KonKraft

THE ENERGY INDUSTRY OF TOMORROW ON THE NCS

CLIMATE STRATEGY TOWARDS 2030 AND 2050

STATUS REPORT

2024

KONKRAFT

KonKraft is a collaboration arena for Offshore Norway, the Federation of Norwegian Industries, the Norwegian Shipowners' Association, the Confederation of Norwegian Enterprise (NHO), and the Norwegian Confederation of Trade Unions (LO), together with three LO members – the United Federation of Trade Unions, the Norwegian Union of Industry and Energy Workers (IE) and the Norwegian Engineers' and Managers' Association (FLT).

KonKraft aims to be a premise provider for national strategies for the petroleum sector and will work to maintain the competitiveness of the Norwegian continental shelf so that Norway remains an attractive investment area for the Norwegian and international oil and gas industry, including supplier companies and the maritime industry.

The council is KonKraft's highest authority. In addition, KonKraft has an executive committee and a secretariat which is responsible for ongoing activities and day-to-day operations.

OFFSHORE NORGE · Norsk Industri · Norges Rederiforbund Norwegian Shipowners' Association · NHO · Fellesforbundet · INDUSTRI ENERGI

WHY A STATUS REPORT?

The KonKraft partnership developed the climate strategy "*The Energy Industry of Tomorrow on the NCS – Climate Strategy towards 2030 and 2050*" in 2020. The strategy describes the industry's efforts to achieve national and global climate goals. The development and follow-up of a common climate strategy demonstrate the partners' willingness to adapt and their ambitions for realizing a low-emission society. The KonKraft collaboration aims to cut greenhouse gas emissions from the Norwegian oil and gas industry by 50 percent by 2030 and to near zero by 2050. In parallel with reducing emissions from petroleum activities, a new and forward-looking energy industry will be built on the Norwegian continental shelf, including offshore wind, hydrogen, and carbon capture and storage (CCS).

To ensure adequate follow-up of the climate strategy, KonKraft prepares an annual status report which presents progress towards the goals through an analysis of opportunities across the operating companies based on planned and potential emission-reducing measures and innovative projects for new value chains. This report is the fourth status report since the climate strategy was launched in 2020. The annual updates provide new insight into the opportunities, industry developments, and suggestions for further improvements in the petroleum industry's climate work within the framework of the KonKraft collaboration.

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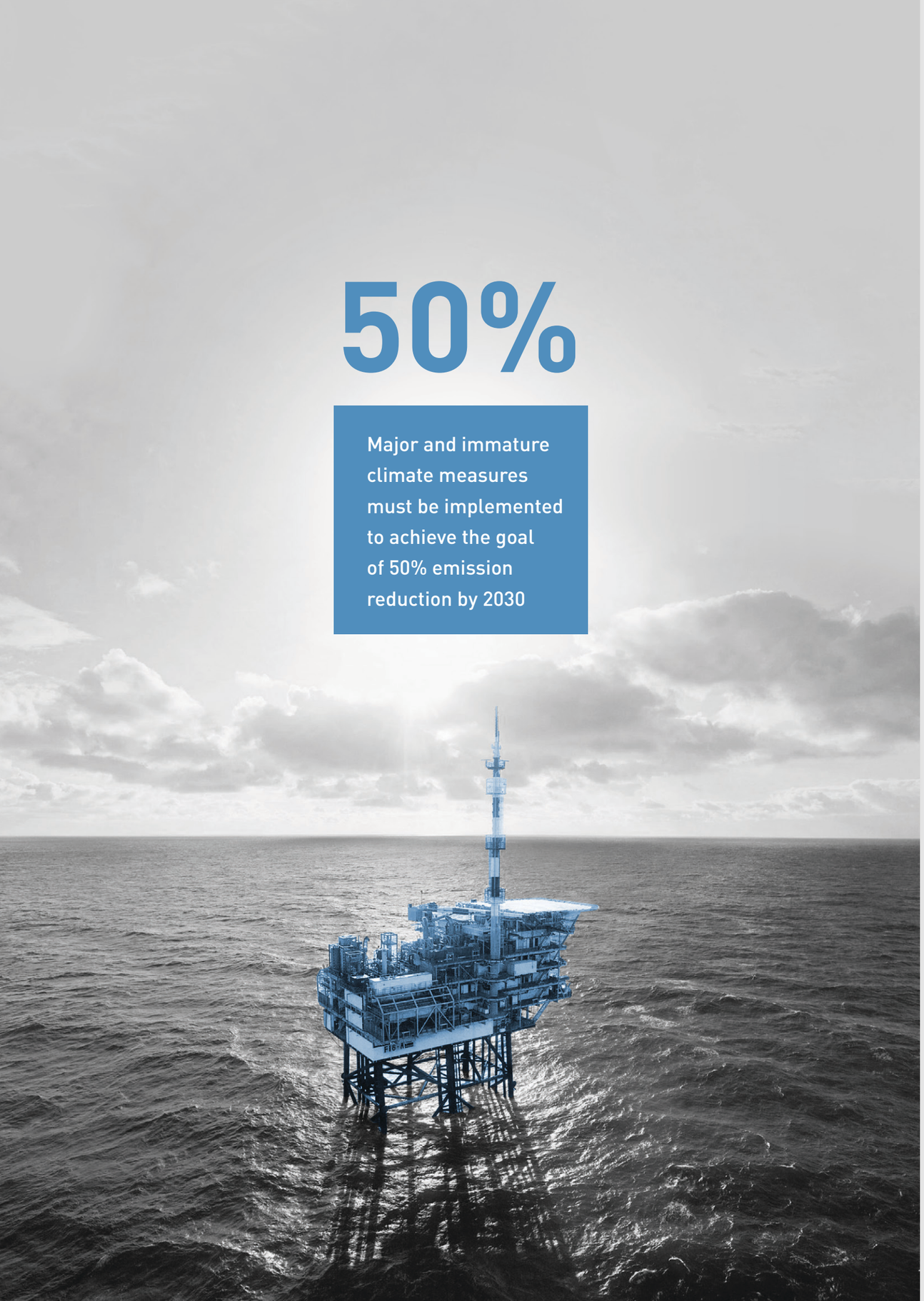


