport electrification, offshore oil and gas installations, and new data centres. This growing pressure on the power system affects manufacturing's ability to secure predictable and affordable electricity, especially in regions with grid bottlenecks or delayed reinforcement projects.

As a result, we expect a limited installation of new energy-intensive industries in Norway, and a slow growth of sector's electricity demand from the 2030s (Figure 3.17).

Emissions outlook

Manufacturing emissions are expected to decline by more than 70% by 2060, but will still account for 40% of Norway's total energy and process-related CO_2 emissions. Achieving further reductions will require not only technological deployment, but also market transformation and international alignment. Emissions reduction will mainly come from fuel switching and the phasing out of fossil fuels, but CCS will play an additional role. In our model, beyond the current CCS installation in the Brevik cement plant, we expect additional capacity to come online for the chemical industry from the 2040s and

Slow growth of electricity in manufacturing

Additional electricity demand (TWh/yr)

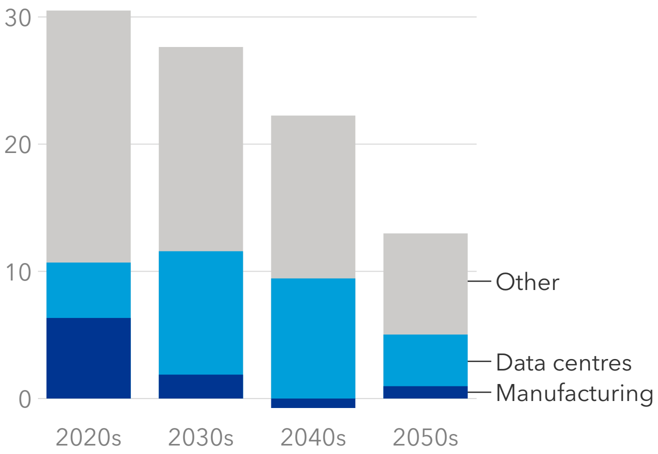


FIGURE 3.17 |

reach 1.6 $MtCO_2$/yr in 2060. Most of remaining emissions in 2060 will come from process-related emissions, notably anodes consumption in the aluminium process.

Regulatory and policy landscape

Norwegian manufacturing operates under environmental permits and is largely covered by the EU Emissions Trading System (EU ETS). Larger industrial facilities are required to follow ISO 50001 energy management standards. Enova continues to play a central role in supporting industrial decarbonization, and in 2025 has expanded its funding schemes to include high-temperature heat pumps, hydrogen and e-fuels for process heat, and waste heat recovery. These measures are designed to accelerate the shift away from fossil fuels, particularly in high-temperature industrial processes where electrification has traditionally been difficult.

Norwegian manufacturers are impacted by climate policies like the EU's CBAM. Higher costs risk reducing competitiveness outside the EU. Without an export solution, sectors with large export shares (e.g. fertilizers) could lose market access.

The manufacturing sector is not uniformly moving from pilot projects to full-scale implementation. While some actors are advancing, others remain cautious, awaiting clearer signals from global markets.

To maintain competitiveness while reducing emissions, Norway must ensure long-term clarity on energy availability and cost structures and align Enova support with industrial investment cycles. Faster permitting and concession processes are a common demand from industry players, as well as improved coordination between grid operators and industrial developers. Monitoring global market trends to anticipate shifts in demand and competitiveness will remain essential to optimizing the efficiency of support.

Norway's structural advantages (low-emission electricity, strong industrial base) will have to balance disadvantages such as high labour costs due to productivity levels, demographic constraints, and geographic distance from major markets.

From ambition to action

In summary, Norwegian manufacturing is at a crossroads. The sector has the tools and resources to decarbonize, but success will depend on aligning infrastructure, policy, and market signals to enable confident investment decisions. The next phase of the transition will require not just ambition, but timely execution.

Demand by subsector

Base materials – includes production of non-metallic minerals (including conversion into cement), chemicals, and petrochemicals; non-ferrous materials, including aluminium; wood and its products, including paper, pulp, and print.

Base materials will continue account for around 70% of the total manufacturing energy demand. Energy consumption in the base material subsector is mainly from industrial high-heat processes and from operating machines, motors, and appliances.

Norway is Europe's leading aluminium producer, and aluminium production demands more than 15% of the total electricity consumption in Norway and more than half of the electricity consumed in manufacturing. The segment plans for a higher ratio of recycled aluminium (Hydro, 2024). That will reduce energy intensity per tonne produced, but will not alter the prominent role of aluminium as an energy user. On the other hand, some emissions will remain as carbon-based graphite used in anodes is hard to replace and will remain in the energy mix in 2060.

Construction and mining – includes mining and construction of roads, buildings, and infrastructure. It accounts for 7-8% of the energy demand in manufacturing from now to 2060. We predict a stable demand for the sector, only slightly declining because of efficiency gains.

Manufactured goods – includes production of general consumer goods; food and drinks; electronics, appliances, and machinery; textiles and leather; and vehicles and other transport equipment. Manufactured goods will have a stable increase in energy demand in the period, as increased efficiency will balance a moderate growth in production. Battery production is an area that could increase demand in this part of manufacturing, but the current developments in Norway and Sweden suggest that getting battery production up and running in Norway is challenging.

Iron, steel, and ferro-alloys production – The sector is already electrified, with electric arc furnaces dominating energy consumption. We forecast a stable production from the subsectors to 2060. A reducing agent is necessary in most processes, explaining why the sector is one of last remaining coal users in Norway. We forecast coal to be progressively replaced by hydrogen, from 7% in 2040 to 70% in 2060.

Natural gas demand for producing ammonia, not for feedstock but for use as an energy carrier, will grow in the future.

Fossil fuels are progressively phased out in all manufacturing subsectors

Share in manufacturing fuel mix by subsector

FIGURE 3.18 |

3.4. Non-energy use

Non-energy use is a category where oil and natural gas are used as industrial feedstock. It represents 10% of the Norwegian energy demand today. We forecast a stable demand to 2040, followed by a decline, leading to a 30% lower demand by 2060.

The decline will come from natural gas consumption. To 2040, we expect a stable demand around 60–65 PJ/yr to cover production of ammonia and methanol as feedstock as well as products in the chemical industries including plastics. After 2040, we forecast methane-based ammonia production will decline, as well as plastics production (due to global trends), and natural gas demand will almost halve to 35 PJ by 2060.

However, an important distinction is to highlight that natural gas demand for producing ammonia, not for feedstock but for use as an energy carrier, will grow in the future (Section 4.6). Natural gas as raw material for producing blue ammonia will increase in the period 2030–2040 as there is an opportunity where Norway is price competitive in delivering blue ammonia as energy carrier. We do not forecast a similar future for methanol as an energy carrier.

For other chemicals and plastics, the demand will be reduced by 40% by 2060. Annual domestic plastic production is around 410,000 tonnes primary plastic today, two thirds of this is exported and one third is used in Norway. The total domestic plastic consumption is higher (900,000 tonnes), but most of this is not visible in the energy/emissions accounting of Norway as it is imported.

Oil consumption for non-energy use is stable around 35 PJ/yr all the way to 2060. This is for all practical purposes used outside the petrochemical industries (e.g. asphalt, bitumen, lubricants). These are uses where we foresee continuing demand and no alternatives at scale for Norway, or at a global scale in general.

Natural gas drives lower feedstock demand

Non-energy demand by carrier (PJ/yr)

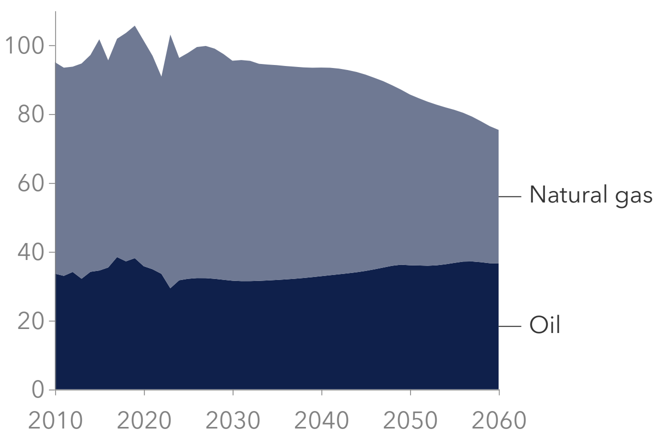


FIGURE 3.19 | Historical data source: IEA WEB (2025)

Yara's renewable hydrogen plant. Photo: Lindsay Leirkjær

4 ENERGY SUPPLY

Based on the latest reserves and development report from Sokkeldirektoratet, we forecast Norway's oil and gas production to decline sharply over our forecast period to 2060, by approximately 80% each (Figure 4.1). This is because many of the largest and most productive fields, such as Ekofisk, Troll, and Ormen Lange, were discovered and developed decades ago; and replacement with new 'giant' fields is becoming harder. In our model, we adopt the Norsk petroleum forecast up to 2029 (updated in October 2025). Beyond this point, the production forecast is from model-based estimates that account for reserves, developments, production costs, Europe's oil and gas demand and willingness to purchase Norwegian oil and gas based on price, as well as domestic energy needs.

Despite the long-term decline, Norway's energy resources remain abundant and will play an increasingly strategic role in Europe as energy security continues to rise on the policy agenda. While we project overall European gas demand to fall, we expect Norway's share in meeting that demand to increase. At the same time, exploration and production (E&P) companies operating on the Norwegian Continental Shelf (NCS) have strong incentives to reduce breakeven costs and increase exploration and development to expand Norway's market share.

Moreover, Norwegian natural gas will be crucial for Europe's green transition – first to replace coal in the power sector through 2030, and later as a feedstock for

Oil and gas production expected to fall by approximately 80% by 2060

Norwegian oil and gas production (Million Sm^{3}oe/yr) and capacity additions (Million Sm^{3}oe/yr)

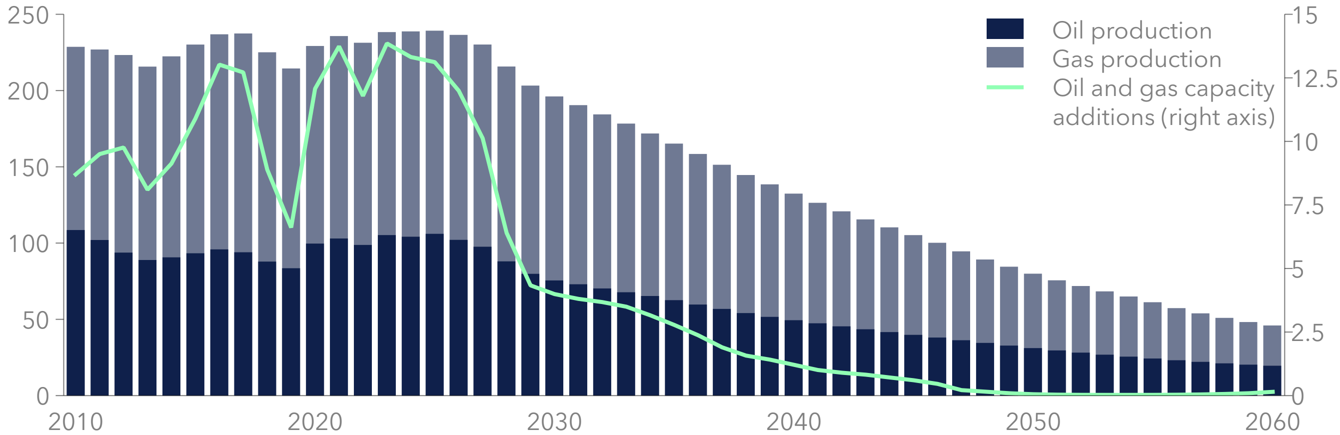


FIGURE 4.1 | Oil includes condensates and natural gas includes NGLs.
Historical data source: NPD (2025), IEA WEB (2025)

blue hydrogen production, as by 2060, we expect hydrogen to account for around 21% of Europe's total gas demand.

Domestic use of oil will fall by about 75% as Norway takes measures to reduce emissions (Figure 4.2). We project natural gas consumption to decline by about 50% by 2040, driven by the electrification of the NCS. After 2040, part of the reduction will be offset by rising demand for hydrogen production. However, similar to oil, we expect total consumption to fall by around 75% by 2060, from today's 330 EJ.

Utility-scale electricity generation in Norway will climb to 236 TWh in 2060 from 156 TWh in 2024. As the only scalable option, wind power will provide around 90% of the additional power generated. In 2060, wind (32%) will be close to delivering half as much electricity as hydropower (62%). The contribution from wind at that time is distributed between onshore (15%), fixed offshore (11%), and floating offshore (6%). The increased power generation and consumption requires substantial investment in strengthening and modernizing the power grid.

Domestic consumption of electricity increases in all sectors, but around 28 TWh and 32 TWh of the generation remains available for export after 2040 and 2050, respectively. In addition, green hydrogen produced from electrolysis will consume around 9 TWh of the total electricity generation in 2060. We foresee the hydrogen produced being used domestically.

Oil and gas consumption decline 75% while wind energy expands almost sixfold by 2060

Primary energy consumption by source (PJ/yr)

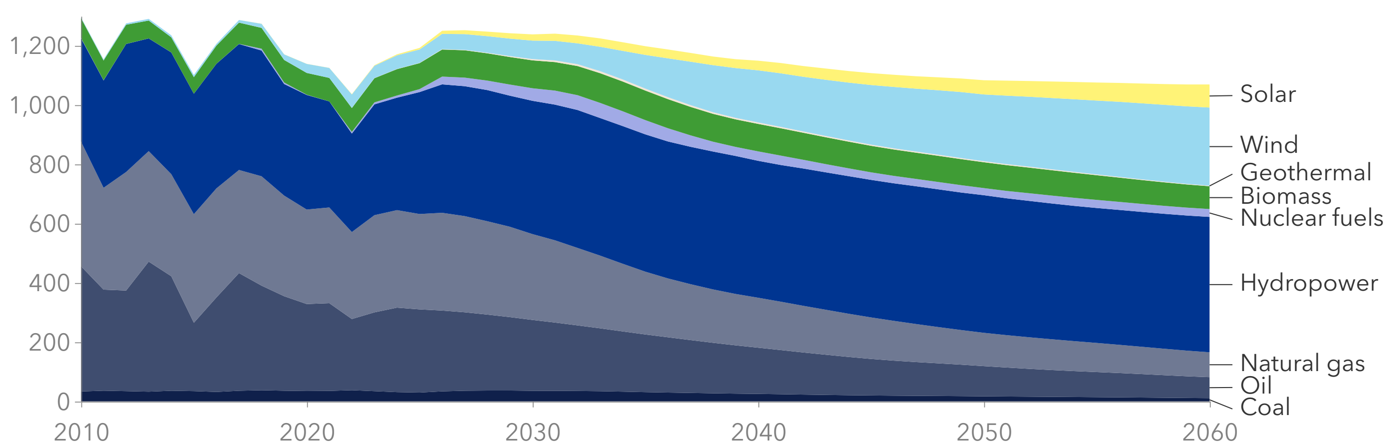


FIGURE 4.2 | Adjusted for primary energy source of electricity imports. Historical data source: IEA WEB (2025)

4.1 Oil

Norwegian crude oil production is projected to decline sharply – by around 80% by 2060 – from today's level of 106 Sm³/yr (1.83 Mbpd) to about 20 Sm³/yr (0.34 Mbpd) (Figure 4.1). Production will start to fall after 2025, with only a modest decline in the first few years as Johan Sverdrup offsets losses from aging fields. After 2028, the decline accelerates as no major new fields are added, and most tie-back projects are delayed. As fields mature, production and export revenues will continue to drop (Chapter 5). Despite this decline, output will remain well above domestic demand, with roughly 90% of production exported throughout the forecast period.

Domestic oil demand decreases from 285 PJ today to 70 PJ by 2060 (Figure 4.3). The main contributor to this reduction is transport, where demand shrinks from 194 PJ in 2024 to 87 PJ in 2040 and 21 PJ in 2060, a decrease of 90%.

In 2024, about half of the transport sector's 194 PJ of oil demand came from road vehicles. Already in Norway, around 90% of sales of new passenger cars are EVs and the fleet is transforming rapidly. Commercial vehicles will also undergo this transformation, but more slowly. Altogether, oil supply for road transport will decrease by 98%, from 101 PJ to 5 PJ over our forecast period.

Total energy demand in maritime transport will fall by 15% from 62 PJ in 2024 to 52 PJ in 2060, mainly due to the reduced transport need from declining oil and gas production. Oil currently covers nearly all (89%) of maritime energy demand. In addition to the demand reduction, there is a diversification of energy carriers in maritime transport leading to a steep decline in oil demand from 55 PJ currently to 4 PJ in 2060. Quite a bit of this oil reduction comes from the switch to natural gas. Today, natural gas supplies only 6% of the maritime transport demand but this will increase to delivering 23% of energy demand in 2040. Beyond then, the share of natural gas will reduce, ending around 20% in 2060. By then, biomass will have grown to be the biggest energy carrier in maritime transport (28%).

Aviation's dependence on oil will be more protracted as 27% will still be covered by oil in 2060. That will be the situation after a steady reduction from 37 PJ to 12 PJ (68%) through the period. In aviation, synthetic fuels and biofuels will drive decarbonization up to 2040 and, together, will be bigger than oil by 2055. After 2045, electricity, hydrogen, and e-fuels will represent a visible share, together meeting around 50% of aviation energy demand in 2060.

The second-largest sector for oil demand is non-energy use, primarily as petrochemical feedstock, with a stable demand of 30–36 PJ throughout the period. Oil is a minor energy carrier in manufacturing, representing only 5% (14 PJ) of current demand, which is projected to decline to 2% (2 PJ) by 2060. Due to regulations, oil use in buildings will be halved (5 PJ) by 2040 and fall to negligible levels after 2050.

Transport oil demand drops 86% by 2060

Oil demand by sector (PJ/yr)

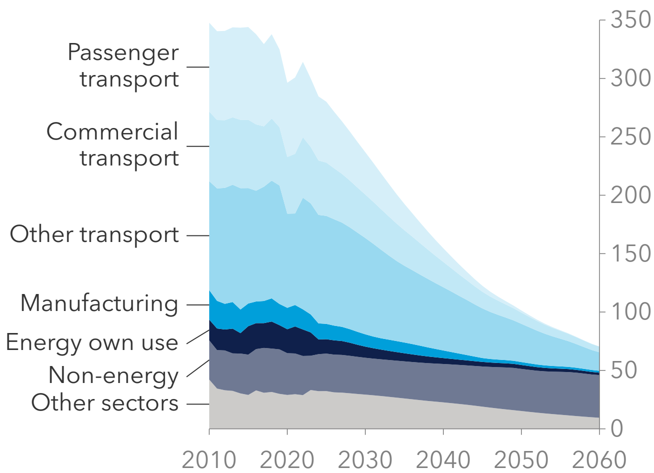


FIGURE 4.3 | Historical data source: IEA WEB (2025)

4.2 Natural gas

Norway's natural gas production, including NGL, totalled 135 Bcm in 2024 and we project it will decline by around 80% to 26 Bcm by 2060. Norwegian gas remains highly valued in Europe for its role in enhancing regional energy security. Given existing export infrastructure and the continued focus on reliable supply, we expect Norway's remaining gas volumes to remain attractive in international markets. Currently, Norway exports about 93% of its natural gas production. We expect this share to remain relatively stable between 93% and 95% throughout the forecast period, as domestic gas demand declines by around 72% from today's 320 PJ to about 90 PJ in 2060.

Historically, more than two-thirds of natural gas in Norway was used in the energy own-use sector (Figure 4.4). This mainly involves natural gas for electricity production on platforms on the NCS and is projected to shrink from 212 PJ to 55 PJ in 2040 and 14 PJ in 2060. This strong decline is continuous and, over the next 20 years, is linked to the electrification of the NCS through shore power and wind turbines, such as Hywind Tampen, which replace gas turbines on offshore installations. Moreover, as oil and gas production decreases, energy demand for own-use will decline accordingly (Figure 4.5).

The reduction in natural gas demand after 2045 is partially offset by hydrogen production demand (Figure 4.4). Hydrogen production through steam methane reforming grows after 2040, from almost 0 to 9 PJ in 2060. Note that in our *ETO Norway 2024*, we had forecasted much higher gas demand for hydrogen production. That forecast was based on Shell's Aukra Hydrogen Hub and Equinor's planned hydrogen export project to Germany, both of which were cancelled due to lack of demand, high costs, and insufficient market development for blue hydrogen, and were consequently removed from our model's project pipelines.

Similar to oil, non-energy use is the second-largest consumer of natural gas. Its demand is expected to decrease from 65 PJ in 2024 to 40 PJ in 2060, but its share of total consumption will increase from 20% to 44% during the same period. We project manufacturing demand will drop from 28 PJ to 15 PJ within the next 10 years due to process improvements, after which it remains stable.

Transport currently has limited natural gas use, about 4 PJ, mostly in maritime applications. We expect this to grow to a maximum of 14 PJ by 2040, as gas temporarily replaces oil in shipping, before levelling off to 10 PJ by the end of the forecast period as gas in maritime applications is replaced by biomass, ammonia, and e-fuels.

Given Norway's hydropower-dominated electricity mix, natural gas accounts for only a marginal share of power generation (approximately 10 PJ in 2024) and will likely decline to zero by 2060. Natural gas use in buildings is negligible.

Energy own-use of gas down 80% by 2060

Gas demand by sector (PJ/yr)

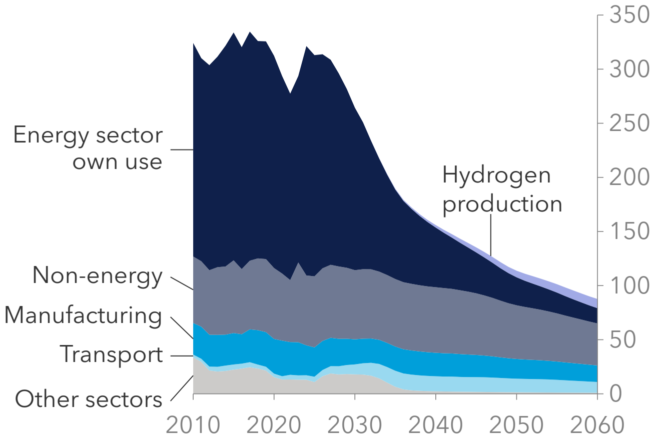


FIGURE 4.4 | Historical data source: IEA WEB (2025)

NCS energy demand drops with electrification

NCS energy demand by carrier (PJ/yr)

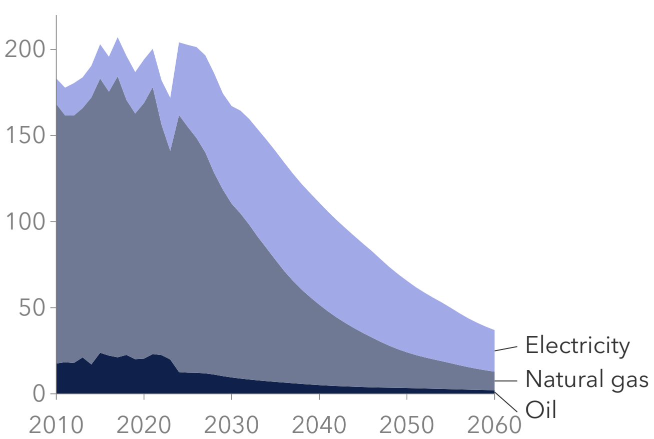


FIGURE 4.5 | NCS: Norwegian Continental Shelf. Historical data source: IEA WEB (2025)

4.3 Electricity

4.3.1 Electricity demand

Norway's annual electricity consumption stands at roughly 140 TWh. Around half of this is used in buildings, mainly for space and water heating, while close to one third goes to manufacturing and processing industries.

Since 1990, electricity use has grown steadily by about 0.7%/yr. This reflects both Norway's exceptional access to hydropower and its long-standing policy to electrify offshore oil and gas operations (Anchustegui and Tscherning, 2024). Over the same period, demand for appliances, lighting, and electronic equipment in buildings has roughly doubled, driven by rising incomes and the growing role of data centres and digital services.

As a result, Norway's per-capita electricity use reached about 25 MWh in 2024, among the highest in the world. Electricity supplied 46% of the country's final energy demand that year, a much larger share than the European average (DNV, 2025a). This combination of abundant low-carbon generation and high electrification gives Norway one of the cleanest and most electricity-dependent energy systems globally.

We foresee growth propelled by the following four drivers.

Transport, specifically EVs and, to a lesser extent, aviation and maritime: Currently, 750,000 passenger EVs consume 2.2 TWh per year. By the mid-2030s, that will double. Electrification of commercial vehicles will have a bigger impact on electricity demand as the annual energy consumption of an average commercial vehicle is about 2.5 times higher that of a passenger vehicle. Norway's whole road vehicle fleet will consume 15 TWh in 2050 and 17 TWh in 2060. Another 5 TWh will be added by 2060 from short-haul aviation and electrified segments of shipping.

Electrification of oil and gas production on the Norwegian Continental Shelf: we expect electricity consumption related to oil and gas production to continue to grow as both new and some existing fields are electrified (Offshore Technology, 2024). We estimate electricity consumption within the sector will reach a plateau of 22 TWh in the mid-2030s. However, there are uncertainties, as further electrification depends on both political decisions and economic viability within environmental requirements.

Production of hydrogen grid-connected electrolysers: Electricity demand for operating grid-connected electrolysers will reach 16 TWh/yr by 2060, from practically nothing today. This quantity of electricity will yield about 350 kt of hydrogen annually to meet the local demand.

Data centres: Electricity demand for data centres is set to grow to 29 TWh by 2060, 21 TWh of which is for data centres that provide services supporting AI.

The projected increase in electricity demand is not a uniform trend. Specifically, the forecast period can be segmented into two phases. Between 2024 and 2034, we expect the annual growth rate to rise modestly to 2.2%, a slight increase over the historical rate (1990–2024) of 1%/yr. In contrast, from 2035 to 2060, we project electricity demand growth will slow back to 1%/yr.

This combination of abundant low-carbon generation and high electrification gives Norway one of the cleanest and most electricity-dependent energy systems globally.

Transport, oil and gas, hydrogen, and data centres drive electricity demand

Norwegian electricity demand by sector (TWh/yr)

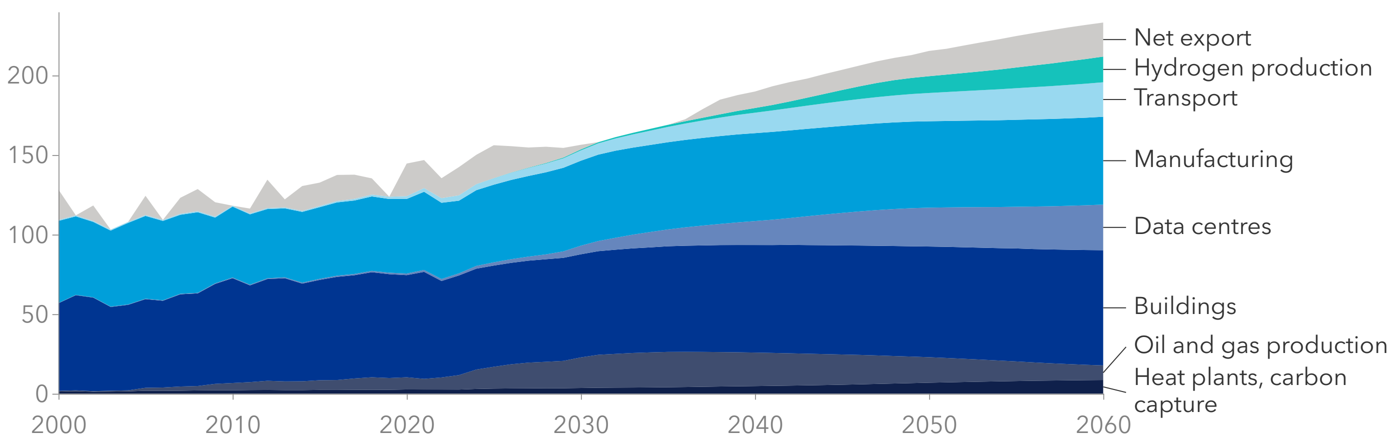


FIGURE 4.6 | Historical data source: SSB (2025), IEA WEB (2025)

4.3.2 Electricity supply

Current system

By the end of 2024, Norway's installed power generation capacity totalled around 41 GW. Hydropower dominates the system with around 34 GW, which supplied about 138 TWh of the 156 TWh produced in 2024 – nearly 90% of total output. The remainder came mainly from about 5 GW of onshore wind (generating about 16 TWh annually), and roughly 800 MW each of solar and gas-fired. Bioenergy and waste-to-energy plants contribute just under 100 MW.

Hydropower's dominance in electricity generation reflects Norway's unique geography: abundant rainfall, deep valleys and vast reservoirs provide both clean energy and exceptional flexibility. Because of the country's dependence on rainfall, annual hydropower output varies widely. Capacity factors have fluctuated between 43% and 58% over the past two decades, producing yearly generation between 120 TWh and 155 TWh, with a normal production of about 138 TWh. In most years, this has resulted in a net export surplus of 10–20 TWh, with only 9 of the past 45 years (since 1980) requiring net electricity imports. These exports flow mainly to Sweden, Denmark, Germany, the Netherlands, and the UK through interconnectors.

In our model, Norway operates as a single interconnected system trading electricity with the rest of Europe. Generation and demand are simulated hour by hour, based on deterministic profiles for wind, solar, hydropower inflow, and load. These profiles capture a typical weather year rather than stochastic variability, representing expected seasonal and daily patterns of production and consumption. Over time, they evolve to reflect changes in technology, such as improved wind turbine performance and higher solar module efficiency.

Hydropower is modelled as a flexible generator constrained by water inflow and reservoir storage. Norway currently has around 1,100 water reservoirs, with a total storage capacity of over 87 TWh. Generation follows an opportunistic pattern: producers generate more when prices are high and hold back when prices are low. We draw the expected price distribution through the year from the results of the previous year's simulation, so decisions reflect evolving market dynamics. This mirrors how Norwegian hydropower companies manage their reservoirs to balance financial returns with water availability.

Seasonal water inflows are highest in spring and autumn, when melting snow and rainfall refill reservoirs. The model's inflow profiles reproduce this rhythm, allowing water to be stored for use in winter when electricity demand peaks. Hydropower therefore acts not only as generation capacity but also as seasonal energy storage. It enables Norway to supply power to Europe during wet years and import electricity in dry ones, maintaining stability across the Nordic and continental grids.

Electricity trade provides an essential buffer. The model allows electricity to flow between Norway and the rest of

Norway faces brief power deficit before wind and solar expand

Electricity supply by technology (TWh/yr)

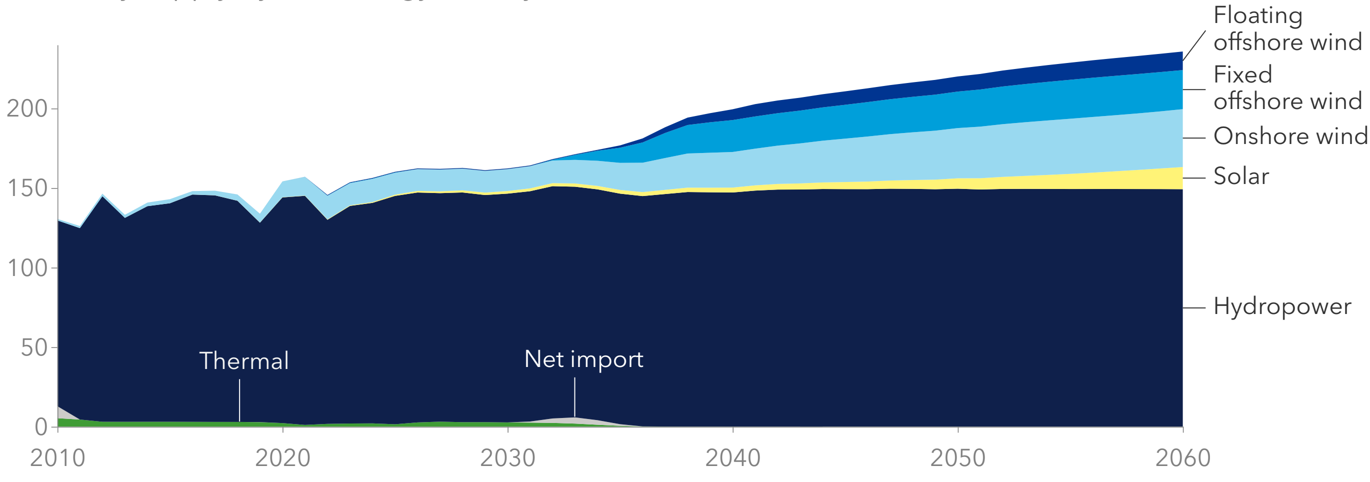


FIGURE 4.7 | Historical data source: SSB & IEA WEB (2025)

Europe according to relative prices, subject to interconnection capacities. When generation output exceeds domestic demand, surplus electricity is exported; when prices abroad are low or storage levels are low, imports increase. This trading behaviour reflects Norway's strong interconnection capacity and its function as a flexible supplier to European markets.

Future developments

Looking ahead, we expect electricity demand to grow faster than supply during the 2020s, eroding the current surplus. By the early 2030s, Norway will experience a temporary power deficit of around 3–4 TWh. We expect hydropower capacity to increase moderately to about 37 GW by 2030 and 41 GW by 2040, largely through upgrading of existing stations rather than new large dams, reflecting environmental and licensing constraints.

Offshore wind will begin to play a meaningful role after 2032, when the government's financial support mechanisms bring around 6.5 GW of capacity online between 2032 and 2040. These projects will help supply follow the increased demand and strengthen the security of supply.

Beyond 2040, as demand growth slows to historic rates and subsidies for offshore wind taper off, most new capacity additions are likely to come from onshore wind and solar photovoltaics. By 2050, we project installed capacity to reach 11.4 GW of onshore wind, 7.8 GW of offshore wind, and 7 GW of utility-scale solar PV, with an additional 2 GW solar capacity behind the meter. While hydropower will remain the cornerstone of generation, the system will gradually become more diversified.

Wind generation is the fastest-growing source of new supply. Onshore wind contributed about 15 TWh in 2024 and will rise to 32 TWh by 2050. After the pause in new onshore wind developments since 2019, we expect the sector to regain momentum. Offshore wind, almost negligible today, expands sharply from the mid-2030s to exceed 32 TWh by 2050, supported by government subsidies. Wind's variability is absorbed efficiently by hydropower, which adjusts output to maintain balance. Utility-scale solar generation, although small, grows from just over 0.5 TWh in 2024 to around 6.6 TWh by 2050, peaking in summer when hydropower reservoirs are replenished. An additional 1.1 TWh will be fed into the grid by prosumers.

Thermal generation plays a minimal role. Gas-fired plants supplied about 1.6 TWh in 2024, declining to almost zero by 2050 as electrification and renewables dominate. Bioenergy and waste contributes less than 0.5 TWh in 2024 and will remain below 1 TWh throughout the forecast period.

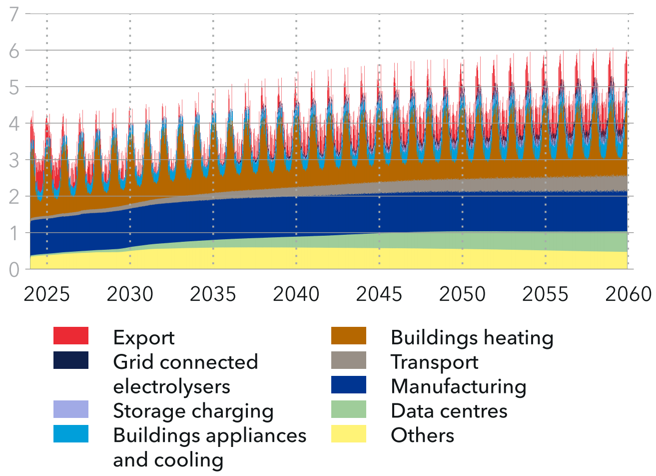
By 2060, Norway's electricity output will reach about 238 TWh, 63% of it from hydropower, 15% from onshore wind, and 15% from offshore wind. Despite greater diversity in generation, hydropower's ability to store and shift energy remains the cornerstone of system stability, ensuring Norway continues to act as a clean, flexible, and reliable partner in Europe's energy transition.

Norway's hourly supply and demand

The Norwegian power system is set to undergo dramatic change in terms of both supply and demand. From a hydropower dominated supply at present, the system will see significant additions of wind producing a third of the electricity in 2060. Delays in getting wind, both onshore and offshore, online will lead to an electricity supply crunch in the interim. From a demand perspective, new demand categories, notably industry, datacentres and road transport

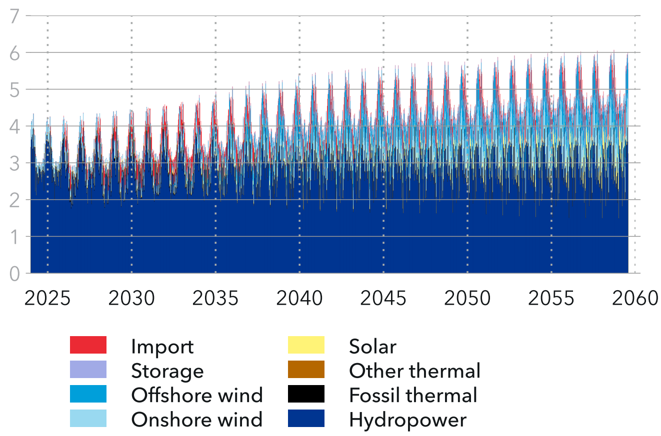
Norway electricity demand by segment; 2024-2060

Units: TWh/week (weekly readings)



Norway electricity supply by source; 2024-2060

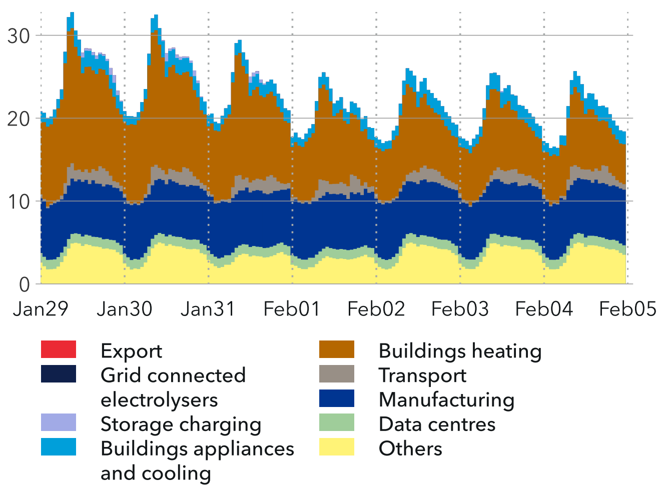
Units: TWh/week (weekly readings)



2024 – 2060: The figure above shows the evolution of demand and supply in the Norwegian power system, cumulated weekly and presented annually. Gross electricity exports, which are strong in 2024, start to decline around 2030 due to a domestic supply shortage, making Norway a net importer until 2037. However, with offshore wind expected to connect to the grid around 2035 to meet growing demand, we forecast both peak supply and peak demand to increase. By the 2040s, a Norway again has surplus of electricity that can be used for power exports to Europe.

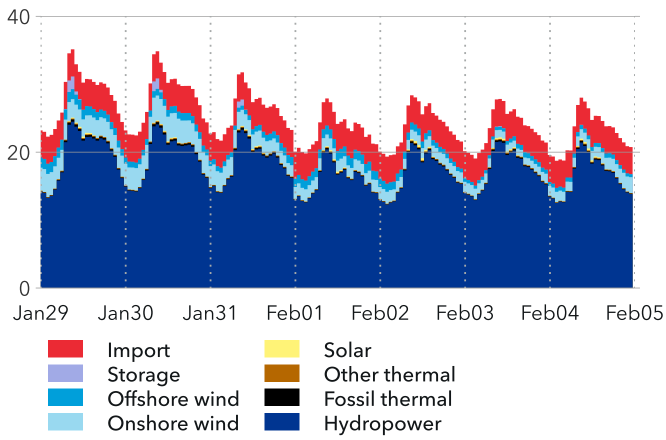
Norway electricity demand by segment; week 5; 2034

Units: GWh/hour



Norway electricity supply by source; week 5; 2034

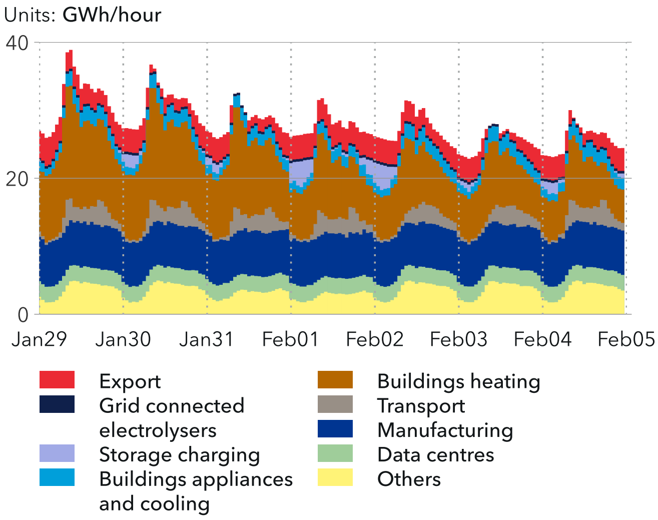
Units: GWh/hour



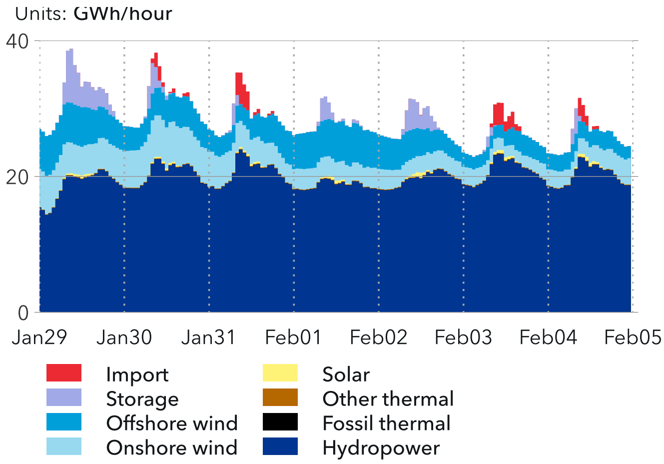
2034, week 5: In week 5 of 2034, Norway remains an electricity importer every hour due to limited generation capacity developments and high winter heating demand, which peaks around midday. During critical evening hours, significant power imports are required as the system encounters sustained, inflexible demand. Limited capacity and storage expansion restrict supply adequacy, and with lower prices across other European markets compared to the marginal cost of hydropower, Norway relies on electricity imports to meet its demand.

will scale up quickly in the 2030s, and further increase the electricity demand growth. We illustrate this change by presenting the weekly power supply and demand for 2024-2050 and forecasting hourly demand and supply for the same winter week in three different years (2034, 2044, 2054).

Norway electricity demand by segment; week 5; 2044

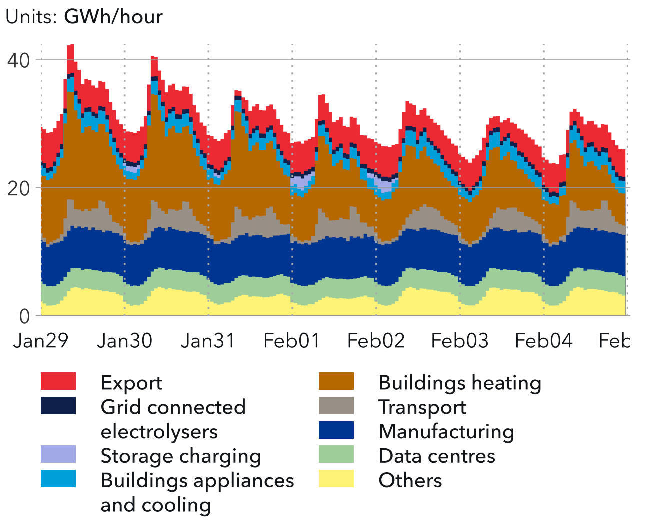


Norway electricity supply by source; week 5; 2044

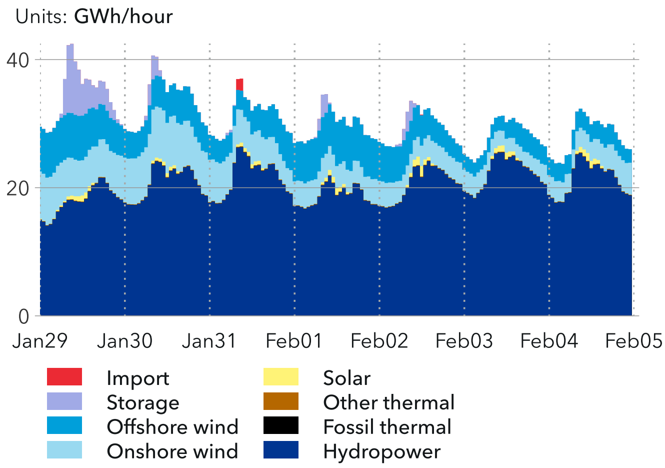


2044, week 5: In week 5 of 2044, Norway shows signs of a shift in power supply and demand dynamics by again exporting electricity, driven by an abundant supply of offshore wind power. However, as offshore wind generation dips in the during parts of the week, Norway relies on its interconnections with Europe to import its electricity, then discharges this stored energy back into the grid during peak demand hours. This strategy supports the grid when heating demand for buildings is at its highest.

Norway electricity demand by segment; week 5; 2054



Norway electricity supply by source; week 5; 2054



2054, week 5: In week 5 of 2054, Norway has transitioned almost completely into a net electricity exporter during this winter week, supported by significant offshore wind capacity added to the grid alongside its hydropower resources. Both vehicle-to-grid and Li-ion storage systems contribute power during midday peaks, while excess electricity is exported. Although Norway exports substantial electricity during the week, it imports power from Europe by the third day of the week, where wind resources cannot support total demand. Effectively, Norway leverages its power trade interconnectors with Europe as a short-term flexibility tool, reducing the need to curtail intermittent wind power.

Norgespris – Norwegian government-subsidized scheme for residential electricity

Norgespris is a state-financed support scheme that effectively gives households a fixed electricity price for a period of time, with the current scheme running until end-2026. Norgespris was instituted as a response to the price crisis of 2021 when peak electricity prices were 10 times higher than normal. The implication of shielding most households from fluctuating market prices means less demand response, shifting more of the balancing burden to industry, public service, commercial users, and neighbouring countries. This will likely increase intra-week/seasonal price volatility while weakening incentives for efficiency, and load-shifting in households. Because private homes (including cabins) are collectively less than a third of Norwegian consumption, the system-wide impact should be limited, though directionally negative for all market participants. Norwegian energy intensive industry and owners of large buildings are already quite advanced in energy management and responding to fluctuating day-ahead prices. Looking ahead, the scheme is confirmed until end of 2029 and authorities will likely keep the scheme but align its price closer to market prices, reducing its overall cost.

What is norgespris?

From the 1 October 2025, Norwegian households have been able to sign up for a subsidized fixed-price contract for electricity to private homes and holiday homes. The scheme is organized as a two-sided single price contract for differences (CfD), such that for each kWh the customer consumes, there is a reimbursement from the government if the wholesale day-ahead price (SDAC) is higher than the contract price. If the day-ahead price is below the contract price, the customer will be invoiced for the difference. For ordinary homes, the scheme is limited to 5,000 kWh per month (more than 90% of households never touch that limit). For holiday homes, the limit is set to 1,000 kWh per month. The current scheme is binding for the connection point from the date of signature until the end of 2026. The government has determined a CfD price of NOK 0.4/kWh plus 25% VAT (i.e. 50 øre/kWh in total).

The scheme is effectively shielding households from both the daily volatility of wholesale prices and any changes in price level that might come during the contract period. However, the government has reserved a right to suspend the scheme, e.g. if for some reason a supply shortage were to occur.

Private homes not signing up for the scheme are still eligible for 'strømstøtte', which is an arrangement that sees the government reimbursing households for 90% of the wholesale day-ahead price above NOK 0.75/kWh (excl. 25% VAT), limited to 5,000 kWh per month (as for norgespris). Holiday homes are not eligible for strømstøtte. Non-private consumers (i.e. commercial, public, and voluntary sectors) are not eligible for any of these schemes. For commercial customers, a similar scheme would most likely have been in violation of EU state aid legislation.

Why is norgespris a subsidy?

From an economic perspective, offering an electricity contract below its market value is equivalent to offering a subsidy. A question is thus what the market value of a contract similar to norgespris would be.

At the power exchanges, participants can buy (or sell) baseload contracts (fixed price, flat volume) for e.g. next year. Based on such forward contracts, suppliers can create a contract to households that would have similar features as norgespris, apart from the prices. A supplier would base his offer on the forward price at the power exchange and calculate a surcharge considering the following:

- Households don't have a flat consumption but use more during winter and in the daytime, when day-ahead prices are generally higher, than in the summer and during nights. There are no forward contracts with different volume night and day, but it is possible to buy more baseload contracts for the winter as compared to the summer. Winter contracts are generally priced higher than summer contracts. Hence, while it is possible to (at least partly) find a wholesale price for the seasonal profile, there is no corresponding market price difference between day and night.