SUMMARY

The oil and gas industry represents Norway's largest industry. Its expertise and technological capabilities are crucial for achieving Norway's climate goals.

The Norwegian oil and gas industry contributes to strengthening energy security in Europe following Russia's invasion of Ukraine, and the players within the Norwegian oil and gas industry are pivotal in establishing new and forward-looking value chains in offshore wind, hydrogen, and carbon capture and storage. In 2023, Norwegian oil and gas production continued at a high level producing 233.2 million standard cubic metres of oil equivalents (Sm^3 o.e.). Production remained at the same level as in 2022 when Norway increased production to ensure energy supply to the rest of Europe.

The Norwegian offshore industry already delivers products and services within new low-emission value chains and is only in the initial stages of what could become a new industrial adventure on the shelf. Projects such as Hywind Tampen, which became fully operational in 2023, and Northern Lights, set to receive CO_2 in 2024, illustrate the execution capability in pioneering new economic sectors. Projects within emerging industries are crucial for securing jobs and the competitiveness of the Norwegian continental shelf in the long term.

FIGURE 01 UPDATED OPPORTUNITY SPACE SPRING 2024
Emissions in Mt CO_2e/year

Source: KonKraft

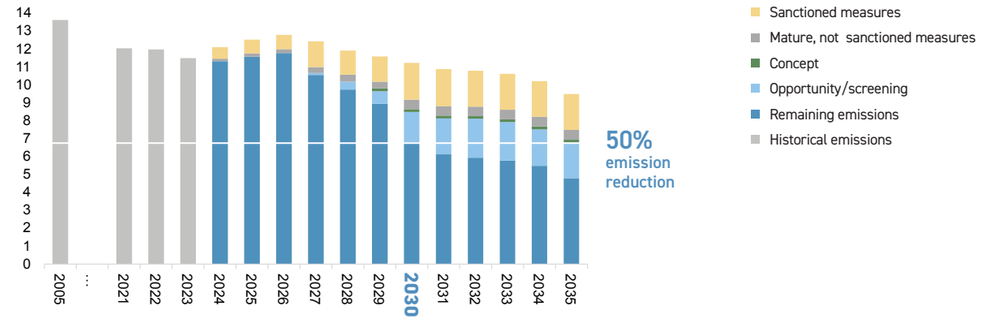


Figure: Updated opportunity space as of spring 2024 with projections for emissions and the estimated effect of large, sanctioned climate measures and measures under assessment. The projections also include planned new field developments, which means that the total effect of emission-reduction measures at the various levels of maturity levels varies somewhat over time.

The goal of a 50 percent emission reduction by 2030 is barely within reach

To ensure proper follow-up of the climate strategy, KonKraft produces an annual status report showing progress towards the goal of a 50 percent emission reduction by 2030 compared to 2005. In 2005, emissions from activities on the Norwegian continental shelf were 13.6 Mt CO_2e, and halving emissions requires reducing them to below 6.8 Mt CO_2e by 2030. The status report analyses the potential to reduce emissions across operator companies based on expected activities and potential emission-reducing measures of varying maturity (opportunity space). The development in emissions and the effect of possible emission-reducing measures with varying degrees of maturity towards 2035 can be seen in Fig. 1.