- Norgespris is essentially a volume option, as the upper limit of 5,000 kWh or 1,000 kWh per month is binding only for very few households and typically during winter. All forward contracts have a fixed volume. Hence, offering a volume option implies a risk for the supplier.

When the government proposed norgespris, the wholesale price at power exchanges for delivery in 2026 in NO1 (south-eastern part of Norway) was around NOK 0.5/kWh for baseload contracts. At the time of writing, the NO1 forward contract for 2026 is traded around NOK 0.65/kWh.

Focusing on 2026 only – ignoring i) the additional cost of a seasonal price pattern, ii) the volume variation within a month, and iii) the embedded volume option – norgespris implies a subsidy of at least (0.65-0.40)x1.25 = NOK 0.31/kWh including VAT. Average household consumption is 16,000 kWh in Norway. The subsidy is thus at least approximately NOK 5,000 per household for 2026.

Why is the Norwegian government subsidizing the electricity consumption of all households?

Since Norway introduced retail competition in the electricity market in the early 1990s, households (and small commercial customers) have mostly opted for spot price contracts (that pass-through wholesale day-ahead prices with a surcharge, as explained above) or contracts with a semi-fixed price that the supplier can change with 14 to 30 days notice. Representatives from various Norwegian authorities and regulatory bodies[1] have repeatedly over more than three decades claimed publicly that this is the cheapest and best alternative for small customers. Hence, when wholesale electricity prices across Europe skyrocketed during the autumn 2021 and winter 2022, most households were hit hard. At the peak of the price crisis, wholesale prices were 10 times or more than the normal price level. As a result, strømstøtte was introduced in December 2021 and subsequently modified repeatedly.

In 2023, the government's Electricity Price Committee (Strømprisutvalget) made a point that the authorities' recommendations of spot price contracts were not supported by facts and that it is not fair that while commercial and industrial end users have always faced efficient fixed price offers, efficient fixed price contracts had never been available to the residential sector. To avoid further political pressure for other changes (and perhaps for other political reasons), norgespris was launched a few days after the minority party stepped out of the coalition government early 2025.

What are the implications?

While there is scientific uncertainty about the electricity demand elasticity with respect to price, there is ample evidence that even from one day to another, Norwegian residential demand does vary with price changes. Other factors – like time of day and week, temperature, etc. – obviously also play a (potentially bigger) role, but the demand elasticity is clearly not zero for the entire sector.

Effectively shielding 2-3 million households from the daily, weekly, and seasonal price changes will have an impact: the extent to which households adapt to changes in availability, and thus prices, of electricity will be somewhat lower. When there is a shortage, other sectors (commercial, public, and industrial end-users in Norway, flexible producers in Norway) and market participants in neighbouring countries will accordingly have to adapt consumption and production to a greater degree. This might imply higher price volatility within the week and season compared with a situation without norgespris.

Norgespris may distort household incentives for energy efficiency investments or investments in the ability to move consumption in time (e.g. EV charging), but the direction is ambiguous and may also depend on other consequences of norgespris.

However, households, including holiday homes, represent less than one third of total Norwegian electricity consumption. The market share for industrial electricity demand is likely to increase over the years to come, and hence, the significance of residential demand will be even less.

Norgespris also has political implications. Without reasonable fixed-price contracts for households, governments struggle to prioritize efficiency over redistribution in energy and climate policy. Norgespris helps separate these roles. Tax and welfare systems handle income distribution, while energy and climate policies can focus on efficiency and effectiveness. In this setting, future discussions about interconnectors between Norway and other countries may become less intense. On the other hand, we might see weaker public support for further development of onshore wind and other measures to increase electricity supply.

What about the future?

The scheme is valid until the end of 2029, and the price level can be adjusted each year from 2027. A too generous scheme impacts the government's ability to pursue policy goals in other sectors. Thus, a potentially attractive way forward for the government is to fix the norgespris price level closer to the wholesale forward price level, and either reduce the volume limit or introduce a fixed volume that the customers must chose. While the state budget for 2026 has set aside NOK 11bn for norgespris, such changes could bring the cost for the government close to zero. These changes would also address the negative impact norgespris might have in dampening behavioural change in favour of demand response and energy efficiency.

[1] The energy regulator (NVE, RME), the Norwegian Consumer Council (Forbrukerrådet) and the government

4.4 Grid, storage and flexibility

The Norwegian power system is one of the most flexible power systems in Europe, with a large power surplus, due to the dispatchable hydropower reservoirs. However, in line with an increasing and fluctuating electricity demand and a more weather-dependent power system from integration of solar and wind, the flexibility demand grows. With an increasingly electrified society, ensuring system stability and security of supply will remain critical.

This section outlines the flexibility supplied by electricity production and storage during the hours of imbalance between consumption and production. Flexibility from price-sensitive industries, such as hydrogen production, is implemented directly in the demand curves. As highlighted by Statnett in their long-term market analysis, hydrogen production from electrolysis has potential to be an important source of flexibility in the power system (Statnett, 2025c). However, the role of hydrogen is uncertain, particularly during the next decade.

Figure 4.8 presents an annual measure of short-term system flexibility, calculated as the reduction in hourly load variability (standard deviation) of each flexibility source. The indicator reflects how much each technology smooths the net load profile over a year, relative to a system without that source. The chart displays both the short-term flexibility need (total variability to be balanced) and its provision source (contribution by different technologies such as hydropower, batteries, EV storage, and trade with other countries) in gigawatts. We predict that the short term-flexibility will increase and reach 2.7 GW in 2040.

Hydropower will remain the main source of flexibility, delivering more than 70% of the system balance support until the late 2030s. This capacity will come from both existing hydropower capacity and expansions to existing plants. The latter can be attractive for hydropower producers who can provide power in the hours where the value of flexibility is high. Such expansions will not increase the energy supply from hydropower, but the power supplied to ensure system stability. However, the need of flexibility is highest in the short term, before the demand flattens out and is saturated by mid-century. New capacity that is built out mainly to provide flexibility will therefore be most valuable to realize during the next decade. Hydropower with reservoirs has a competitive advantage in long-term and seasonal flexibility and is expected to shift away from the most short-term use cases towards providing long-term flexibility.

We predict increasing system balance support from vehicle-to-grid (V2G) solutions and Li-ion batteries. The uptake of the latter will slowly increase from 2030, before stabilizing at between 13% and 17% of the short-term flexibility supply from the mid-2040s. The short-term flexibility provided from EV storage will increase from less than 1% in 2030 to around 11% (0.27 GW) in 2040. This is a source of flexibility with no significant additional CAPEX, and therefore a cheap source of flexibility to utilize in preference to more CAPEX-intensive solutions such as pumped storage hydropower. However, for this scenario to be realized, the market mechanisms for utilizing aggregated household (EV) flexibility must be in place. Currently, flexibility aggregators in Norway have highlighted challenges with participating in the balancing markets, due both to capacity requirements from Statnett and regulatory barriers (Teknisk Ukeblad, 2025). This is despite Statnett having decreased the bid size requirements in the balancing market (mFRR) from 10 to 1 MW (Statnett, 2025d). Norway has not yet signalled any plans to implement the EU rules about independent aggregation.

In addition to increasing the flexibility capacity, efficient markets for balancing power supply and demand are important to support system stability. In line with this, several market mechanisms have been introduced, including a higher-resolution power market and balancing market integration in the Nordics. In 2025, the European intraday and day-ahead market coupling transitioned from 60- to 15-minute resolution to improve system stability in the grid. Additionally, the Nordic TSOs are harmonizing

Norway's flexibility supply will diversify

Short-term flexibility by technology (GW)

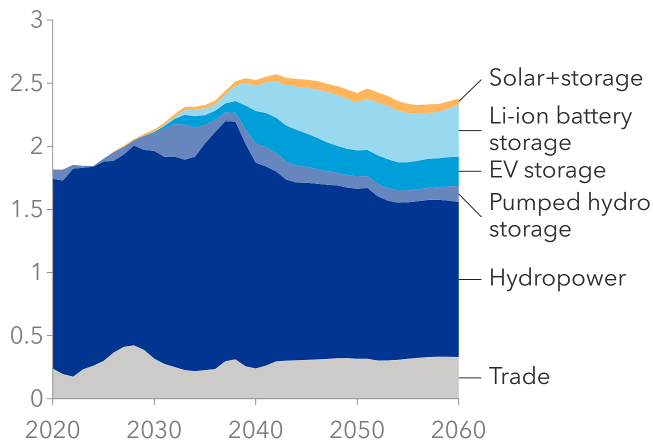


FIGURE 4.8 |

automated electricity balancing across the Nordic region (Statnett, 2025e). The Nordic Balancing Model (NBM) went live in March 2025, with the launch of a common Nordic automated mFRR Energy Activation Market (EAM). This also marked the shift from manual 60-minute balancing to automated 15-minute balancing across the Nordic region (Statnett, 2025f). The effects of these implementations are yet to be demonstrated and are not included in the model results.

4.4.1 Grids

Historically, Norway has had abundant grid capacity, due to large investments during the late 20th century to facilitate supply from the hydropower buildouts. However, in recent years, high demand for grid access and limited grid capacity in many regions have led to long queues for grid connections. In 2025, the National Audit Office of Norway concluded that the current grid is an obstacle to industrial developments and the transition towards a low-emission society, and recommended a more holistic and forward-looking approach to grid development (Riksrevisjonen, 2025). This is in line with Statnett's long-term strategy for Norway's power system to focus, among other things, on the need for efficient utilization of existing grid and to prioritize development of transport corridors where the demand growth is known (Statnett, 2025c).

Over the past year, the Norwegian government has introduced several initiatives to address grid capacity challenges, in line with its action plan for faster grid development and improved utilization of the existing grid (Norwegian Ministry of Energy, 2023). Amongst others, measures for faster licensing processes and new principles for organizing the grid capacity queue were introduced in 2025. The latter was incorporated into regulation to ensure that capacity is allocated to realistic projects, by requiring projects to demonstrate their realism (maturity) to be able to reserve capacity or enter the capacity queue (Regjeringen, 2024b). The regulatory updates also allow network operators to withdraw unused reserved capacity. There are also ongoing discussions about whether political prioritizations should be made to ensure priority access to grid capacity for certain industries, such as defence.

Even though there are long queues for capacity, many industry projects spend several years realizing the utilization of their installed capacity. Additionally, large parts of the reserved capacity in the transmission grid are allocated to sectors that are experiencing delays and uncertainty. As of November 2025, around 22% of the reserved capacity in Statnett's transmission grid is allocated to hydrogen projects and around 50% to data centres (Statnett, 2025a). The likely delay or even cancellation of a share of these projects, as well as a slow ramp-up of utilization of already installed capacity, suggests a smaller gap between grid capacity development and industry buildout than is reflected in current public discussions.

The current length of the transmission lines operated by Statnett is about 12,000 km (Figure 4.9). Half of the network is at 300 kV and a third is at 420 kV. Statnett plans to

The grid will expand and shift to a 420 kV transmission grid

Length of power lines (km)

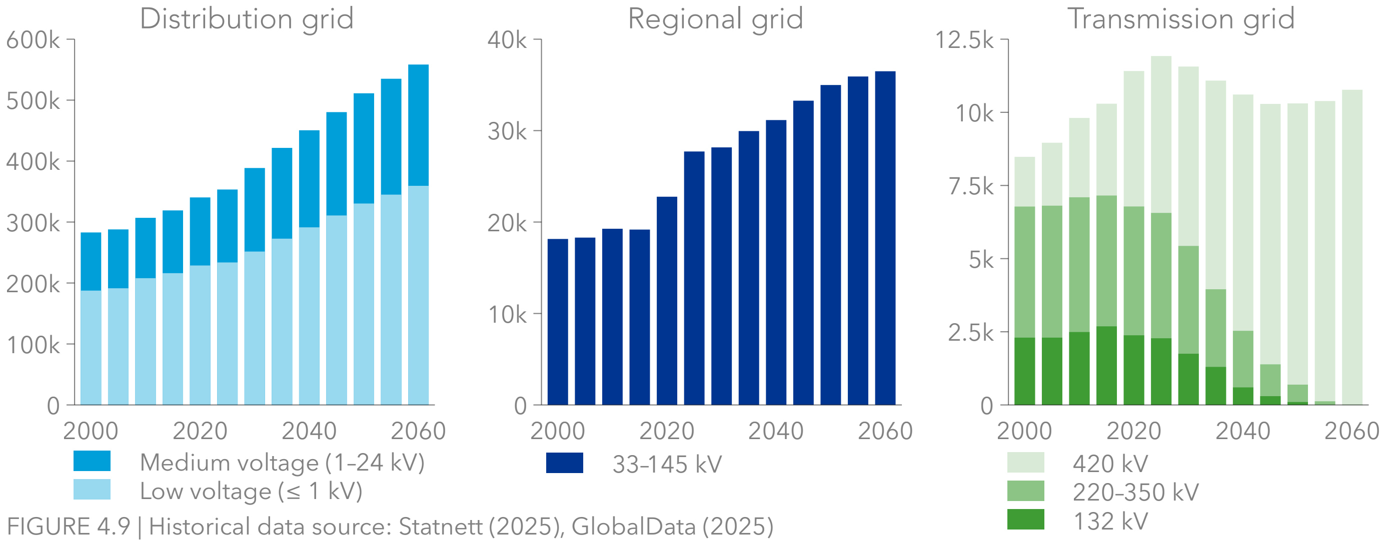


FIGURE 4.9 | Historical data source: Statnett (2025), GlobalData (2025)

transition towards a fully 420 kV transmission grid during the next two decades, both by establishing new capacity, and by replacing 300 kV grid approaching end of life. This will significantly increase the power flow capacity and, according to Statnett, facilitate a doubling of consumption and production by 2050 (Statnett, 2025b). As a result of increased demand from new consumption and production, Norway's regional grid is set to increase by another 32% by 2060, reaching shy of 40,000 km. The efficiency brought by upgrades will keep the transmission grid length flat stable around 10,000 to 11,000 km while increasing capacity. The distribution grid will also grow by 58% in the same period as end-use load continues to grow.

In addition to new grid investments, efficient utilization of existing infrastructure can potentially release additional grid capacity. Sector initiatives, such as MaksGrid, a Pilot-E project that will investigate solutions to release up to 25% of the existing grid capacity, will be important to understand future solutions and opportunities (MaksGrid, 2025).

4.4.2 Capacity developments

Figure 4.10 presents the forecast renewable capacity buildouts, both grid-connected and behind the meter or off-grid. Hydropower will continue as the backbone of the power system, with some new hydropower additions added until early 2040. From 2040, the largest capacity buildouts will be onshore wind, favoured over offshore wind due to a lower LCOE. The solar PV capacity will steadily increase to dominate the renewable buildouts from the late 2050s. We foresee that challenges related to local acceptance will be less relevant. Additionally, capture prices must be high enough to trigger investment in new capacity, which is a challenge for variable renewable energy sources. The impact of hydropower can mitigate the largest price fluctuations and thereby contribute to higher capture prices for solar PV and wind projects, compared to markets with less flexible generation capacity.

The LCOE of offshore wind is 40% to 50% higher than for onshore wind, and the capacity development is much more dependent on subsidies. Norway has political ambitions to allocate areas for 30 GW offshore wind production by 2040, whereas 5 GW of this capacity is to be installed by 2030. We therefore predict capacity additions from fixed and floating offshore wind projects from 2032 and 2034, respectively, with an assumed governmental support for these projects. However, our projections for offshore wind capacity developments are less ambitious than last year's report. Experiences from Norway's first offshore wind auctions, with the results from Utsira Nord still being uncertain, have resulted in public debates on whether Norway should keep subsidizing the industry. Until the technology is standardized and the LCOE is reduced, there is inherent uncertainty related to the development of offshore wind capacity.

We expect Norway's power system will maintain a strong adequacy margin through 2060 (Figure 4.11). In other words, we project the country will have enough dispatchable capacity – power that can be produced

Onshore wind and solar PV will dominate capacity additions from 2040

Capacity additions becoming operational (including off-grid) (GW/yr)

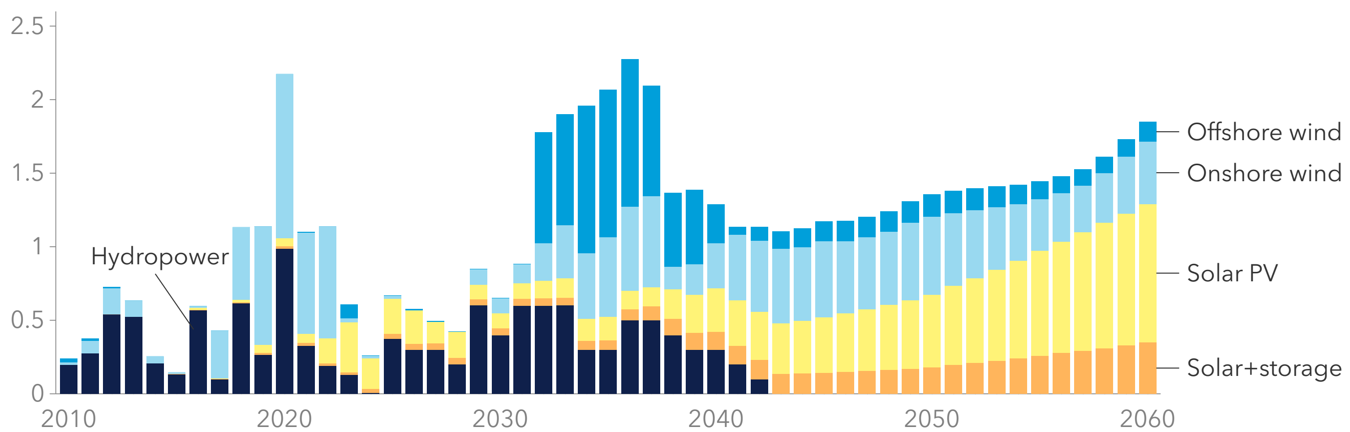


FIGURE 4.10 | Historical data source: GlobalData (2025)

when it is needed – to meet electricity demand even during peak periods. Hydropower dominates Norway's generation mix and provides the bulk of dispatchable capacity. Unlike solar or wind, hydropower plants can adjust output within minutes, making them ideal for balancing the system during hours of high demand or low renewable output elsewhere. Thermal generation remains minor, and the system relies only marginally on fossil-based backup. The green lines in Figure 4.11 show peak residual load – the highest hourly demand that must be met by dispatchable sources, such as hydropower, after subtracting the output from variable renewables (solar and wind). The dotted version includes reductions from electricity trade, hydrogen production flexibility and storage operation. Both stay well below the total available capacity from hydropower and thermal sources, indicating that Norway has ample supply even in extreme situations. The blue line, showing average load, highlights how far typical demand remains from these peaks.

Norway's situation is unique in Europe. Its vast hydro-power reservoirs act like a giant battery, allowing stored water to be released when needed. This inherent flexibility means the system can handle large swings in demand without new capacity support mechanisms such as capacity charges – payments used in other markets to keep backup plants available. Norwegian hydropower provides both energy and reserve capacity at low cost, so there is little need for additional incentives to ensure adequacy.

4.4.3 Electricity prices

While not implemented in the ETO model, Norway has five bidding zones (NO1-NO5). Regional supply and demand differences in Norway have resulted in large electricity price deviations between these bidding zones, since 2022. The power balance has been very different in the south and north of Norway, with a power surplus in the latter. Supported by the interconnection to surplus areas in Sweden, this has led to low electricity prices. Several parts of Southern Norway have experienced power deficits and more exposure to European electricity prices. The current production surplus in Northern Norway will be reduced due to, among other reasons, the electrification of Melkøya and large industry projects. In line with reduced differences in power balance, as well as plans for increasing the transmission capacity between Northern and Southern Norway, Statnett projects that the average electricity prices are likely to converge from 2040 (Statnett, 2025c).

While we do not model the bidding zones and the grid bottlenecks, our hourly power dispatch model is still able to give indications about electricity price trends depending on demand supply balance. As Norway becomes a temporary net importer in the 2030s, the average wholesale electricity price will rise. From the 2040s onwards, we also forecast that the expansion of wind and storage capacity will lead to a clear reduction in the wholesale price levels.

Norway will have enough reliable power capacity even at demand peaks

Reliable capacity vs peak residual load (GW)

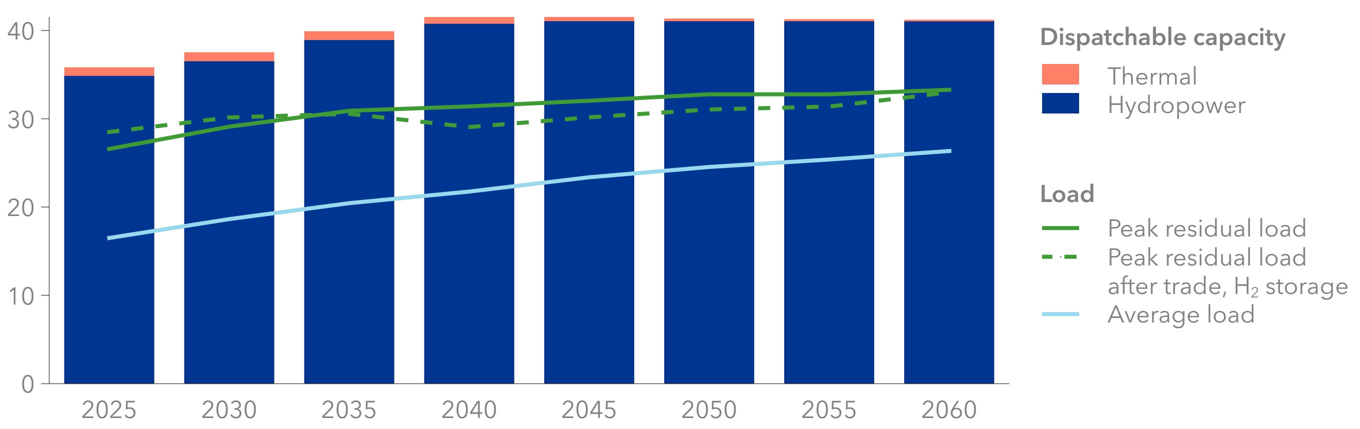


FIGURE 4.11 | Data source: DNV simulations.

Figure 4.12 shows the projected residential end-use electricity price in Norway, including the government's norgespris fixed-price contract. Norgespris shields households from swings in wholesale markets, so the price paid by consumers sits below the underlying market level. We estimate the annual fiscal cost of keeping this arrangement in place to be at about NOK 24bn until wholesale prices begin to fall in the late 2030s.

Taxes and levies form a large and steady share of household bills. Value added tax is charged at 25%, although households in Northern Norway are exempt. This exemption lowers the effective national average to roughly 22%. In addition to VAT, households have long paid the electricity consumption tax (elavgift) and the Enova levy (Enova-avgiften). Elavgift dates back to 1951, while the Enova levy was introduced in 2001 to fund energy-efficiency and innovation programmes. In our projections, we assume elavgift will be removed from household bills once norgespris is introduced.

The taxes and levies category in Figure 4.12 also includes the household electricity support scheme (strømstøtte) introduced in 2022. The support was large enough in 2022 and 2023 to outweigh VAT, elavgift, and the Enova levy, bringing the net tax contribution below zero in both years.

Network charges (nettleie) rise steadily across our Outlook. This reflects higher investment needs in wind power connections, upgrade of transmission grid to 420 kV lines and wider grid reinforcement, which increase the cost base for distribution and transmission companies.

On the industrial price side, the largest energy-intensive industries often rely on long-term power purchase agreements (PPAs) or direct supply contracts. These give more stable and often lower prices than the medium-sized group. However, electricity prices will generally rise for industrial consumers into the 2030s following the wholesale price as imports increase and then settle as new capacity enters the system. Network charges have constituted 10-25% of the final price, varying mostly due to variations in the wholesale price. They will stay in that range until 2040s when wholesale prices start to decline and network charges become 30-35% of the end-use industrial electricity price. Industrial customers are formally subject to 25% VAT, but most firms deduct it against the VAT they charge on their own sales, so the effective rate is close to zero. The remaining non-deductible elements are the reduced electricity consumption tax (elavgift) and the Enova levy, which together amount to about 1.6 øre/kWh.

Norgespris shields households from volatility

Residential electricity price (øre/kWh)

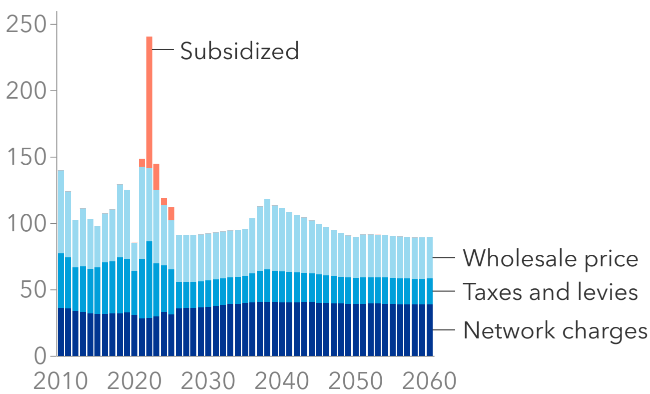


FIGURE 4.12 | Historical data source: SSB (2025), Eurostat (2025), IEA (2024)

4.5 Power sources

4.5.1 Hydropower

Newbuilding, improved efficiencies through upgrades, and increased precipitation contribute to an expected increase in generation from the actual 138 TWh in 2024 to 149 TWh for a normal year in 2060 (Figure 4.7.). Our results here are relatively close to the NVE forecast of a 10 TWh increase to 2050 (NVE, 2025e).

Although the potential for new hydropower generation in Norway is limited, the value of existing resources can be increased. The main opportunity lies in leveraging the storage capabilities of hydropower reservoirs by expanding installed capacity. Plants built in the mid-20th century for baseload supply are now being upgraded to add capacity to produce more during periods of high demand and prices, rather than running continuously. This means that power plants can better optimize their production based on market signals to increase the revenue of the plant, even though the total annual generation remains the same. In some upgrade projects, there are profitable opportunities to extend the capture area for inflow or reduce water losses in the watercourse, thereby increasing expected energy production too. Enhanced flexibility also strengthens the overall power system, helping to reduce price volatility and the occurrence of negative prices. Currently, 274 MW of hydropower upgrades and expansion projects are under construction, 510 MW of expansion projects have either received approval or are exempt from the application process, and 2,303 MW are in the application phase or under consideration (NVE, 2025f). While the capacity upgrades do not add new energy sources, they still contribute to increased generation by better utilizing the inflow potential. We see 6 GW of added hydropower capacity between 2025 and 2040, ending at 41 TW in 2040 and remaining at this level for the rest of the period. High investment costs and temporary income stops because of shutdowns during upgrades challenge profitability of such projects. Also, as increased flexibility tends to reduce the power price volatility, the arbitrage income potential decreases the more capacity upgrades are completed, further limiting capacity expansion in the long run.

Pumped hydro will experience increased competition from battery storage, also in Norway. There are a few pumped hydro projects in the pipeline in Norway (NVE,2025g). The largest is a project with several locations (altogether 540 MW). It is going through the approval process now and could be online from 2035. The next one, when it comes to size (48 MW), is part of a bigger hydropower development project. It has an updated approval to be online within five years, and the owner took an investment decision in November 2025.

In the longer run, we find increasing competition with battery storage (DNV,2025g) and we believe the realization of pumped hydro will be constrained over time. This is also visible in our model where the results show that the levelized cost for achieved flexibility is twice as high for pumped hydro as for battery storage from 2035. Pumped hydro also competes with plain capacity increases.

That said, we find that there will be financially attractive cases in Norway's existing hydropower system that can be implemented as they fit with upgrades of existing system designs. These will be smaller projects that add wanted flexibility, even with their lower efficiency, but they will not make a significant difference in electricity generation itself.

New regulations passed this year allow for hydropower development in protected water courses if the societal benefits (e.g. flood control) are significant and the environmental consequences acceptable (Hjort, 2025). However, we do not expect a major increase in new hydropower buildout. Most of Norway's hydropower potential in these areas has already been utilized, leaving few remaining possibilities for expansion. Moreover, nature conservation remains a strong societal priority, and the threshold for what is considered an acceptable environmental impact in protected areas is high. The remaining potential for hydropower is therefore both environmentally disputed and more expensive to realize. As a consequence, we see strong growth in other renewables instead of greater hydropower buildout.

Inflow to hydropower stations varies a lot from year to year, historically with a potential between 95 and 170 TWh, with a normal year being in the middle of this range. Results from 2024 (Lutz et al., 2024) describe a future situation with increased expected precipitation for a normal year and thereby increasing the potential for electricity generation. The study, based on Norwegian historic data (two data sets from 1961 to 2020) shows a 7% increase over 35 years; if prolonged, this would mean an additional 10TWh on top of today's normal year by 2060, but there is a high uncertainty around prolonging this increase. A recent thesis (Selstad, 2025) supports the continuation of the trend identified by Lutz. The recent scenario from NVE (NVE, 2025e) includes a 3 TWh increase by 2050 due to increased water inflow to the reservoirs. We have not explicitly modelled precipitation increase in our model. Changes in the precipitation patterns also include reduced snow (more rain) and intensified extremes. Both challenge reservoir management and the possibility to exploit the full inflow, especially for run-of-river installations that cannot delay the water flow.

4.5.2 Wind

We expect wind energy to play an increasingly vital role in Norway's energy transition, with installed capacity forecasted to quadruple to 21 GW by 2060. While today's 5 GW is almost entirely onshore, and offshore wind is set to grow significantly, onshore wind will continue to represent the largest share of installed capacity towards 2060. However, in terms of electricity generation, we expect the contribution from onshore and offshore wind to be evenly split by 2060, reflecting the higher output per installed megawatt from offshore installations.

Wind energy is emerging as a key solution to meet Norway's rising electricity demand, which we project to grow by 55% by 2060. Although Norway's electricity mix is already predominantly renewable, dominated by hydropower, further expansion of hydropower is limited and solar PV uptake is constrained by meagre and highly seasonal irradiation. Wind power, however, benefits from strong and consistent wind conditions along Norway's long, inhabited and grid-connected coastline, making it the most promising candidate to fill the emerging supply gap.

Onshore wind is regaining momentum

After a hiatus in new onshore wind developments since 2019, we expect onshore wind to regain momentum in the coming decades, with installed capacity forecast to reach 13 GW by 2060 – almost tripling from today's levels. Despite its low cost and technological maturity, development has been hindered by strong local opposition.

The importance of local acceptance has been significantly reinforced following amendments to the *Planning and Buildings Act* and the *Energy Act*, which stipulates that no concession for onshore wind can be granted until the project has been clarified in the municipalities zoning plan. This effectively grants municipalities veto rights, increasing the risk of delays and uncertainties. Many municipalities lack the resources or expertise to evaluate such projects, and some have even taken principled stances against wind development without fully assessing the trade-offs.

While these legislative changes have introduced new challenges for wind power development in Norway, strengthened local control presents opportunities to rebuild local support. Since 2022, host municipalities have received a production tax, which increased to 2.36 øre/kWh in 2025 (NVE, 2025h). Ownership structures are also evolving: in 2024, 42% of wind power was publicly owned, with municipalities holding 22% – a notable increase from just 10% in 2019 (NVE, 2025i). These incentives, combined with potential revenue from property tax and local employment, in addition to better collaboration between developers and municipalities, may help rebuild trust and revive support for onshore wind.

As of early 2025, no new turbines have been given concession since 2019. Yet around 40 TWh of wind projects remain under review by NVE. Of these, 11 totalling 16.5 TWh have been prioritized as part of the *Kraft- og industriløftet* initiative in Finnmark (NVE, 2025g). Despite significant capacity in the pipeline, historical trends suggest that only one-third of such projects receive final approval.

Despite recent challenges, onshore wind remains one of the most cost-effective and technologically mature forms of renewable energy in Norway. Its low levelized cost of energy (LCOE), relatively short construction timelines, and ability to operate profitably without subsidies make it essential in meeting the country's growing electricity demand.

Offshore wind – slow but growing

Offshore wind is expected to play a central role in Norway's future electricity mix. The country's geography is particularly suited for offshore wind, with vast maritime areas and strong coastal winds. The deep waters off the west coast favour floating wind, which, although currently expensive and immature, will likely become more competitive over time. Public acceptance for offshore wind is also higher than that for onshore, partly due to fewer land-use conflicts and visual concerns.

From 0.1 GW installed capacity today, we expect offshore wind will play an increasingly prominent role. By 2060, we forecast installed offshore wind capacity to reach 8 GW, more fixed than floating, accounting for half of the country's total wind power generation.

By 2040, the Norwegian government aims to allocate areas with the potential of 30 GW offshore wind. Today, Hywind Tampen is the only operational offshore wind park in Norway, with a capacity of 94.6 MW (Equinor, 2025a). The demonstration project GoliatVIND is in the process of getting concession from NVE. GoliatVIND (operational by 2028/29) expects yearly production of 0.3 TWh (ZERO, 2025).

The amount of offshore wind that can be built in the near future depends on the Sørlige Nordsjø II and Utsira Nord projects. The fixed offshore wind farm Sørlige Nordsjø II can, according to Ventyr, be operational by 2031, with a planned capacity of 1.5 GW (Ventyr, 2025). There are greater uncertainties regarding the realization of Utsira Nord, primarily due to high costs associated with floating wind. However, following the auction earlier this year, two consortia have submitted bids, and the development is moving forward. Only one of the three areas will receive government funding, which adds to the complexity and risk. Each area at Utsira Nord will have a maximum capacity of 0.5 GW (Energidepartementet, 2025a). With the realization of the Sørlige Nordsjø II and Utsira Nord, capacity additions of 3.5 GW can be expected by 2035.

Substantial public funding is seen as essential to enable large-scale offshore wind development in Norway. The government has committed NOK 23bn through a contract of difference (CfD) to Sørlige Nordjø II, and NOK 35bn through a direct investment grant to Utsira Nord (Energidepartementet, 2024; Energidepartementet, 2025b). Such long-term investments are regarded as necessary to establish a competitive offshore wind industry and to leverage Norway's offshore expertise. Offshore wind is also seen as one of the more available technologies for Norway to increase its electricity production in the coming decade.

Several barriers hinder the development of offshore wind. High costs (associated with materials, labour, specialized equipment, and high cost of capital) and long lead times make projects financially risky, especially in a market where installed capacity is still limited and the supply chains are not fully established. Although Norway has a nearly complete domestic value chain, there are some bottlenecks, particularly in cable manufacturing, that pose serious challenges. With many suppliers fully booked for the next five to seven years, delays and cost overruns are possible (Energy Global, 2025). These issues are compounded by the fact that developers in Norway must finance and build grid infrastructure themselves, unlike in countries such as the UK, where such costs are reimbursed.

Access to area is another significant barrier. While offshore wind avoids many of the land-use conflicts associated with onshore wind, it must still compete for area with other marine activities such as fishing, shipping, and environmental preservation. This is especially relevant for bottom-fixed offshore wind, which occupies shallow seabed areas. Floating offshore wind has an advantage over bottom-fixed, since Norway has large areas with deeper water and the technology is less invasive to life on the seabed. There could also be synergies between offshore wind and environmental preservation, as pressure from fishing on the ecosystem will be reduced within wind farms. Spatial competition and co-existence opportunities are discussed in further detail in our *North Sea Forecast* (DNV, 2025e).

We expect large cost reductions for offshore wind in Norway over the coming decades due to learning effects and technological advancements. Over the last decade, the global average LCOE for fixed offshore wind has fallen 44%, and we expect similar reductions in Norway as supply chains strengthen and larger projects are commissioned. In 2024, the estimated LCOE for floating offshore wind was USD 285 per MWh – more than double that of fixed offshore wind and four times higher than onshore wind (Figure 4.13). The higher balance-of-plant costs of floating offshore wind imply that even in 2050, its LCOE will be 28% higher than that of fixed offshore wind. However, long-term projections are optimistic. By 2060, the LCOE for fixed and floating offshore wind could see a 50% and 74% reduction, respectively. Despite this, both technologies are likely to require continued subsidies until economies of scale are achieved and the market becomes more established.

> We expect offshore wind to play a central role in Norway's future electricity mix.

Cost of floating offshore wind to fall sharply

Levelized cost of wind electricity (USD/MWh)

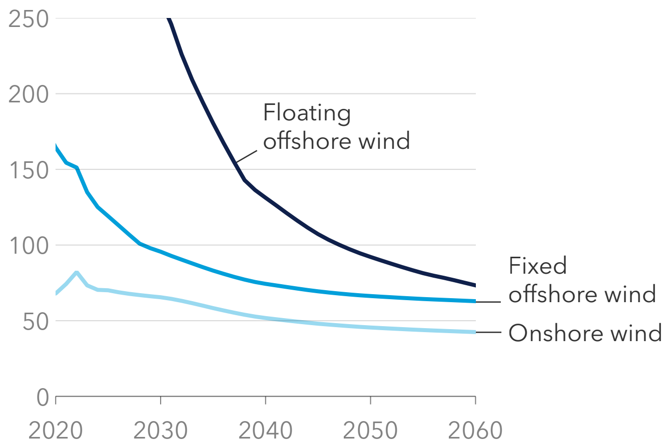


FIGURE 4.13 | Historical data source: GlobalData (2025), DNV analysis

4.5.3 Solar PV

After a record-breaking year for solar capacity additions in 2023, the momentum in Norway's solar sector has stagnated. From just over 1 GW installed capacity in 2024, we foresee an ambitious 17-fold growth to almost 18 GW in 2060 (Figure 4.14). Initially, most capacity additions will be stand-alone solar PV. However, as the energy system becomes more variable and demand patterns shift, solar co-located with storage is expected to play a more notable role.

Norway's solar power sector is dominated by small-scale installations, with 82% of the country's 34,263 registered systems under 20 kW, typically mounted on rooftops or building facades (NVE, 2025j). This substantial market primarily serves as a source of supplementary power for owners – helping them reduce both electricity and grid-related costs. Yet, solar PV mounted on roofs only contributes to around a third of Norway's total solar production capacity (Karlsen, 2025). Larger systems, particularly those over 100 kW, have seen the greatest relative growth in recent years, and this is also where we foresee the most growth looking ahead.

Regardless of the positive trajectory, several barriers continue to hinder the pace of solar deployment. Despite the government's target of 8 TWh of solar power by 2030 (Regjeringen, 2024a), we do not forecast this level of generation happening until late 2040. One of the key barriers to further growth is low profitability. Household systems already have high unit costs (USD/kWh) due to their small scale, and recent policy measures, such as electricity subsidies and norgespris, have increased the uncertainty of the financial incentives for investment in solar PV.

Utility-scale solar can be economically viable but typically requires installations of considerable capacity to be so – a large flat area without rocks, maximum solar irradiation, and close proximity to a transformer with available capacity. Such locations are scarce in Norway. Many proposed projects require large green areas such as forest or farmland, and thus encounter public pushback related to land use and environmental impact. While grey areas such as industrial zones, parking lots, and roadside land offer more socially acceptable alternatives, their total capacity is limited and may be reserved for other use. Estimates suggest that grey areas could support up to 5 TWh of annual solar production, but costs are generally higher than for bigger developments in forests and agricultural land (DNV et al., 2024).

Solar co-located with storage will play a smaller role in Norway's solar future. Although storage adds to the initial investment cost, it enables better utilization of an otherwise costly network connection. While solar PV co-located with storage allows for electricity to be stored and sold during price peaks, this only offers financial gain for the individual investor, but the broader socio-economic benefits remain limited compared to stand-alone PV installations. As of 2024, 11% of Norway's installed solar capacity includes storage. By 2060, this share is expected to grow to 21%,

Solar capacity to grow 17-fold by 2060

Installed capacity (GW)

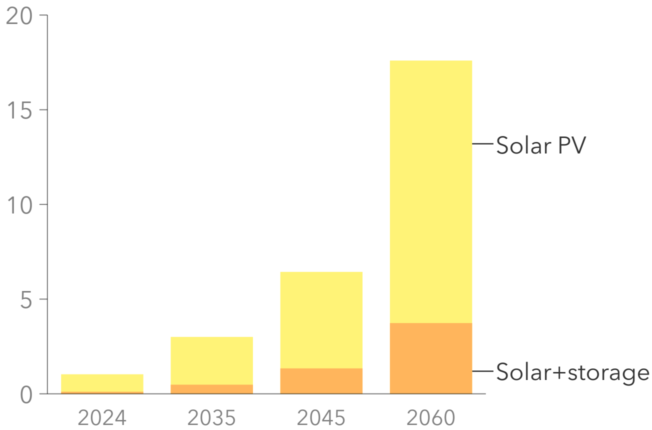


FIGURE 4.14 | Includes behind-the-meter and dedicated capacity to hydrogen.

reflecting the increasing importance of dispatchable solar power in an energy system with greater variability.

Globally, solar PV is among the fastest-growing energy sources, driven by falling costs of modules as production moved to China. Today, solar PV is the least expensive form of new power capacity to build. However, due to lower solar irradiance, the same solar panels produce less electricity in Norway than in southern countries. Coupled with lower electricity prices, this makes utility-scale solar less profitable in Norway. Solar PV is also the quickest to build, with most utility plants able to come online within a year of the final investment decision (FID). In Norway, the LCOE has declined 70% over the past 15 years. While future cost reductions may be slower, we expect them to continue, making solar increasingly competitive. Future cost reductions will come from installation efficiencies and learning curves in other components, such as inverters.

4.5.4 Nuclear

Rising geopolitical tensions are sharpening the focus on national and energy security, reigniting interest in nuclear power. Surging electricity demand from AI-driven data centres, transport, and decarbonization further strengthens the case. Globally, we find that nuclear generation grows 150% towards 2060. However, much of the growth is in China. For Europe and North America, we see an ageing nuclear fleet in need of replacement during the forecast period, with an increased focus on small modular reactors (SMR). Energy security concerns, increasing demand for decarbonized electricity, and potential lower costs and project risks are driving interest and investment in SMR. However, much of these stated benefits of nuclear, particularly SMRs, are not directly relevant for Norway as there are no competitive advantages compared with countries with existing nuclear fleets. Additionally, unlike most countries, Norway does not need to rely on nuclear for the dispatchable power necessary to support variable renewables thanks to its large fleet of hydropower with reservoirs (representing approximately half of Europe's hydropower reservoir capacity). Norway also still has unexploited renewable energy resources, while many other nations find themselves without any reasonable alternative to nuclear.

Based on our global nuclear technology model, we include the expected nuclear technology developments and cost reductions based on capacity additions globally. Assuming that Norway will only consider building SMRs, we use results based on our main ETO Model for Europe (DNV, 2025a) and add a cost premium for CAPEX (20%) and OPEX (10%) in Norway, based on it not having any experience with commercial nuclear plants, including regulations. The conclusion is that we do not see any nuclear additions happening in Norway by 2060.

Nuclear power is unlikely to be competitive in Norway and thus will not play a role in the power mix. SMRs, currently pre-commercial, are likely to be in operation in Europe in the late 2030s, but even if they are deployed, our conclusion is unchanged. The core reason is the strong complementarity between wind (especially offshore) and flexible hydropower. By the late 2030s, Norway is likely to face an electricity surplus, with only limited need for new firm capacity unless there is new policy prioritizing large-scale exports, or power-to-hydrogen.

In a merit-order system, wind and solar, with near-zero marginal costs, displace higher-cost generation whenever resources are available, leaving nuclear to compete for residual load against low-cost wind or imported solar and potentially failing to recover even operating costs. During periods of low wind and high demand, hydro-power can provide balancing at lower cost than nuclear. In short, variable renewables set the operating envelope for any nuclear option in Norway's grid (Reed, 2024), which is also our finding based on the model forecast. Electricity from nuclear power has limited potential for export, as neighbouring countries (e.g. Sweden) will likely be able to produce nuclear power at the same or even lower costs, given their existing experience with nuclear power.

In our 2025 main *Energy Transition Outlook* (DNV, 2025a) and our *2025 Maritime Forecast* (DNV, 2025c), we discuss the potential for nuclear shipping. On ships, nuclear SMR technology does not have to compete with lower-cost renewables but more expensive biofuel or hydrogen derivatives. We find that nuclear shipping might scale in the 2040s, but as most ships calling at Norwegian ports have relatively moderate engine sizes, they are not the most likely to deploy nuclear for propulsion, and thus we have not included nuclear in Norway's domestic shipping fuel mix.

Nuclear power is unlikely to be competitive in Norway, and thus will not play a role in the power mix.

Managing risk in the high north – energy strategy amid geopolitical change

Northern Norway stands at a strategic crossroads where geopolitics, national security, and industrialization converge. With increased geopolitical tensions, the Arctic has gained in importance, and the region faces both immense opportunities and complex new risks. In 2025, the government's new High North strategy *Norge i Nord – Nordområdepolitikken i en ny virkelighet* makes this explicit, framing the High North as Norway's key strategic focus area and tying settlement, business activity, and preparedness directly to national security (Regjeringen.no, 2025). NATO is deepening its presence and Nordic cooperation is intensifying, while new Arctic sea routes are opening access to the Atlantic in new directions. In this setting, a 'total defence' approach – integrating civilian and military preparedness – is essential given sparse populations, harsh climate and vast distances. Drawing on the Arctic's existing strengths in oil and gas, minerals, and relatively low-cost power is a prerequisite for sustaining an enduring Norwegian presence in the High North.

Within this broader security context, the energy system becomes a critical enabler of both deterrence and development. Norway is a long country with a highly decentralized power supply and extensive emergency-preparedness experience from operating through severe weather conditions. Increasingly, however, threats to the sector come from other directions: sabotage, cyber attacks, and hybrid operations. A recent SINTEF–NTNU report on energy security characterizes the energy system as the 'nervous system' of society and calls for upgraded preparedness, strategic reserves, and closer integration between different parts of the energy system to improve robustness (SINTEF, 2025). This makes it more important than before for the power sector's own preparedness work to go hand in hand with broader national and allied resilience efforts. These are no longer merely sector-specific threats to the power industry, but general vulnerabilities that affect large parts of society as everything becomes more electric.

One of the most pressing challenges in the High North is therefore the capacity and resilience of the power grid. Northern Norway's vast renewable energy resources offer a clean and relatively stable energy base, but the grid infrastructure is relatively old and weak, reflecting low population density and huge distances. The network is less meshed than in densely populated regions, and during peak periods there is little if any spare capacity beyond what is required to meet the N-1 criterion (withstanding the loss of one major component). As a consequence, the current network is not yet fully equipped to support potential new demand. The emergence of energy-intensive industries, including data centres, and the much-needed decarbonization of transport, fisheries and local industry require significant upgrades to transmission, local grids, storage, and hydropower flexibility. Without these improvements, the region risks bottlenecks that could stall economic growth and compromise energy security.

The new High North strategy explicitly recognizes this. The 'Power and Industry Promise' (*Kraft- og Industriløftet*) calls on Statnett to prioritize grid development in the north, with particular emphasis on Finnmark, and to ensure that geopolitical considerations are weighted in assessments of new grid and production capacity (Østhagen, 2025) As an early milestone, Statnett

has been granted a concession for a new 420 kV line from Skaidi to Lebesby, together with a new transformer station in Lebesby. Security of supply was particularly emphasized in this concession assessment, signalling that grid investments in Finnmark are now also understood as security policy measures, not just regional development tools. Statnett (as TSO) and the major DSOs are planning further reinforcements, but uncertainty about future demand and the timing of new industry still hampers the speed of decision-making and implementation.

While many of the large grid projects will only be realized over longer time horizons, the key actors must also identify and co-ordinate short-term solutions. The electricity system is relatively robust against 'normal' incidents caused by bad weather, but preparedness for deliberate or complex incidents is still evolving. Following the SINTEF–NTNU recommendations, faster gains in resilience can come from strengthening contingency planning, clarifying responsibilities, improving access to spare parts and expertise, and exploiting integrated solutions across electricity, heating and backup generation (Tomasgard et al., 2025). Through strategic and operational collaboration between Statnett, DSOs, large consumers, and authorities, there is scope both to enhance system resilience quickly and to connect new customers ahead of full grid buildout, provided that risk is transparently assessed and managed.

Collaboration is thus the cornerstone of success in Northern Norway. Regional authorities, industry leaders, research institutions and international partners must work together to align energy and grid development with the strategic goals set out in *Norge i Nord*. This includes cross-border cooperation within NATO and the Nordic region, joint investments in energy, and transport corridors.

Northern Norway can become a hub for green industrialization and strategic defence. Realizing this potential, however, depends on addressing power-grid limitations, strengthening total-defence capabilities, and fostering collaboration across sectors and borders. With the right operational and strategic partnerships, the region can turn geopolitical pressure into an opportunity for resilience, innovation, and long-term prosperity – for both the High North and Norway as a whole.

Hellesylt Hydrogen Hub – a Norwegian Hydrogen production facility for green hydrogen, and also a refuelling station. Photo: Kristin Støylen

4.6 Hydrogen

Hydrogen in Norway has traditionally been used as an industrial feedstock, particularly in refining processes, ammonia production, and methanol production. In the coming decades, low-emission hydrogen will be increasingly used as an energy carrier, either in its pure form or through derivatives such as ammonia, e-fuels, or other synthetic fuels.