The opportunity space in spring 2024 shows that the Norwegian oil and gas industry can still cut emissions by 50 percent by 2030, but it has become even more challenging. A compilation of the operators' expected emissions towards 2035, including planned and potential climate measures, shows a total potential for emission reductions in 2030 of 4.4 Mt CO_2e. Realizing the full potential in the portfolio of climate measures will result in residual emissions of 6.8 Mt CO_2e, which corresponds to the goal of a 50 percent reduction. It is therefore necessary that all reported measures are implemented to achieve the climate target.

Electrification using power from shore is the industry's most important climate measure

Power from shore remains the measure with the greatest potential, with a total reduction potential of nearly 3.5 Mt CO_2e. Approximately half of the electrification potential consists of sanctioned measures, while a sizeable portion, around 1.4 Mt CO_2e, is still in the opportunity/screening phase.

To achieve the climate goals, the industry depends on political prioritization and willingness, as well as predictable framework conditions, to realize planned electrification projects using power from shore.

Since the climate goals were established in 2020, KonKraft has emphasized that power from shore will be crucial to achieving the 2030 goal. The Norwegian parliament's increase of the target from 40 to 50 percent in the same year contributed to reinforcing this dependency. The high carbon costs on the Norwegian continental shelf mean that, in many cases, power from shore is a profitable emission-reducing measure. Other measures, such as offshore wind combined with existing gas power, will be much more expensive to implement and provide significantly lower emission reductions. The ongoing power debate and political signals create uncertainty in the planning of the major remaining electrification measures on the continental shelf that must be realized to reach the 2030 target.

If power from shore is not allowed as a solution for new projects on the Norwegian continental shelf, the industry will have to implement measures that, despite the Norwegian continental shelf having the world's highest carbon cost levels, are commercially unviable to meet the climate targets. Projects may be put on hold, and new solutions that are not feasible within the timeframe towards 2030 will have to be started. The result could entail shutdown of otherwise profitable oil and gas production from some of these fields, thereby reducing energy exports to Europe.

Long-term emission projections – a continued focus on climate measures could lead to near-zero emissions by 2050

KonKraft's 2020 climate strategy for the Norwegian continental shelf established a long-term goal of near-zero emissions by 2050. To achieve this objective, the oil and gas industry must either implement extensive emission-reducing measures or phase out parts of its operations on the Norwegian continental shelf.

Since both Norwegian authorities and industry stakeholders are clear that they want to develop, not wind up activities on the Norwegian continental shelf, it means that the objective should be achieved through a commitment to emission-reducing measures.

A separate long-term emission forecast towards 2050 has been prepared for this year's status report. To compile the forecast, operator companies have provided current and uncertain estimates of long-term activity and emissions up to 2050, including expectations for exploration, new discoveries, ambitions for increased production, and field decommissioning. Figure 2 with the long-term forecast shows that emissions can decrease by over 70 percent by 2040 and 95 percent by 2050 if all identified climate measures are implemented. The forecast indicates that it is possible to achieve near-zero emissions while continuing to develop activity on the Norwegian continental shelf towards 2050.

Both emission pathways show a significant decline in emissions on the Norwegian continental shelf towards 2050, and the difference between the emission pathways is also decreasing. The decline in both emission pathways from 2040 onwards is driven by expectations of decommissioning installations on fields where the potential is exhausted. The long-term emission forecast also emphasizes the importance of implementing all identified climate measures. Throughout the 2030s, emissions from the oil and gas industry on the Norwegian continental shelf are projected to be approximately 2.5 Mt CO_2 higher per year in the scenario where only sanctioned measures are implemented compared to the pathway where all identified measures are realized. As a result, cumulative emissions will be approximately 25 Mt CO_2e higher during the 2030s if not all measures beyond those already sanctioned are implemented. Furthermore, these cumulative emissions will incur significant carbon allowance costs for the industry.