Hydrogen is usually produced either through the electrolytic breakdown of water into hydrogen and oxygen or via steam methane reforming (SMR) of natural gas. The latter is currently the preferred option due to the existing SMR infrastructure. With increasing carbon prices, we expect hydrogen from SMR to be gradually decarbonized with CCS, along with the uptake of renewable hydrogen produced through electrolysis.

High costs are currently limiting the growth in renewable and low-carbon hydrogen, and we expect short-term demand to arise from regulatory mandates and subsidies. However, we forecast renewable hydrogen production to grow in the coming years, driven by improvements in electrolysis technology, falling production costs, and gradually increasing market demand. While we expect the initial growth in electrolysis-based hydrogen to be modest, demand and production will likely accelerate after 2040 as electricity prices decline. We anticipate renewable hydrogen will meet all new demand for hydrogen as an energy carrier and an increasing share of feedstock needs for derivatives production. Concurrently, we also project low-carbon hydrogen produced through SMR with CCS to gain momentum in the late 2030s, primarily serving feedstock applications such as ammonia production. Together, our analysis indicates that renewable and low-carbon hydrogen will account for 32% of total hydrogen supply by 2040, rising to almost 75% by 2060 (Figure 4.15).

This year, our hydrogen production forecast is significantly reduced compared to last year, from 2.9 to 0.5 MtH_2/yr in 2050. This adjustment reflects major hydrogen pipeline plans from Norway to Germany by Shell and Equinor being shelved due to market challenges (Reuters, 2024; SPGlobal, 2024). While in the previous years we assumed that large volumes of hydrogen produced in Norway, especially low-carbon hydrogen from natural gas, would be exported by pipeline to Europe, this forecast only includes domestic production to cover domestic demand. Other factors driving down the production forecast are more modest growth in demand for hydrogen as an energy carrier, both in manufacturing and transport, and some ship import of hydrogen derivatives later in the forecast period.

Within hydrogen project development in Norway, we see that both renewable and low-carbon projects are being delayed, put on hold, and cancelled due to high costs and lack of offtakers. This is particularly the case for large-scale projects oriented toward low-carbon hydrogen exports. However, some smaller or medium-scale electrolysis-based projects targeting local offtakers are moving forward and reaching FID, with funding support from Enova and the European Hydrogen Bank. Five projects targeting maritime offtakers, three from GreenH and two from Hydrogen Solutions, were awarded a total of NOK 777m from Enova in November 2024. In May 2025, three more hydrogen projects from Norway – developed by Norwegian Hydrogen, Gen2Energy, and GreenH – were awarded a total of EUR 97m from the European Hydrogen Bank to supply renewable hydrogen to the maritime sector. GreenH Bodø will supply the Torghatten Nord ferries Bodø-Moskenes with compressed hydrogen with a planned startup by the end of 2026 (NRK, 2025).

Despite these setbacks, hydrogen produced from natural gas with CCS is gaining broader acceptance across Europe, as evidenced by newly adopted regulations defining low-carbon hydrogen. Particularly in light of the challenges in scaling up electrolytic hydrogen production, this growing support may indicate that low-carbon hydrogen and ammonia can play a niche role in the energy mix for decades to come for sectors that are hard or impossible to electrify.

Renewable and low-carbon hydrogen will account for 75% of total hydrogen supply by 2060

Norway hydrogen production by production route (MtH_2/yr)

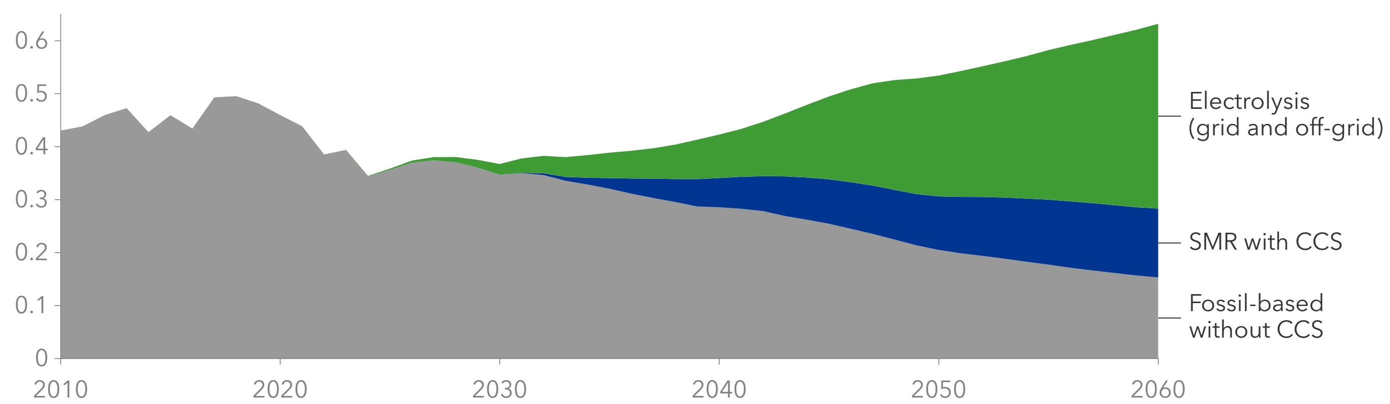


FIGURE 4.15 | Historical data source: IEA Future of Hydrogen (2019), IEA Global Hydrogen Review (2021). Hydrogen production for energy purposes and for feedstock, including for production of ammonia and e-fuels.

Hydrogen can be used as a zero-emission energy carrier for heat applications in manufacturing, but this year, due to the high costs, we forecast a significantly lower volume than last year (0.1 MtH_2/yr by 2050, 80% lower compared to last years forecast), covering only 2% of heat demand. Most of the hydrogen will be used in iron and steel production and by the construction industry, followed by the manufacturing of aluminium and other base materials (Figure 4.16).

While hydrogen was once seen as key for decarbonizing heavy trucking, battery-electric solutions are now set to play a major role in this segment. This will likely limit hydrogen's role in road transport despite developments in hydrogen combustion engines for trucks. In our view, hydrogen use in Norway for road transport will be marginal and reach less than 1.5% of road transport energy demand in 2060.

Within maritime transport, covered thoroughly in our *Maritime Forecast report* (DNV, 2025c), we expect significant uptake of low- and zero-emission fuel alternatives derived from hydrogen (e.g. ammonia and synthetic fuels like e-methanol) by 2050. They will be partly implemented in hybrid configurations combining diesel and gas-fuelled propulsion options, and will provide 15% (9 PJ) of the maritime fuel mix by 2040 and 35% (18 PJ) by 2060. There are risks that the maritime offtake estimated for 2030 will be delayed or somewhat reduced, as the IMO *Net-Zero Framework* implementation has been delayed by at least one year.

Norwegian aviation is well-suited for battery-electric flights on its short-haul network connecting coastal cities. However, for medium and long-haul flights, we forecast pure hydrogen and SAF, including both biofuels and synthetic fuels, to play a role in decarbonizing aviation. While we expect small volumes of e-fuels to begin replacing regular jet fuel from 2030, the main growth in e-fuels and pure hydrogen for aviation will occur after 2040, when infrastructure and technology have developed and costs have declined. By 2060, we forecast that 29% of aviation energy demand will be covered by hydrogen and e-fuels.

This year, our hydrogen production forecast is significantly reduced compared to last year, from 2.9 to 0.5 MtH_2/yr in 2050. This adjustment reflects major hydrogen pipeline plans from Norway to Germany by Shell and Equinor being shelved due to market challenges.

Energy use will account for 60% of hydrogen demand by 2060

Norway hydrogen demand by uses (MtH_2/yr)

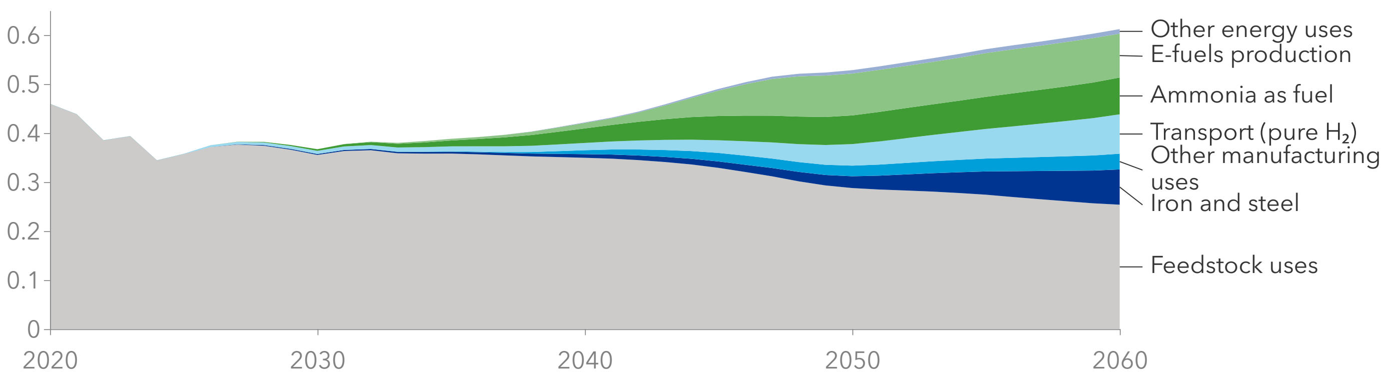


FIGURE 4.16 | Feedstock uses include production of ammonia and methanol for feedstock.
Hydrogen demand for production of derivatives includes local production and does not include imports.

5 ENERGY TRADE

Norway has been a significant net energy exporter and will continue to be, though overall energy exports will contract over the next three decades.

Europe's pivot away from Russian fuels after 2022 increased the importance of Norwegian gas, and high gas prices helped to boost output from existing fields and add a few small links to nearby deposits. Even so, the uplift is cyclical rather than structural: it does not rebuild the early-2000s export peak, and from the mid-2020s, underlying production in Norway's offshore fields drops. (Figure 5.1). By 2060, we expect oil production near 19% of today's level and gas production at 20% of 2024 volumes, as European, and later global, oil and gas demand trends lower and resource availability tightens.

EU policies like *Fit for 55* and *REPowerEU* aim to cut emissions while keeping energy secure. In the 2020s, Norway helps as a steady oil and gas supplier that reduces Europe's exposure to supply from other regions. But as Europe shifts to more electricity and clean hydrogen, Norway is not set to expand exports beyond what exists today. Domestic priorities (keeping power prices low and protecting nature), slow grid and interconnector buildout, and the economics of hydrogen logistics with no dedicated hydrogen pipeline to Europe are all causing slow to no progress in transitioning Norway to other energy carrier exports. Thus, growth in power and hydrogen derivative exports is likely to be gradual and yield thinner trading margins.

The export revenue implications are clear. The 10-year average value of oil and gas exports (NOK 490bn/yr pre-gas price shock) surged to NOK 1,900bn in 2022 before normalizing toward NOK 1,100bn in 2024 (Norsk Petroleum, 2025). With oil exports down 81% and gas export declining 80% over the forecast period, total energy-export volumes revert back to levels similar to those in the late 1970s. Incremental electricity and hydrogen derivatives exports help diversify flows, but given infrastructure constraints and softer appetite for vast power exports, they cannot bridge the gap left by declining hydrocarbons. From a portfolio standpoint, Norway transitions from a volume-led exporter to a flexibility and optionality seller – valuable, but a much lower revenue earner than the hydrocarbon era.

Norwegian exports decline towards 2060

(Million Sm³oe/yr)

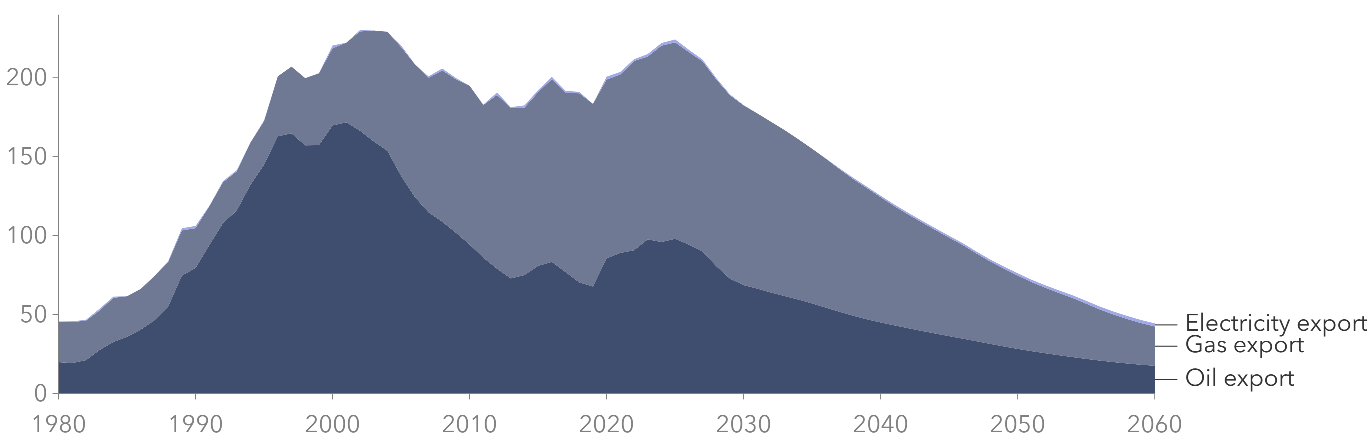


FIGURE 5.1 | Historical data source: NPD (2025). Hydrogen and derivatives account for an average 0.1% of annual exports.

5.1 Oil and gas exports

Oil production in Norway peaked around 2000 and has more than halved since then. Over 90% of oil produced is exported, meeting about 2% of global oil demand. With expected further decline in production and new exploration favouring gas fields, we forecast that Norway's share of the global oil market will gradually reduce to 1.2% by 2040. As we also expect global oil demand to decline 50% to 2060, Norwegian oil will have reduced its market share to cover 0.8% of oil demand by 2060.

Total oil exports (including oil products) will fall to 0.75 Mbpd (45 million Sm³oe/yr) in 2040 and 0.3 Mbpd (18 million Sm³oe/yr) in 2060.

Europe has become increasingly dependent on imported gas, where Norway today supplies close to 30% of its gas demand (Norsk Petroleum, 2025). Europe is set to further reduce its gas dependency, but has also committed to ban all imports of Russian gas by 2028 and consequently remains highly dependent on continuous gas imports in the short term. In the longer term, several initiatives like increased renewables, energy-efficiency improvements and emphasis on biomethane and hydrogen leads to a long-term decline in gas demand. By 2060, European gas demand will have declined by 78%. Norway's gas exports (including NGLs) will start to decline within this decade. In 2040, Norwegian gas exports will be 80 billion m³/yr, and by 2060 this will have declined to 25 billion m³/yr, some 80% lower than today.

We expect LNG exports to stay at existing levels for quite some years as the facilities at Melkøya are scheduled for electrification and, if this takes place, will operate well beyond 2040. Most LNG from Norway is exported to Europe and LNG export capacity is unlikely to grow in the future, as gas pipelines will remain the main means of export to Europe.

5.2 Electricity exports

Norway's total net transfer capacity to other countries is currently 8.9 GW. Of this, 3.7 GW goes to Sweden, 1.7 GW to Denmark, 0.7 GW to the Netherlands, and 0.1 GW to Finland. There is now also additional export via the two HVDC cables: the NordLink subsea cable to Germany (1.4 GW) and the North Sea Link to the UK (1.4 GW), both of which came online in 2021 (NVE, 2023) (Figure 5.2). We foresee an increase in Norway's cross-border capacity to neighbouring countries, but without direct plans and limited need in the near future this is only added as new capacity is brought online in Norway. We have thus assumed 1.4 GW added by 2040 after several GW of offshore wind is built out and another 1.4 GW in 2050.

Norway's power system is split into five bidding zones (NO1–NO5). Cross-border flows and prices are shaped by zonal supply–demand balances and by interconnector and internal transmission constraints. In our modelling, we simplify this to a two-node setup: Norway as one market and the rest of Europe as another, without internal grid constraints. The model clears hourly and determines Norway–Europe trade from the resulting price spread between the two nodes. This representation reproduces aggregate historical net trade reasonably well. However, it cannot capture intra-Norway congestion and zonal price divergence, especially persistent north-south splits driven by transmission bottlenecks, nor individual interconnector-specific constraints. While ongoing grid reinforcements may narrow structural price differences over time, localized constraints and weather-driven imbalances will continue to produce zonal spreads that a two-node model cannot resolve.

Cross-border capacity will increase

Norway interconnector capacity (GW)

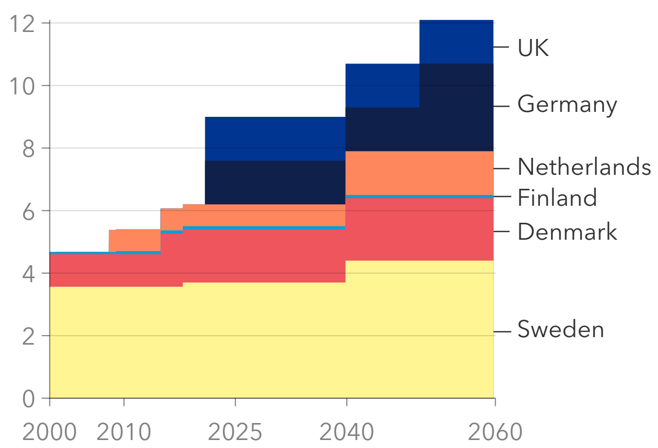


FIGURE 5.2 | Historical data source: ENTSO-E (2024)

Over the past two decades, Norway's average annual net electricity export has been roughly 10 TWh/year. We expect lower net exports going forward with declining gross exports, and by the early 2030s, this converts to a net import as demand growth outpaces supply. With limited additions to firm supply, the balance tilts toward net imports of up to 5 TWh in 2033, contingent on spreads to neighbouring markets and available interconnector capacity.

Weather remains the dominant swing factor, determining the balance between net export or import. Hydrology can vary by up to 60 TWh between wet and dry years, materially shifting Norway's net position via reservoir levels, expected inflows, and the marginal value of water. For planning, we assume average hydropower output of 138 TWh/yr, recognizing that realized production (and hence trade) will track the hydrological and wind conditions in the Nordics and Continental Europe.

From the 2030s, new offshore and onshore wind developments begin to add capacity, gradually improving the balance. In our forecast, Norway returns to a net-export position from 2037, reaching 10 TWh/yr by 2040, and expanding through the 2040s as additional wind commissions. By 2050, surplus generation supports almost 20 TWh/yr of net exports, and grows slowly to stabilize around 20 TWh/yr assuming interconnector availability and domestic demand increase as per our forecast.

In the near term, tighter system balances, with rising imports to cover deficits, limited new power generation capacity, and constrained flexibility will push the price level higher and increase volatility. Scarcity episodes will be more frequent, with spreads to neighbouring markets and interconnector availability dictating the timing and depth of imports. The implementation of norgespris might further exacerbate the situation as a third of demand is not affected by this imbalance (see Factbox on norgespris for further details).

As new capacity connects and cross-border volumes scale, both the average price and intra-year volatility tend to decline. The volatility mix also changes with extreme scarcity spikes becoming less common, while an expanding share of low- or negative-price hours emerges during high-renewables periods. Greater flexibility, such as additional interconnections, utility-scale storage, vehicle-to-grid participation from EVs, and price-responsive demand enabled by smart-grid rollouts will flatten the shape, narrow peak/off-peak spreads, and dampen imbalance costs.

From the 2030s, new offshore and onshore wind developments begin to add capacity, gradually improving the balance.

5.3 Hydrogen and derivatives exports

Hydrogen as an energy carrier currently remains too costly for large-scale adoption, so demand is still predominantly policy-driven through mandates, quotas, tax credits, contracts for difference, and targeted subsidies, especially in Europe. By the late 2030s, we project average hydrogen costs will fall to around half of levels in the 2020s, supporting some uptake in high-temperature industrial heat and selected process applications, though energy use will remain secondary to hydrogen's role as a chemical feedstock. In the 2040s, demand is likely to diversify as hard-to-electrify sectors decarbonize, with ammonia and synthetic e-fuels (e.g. e-methanol and e-kerosene with biogenic CO_2) gaining ground in shipping and aviation under tighter climate policies and fuel standards. Even so, we estimate hydrogen and its derivatives will provide only about 4% of final energy demand globally by 2050, rising to roughly 6% by 2060.

The EU, with its relatively strong hydrogen support policies, will lead global hydrogen uptake with 9% hydrogen and its derivatives in its 2060 final energy mix. The EU has set ambitious hydrogen targets for 2030 as part of its green transition goals, aiming for 20 Mtpa of renewable hydrogen, with 10 Mtpa produced within Europe and another 10 Mtpa imported (EC, Europa.eu, 2024). This target is highly unlikely to be met and requires significant investment in hydrogen infrastructure, both with respect to electrolyser capacity as well as sufficient renewable energy capacity to deliver low-cost electricity for the electrolysers. Hydrogen is difficult and expensive to transport over long distances, which means imports will have to come from regions close to the EU, and any country with surplus energy capacity will be incentivized to contribute.

Norway has the technical capability and resource base to produce low-carbon hydrogen, but large-scale pipeline exports to Europe are unlikely to materialize. The likely scenario is to export natural gas and gradually increase carbon capture capacity at the end-use locations for blue hydrogen production. Domestic hydrogen today is mostly made from natural gas for feedstock uses. We expect Norway's hydrogen demand to more than double by mid-century. However, scaling production far beyond domestic needs and exporting hydrogen by repurposed gas pipelines faces weak economics, uncertain offtake, and mounting project risk. Recent cancellations of blue-hydrogen export proposals by major developers underscore these headwinds (Reuters, 2024; SPGlobal, 2024).

Without a step-change for policy with regulatory implementation and updating of laws, new hydrogen production pathways will not be able to become competitive. Producing renewable and low-carbon hydrogen at scale requires surplus low-cost power. Renewable power is needed both for electrolysis and carbon capture based low-carbon hydrogen production. A robust willingness to pay, by fulfilling compliance regulations, or certain voluntary markets, are needed and neither condition currently supports pipeline exports. Even if EU policy sustains interest, declining gas throughput and the combination of high conversion and transport costs for repurposing pipelines or establishing new infrastructure make pipeline exports commercially tenuous. Consequently, our previously assumed ramp-up to 1 Mtpa of exports by 2040 and 2 Mtpa by early 2050 should be treated as unlikely.

The practical consequence is a reorientation toward domestic decarbonization and niche maritime trade routes rather than continental pipeline sales. For exports, low-carbon ammonia or methanol shipped by sea is the more plausible vector, but volumes are modest. Currently, our forecast gives no export of ammonia, and only a modest amount of methanol, around 0.5 Mtpa by 2060. This is due to strong competition from lower-cost producers (e.g. the Middle East) and global price dynamics that limit Norway's market share.

Without a clear ambition to scale production by leveraging low-cost electricity and electrolysis, Norway is unlikely to achieve any significant future exports of hydrogen or its derivatives.

6 EMISSIONS

The energy sector is the main source of greenhouse gas (GHG) emissions from human activities globally. Norway is no exception. Carbon dioxide (CO_2), primarily from fossil-fuel combustion, accounts for most of these emissions.

Our forecast indicates that Norway will not decarbonize rapidly enough to meet its national targets; by 2030, emissions will have declined 30% versus the stated target of 55% relative to 1990 levels. We estimate that by 2050, emissions will have reduced by 75%, short of the stated goal of a 90–95% reduction from 1990 levels. By 2060, emissions are 7.6 Mt, a reduction of 83% compared to 1990, still above Norway's 2050 goal.

This chapter explains Norway's climate commitments and then describes the findings from our forecast. We begin with energy-related CO_2 emissions, before summarizing other GHGs and their sources. Because the model focuses on the energy system, we apply assumptions on how non-energy emissions can decline. We conclude with a brief assessment of carbon capture and storage (CCS) and direct air capture (DAC).

6.1 Norway's international and national climate commitments

Norway's climate policy is framed by a series of binding commitments, both nationally and internationally. At the core is the *Climate Change Act*, passed by the Norwegian Parliament, which legally anchors the country's climate targets in line with its nationally determined contribution (NDC) submitted under the *Paris Agreement*. These include a minimum of 55% reduction in GHG emissions by 2030 and a 90-95% reduction by 2050, compared to 1990 levels. In line with the *Paris Agreement*, Norway is required to update its climate targets every five years. The most recent update sets a new goal of 70-75% emissions reduction by 2035 – now also enshrined in the *Climate Change Act* (Ministry of Climate and Environment, 2025).

By 2030, emissions will have declined 30% versus the stated target of 55% relative to 1990 levels.

Norway plans to fulfil its targets in cooperation with the EU. This is done by leveraging EU's climate policy framework, which is structured around three pillars:

1. **The EU Emissions Trading System (ETS):** The ETS covers approximately half of Norway's total emissions, including those from industry, oil and gas extraction, and aviation. As of 2024, maritime transport is also included. The ETS operates by gradually reducing the number of available emission allowances in the EU, thereby driving down emissions over time.

2. **The Effort Sharing Regulation (ESR):** The ESR sets national emission budgets for the 2021-2030 period, targeting sectors not covered by the ETS – such as road transport, buildings, and waste. It also includes emissions from industry and petroleum sectors outside the EU ETS system. From 2028, road transport and buildings will be covered by a new quota scheme – ETS2 (Miljødirektoratet, 2025b). The ESR pillar introduces various flexibility mechanisms in case a country falls short of its target, including transferring EU ETS allowances, and purchasing unused emission allocations from other countries within the European Economic Area (EEA).

3. **Land use, land-use change and forestry (LULUCF):** This pillar addresses emissions and removals related to forestry and land use.

EU climate targets

The EU has set a target of at least 55% GHG emissions reductions by 2030 compared to 1990 levels and climate neutrality by 2050. These targets are legally binding under the *European Climate Law*.

The EU and its member states report on climate targets under the *Paris Agreement* through a joint *Nationally Determined Contribution* (NDC), a climate action plan setting out specific national targets for reducing GHG emissions. The NDC states that the EU and its Member States intend to fulfil their commitments jointly.

In line with the *Paris Agreement*, the EU has agreed to an emission reduction range of 66.25% to 72.5% by 2035, with the updated NDC submitted to the UN (Council of the EU, 2025a).

In addition, the European Commission has proposed a legally binding 2040 target of 90% net GHG emissions reductions compared to 1990 levels. This target was formally agreed by the Council on November 5, 2025, following intensive negotiations among ministers in Brussels. Under the 2040 agreement, member states will be able to outsource up to 5% of their national effort in reducing emissions to non-EU countries through high quality international carbon credits (Council of the EU, 2025b).

Norway has participated in the EU ETS since 2008 through the *EEA Agreement*. In 2019, Norway made an agreement with the EU and Iceland on non-ETS sectors, committing to binding emissions reduction targets under the ESR-framework of 40% by 2030, compared to 2005 levels (Ministry of Climate and Environment, 2025b). This agreement is valid until 2030, with EU negotiations for the 2031-2040 ESR-framework ongoing. Norway has yet to finalize its position for EU collaboration on non-ETS sectors post-2030, although the government has stated that it intends to continue the cooperation (Alltinget, 2025).

Implications for Norway

Norway's climate targets do not impose binding requirements for specific domestic emissions reductions, although parts are indirectly covered through the climate agreement on non-ETS sectors. The *Climate Change Act* states that "Climate targets shall be consistent with Norway's nationally determined contributions under the Paris Agreement of 12 December 2015 and with joint fulfilment with the EU, if agreed". Norway's NDC outlines a strategy to meet its targets through domestic measures, in cooperation with the EU, and — if necessary — through the purchase of international credits outside the EEA (Norway, 2025).

Despite this framework, several unresolved issues could affect how Norway's progress is assessed. First, it remains unclear how many EU ETS allowances Norway is accountable for under the *Paris Agreement*. Secondly, Norway's participation in the ESR and LULUCF pillars has not yet been formally linked to its 2030 *Paris Agreement* target. The government assumes that flexibility mechanisms under these regulations will count towards the target, but this is yet to be confirmed.

In its annual climate status and plan (also known as the *Green Book*), the government identifies flexibility mechanisms as one strategy for addressing the growing emissions gap in non-ETS sectors. Given the considerable uncertainty surrounding these mechanisms, as well as the cost and availability of emission units within the EEA, the government is currently planning to purchase international carbon credits worth approximately NOK 15bn annually (Ministry of Climate and Environment, 2025b).

This has sparked national debate over whether Norway should prioritize supporting emission reductions abroad or invest more heavily in domestic transition efforts. Similar discussions are taking place within the EU, where the 2040 climate target allows Member States to outsource up to 5% (10% if deemed necessary) of their national effort in reducing emissions through purchasing international carbon credits. This measure was introduced to safeguard European industrial competitiveness and promote social equality.

While directing support toward lower-cost emission reductions outside the EU may be economically efficient from a global perspective, it could raise concerns about the potential further distortion of competitive dynamics. In effect, such measures could subsidize transition efforts in industries that compete directly with European counterparts. However, the Council's agreed position on the 2040 target also introduces a biennial review to assess progress toward intermediate goals. Importantly, it will consider the evolving global competitiveness of EU industries and evaluate the impact of energy prices on households and industries. Based on the findings, the Commission may propose an adjustment to the 2040 target or additional measures to secure the EU's competitiveness, prosperity, and social cohesion (Council of the EU, 2025b), which could affect Norway. While this conditional approach may help protect industries and households, it also introduces uncertainty around the durability of climate commitments, potentially complicating long-term planning and investment decisions for industries undergoing transition.

This has sparked national debate over whether Norway should prioritize supporting emission reductions abroad or invest more heavily in domestic transition efforts.

Comparing Norway's climate commitments on legal enforceability and emerging accountability through international court rulings

Norway's climate agreements display varying degrees of legal bindingness.

EU/EEA commitments have the strongest degree of enforcement with supranational monitoring by ESA and binding annual emission budgets.

The *National Climate Change Act* targets are legally binding domestically, but enforcement is political with limited judicial review.

The *Paris Agreement* NDCs have binding procedural obligations but non-binding substantive targets, relying on transparency, peer pressure, and reputational mechanisms rather than sanctions.

Recent international court rulings are establishing stronger human rights-based obligations that may increase enforceability through litigation. Examples include:

- The European Court of Human Rights (ECHR) ruling in April 2024 in *KlimaSeniorinnen et al. v. Switzerland,* where it was ruled that all states party to the ECHR must reduce GHG emissions to protect individuals' rights to life, health, and quality of life (ECHR, 2024).
- On 23 July 2025, the International Court of Justice (ICJ) delivered an advisory opinion confirming that states have binding obligations under customary international law to take climate action, and that the 1.5°C target is legally binding (Schaugg et al., 2025).
- The *Greenpeace Nordic and Others v. Norway* ruling from October 2025. Although the ECHR found that Norway did not violate climate obligations when awarding 10 petroleum exploration licenses in the Arctic Barents Sea in 2016, it affirmed that Norway must conduct a full environmental impact assessment that includes Scope 3 emissions before approving new oil and gas projects (NHRI, 2025). The ECHR has thus established that 'exported emissions' are relevant to Norway's human rights obligations.

6.2 Emissions

Norway's energy-related CO_2 emissions increased for three decades and have only started to decline notably since 2018. Beyond fuel combustion, a substantial share of national CO_2 arises from industrial processes. This includes the use of fossil feedstocks in steel and petrochemicals, cement calcination, and anode-related process emissions.

Non-CO_2 gases like methane, nitrous oxide, and fluorinated gases (HFCs, PFCs, SF_6) have far higher warming potentials than CO_2. Though smaller in tonnes and originating mainly from agriculture, landfills, waste management, and industry, they accounted for 17% of Norway's GHG emissions in 2024 and are projected to rise to represent 50% of all emissions by 2060 (in CO_2-equivalents).

Total GHG emissions were slightly below 1990 levels at 44.6 $MtCO_2e$ in 2024. We forecast a 30% reduction by 2030 and 75% by 2050 versus 1990 levels, reaching 13 $MtCO_2e$ in 2050. This falls well short of the targets of at least 55% reduction by 2030, 70 to 75% by 2035 and 90 to 95% by 2050. By the end of our forecast period (2060) emissions will be 8.6 $MtCO_2e$, a decline of 81% compared with today, and if we include DAC the reduction is 83% leaving 7.6 $MtCO_2e$. The largest reductions are achieved in road transport through electrification and the resulting fall in oil consumption. Other reductions are achieved through declining oil and gas activities on the Norwegian Continental Shelf and the electrification of those offshore operations and, finally, process changes in heat-intensive industries.

Because our energy model centres on CO_2, non-CO_2 trajectories are derived from current levels and emission sources are then tied to an activity we model. For example, methane emissions from oil and gas are tied to sector activity and calibrated to historical exploration and production levels.

Emissions by sector

We map all emissions in Norway and associate them with the main sectors described in our energy systems model. CO_2 emissions dominate all sectors except the 'Other' category, which in this context is mainly agriculture and contains predominantly methane.

The energy sector with oil and gas production, transport, and manufacturing are the three biggest emitting sectors in 2024, accounting for 81% of national GHGs. We project these emissions to decline substantially through to 2060, (Figure 6.2).

Road transport emitted 7.5 $MtCO_2e$ in 2024. We forecast emissions falling to 5.4 $MtCO_2e$ by 2030, 29% below 2024 and 28% below 1990, driven primarily by electrification,

Reductions insufficient to meet targets

Emissions by carrier ($MtCO_2e$/yr)

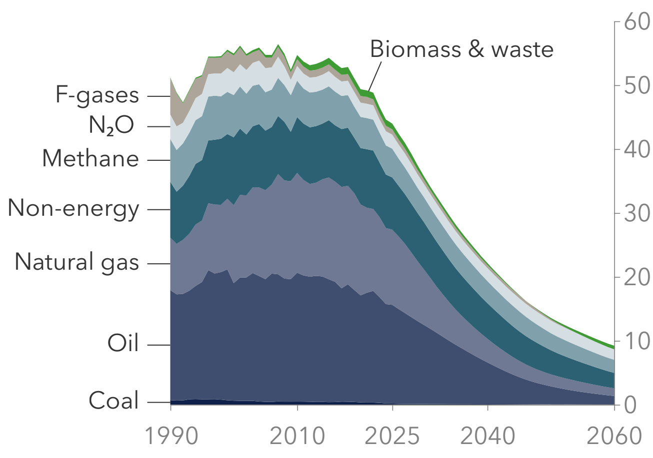


FIGURE 6.1 | Historical data source: SSB (2025)

Sectors decarbonize at different speeds

Emissions by sector ($MtCO_2e$/yr)

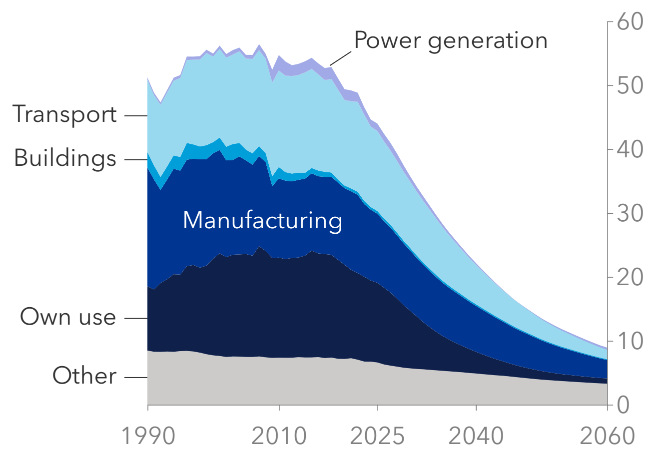


FIGURE 6.2 | Other category includes agriculture. Historical data source: SSB (2025)

especially in passenger cars (where emissions decline 57% from 1990 by 2030). The planned expansion of biofuel use, especially in commercial vehicle segment, provides additional abatement. By 2060, road transport emissions fall by 96% to 300 ktCO_2e, representing roughly 4% of Norway's total emissions.

Emissions from aviation, maritime and rail transport have been stable since 2000, are currently 30% higher than 1990, and represent 40% of Norwegian transport emissions (5 MtCO_2e). With limited electrification potential in shipping and aviation, these subsectors' emissions will not decline as fast as those from road transport. Helped by synthetic fuels, biofuels, and hybrid/fully electric solutions, we expect overall GHG emissions from these non-road sectors to stay flat until 2030 and then start falling. By 2050 they will likely be half of today's level and then fall further. By 2060, these emissions are 71% lower than today at 1.5 MtCO_2e.

Manufacturing today emits 11.1 MtCO_2e, a quarter of Norway's total GHG emissions. Just over two thirds of the sector's emissions are from process related CO_2 emissions in heavy industry, and the remainder comes from combustion of fossil fuels and fluorinated gases. By 2030, the sector's emissions will have declined by 15%, mainly due to electrification of heating processes. Emissions will continue to decline with further switching use of electricity for heating, but also increased uptake of hydrogen and CCS will help drop emissions to 7.2 MtCO_2e by 2040. By 2050, emissions will have declined almost 60% and in 2060 the emissions will be 2.9 MtCO_2e, 74% lower than today.

'Energy sector own use', mainly from energy extraction and production, represents the other big GHG emissions sector in Norway. Today these emissions are 12.7 MtCO_2e (28% of total emissions), and most (77%) of these are CO_2 from gas turbines generating electricity as part of oil and gas production on the Norwegian continental shelf. Many fields have successfully already electrified through shore connections or offshore wind, but there are some recent delays and increase in cost that put future electrification into question (Equinor, 2025b). By 2060, we expect emissions from energy sector own use to reduce 93% to 0.8 MtCO_2e since 2024 due to declining activities levels on the NCS and an electrification rate of 70%.

The buildings sector's energy use in Norway is largely linked to electric heating, though some fossil fuels are still used for space and water heating for commercial buildings. The remaining emissions are methane from burning biomass for heating. Today, the buildings sector represents less than 1% (around 400 ktCO_2e) of Norwegian emissions. Even with an expected increase in building mass and floor space, these emissions will decline further due to building standards efficiencies, fuel switching, and the further introduction of heat pump systems, making electric heating even more prevalent and efficient. By 2060, these emissions will have further declined by 68% to 130 ktCO_2e/yr.

Agricultural emissions are largely methane from enteric fermentation and manure. The other major source in the 'other' category is methane from landfills, which combined currently represent 15% of Norwegian emissions at 6.7 MtCO_2e in 2024. We expect some progress in reducing emissions from agriculture and animal management by 2030 and 2050, but these are tied to activity level and thus relatively difficult to reduce through technical means. We have included some progress as described in the Norwegian Government's *Green Book* (2025), see policy chapter. However, we do not assume Norwegian agriculture and animal activity levels will decline. Some activities, such as mechanical machinery in the agricultural sector, will have CO_2 emission reductions comparable to those in the commercial vehicle segment, through electrification. Thus, by 2050 these emissions have declined 42% and by 2060 have halved compared to today, with 3.3 MtCO_2e remaining. This means that by 2060, 40% of emissions in Norway will come from this sector, highlighting the difficulty in reducing emissions from agriculture and food production without addressing production output.

Thus, existing and planned policies are insufficient to deliver the required step-change in reducing emissions in line with Norway's climate ambitions. Ambitions must be translated into concrete sector-specific policy packages that address permitting, risk-sharing, and early-mover costs. Over time, policies shaping behavioural changes will also be needed if Norway is to approach near-net-zero domestic emissions before 2050.

We forecast a 30% reduction by 2030 and 75% by 2050 versus 1990 levels, reaching 13 MtCO_2e in 2050. This falls well short of the targets of at least 55% reduction by 2030, 70 to 75% by 2035 and 90 to 95% by 2050.

6.3 Carbon capture and storage

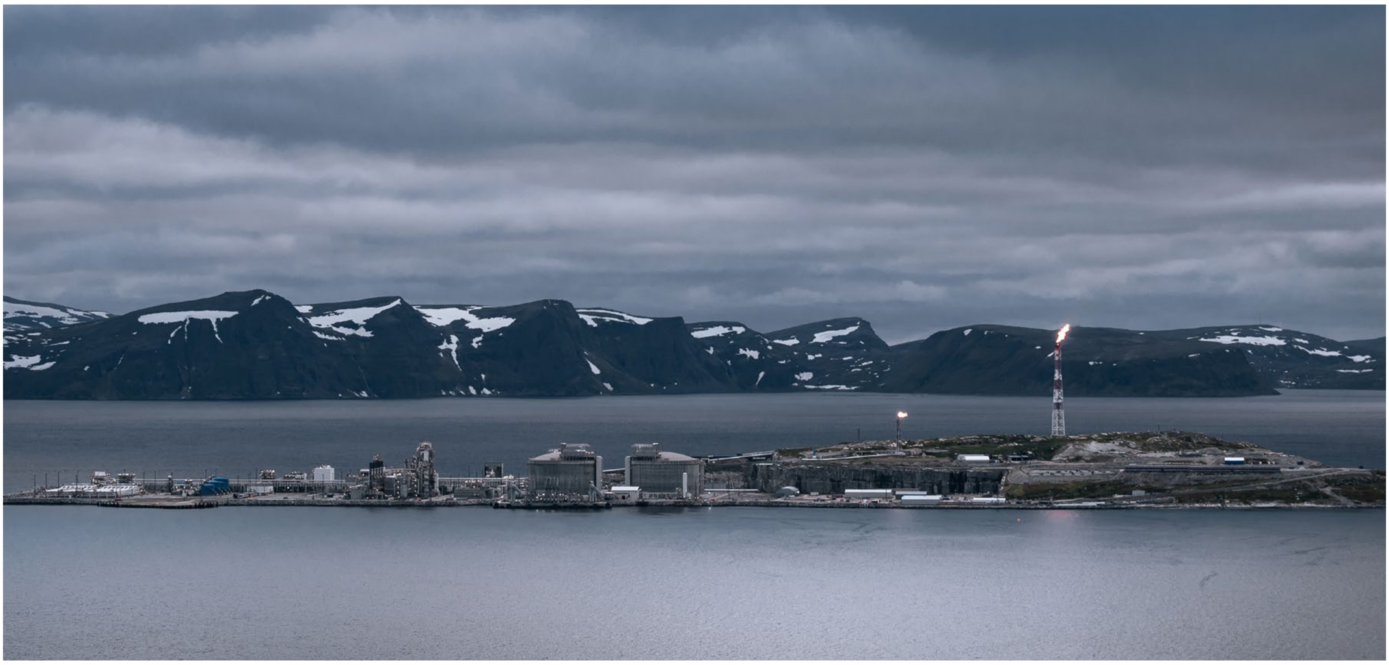
Historically, fossil gas processing has dominated the carbon capture sector, comprising around 85% of installed capacity globally (DNV, 2025f). Fossil gas processing is a mature industry with over 60 years of experience, a firm business case to achieve market specifications for fossil gas, and is closely tied to fossil gas and oil prices as most of the CO_2 is used for enhanced oil recovery. Other carbon capture sectors are highly dependent on subsidies for development due to the lack of a strong business case for capture and permanent storage, and as a result deployment has been slow and subject to high cancellation rates (Kazlou et al., 2024). The lack of progress in other sectors is starting to shift with increased project announcements (DNV ETO CCS report, 2025) but cancellations are still stubbornly high (Rystad, 2025). Carbon capture in Norway is not developing at sufficient scale to make a significant contribution to Norway's legally binding emissions reduction targets.

Current deployment of carbon capture in Norway

The introduction of a carbon tax on the Norwegian continental shelf in the 1990s led to the development of the first offshore CCS project at the Sleipner Vest field. Capable of removing approximately 1 Mtpa of CO_2 from the produced gas, the Sleipner project has captured and injected approximately 19 million tonnes of CO_2 since 1996 (Miljødirektoratet, 2024). In 2007, a second gas processing CCS project was developed at the Snøhvit field. This project has a capacity of 0.8 Mtpa and has injected approximately 7 million tonnes of CO_2 since 2007 (Miljødirektoratet, 2024). DNV expects Sleipner to close around 2030, and Snøhvit in the late 2030s.

The Heidelberg cement plant at Brevik began operations this year, with a capture capacity of 400 ktCO_2/yr (Heidelberg Materials, 2025), and FID has been reached for the Klemetsrud carbon capture project in Oslo which aims to capture up to 350 ktCO_2/yr from 2029 from a waste-to-energy plant. These projects are both part of the wider Langskip CCS project which will store their CO_2 on the Norwegian continental shelf via the Northern Lights transport system.

In Langskip, the Norwegian government has committed around NOK 23bn (approx. USD 2.3bn) of the project's NOK 35bn (approx. USD 3.5bn) estimated costs (Norwegian government, 2025). This commitment is for 10 years and applies to both construction and operating costs. The storage component of Langskip, Northern Lights, is a joint venture between Equinor, Shell, and TotalEnergies, and handles CO_2 transport and storage. This year, phase 1 became operational and FID was reached for phase 2 which expands storage capacity from 1.5 Mtpa to 5 Mtpa CO_2. For phase 2, a capacity of 900,000 tonnes has been confirmed from Stockholm Exergi with operation expected in 2028 (Northern Lights, 2025).



Net Zero Industry Act and Norway's future CO_2 storage industry

The EU's *Net Zero Industry Act* (NZIA) (European Union, 2024) is a regulatory framework to boost competitiveness of industry and technologies for decarbonisation. Part of the framework is an obligation for EU oil and gas producers to develop 50 million tonnes of subsurface CO_2 injection capacity by 2030. This framework does not include Norway and creates a situation where cheaper, more plentiful CO_2 storage in the EU will stifle the development of a large-scale Norwegian CO_2 storage industry. Combined with weak incentives for emitters to develop carbon capture and resistance from operators to developing storage, the EU target of 50 million tonnes is likely to be missed.

What is the *Net Zero Industry Act* CO_2 storge obligation?
The NZIA lists 44 oil and gas companies which are required to develop 50 Mtpa of CO_2 injection capacity in the EU by 2030 (European Commission, 2025b). The amount of CO_2 injection capacity each operator is responsible for is in proportion to their share of production of crude oil and gas from 2020 to 2023. The only specified financial incentives are that members states should induce penalties for non-compliance. This obligation does not include Norway.

What has the reaction been from European operators?
The response from operators has predominantly been resistance. Shell called the 2030 target 'very unrealistic' (Penson, 2025) and ExxonMobil states it takes 7 to 10 years to develop a storage site and wants the target date pushed to 2035 (ExxonMobil, 2025). The strongest reaction has come from the Romanian operators Romgaz, OMV Petrom, and Black Sea Oil and Gas, who are suing the European Commission to drop the targets entirely (Romania Journal, 2025). There are already some CO_2 storages in operation or construction in the EU, for example Ravenna CO_2 storage (Eni, 2024), Porthos (Porthos, 2025), and Greensand (Greensand, 2025) – together accounting for 2.9 million tonnes of injection capacity.

What does this mean for Norway?
The Norwegian government sees CO_2 storage as an opportunity for the future of the continental shelf (Norwegian Ministry of Energy, 2024) and has released 13 licences for CO_2 storage in the NCS (Norwegian Offshore Directorate, 2025). CO_2 is being injected at one licence as part of the Langskip CCS project. In the latest budget, the Norwegian government is not providing additional support for CCS projects outside of the current 80% subsidies for Langskip (Norwegian Ministry of Finance, 2025). During the feedback round for the NZIA legislation, Offshore Norge (an interest organisation for Norwegian oil and gas operators) argued that Norwegian operators should not be given storage obligations and that development of storage should be on a commercial basis only (Offshore Norge, 2024).

At Oslo Innovation week in October 2025, Equinor stated that plans for a 1,000 km CO_2 pipeline from Europe to Norway were not commercially competitive with local EU CO_2 storage projects due to the greater distance (Equinor, 2025c). They stated the need for government subsidies to build first and lock-in emitters to their infrastructure, if it is to be developed.

Meanwhile, the incentives for emitters to develop carbon capture on the continent are not strong; exemptions from paying the full EU ETS for industries generally seen as hard-to-abate will continue until the mid-2030s (European Commission, 2021), at which point the carbon price is still unlikely to be high enough for an unsubsidized business case. According to our detailed analysis of EU emitters, carbon prices above EUR 230/tonne are needed to make CCS economically viable without subsidies in the major industrial hubs in Western Europe.

Therefore, the development of a large-scale Norwegian CO_2 storage industry in the short to medium term is unlikely due to competition from cheaper EU projects, exclusion from NZIA obligations, a lack of further subsidies from government, and weak decarbonisation incentives for hard-to-abate emitters in Europe.

Cheaper, more plentiful CO_2 storage in the EU will stifle the development of a large-scale Norwegian CO_2 storage industry.

The future of carbon capture in Norway

We expect carbon prices in Norway to reach USD 125/t in 2030 and USD 230/t in 2050 in ETS compliant sectors. For most sectors, this is not high enough for an unsubsidized CCS business case in the short to medium term. The potential exceptions are fossil gas processing (which is subject to a different business case from climate action) and sectors where biogenic CO_2 can be captured and stored allowing credits to be sold. Credits will become an increasingly attractive business case as carbon prices increase.