FIGURE 02 EMISSION FORECAST FOR THE NORWEGIAN CONTINENTAL SHELF 2030-50
Mt CO_2e

Source:KonKraft

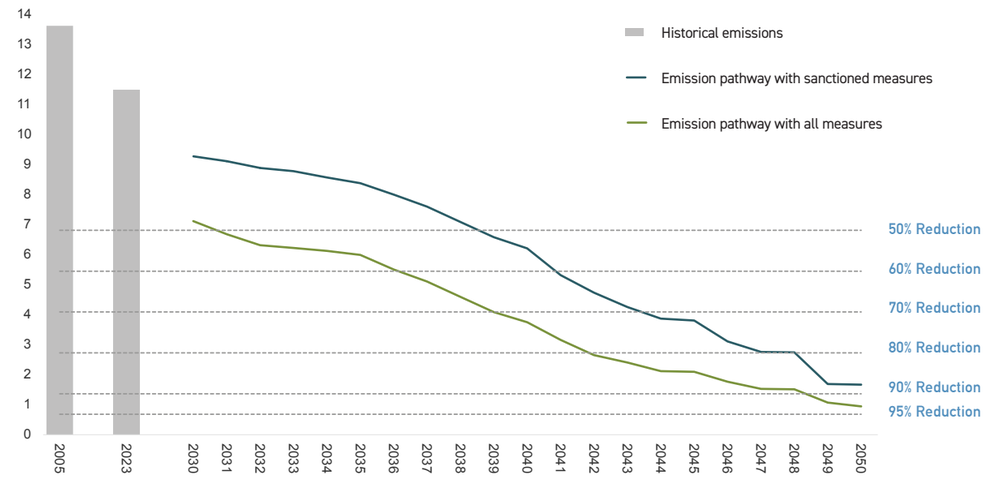


Figure: Emission forecast for the Norwegian continental shelf 2030–50, emission pathway given only already current sanctioned climate measures and pathway with all planned and potential climate measures.

Energy partnership for emission reductions in the oil and gas industry and strengthened power balance

The oil and gas industry has consistently expressed its desire to participate in expanding renewable energy through offshore wind and is positive about taking responsibility for its own power needs on the shelf. The industry has delivered and evaluated solutions for offshore wind directly connected to petroleum installations or in combination with onshore power and evaluated solutions for power delivery from offshore wind directly into the Norwegian power system, as outlined in the Troll Wind project. In May, the Norwegian government announced a desire to establish an energy partnership with the oil and gas industry for initiatives that will improve the power balance and reduce emissions on the continental shelf. The partnership was positively received by the industry, which requires a faster pace in the development and clarification of regulatory frameworks if offshore wind is to play a larger role in electrifying the shelf and alleviating the strained power situation.

The oil and gas industry expects equal treatment of all sectors in accordance with current laws and regulations for projects that have reserved grid capacity. KonKraft anticipates that future changes in regulations, currently based on the principle of equal market access for all players on non-discriminatory and objective terms, will be based on an objective rationale. Projects that have already reserved grid capacity should not face retroactive changes in regulatory frameworks, as this would weaken the competitiveness of the Norwegian continental shelf. KonKraft supports the state taking a constructive partner role and applying the Petroleum Tax Act to offshore wind power production that entirely benefits installations governed by the Petroleum Act.

"Remaining projects to meet the Norwegian parliament's expectation of a 50% emission reduction by 2030 are now being prepared. The oil and gas industry is to achieve near-zero emissions by 2050. Electrification is the most important measure to achieve these goals. But it is also crucial for the industry to remain competitive in delivering the energy demanded by Europe."

Hildegunn T. Blindheim
Managing Director, Offshore Norway

"To ensure predictability and long-term stability of the industry's regulatory framework, solutions that endure over time are crucial. Through broad political consensus on this important work, predictability for the industry's development is secured going forward, thereby developing a competitive oil and gas industry for the future.""

Frode Alfheim
Union Leader, Industri Energi and FLT

Emissions from offshore maritime operations continue to decline, particularly within the rig segment

For 2023, emissions from offshore maritime operations are estimated at 1.73 Mt CO_2, a decrease of 7 percent from 2022 and 18 percent lower than in 2008. Emissions from offshore vessels and tankers have remained stable compared to previous years, while emissions from mobile rigs have seen a significant decrease due to energy efficiency measures and operational experience gains.

Although emissions from offshore vessels have remained stable from 2022 to 2023, there is a change in emission patterns. Decreasing emissions from supply vessels are offset by increased emissions in other vessel categories within the segment. However, considering the activity within offshore vessels, the emissions intensity is still on a downward trend. Increased use of shore power and energy efficiency are important measures currently contributing to reducing emissions from offshore vessels, but there is room for improvement.