The high-profile cancellations of two large-scale blue hydrogen projects from Shell (Bull, 2024) and Equinor (Adomaitis, 2024) last year leave no further plans to scale blue hydrogen in Norway at present. This year's modelling reflects that the Norway-Germany hydrogen pipeline will not go ahead by 2060. Much of the reduction in CO_2 captured from last year's ETO Norway is due to this along with further delays and cancellations to the project pipeline, including the hiatus of the large-scale Barents Blue ammonia project due to partners and storage operators leaving the project (Burgess, 2025).

Direct air capture (DAC) – capturing CO_2 direct from the atmosphere – is still an emerging technology. It shows promise, but is currently only at the pilot stage and needs proving at scale. In our forecast, DAC grows slowly in Norway, reaching commercial scale in the mid-to-late 2040s. Therefore CO_2 volumes captured by DAC in Norway are modest, with 0.4 $MtCO_2$/yr by 2050 and 1 $MtCO_2$/yr by 2060. Nevertheless, it is a technology that could remove CO_2 from the atmosphere which will almost certainly be required to limit global warming to 1.5°C.

In total, from point source CCS and DAC, we expect 6.9 $MtCO_2$/yr captured in 2060 (Figure 6.3). Remaining CO_2 emissions stem from sectors such as transport, where emissions are difficult to capture, as well as from other point sources where capture remains too expensive and complex.

> The carbon price is not expected to reach levels high enough for an unsubsidized CCS business case in the short to medium term.

Gradual uptake of CCS in Norway

CCS deployment by different sectors (Mt CO_2/yr)

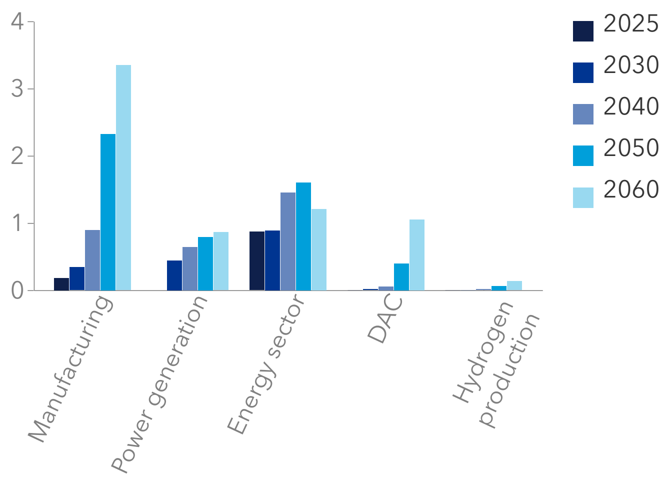


FIGURE 6.3 |

Onshore storage tanks. Photo: Ruben Soltvedt / Northern Lights

7 ETO MODEL AND ASSUMPTIONS

Our ETO model is driven by the dynamic changes in the Norwegian energy system, which in turn is connected to Europe and the rest of the world. We make use of external data sources for some key input parameters that help determine the energy forecast. These are linked to areas such as population, economic development, technology development, and policy, with the latter covered separately in Chapter 2.

Population
We use the most recent research and results from the Austria-based IIASA Wittgenstein Centre for Demography and Global Human Capital. These results have been updated in 2023 and track closely to the most recent UN population estimates for 2060. The Norwegian population is expected to keep growing from 5.6 million today and reach 6.3 million in 2060. Decreasing fertility rates and limited immigration give Norway this relatively slow population increase, which is comparable with other neighbouring countries such as Sweden and Denmark.

Economic development
GDP per capita is a measure of the standard of living in a country and is a major driver of energy consumption in our model. We base our GDP per capita forecast from today to 2030 on the growth rates implied by the recent update of the *World Economic Outlook* by IMF (2025). After 2030, we base our projections to 2060 on the GDP per capita growth rates implied by OECD (2024) and Applied Systems Analysis (IIASA, 2024).

Due to the current geopolitical landscape and uncertainties in future economic development, we deviate this year from following a pure central scenario (SSP2) for GDP per capita growth. Instead, we combine two pathways, SSP2 and SSP3, and use the average, based on both OECD and IIASA data, indicating a slower GDP per capita growth trajectory. The implication is that we no longer assume that future economic developments will continue along historical trends. However, we also do not assume that we will transition purely to SSP3 ('Regional rivalry pathway') and have therefore chosen a development between these two trajectories (see our *Energy Transition Outlook* 2025 for more details (DNV, 2025a)).

For Norway, 2024 GDP was USD 535bn, or NOK 5,200bn in current prices, and is likely to rise to USD 817bn in 2060. This implies a compound annual growth rate (CAGR) of 1.2%/yr. GDP per capita increases from USD 97,400 to USD 129,600 in the same period. All numbers are stated in 2017 purchasing power parity terms in international 2024 USD and therefore not directly translatable to real or nominal GDP.

Technology development
We base our forecast on the continued development of proven technologies in terms of costs and technical feasibility, not uncertain breakthroughs. However, during the period covered by this Outlook, the list of technologies we currently consider 'most promising' could change due to shifts in levels of financial support or altered potential for cost reduction. Other technologies may achieve a breakthrough, such that they become cost competitive.

With technology learning curves, the cost of a technology typically decreases by a fraction with every doubling of installed capacity. This cost learning rate (CLR) dynamic occurs because ongoing market deployment brings greater experience, expertise, and industrial efficiencies, as well as further R&D. Technology learning is global for many technologies, and we use the global capacity in CLR calculations. However, for some technologies, like nuclear, we believe learning is only captured within regions willing to collaborate on nuclear technology. E.g. we do not think OECD countries will accept to install Chinese or Russian nuclear reactors, thus reducing opportunities for capacity learning.

CLRs cannot easily be established for technologies with low uptake and which are still in their early stages of development. In such cases, our calculations rely instead on insights from similar but more mature technologies. Carbon capture and storage (CCS) – other than that used in enhanced oil recovery – and next-generation electrolysis for hydrogen production are examples of this. New nuclear technologies based on small modular reactors

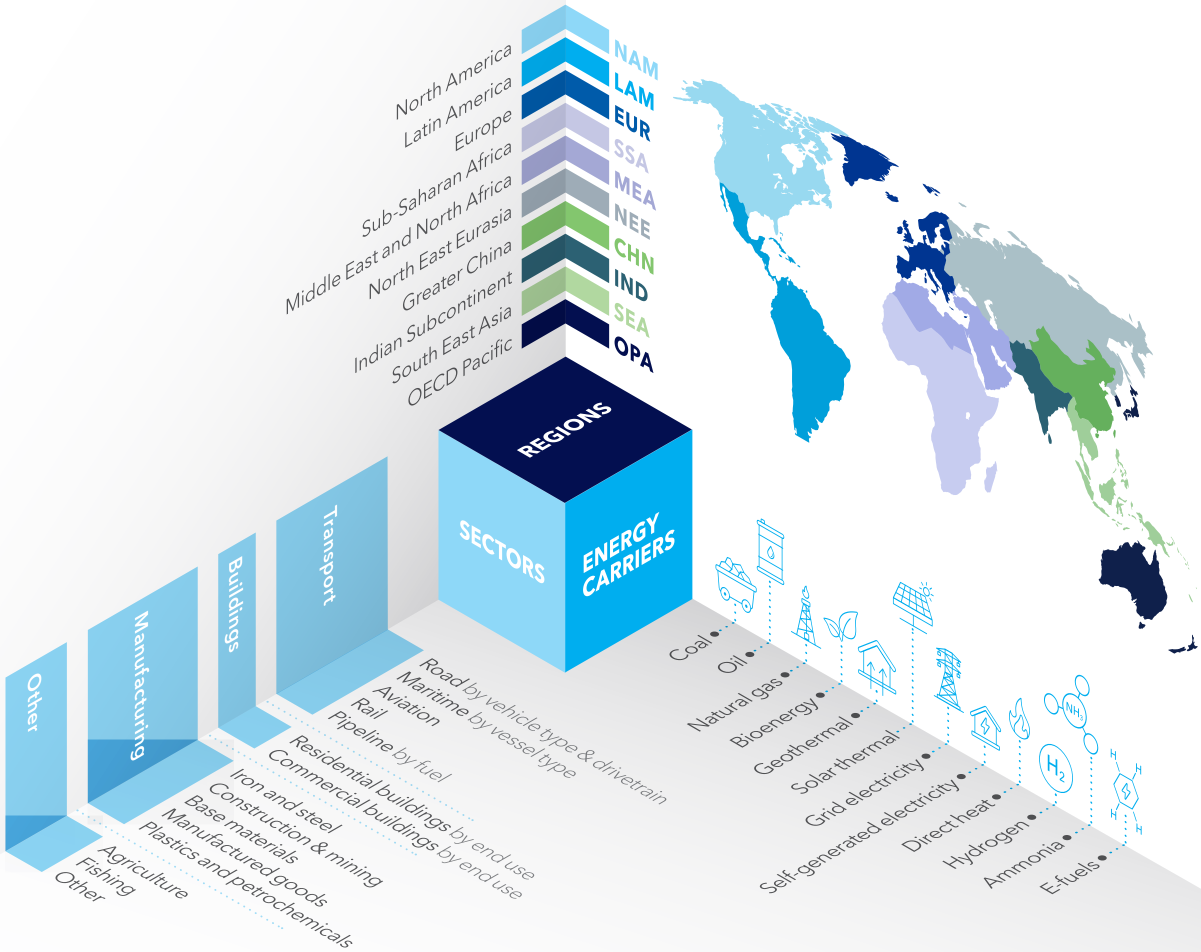
(SMR) face a similar challenge and here we use literature and empirical data to evaluate the potential cost reductions. Solar PV, batteries, and wind turbines are proven technologies with significant grounds for establishing CLRs with more confidence. Further down the experience spectrum are oil and gas extraction technologies where unit production costs and accumulated production levels are high and easy to establish. However, hydrocarbons face pressures from the structural decline in oil demand in tandem with rising extraction costs and carbon prices. It is virtually impossible to disentangle these two effects using costs and volumes alone; we therefore use historical datasets to separately estimate CLR and depletion effects.

Core technology CLRs that we have used through to 2060 in our forecast include 16% for batteries, 16% for wind turbines. The system cost for offshore wind has increased as a consequence of differentiating learning rates between regions, delays in early projects, and increasing supply-chain costs. Solar panels have a CLR of 26%, but this will fall to 17% later in the forecast period. For new nuclear, such as SMR, we use a CLR of 10%, but this declines towards the end of the forecast period. Oil and gas development has a CLR of 10–20%, but the annual cost reduction is minor because it can take decades for the cumulative installed capacity to double. This last point is academic only, because global fossil fuel production declines in our forecast period.

The ETO Model

The ETO is a simulation-based forecast that reflects how the energy system behaves under a most-likely scenario. It is not a best-case pathway or a cost-optimized solution. Instead, it considers how different parts of the system interact over time, shaped by known constraints and real-world decision making.

What makes this approach distinctive is its focus on system response. We do not assume that choices are perfect or coordinated. We account for how policies, technologies, and behaviours influence one another, sometimes in unexpected ways. Falling battery costs can accelerate EV adoption, which both raises electricity demand and, through vehicle-to-grid services, can feed power back to the grid. As the system transitions, these cross-sector links grow in number and importance – what once happened in isolation now has knock-on effects across the whole system. A model that captures these connections becomes not just useful, but essential. For more detailed information on our ETO Model, see our main report (DNV, 2025a).



REFERENCES

Adomaitis, N. & Buli, N. (2025) 'Equinor drops offshore electrification plans over rising costs.' *Reuters.* 10. October. https://www.reuters.com/sustainability/climate-energy/equinor-drops-offshore-electrification-plans-over-rising-costs-2025-10-10/

Adomaitis, N. (2024) 'Norway's Equinor scraps plans to export blue hydrogen to Germany'. *Reuters.* 21 September. https://www.reuters.com/business/energy/norways-equinor-scraps-plans-export-blue-hydrogen-germany-2024-09-20

Alltinget (2025) *Tar sikte på å videreføre klimaavtalen med EU etter 2030, og hvordan ser statsråden for seg at dette skal skje dersom Norge ikke stiller seg bak EUs skogregelverk?* https://www.altinget.no/statsradensvarer/17554

Anchustegui, I. H., and Tscherning, R. (2024). *Offshore oil and gas infrastructure electrification and offshore wind: a legal explaoration.* https://doi.org/10.1093/jwelb/jwad035

Ask, A. O. (2025) *Tre omstridte energidirektiver inn i EØS-avtalen i juni.* https://www.energiogklima.no/nyhet/brussel/tre-omstridte-energidirektiver-inn-i-eos-avtalen-i-juni

Bull, N. (2024) 'Shell shelves Norway hydrogen project due to lack of demand'. *Reuters.* 23 September. https://www.reuters.com/business/energy/shell-shelves-norway-hydrogen-project-due-lack-demand-2024-09-23/

Burgess, J. (2025) 'Fertiberia pulls out of Norwegian Barents Blue ammonia project'. *S&P Global*, 14 February. https://www.spglobal.com/commodity-insights/en/news-research/latest-news/energy-transition/021425-fertiberia-pulls-out-of-norwegian-barents-blue-ammonia-project

CICERO (2025) *Statsbudsjettet 2026: Ingen økt klimatrygghet.* 15 October. https://cicero.oslo.no/no/artikler/statsbudsjettet-2026-ingen-okt-klimatrygghet

Council of the EU (2025a) *Paris Agreement: the EU submits its updated NDC with an indicative target for 2035 to the UN ahead of COP30.* https://www.consilium.europa.eu/en/press/press-releases/2025/11/05/paris-agreement-the-eu-submits-its-updated-ndc-with-an-indicative-target-for-2035-to-the-un-ahead-of-cop30/

Council of the EU (2025b) *'2040 climate target: Council agrees its position on a 90% emissions reduction'.* 5 November. https://www.consilium.europa.eu/en/press/press-releases/2025/11/05/2040-climate-target-council-agrees-its-position-on-a-90-emissions-reduction/

Correa, M. (2025) *Europe data centers to grow 6 times, €115B of capex by 2035.* https://seekingalpha.com/news/4127629-europe-data-centers-to-grow-6-times-115b-of-capex-by-2035-ms

DNV (2025a) *Energy Transition Outlook 2025.* https://www.dnv.com/energy-transition-outlook/2025/

DNV (2025b) *Barometer for grønn omstilling av skipsfarten 2024. Klima- og miljødepartementet.* https://www.regjeringen.no/no/dokumenter/barometer-for-gronn-omstilling-i-skipsfarten/id3014377/

DNV (2025c) *Maritime Forecast to 2050.* https://www.dnv.com/maritime/maritime-forecast/

DNV (2025d) *Ekte kraft til kunstig intelligens. Fornybar Norge.* https://www.fornybarnorge.no/contentassets/bcd9c95d-4d954de0ac31568bb0fda2b6/ekte-kraft-til-kunstig-intelligens_dnv-ferdig-rapport.pdf

DNV (2025e) *North Sea Forecast.* https://www.dnv.com/publications/north-sea-forecast/

DNV (2025f) *Energy Transition Outlook: CCS to 2050.* https://www.dnv.com/energy-transition-outlook/carbon-capture-storage/

DNV (2025g) *The competitive position of long-duration storage solutions in the power system.* https://www.dnv.com/publications/the-competitive-position-of-long-duration-storage-solutions-in-the-power-system/

DNV, Menon economics (2024) *Virkemidler for 8 TWh solkraft innen 2030.* 21 March. https://www.nhoelektro.no/contentassets/2a565c21e2a34a84868223c299322287/240321-dnv-menon-solrapport.pdf

EASA – European Union Aviation Safety Agency (2025) *ReFuelEU Aviation Annual Technical Report.* https://www.easa.europa.eu/en/domains/environment/refueleu-aviation/annual-technical-report

EC, Europa.eu (2024) *Hidrogen.* https://energy.ec.europa.eu/topics/eus-energy-system/hydrogen_en

ECHR (2024) *Violations of the European Convention for failing to implement sufficient measures to combat climate change.* https://www.klimaseniorinnen.ch/wp-content/uploads/2024/04/Judgment-Verein-KlimaSeniorinnen-Schweiz-and-Others-v.-Switzerland-Violations-of-the-Convention-for-failing-to-implement-sufficient-measures-to-combat-climate-change.pdf (Accessed: 06.11.2025)

EEA (2025) *Renewables and electrification: key to cutting costs and powering EU's clean industry and competitiveness.* https://www.eea.europa.eu/en/newsroom/news/renewables-and-electrification-key-to-cutting-costs-and-powering-eus-clean-industry-and-competitiveness

Energidepartementet (2025a) *Utsira Nord. Regjeringen.no.* 29 August. https://www.regjeringen.no/no/tema/energi/fornybar-energi/havvind/utsira-nord-/id3052997

Energidepartementet (2025b) *Støttemodell for flytande havvind er godkjent. Regjeringen.no.* https://www.regjeringen.no/no/aktuelt/stottemodellen-for-flytande-havvind-er-godkjent/id3097759/

Energidepartementet (2024) *Sørlige Nordsjø II. Regjeringen.no.* 24 October. https://www.regjeringen.no/no/tema/energi/fornybar-energi/havvind/sorlige-nordsjo-ii/id2967231

Energikommisjonen (2023) *Mer av alt – raskere – Energikommisjonens rapport, NOU 2023:3.* 1 February. https://www.regjeringen.no/contentassets/5f15fcecae3143d1bf9cade7da6afe6e/no/pdfs/nou202320230003000dddpdfs.pdf

Energy Global (2025) *Autumn 2025.* 8 September. https://issuu.com/palladianpublications/docs/energy_global_-autumn_2025

Eni (2024) *Eni and Snam launch Ravenna CCS, Italy's first Carbon Capture and Storage project.* https://www.eni.com/en-IT/media/press-release/2024/09/eni-snam-launch-ravenna-css-italy-s-first-carbon-capture-storage-project.html (Accessed: 06 November 2025)

ENOVA (2025) *Statistikk over Energimerkeordningen.* https://portal.ems.enova.no/statistikk

Epoch AI (2025) *GATE: An Integrated Assessment Model for AI Automation.* https://arxiv.org/abs/2503.04941

Equinor (2025a) *Hywind Tampen.* https://www.equinor.com/no/energi/hywind-tampen (Accessed 30 October 2025)

Equinor (2025b) *Electrification on the Norwegian continental shelf.* https://www.equinor.com/energy/electrification

Equinor (2025c) *CCS Pit Stop - Oslo Innovation Week.* 23 Oct 2025. https://www.oiw.no/event/CCS-Pit-Stop

ExxonMobil (2025) *Feedback from: ExxonMobil Producing Netherlands BV.* https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14408-Carbon-storage-oil-and-gas-producers-contributions-to-the-EUs-2030-storage-objective/F3535884_en (Accessed: 06 November 2025)

European Commission (2025a) *Report on energy prices and costs in Europe.* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52025DC0072

European Commission (2025b) *Commission decision (EU) 2025/1479.* https://eur-lex.europa.eu/eli/dec/2025/1479 (Accessed: 06 November 2025)

European Commission (2021) *Allocation to industrial installations.* https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/free-allocation/allocation-industrial-installations_en (Accessed: 06 November 2025)

European Union (2024) *EU Net-Zero Industry Act.* https://eur-lex.europa.eu/EN/legal-content/summary/eu-net-zero-industry-act.html

Finansdepartementet (2025) *Foreslår nedtrapping av elbilsubsidier. Regjeringen.no.* 15 October. https://www.regjeringen.no/no/aktuelt/foreslar-nedtrapping-av-elbilsubsidier/id3124394/

Fornybar Norge (2025) *Tre gode nyheter fra statsbudsjettet for 2026.* 15 October. https://www.fornybarnorge.no/nyheter/2025/tre-gode-nyheter-fra-statsbudsjettet-for-2026/

Forskningsrådet (2025) *Regjeringens milliardsatsing: Dette er Norges seks nye forskningssentre for kunstig intelligens.* 11 June. https://www.forskningsradet.no/nyheter/2025/forskningssentre-kunstig-intelligens/

Greensand (2025) *A world-leading CO_2 storage facility.* https://greensandfuture.com/next-chapter (Accessed: 06 November 2025)

Guttormsen, M., Skjelvik, S. (2023) 'Freyr kutter kraftig i batterisatsingen i Mo i Rana'. *NRK.* 10 November. https://www.nrk.no/nordland/freyr-kutter-kraftig-i-batterisatsingen-i-mo-i-rana-1.16630920

Heidelberg Materials (2025) *Brevik CCS.* https://www.brevikccs.com/en/facts-and-faq (Accessed: 06.11.025)

Hjort (2025) *Fritt frem for utbygging av kraft i vernede vassdrag?* https://www.hjort.no/fritt-frem-for-utbygging-av-kraft-i-vernede-vassdrag

Holter, M., Ånestad, M., Christensen, J., & Solgård, J. (2025) 'Equinor kutter fornybarmål og øker i olje: – Vi tilpasser oss markedssituasjonen'. *DN.* 5 February. https://www.dn.no/olje/equinor/resultater/equinor-kutter-fornybarmal-og-oker-i-olje-vi-tilpasser-oss-markedssituasjonen/2-1-1774032?abtest=a

Hydro (2024) *Hydro opens new recycling facility in Høyanger to meet demand for low-carbon aluminium.* 19 April 2024. https://www.hydro.com/en/global/media/news/2024/hydro-opens-new-recycling-facility-in-hoyanger-to-meet-demand-for-low-carbon-aluminium

IIASA – International Institute for Applied Systems Analysis (2024). *IIASA GDP Data prepared by Jesus Crespo Cuaresma and Jakob Gregor Zellmann.* https://data.ece.iiasa.ac.at/ssp/#/about

REFERENCES

IMF – International Monetary Fund (2025). *World Economic Outlook - A Critical Juncture amid Policy Shifts.* https://www.imf.org/en/Publications/WEO/Issues/2025/04/22/world-economic-outlook-april-2025

Indrebø-Langlo, M. (2025) 'Rekordhøy støtte til olje og gass'. *TV2.* 17 November. https://www.tv2.no/nyheter/innenriks/rekordhoy-stotte-til-olje-og-gass/18285383/

Karlsen, Tia (2025) *NVE:* 'Betydelig nedgang I solkraftmarkedet for private boliger.' *Teknisk ukeblad.* 26 March. https://www.tu.no/artikler/nve-betydelig-nedgang-i-solkraftmarkedet-for-private-boliger/557278

Kazlou, T., Cherp, A., Jewell, J. (2024) 'Feasible deployment of carbon capture and storage and the requirements of climate targets'. *Nature Climate Change 14, 1047–1055.* https://www.nature.com/articles/s41558-024-02104-0

Klima- og miljødepartementet (2025a) *Regjeringens klimastatus og -plan for 2026.* https://www.regjeringen.no/no/aktuelt/regjeringen-skjerper-kravene-til-biodrivstoff-fra-2026/id3114089/

Klima- og miljødepartementet (2025b) *Regjeringen skjerper kravene til biodrivstoff fra 2026. Regjeringen.no.* 2 July. https://www.regjeringen.no/no/aktuelt/regjeringen-skjerper-kravene-til-biodrivstoff-fra-2026/id3114089/

Klimastiftelsen (2025). *Tilnull kvartalsrapport.* https://api.klimastiftelsen.no/wp-content/uploads/2025/10/TIL_NULL_Kvartalsrapport_3_2025.pdf#page=41

KS (2024) *EUs fornybardirektiv ivaretar kommunalt selvstyre.* 10 September. https://www.ks.no/ks-advokatene/nyheter/eus-fornybardirektiv-ivaretar-kommunalt-selvstyre/

Lund, K. (2025) 'Grunnrenteskatt på småkraft: – Dette blir ikke noe av, men skaden har allerede skjedd'. *DN.* 20 October. https://www.dn.no/energi/smakraftverk/energi/vannkraft/grunnrenteskatt-pa-smakraft-dette-blir-ikke-noe-av-men-skaden-har-allerede-skjedd/2-1-1887631

Lutz, J., Hanssen-Bauer, I., Tveito, O.E., Dobler, A. (2025) *Precipitation variability in Norway* 1961-2020. (NMI,2025) (ISSN 2387-4201). https://www.met.no/publikasjoner/met-report/met-report-2024/_/attachment/inline/f5ba4d69-dba2-4eb6-bed9-0189178b5e7a:ba4f4974e503f9509d33f101ef-c40145b47a59e6/MET%20report%201%202024.pdf

Maksgrid (2025) *Prosjekt: MaksGrid.* https://smartgrids.no/prosjekt-maksgrid/

Miljødirektoratet (2025) *Klimatiltak i Norge: Kunnskapsgrunnlag 2025.* https://www.miljodirektoratet.no/publikasjoner/2025/januar-2025/klimatiltak-i-norge-kunnskapsgrunnlag-2025/

Miljødirektoratet (2025b) *Klimakvoter: Mulige endringer i regelverket for ETS2.* https://www.miljodirektoratet.no/aktuelt/fagmeldinger/2025/november-2025/klimakvoter-mulige-endringer-i-regelverket-for-ets2/

Miljødirektoratet (2024) *Norway's Greenhouse Gas Emissions 1990-2022: National Inventory Report.* https://www.miljodirektoratet.no/publikasjoner/2024/mars-2024/greenhouse-gas-emissions-1990-2022-national-inventory-report/ (Accessed: 06.11.025)

Ministry of Foreign Affairs (2025) *Fakta om EØS-etterslepet.* https://www.regjeringen.no/no/aktuelt/fakta-om-eos-etterslepet/id3085350/

Milne, R. (2024) 'Norway campaigns to cut energy links to Europe as power prices soar'. Financial Times. https://on.ft.com/43lEAUA

Naschert, C. (2025) 'Complex continuity in Norway spells difficult energy compromises post-election'. *S&P Global* https://www.spglobal.com/market-intelligence/en/news-insights/articles/2025/9/complex-continuity-in-norway-spells-difficult-energy-compromises-postelection-92631393

NHRI (2025) *ECtHR finds no violation in climate case against Norway, but clarifies obligations for petroleum projects.* https://www.nhri.no/en/2025/ecthr-finds-no-violation-in-climate-case-against-norway-but-clarifies-obligations-for-petroleum-projects/ (Accessed: 06.11.2025)

NKOM (2025) *Registrerte datasenteroperatører og datasentre.* https://nkom.no/datasenter/oversikt

Norsk Petroleum (2025) *Export value of Norwegian petroleum.* https://www.norskpetroleum.no/en/production-and-exports/exports-of-oil-and-gas

Norway (2025) *Norway's nationally determined contribution for 2035.* https://unfccc.int/sites/default/files/2025-06/Norways%20NDC%20for%202035..pdf (Accessed: 06.11.2025)

Northern Lights (2025) *Northern Lights is expanding capacity through commercial agreement.* https://norlights.com/news/northern-lights-is-expanding-capacity-through-commercial-agreement/

Norwegian government (2025) *National Budget 2026.* https://www.regjeringen.no/no/dokumenter/meld.-st.-1-20252026/id3123808/?q=langskip&ch=1#match_0 (Accessed: 06.11.025)

Norwegian Offshore Directorate (2025) *Licences for carbon storage.* https://www.sodir.no/en/facts/carbon-storage/licences-for-carbon-storage/ (Accessed: 06 November 2025)

Norwegian Ministry of Climate and Environment (2025a) *Meld. St. 35 (2023–2024) Report to the Storting (white paper): Sustainable use and conservation of biodiversity.* https://www.regjeringen.no/contentassets/c8122f7641734da2b892738b796d4725/en-gb/pdfs/stm202320240035000engpdfs.pdf

Norwegian Ministry of Climate and Environment (2025b) *Regjeringens klimastatus og -plan for 2026.* https://www.regjeringen.no/no/dokumenter/regjeringens-klimastatus-og-plan/id3123115/

Norwegian Ministry of Climate and Environment (2024) *Meld. St. 35 (2023–2024) Report to the Storting (white paper): Sustainable use and conservation of biodiversity.* https://www.regjeringen.no/contentassets/c8122f7641734da2b892738b796d4725/en-gb/pdfs/stm202320240035000engpdfs.pdf

Norwegian Ministry of Energy (2025) *Spørsmål og svar om fornybardirektivet. Regjeringen.no. 23* January. https://www.regjeringen.no/no/tema/energi/eueos_og_energi/spors-mal-og-svar-om-fornybardirektivet/id3047839/

Norwegian Ministry of Energy (2024) *Norway leads the way in offering commercial CO_2 storage.* https://www.regjeringen.no/en/whats-new/norway-leads-the-way-in-offering-commercial-co2-storage/id3037033/ (Accessed: 06 November 2025)

Norwegian Ministry of Energy (2023) *Regjeringens handlingsplan for raskere nettutbygging og bedre utnyttelse av nettet.* https://www.regjeringen.no/globalassets/departementene/ed/ingrid/regjeringens-handlingsplan-for-raskere-nettutbygging-og-bedre-utnyttelse-av-nettet.pdf

Norwegian Ministry of Finance (2025) *National Budget 2026.* https://www.regjeringen.no/no/dokumenter/meld.-st.-1-20242025/id3056833/?ch=1 (Accessed: 06 November 2025)

Norwegian Ministry of Foreign Affairs (2025) *Fakta om EØS-etterslepet.* 31 January. https://www.regjeringen.no/no/aktuelt/fakta-om-eos-etterslepet/id3085350/

Norwegian Ministry of Foreign Affairs (2024) *NOU 2024:7 Norway and the EEA: Development and experiences.* https://www.regjeringen.no/en/documents/nou-2024-7/id3033576/

Norwegian Ministry of Trade, Industries and Fisheries (2025) *Meld. St. 16 (2024–2025) Report to the Storting (white paper): The Norwegian industry - competitiveness for a new time.* https://www.regjeringen.no/en/documents/the-norwegian-industry-competitiveness-for-a-new-time/id3108633/

Norwegian Ministry of Trade, Industry and Fisheries (2022) *The Green Industrial Initiative.* https://www.regjeringen.no/contentassets/1c3d3319e6a946f2b57633c0c5fcc25b/roadmap_the-green-industrial-initiative_spreads_web.pdf

NRK (2025) *Bygger unik hydrogenfabrikk til 1,2 milliarder: – Det eneste stedet i verden hvor dette blir gjort.* https://www.nrk.no/nordland/bygger-hydrogenfabrikk-til-1_2-milliarder_-_-det-eneste-stedet-i-verden-hvor-dette-blir-gjort-1.17224449

NSCALE (2025) *Nscale, Aker and OpenAI to establish Stargate Norway: a 100,000 NVIDIA GPU AI Gigafactory powered by renewable energy in Northern Norway.* 31 July. https://www.nscale.com/press-releases/stargate-norway-nscale-aker-openai

NVE (2025a) *Ny kraftproduksjon.* https://www.nve.no/ energi/analyser-og-statistikk /ny-kraftproduksjon/ (Accessed 30 October 2025)

NVE (2025b) *Data for utbygde vindkraftverk i Norge.* https://www.nve.no/energi/energisystem/vindkraft-paa-land/data-for-utbygde-vindkraftverk-i-norge/ (Accessed 30 October 2025)

NVE (2024c) *Krevende, men mulig, å redusere strøm–forbruk med 10 TWh.* 12 March. https://www.nve.no/nytt-fra-nve/nyheter-energi/krevende-men-mulig-aa-redusere-stroemforbruk-med-10-twh/

NVE (2024d) *Mål om 10 TWh mindre strømforbruk I bygninger innen 2030.* https://www.nve.no/media/16914/endelig-versjon-10-twh-redusert-stroembruk-i-bygningsmassen-til-2030_notat-19feb24.pdf

NVE (2025e) *Langsiktig kraftsmarkedanalyse 2025 (NVE-rapport 15/2025).* https://publikasjoner.nve.no/rapport/2025/rapport2025_15.pdf

NVE (2025f) Nettside: *Status for ny vannkraftproduksjon.* https://www.nve.no/energi/energisystem/vannkraft/status-for-ny-vannkraftproduksjon/

NVE (2025g) *Konsesjonssaker.* https://www.nve.no/konsesjon/konsesjonssaker

NVE (2025h) *Produksjonsavgift for vindkraft på land.* 16 October. https://www.nve.no/energi/energisystem/vindkraft-paa-land/produksjonsavgift-for-vindkraftverk-paa-land

NVE (2025i) *Eierskap til kraftverk.* 11 August. https://www.nve.no/energi/analyser-og-statistikk/eierskap-til-kraftverk

NVE (2025j) *Oversikt over solkraftanlegg i Norge.* https://www.nve.no/energi/energisystem/solkraft/oversikt-over-solkraftanlegg-i-norge/

NVE (2025k) *Regulatoriske utfordringer for batteriaktører.* https://www.nve.no/media/18953/sommerprosjekt-rme-2025.pdf

REFERENCES

NVE (2024) *Norsk og nordisk effektbalanse mot 2035*. https://publikasjoner.nve.no/rapport/2024/rapport2024_20.pdf

NVE (2023) *Norway and the European power market*. https://www.nve.no/norwegian-energy-regulatory-authority/wholesale-market/norway-and-the-european-power-market/

Offshore Norge (2024) *EUs Net-Zero Industry Act: Offshore Norge's response*. https://www.offshorenorge.no/contentassets/c114142fe7e24fbf84b26695c4f33c2f/ccs/net-zero-industry-act---english-version-of-offshore-norge-response-28-oct-2024.pdf (Accessed: 06 November 2025)

Offshore Technology (2024) *Equinor announces partial electrification of North Sea Troll B and C platforms*. https://www.offshore-technology.com/news/equinor-partial-troll/

Olje- og energidepartementet (2023) *Handlingsplan for energieffektivisering i alle deler av norsk økonomi*. https://www.regjeringen.no/contentassets/76641946084c49e9910bf60cd7df5dd3/no/pdfs/handlingsplan-for-energieffektivisering.pdf

Penson, S. (2025) *Letter from London: Shell blasts EU carbon storage targets*. https://www.pemedianetwork.com/carbon-economist/articles/ccus/2025/letter-from-london-shell-blasts-eu-carbon-storage-targets/ (Accessed: 06 November 2025)

Porthos (2025) *Porthos Project Description*. https://www.porthosco2.nl/en/project/ (Accessed: 06 November 2025)

Reed (2024) *Kjernekraften må finne sin plass*. https://cicero.oslo.no/no/artikler/kjernekraften-ma-finne-sin-plass

Regjeringen (2025) *Åpning av superdatamaskinen Olivia*. 17 June. https://www.regjeringen.no/no/aktuelt/apning-av-superdatamaskinen-olivia/id3110235/

Regjeringen (2025b) *Norge i Nord*. https://www.regjeringen.no/no/dokumenter/norge-i-nord-nordomradepolitikken-i-en-ny-virkelighet/id3116799/

Regjeringen (2024a) *Meld. St. 4 (2024–2025): Anmodnings- og utredningsvedtak i stortingssesjonen 2023–2024*. https://www.regjeringen.no/no/dokumenter/meld.-st.-4-20242025/id3056808/?ch=5

Regjeringen (2024b) *Modne prosjekter skal prioriteres i nettkøen*. https://www.regjeringen.no/no/aktuelt/modne-prosjekter-skal-prioriteres-i-nettkoen/id3080139/

Regjeringen (2024c) *The green industrial initiative*. https://www.regjeringen.no/contentassets/b5a51f3220474b3197ea21feb260f5b3/en/roadmap-2.0_the-green-industrial-iniative_eng_uu.pdf

Reuters (2024) *Norway's Equinor scraps plans to export blue hydrogen to Germany*. https://www.reuters.com/business/energy/norways-equinor-scraps-plans-export-blue-hydrogen-germany-2024-09-20/?_sm_au_=iHVr5nrbnR-R70MtRctQQFK3qWK4TJ

Ripple, W. et. al '(2025) The 2025 state of the climate report: a planet on the brink'. *BioScience, 2025;, biaf149*. https://doi.org/10.1093/biosci/biaf149

Riksrevisjonen (2025) *Dokument 3:7 (2024–2025): Riksrevisjonens undersøkelse av kapasiteten i strømnettet*. https://www.riksrevisjonen.no/globalassets/rapporter/no-2024-2025/kapasiteten-i-stromnettet.pdf

ROE (2025) *Return on Europe. European Data Centres Market 2025: Growth, Power Bottlenecks and AI Impact*. https://returnoneurope.com/european-data-centres-market-2025/

Romania Journal (2025) *Romanian Oil Producers Sue EU Over Costly Mandatory CO_2 Storage*. https://www.romaniajournal.ro/business/romanian-oil-producers-sue-eu-over-costly-mandatory-co2-storage/ (Accessed: 06 November 2025)

Rystad Energy (2025) *From talk to action what enables positive CCS decisions, Oslo Innovation Week CCS pitstop*. Dated: 23 October 2025.

Samferdselsdepartementet (2017) *Meld. St. 33 (2016–2017), Nasjonal transportplan 2018–2029*. https://www.regjeringen.no/no/dokumenter/meld.-st.-33-20162017/id2546287/

Samferdselsdepartementet (2024) *Meld. St. 14 (2023–2024), Nasjonal transportplan 2025–2036*. https://www.regjeringen.no/no/dokumenter/meld.-st.-14-20232024/id3030714/

Sandvik, L. (2024) 'Shell legger planer om blått hydrogen på is'. *Energiwatch*. 24 September. https://energiwatch.no/nyheter/fornybar/article17473150.ece

Sandvik, L. (2025) 'Statnett har frigjort 3.000 MW – halvparten fra hydrogen'. *Energiwatch*. 17 October. https://energiwatch.no/nyheter/nett_teknologi/article18648176.ece

Schaugg, L., Jones, N. Qi, J. (2025) *Historic International Court of Justice Opinion Confirms States' Climate Obligations*. https://www.iisd.org/articles/deep-dive/icj-advisory-opinion-climate-change (Accessed: 06.11.2025)

Selstad, F. (2025) *Future changes in precipitation variability and implications for hydropower in Norway*. https://bora.uib.no/bora-xmlui/handle/11250/3205891

SINTEF (2025) *How can Norway secure its energy system in the face of current threats?* https://www.sintef.no/en/latest-news/2025/how-can-norway-secure-its-energy-system-in-the-face-of-current-threats/

Sjøfartsdirektoratet (2025) *Consultation and implementation status for FuelEU Maritime*. 5 September. https://www.sdir.no/en/news/consultation-and-implementation-status-for-fueleu-maritime/

SPGlobal (2024) *Shell pulls plug on Norwegian blue hydrogen project citing lack of demand*. https://www.spglobal.com/commodityinsights/en/market-insights/blogs/energy-transition/100224-et-highlights-shell-blue-hydrogen-project

SSB (2025a) *Statistikk om investeringer i olje og gass, industri, bergverk og kraftforsyning*. https://www.ssb.no/energi-og-industri/industri-og-bergverksdrift/statistikk/investeringer-i-olje-og-gass-industri-bergverk-og-kraftforsyning (Accessed 30 October 2025)

SSB (2025b) *Table 11561: Energy balance. Supply and consumption, by energy product 1990 – 2024*. https://www.ssb.no/en/statbank/table/11561

Statnett (2025a) *Statistikk om tilknytningssaker*. https://www.statnett.no/for-aktorer-i-kraftbransjen/nettkapasitet-til-produksjon-og-forbruk/foresporsler-og-reservasjon-i-nettet/#kapasitetsk%C3%B8 (Accessed 13 November 2025)

Statnett (2025b) *Systemutviklingsplan 2025*. https://www.statnett.no/globalassets/for-aktorer-i-kraftsystemet/planer-og-analyser/sup/systemutviklingsplan-2025.pdf

Statnett (2025c) *Langsiktig Markedsanalyse*. https://www.statnett.no/globalassets/for-aktorer-i-kraftsystemet/planer-og-analyser/lma/langsiktig-markedsanalyse-2024-50.pdf

Statnett (2025d) *1 MW som minste budstørrelse for mFRR-reserver fra 2.desember*. https://www.statnett.no/for-aktorer-i-kraftbransjen/nyhetsarkiv/1-mw-som-minste-budstorrelse-for-mfrr-reserver-fra-2.desember

Statnett (2025e) *Confirmation of mFRR EAM go live March 4th 2025*. https://www.statnett.no/en/for-stakeholders-in-the-power-industry/news-for-the-power-industry/confirmation-of-mfrr-eam-go-live-march-4th-2025/

Statnett (2025f) *Automatisert systemdrift*. https://www.statnett.no/for-aktorer-i-kraftbransjen/utvikling-av-kraftsystemet/prosjekter-og-tiltak/finere-tidsopplosning-i-det-nordiske-kraftmarkedet/

Strømprisutvalget (2023) *Balansekunst. Energidepartementet*. https://www.regjeringen.no/contentassets/10f00b5f-c453430a867deea8b9d1f355/stromprisutvalgets-rapport.pdf

Søreide, A. (2025) 'Norge på europatoppen i antall varmepumper per husstand'. *Norsk Varmepumpeforening*. 6 August. https://www.novap.no/artikler/norge-pa-europatoppen-i-antall-varmepumper-per-husstand

Teknisk Ukeblad (2025) *Tibber får fortsatt ikke delta i balansemarkedet*. https://www.tu.no/artikler/tibber-far-fortsatt-ikke-delta-i-balansemarkedet-br/563337

The Norwegian Association of Local and Regional Authorities (2024) *EUs fornybardirektiv ivaretar kommunalt selvstyre*. https://www.ks.no/ks-advokatene/nyheter/eus-fornybardirektiv-ivaretar-kommunalt-selvstyre/

Tomasgard, A., Røkke, N. et al. (2025) *Towards an Energy-Secure and Resilient Society*. https://nva.sikt.no/registration/019a10d48278-df63273d-7381-4000-ad3d-118616b54b4d

Ulvin, P. B. (2025) 'Strid om sokkelen mellom Norge og EU: Norge kan miste ledertrøya for CCS'. *Energi og Klima*. 21 October. https://www.energiogklima.no/nyhet/brussel/strid-om-sokkelen-mellom-norge-og-eu-norge-kan-miste-ledertroya-for-ccs

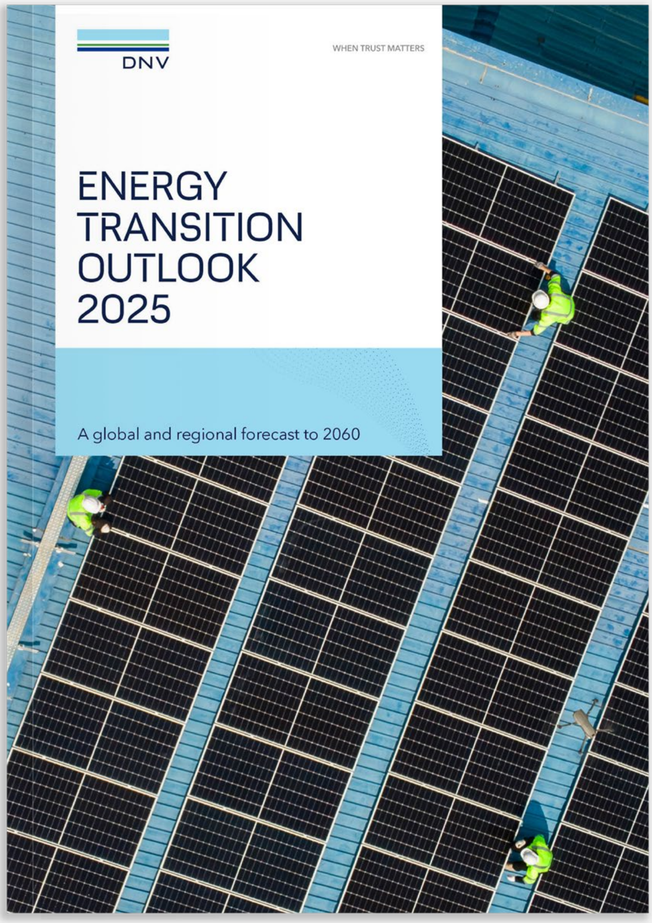
Ventyr (2025) *Q & A – Sørlige Nordsjø II*. 12 May. https://ventyrenergy.com/nyheter/snii-q-and-a

WGI (2024) *Worldwide Governance Indicators*. https://www.worldbank.org/en/publication/worldwide-governance-indicators

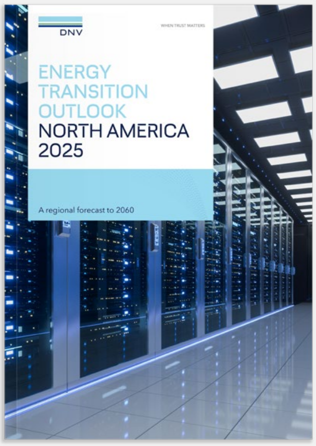
ZERO (2025) *Zerorapporten 2025 – Klimakrisen forsvinner ikke*. 27 March. https://zero.no/wp-content/uploads/2025/04/zerorapporten2025_nett.pdf

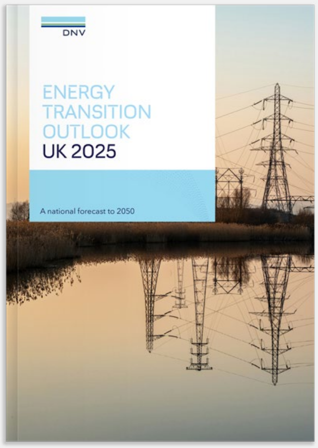
Østhagen, A. (2025) *Norway Under Pressure: A New Strategy for the High North in 2025*. https://www.nord.no/en/news/norway-under-pressure-a-new-strategy-for-the-high-north-in-2025

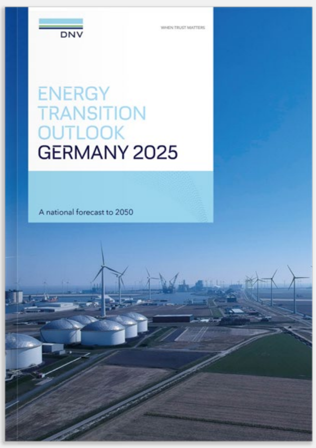
ETO REPORTS FROM DNV

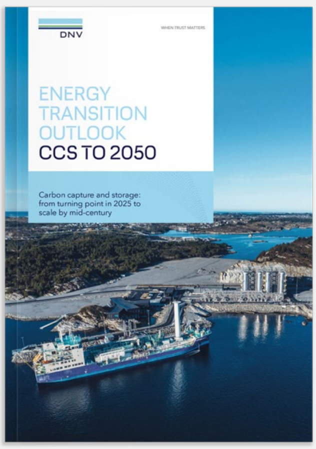


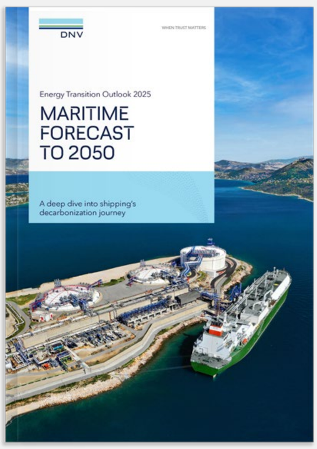
Subscribe to the latest Energy Transition insights from DNV
dnv.com/energy-transition/subscribe.html











PROJECT TEAM

Core contributors from DNV

This report has been prepared by DNV as a cross-disciplinary exercise between the Group Technology and Research unit and our business areas.

Project responsible:
Sverre Alvik

Project manager:

Mats Rinaldo
(mats.rinaldo@dnv.com)

Modelling responsible
Onur Özgün

Core modelling- and research team and contributing authors:
Aasta Andreassen, Adrien Zambon, Alireza Bayat, Anja Myhre Waitz, Eduard Romanenko, Erica McConnell, Frida Berglund, Henna Narula, Ingeborg Hutcheson Fiskvik, Ingrid Bye Løken, Jonny Scafidi, Jørgen Bjørndalen, Karolina Alexandra Ryszka, Kjetil Ingeberg, Mahnaz Hadizadeh, Ole Andreas Flagstad, Roel Jouke Zwart, Rosemarie Michaela Frigstad Luke, Sondre Vik Furuseth, Sujeetha Selvakkumaran.

Editor:
Mark Irvine

Historical data
This work is partly based on the World Energy Balances database developed by the International Energy Agency© OECD/IEA 2025, but the resulting work has been prepared by DNV and does not necessarily reflect the views of the International Energy Agency. For energy related charts, historical (up to and including 2024) numerical data is mainly based on IEA data from World Energy Balances© OECD/IEA 2024, www.iea.org/statistics, License: www.iea.org/t&c; as modified by DNV.

Published by DNV AS

Design: Minnesota Agency.
Print: Aksell
Paper Silk 150/250 g
Images: Cover image: Unsplash
Unsplash: P. 9, 64, 67.
DNV: P. 57.
Adobestock: P. 35, 36, 51.
Shutterstock: P. 4, 6, 13, 23, 25, 39, 41, 54, 61, 70

WHEN TRUST MATTERS

About DNV

DNV is an independent assurance and risk management provider, operating in more than 100 countries, with the purpose of safeguarding life, property, and the environment. Whether assessing a new ship design, qualifying technology for a floating wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to manage technological and regulatory complexity with confidence. As a trusted voice for many of the world's most successful organizations, we use our broad experience and deep expertise to advance safety and sustainable performance, set industry standards, and inspire and invent solutions.

Download the Norwegian Executive Summary here:

dnv.no/ETO2025

Headquarters:
DNV AS
NO-1322 Høvik, Norway
Tel: +47 67 57 99 00
www.dnv.com