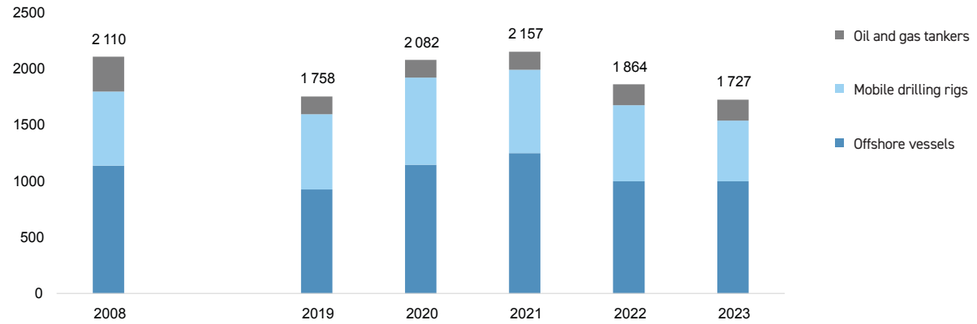
The effort to improve the data basis within maritime operations continues, and this year's report shows an even higher number of vessels with directly reported data (almost 70 percent). Additionally, VPS has developed data tools to analyse the remaining vessels by matching movement patterns, ship type, and operational profile. This year's report also includes the first draft of a baseline forecast for offshore maritime activity to 2035. The forecast will be further developed and used as an initial basis for discussions on potential emission-reduction targets for offshore maritime segments going forward.

Projects within new value chains on the continental shelf are beginning to be realized

The Norwegian offshore industry can already this year deliver products and services within new value chains and is in the initial stages of what could become a new industrial adventure on the continental shelf. By investing in new value chains such as offshore wind, hydrogen, and CCS, Norwegian industry players are developing a forward-looking energy industry on the Norwegian continental shelf and facilitating the transition to a zero-emission society in Norway and Europe.

FIGURE 03 DEVELOPMENT IN EMISSIONS FROM OFFSHORE MARITIME EMISSIONS HISTORICALLY (2008) AND THE LAST FIVE YEARS (2019-2023) 1000t CO_2

Source: VPS, DNV og Footprint[1]



1 Data for offshore vessels are compiled by VPS, DNV has provided the estimates for oil and gas tankers, and the rig data is sourced from the emissions database Footprint.

Norway's first offshore wind auction has been successfully completed

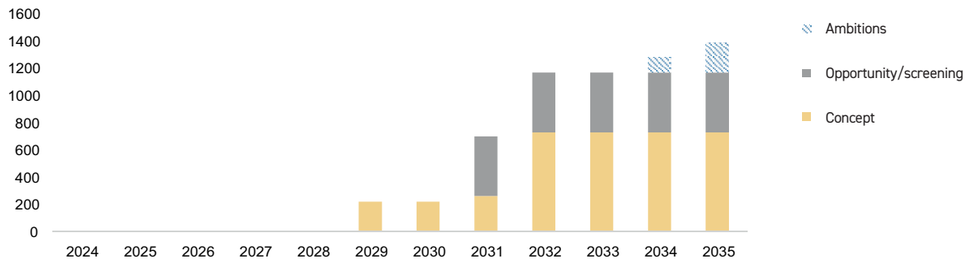
In March, the first offshore wind auction on the Norwegian continental shelf was conducted. The auction for the Sørlige Nordsjø II (Southern North Sea II) area was won by Ventyr, marking the start of large-scale offshore wind farm development in Norway. In the same month, it was also announced that Enova awarded GoliatVind up to two billion NOK in support for the realization of a floating offshore wind project that will supply renewable power to the Hammerfest region via the Goliat platform in the Barents Sea. KonKraft has noted the government's announcement in March that the application deadline for offshore wind development at Utsira Nord has been postponed. A delay implies setbacks in the allocation of project areas for floating offshore wind. However, the agreement in the revised national budget on offshore wind development may help ensure activity in the supplier industry going forward.

Ambitions for the production and delivery of blue hydrogen

The initiation of projects for the production of blue hydrogen linked to the Norwegian continental shelf is still in an early phase. But even though no projects have yet been finally approved, several industry players are working to mature a significant overall portfolio of large-scale hydrogen production. The updated forecast in this report shows that production can start in 2029, with a potential of 1.4 Mt in 2035. In KonKraft's updated strategy for blue hydrogen, an ambition of 2 Mt of hydrogen per year by 2035 has been set. The realization of this ambition depends on new projects being developed and matured in the coming years. Gassco and Dena conducted a study in 2023 which shows that a German-Norwegian hydrogen value chain is feasible. The interest in exporting Norwegian hydrogen to Europe is great, and in December 2023, Equinor signed a long-term letter of intent with Germany, the Netherlands, and the United Kingdom for deliveries of blue hydrogen from 2029 to 2060. The agreement is considered an important milestone in the development of the Norwegian continental shelf as a future hydrogen supplier.

Source: KonKraft

FIGURE 04 PROGNOSIS FOR ANNUAL BLUE HYDROGEN PRODUCTION RELATED TO LARGE-SCALE PROJECTS AND PLAYERS ON THE SHELF (1000T H_2/YEAR)



In the EU, goals and legislation have been established through the hydrogen and decarbonization package for the gas market and the revised Renewable Energy Directive, which came into force towards the end of 2023. Detailed classification criteria for low-carbon hydrogen have not yet been adopted but will be established within a year after the hydrogen and decarbonization package is adopted.

High CCS activity both in Norway and Europe

Several carbon storage projects are ongoing on the Norwegian continental shelf, and the first year of injection is expected in 2025, where Northern Lights will be able to receive 1.5 Mt of CO_2 annually. A realization of the companies' plans for the development of carbon injection capacity on the shelf will lead to a rapid scale-up towards 2030. The updated forecast in this report shows that industry players will potentially be able to receive and inject a significant volume as early as 2030 and that the volume could increase towards 2035.

The uncertainty in the forecast is high since several projects are in an early project phase and commitments from customers are needed to secure a sufficient volume to make investment decisions. In March 2024, two more areas on the Norwegian continental shelf were announced for carbon storage.

In the EU, there is an increasing focus on CCS as a tool to achieve climate goals. In February, the European Commission presented a strategic document for industrial CO_2 value chains, where several initiatives and development plans for technology, regulatory frameworks, and investment mechanisms are described. In February, the EU also agreed on the main principles of the Net-Zero Industry Act regulation, which sets a target for CO_2 injection capacity of 50 Mt CO_2 in the EU by 2030. It is not yet clear whether the regulation will apply to the EEA, which could affect the market opportunities for Norwegian carbon storage players in the EU – but could also have consequences for oil and gas producers on the Norwegian continental shelf.

Source:KonKraft

FIGURE 05 PROGNOSIS FOR ANNUAL CO_2-INJECTION CAPACITY FOR STORAGE PROJECTS ON THE SHELF Mt CO_2/year

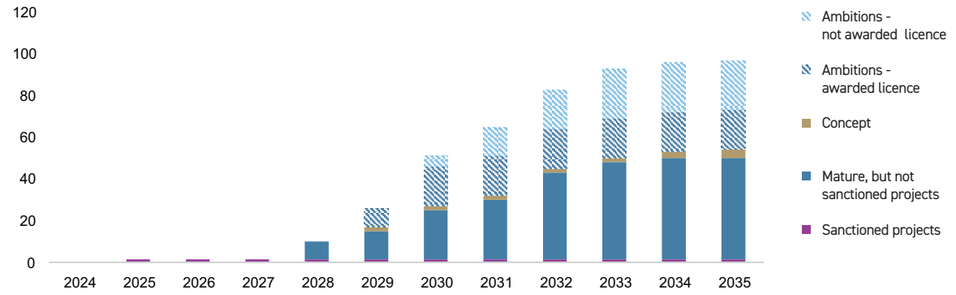


Figure: Forecast for annual CO_2 injection capacity for storage projects on the shelf with varying degrees of maturity. The graph shows the expected future cumulative injection capacity in storage projects planning to commence injection before the year on the x-axis. Note that storage projects typically scale up injection over time as they contract and receive CO_2 from multiple customers. Commencing injection in a particular year therefore does not imply reaching full injection capacity in the same year.

EU energy and climate policy is crucial for developments on the Norwegian continental shelf – many important decisions have been made, and more are expected ahead

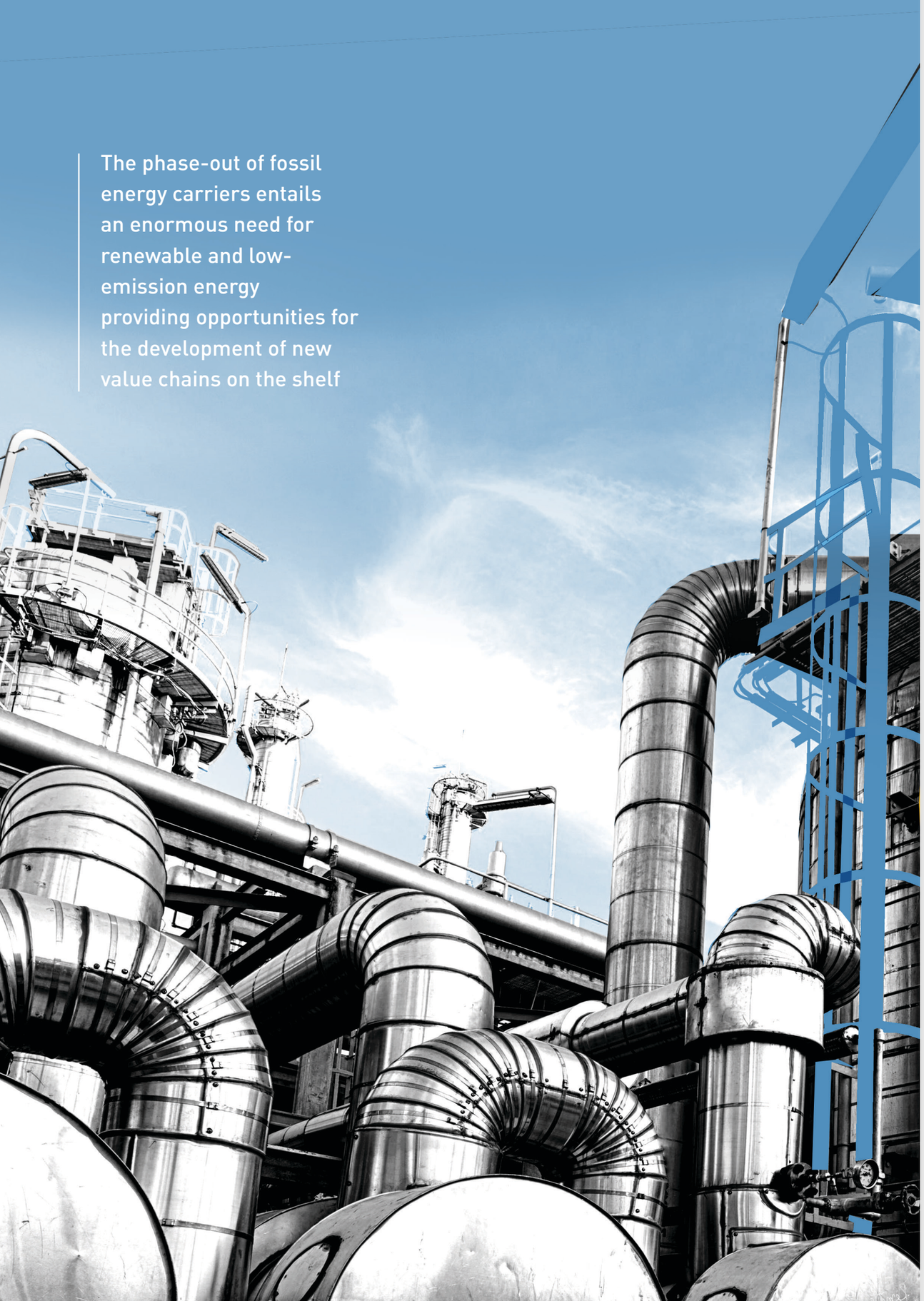
Developments in EU energy and climate policy are crucial for KonKraft's efforts to develop a future-oriented energy industry on the Norwegian continental shelf. This year's status report includes an overview of key changes in EU legislation that will impact the industry's regulatory framework. The overview serves as a reference point for climate and energy policy decisions and ambitions in the EU that are and will remain crucial for stakeholders on the Norwegian continental shelf going forward.

The EU is the most important market for Norwegian petroleum resources, and the Union's efforts to phase out fossil energy in a manner that does not compromise prices and energy security will be crucial for the further development of Norwegian resources.

For Norwegian oil and gas operations, tighter EU energy and climate policies will particularly affect the end-user market. For the further development of the industry, it is crucial to reduce emissions from the Norwegian oil and gas sector to enhance competitiveness on the shelf going forward and ensure jobs and revenue for the community. The EU also has high ambitions and is developing policies to scale up value chains for CCS, hydrogen, and offshore wind. EU framework conditions such as market design, support schemes, carbon prices, and requirements will significantly impact the pursuit of these value chains on the Norwegian continental shelf. Norwegian authorities must be engaged, coordinated, and proactive to ensure that Norwegian players maintain and strengthen their competitive advantages.

For the further development of the industry, it is crucial to reduce emissions from the Norwegian oil and gas sector in production to strengthen competitiveness on the shelf going forward and ensure jobs and revenue for the community

The phase-out of fossil energy carriers entails an enormous need for renewable and low-emission energy providing opportunities for the development of new value chains on the shelf



1

BACKGROUND

The oil and gas industry represents Norway's largest sector, and the industry's expertise and technological capabilities are crucial to achieving Norway's climate goals. Norwegian oil and gas industry maintains energy supply to Europe in 2023 and is a reliable supplier contributing to EU's ambitions to phase out Russian gas by 2027. Norwegian oil and gas industry players are key to establishing new and forward-looking value chains in offshore wind, hydrogen, and carbon capture and storage, and already deliver products and services within new low-emission value chains.

1.1 The Norwegian continental shelf – a reliable energy supplier with a focus on a low-emission society

In 2023, the high production levels of Norwegian oil and gas continued at 233 million Sm^3 o.e. Production remained at the same level as in 2022 when Norway increased production to secure energy supply to the rest of Europe. Compared to 2022, oil production was slightly higher in 2023 due to the start-up of new projects, while gas production decreased due to maintenance at onshore facilities. Norway continues to maintain energy supply and is a dependable supplier contributing to EU's ambitions to phase out Russian gas by 2027.

In the past year, the EU has emphasized its ambition to lead the world in transitioning to a low-emission society. In February, the European Commission recommended a target of a 90 percent net emission reduction by 2040 compared to 1990 levels. An impact assessment of this target indicates it could lead to an 80 percent reduction in fossil fuels for energy purposes compared to today, with coal being fully phased out. As a result of the ambition for a 90 percent net reduction by 2040, the Commission's assessment also stipulates that the power system must be nearly decarbonized by 2040. [2]

The phase-out of fossil energy carriers entails an enormous need for renewable and low-emission energy, creating opportunities for further development of new value chains on the continental shelf. The European Commission estimates that to achieve the goal of a 90 percent net emission reduction by 2040, renewable capacity in the EU must more than double, with most of it coming from wind and solar power. For sectors where emission reductions through direct electrification are challenging, such as parts of the industrial and transport sectors, hydrogen and hydrogen carriers

2 Europe Commission (2024) – 2040 Climate Target

will be important for decarbonization. Both low-carbon hydrogen and renewable hydrogen can play a role. So far, only goals and requirements for the use of renewable hydrogen have been set, and the detailed criteria for low-carbon hydrogen are still not finalized. For renewable hydrogen, the pace of renewable power development will be crucial for the volumes that can be produced.

The EU is focusing on CCS, and this spring, the European Commission launched a new strategy for industrial carbon removal[3] , highlighting a significant need for carbon storage and an estimated annual injection capacity in the EEA of at least 250 Mt CO_2 by 2040[4]. The EU has also set a carbon injection capacity target of 50 Mt CO_2/year by 2030 as part of the Net Zero Industry Act. The target only applies to the EU until the legislation is incorporated into the EEA and will be increased if the NZIA becomes EEA-relevant.

Norwegian offshore industry is already delivering products and services within new low-emission value chains starting this year. We are only at the beginning of what could become a new industrial adventure on the continental shelf, and there is great potential and clear willingness among the players to realize large-scale projects in hydrogen, CCS, and offshore wind in the coming years.

This year, Northern Lights will be ready to receive CO_2. It is the first commercial carbon storage project on the continental shelf with an annual injection capacity of 1.5 Mt CO_2/year. In April, Norway signed an agreement with Belgium, Denmark, the Netherlands, and Sweden for the transport of CO_2 for storage on the Norwegian continental shelf.

In the offshore wind segment, 2024 is the first year of full operation of the world's largest floating wind farm, Hywind Tampen, which produces electricity for the Snorre and Gullfaks petroleum fields. The first offshore wind auction in Norway was held in March for Sørlige Nordsjø II, with Ingka Investments and Ventyr as the winners. The industry is positive about the auction and points out that the project will be central to supplying Norway with renewable energy and that offshore wind has all the prerequisites to become an important new offshore industry.[5]

In blue hydrogen, Equinor's signing of a long-term memorandum of understanding with Germany, the Netherlands, and the United Kingdom in December is an important milestone in developing the continental shelf as a future hydrogen supplier. The memorandum concerns deliveries of blue hydrogen from 2029 up to 2060 and is an addition to an extensive long-term gas agreement.

3 European Commission (2024) - Towards an ambitious Industrial Carbon Management for the EU

4 There is a difference between the estimated capture and injection volume as part of the captured CO_2 is expected to be used (for e.g. e-fuels) rather than stored.

5 Offshore Norway (20.03.2024), Offshore Wind Auction – now we are underway!

> A long-term memorandum of understanding with Germany, the Netherlands, and the United Kingdom in December represents a significant milestone in the development of the continental shelf as a future hydrogen supplier

1.2 KonKraft's Climate Strategy – 50 percent emission reduction by 2030 and near zero by 2050

In 2020, KonKraft developed the climate strategy «*The Future Energy Industry on the Norwegian Continental Shelf – Climate Strategy towards 2030 and 2050*». Subsequently, the parliament issued a resolution requesting that the government present a plan together with the industry to reduce greenhouse gas emissions by 50 percent by 2030. KonKraft thus bases its ambitions on the following:

- The oil and gas industry in Norway[6] will reduce its absolute greenhouse gas emissions by 50 percent by 2030 compared to 2005, and further reduce emissions to near zero by 2050.
- The Norwegian oil and gas industry, together with shipping companies and rig owners, will be a driving force in ensuring that vessel categories within offshore maritime activities actively contribute to achieving the goal in the government's action plan for green shipping of a 50 percent emission reduction by 2030 in domestic sea transport and fishing.

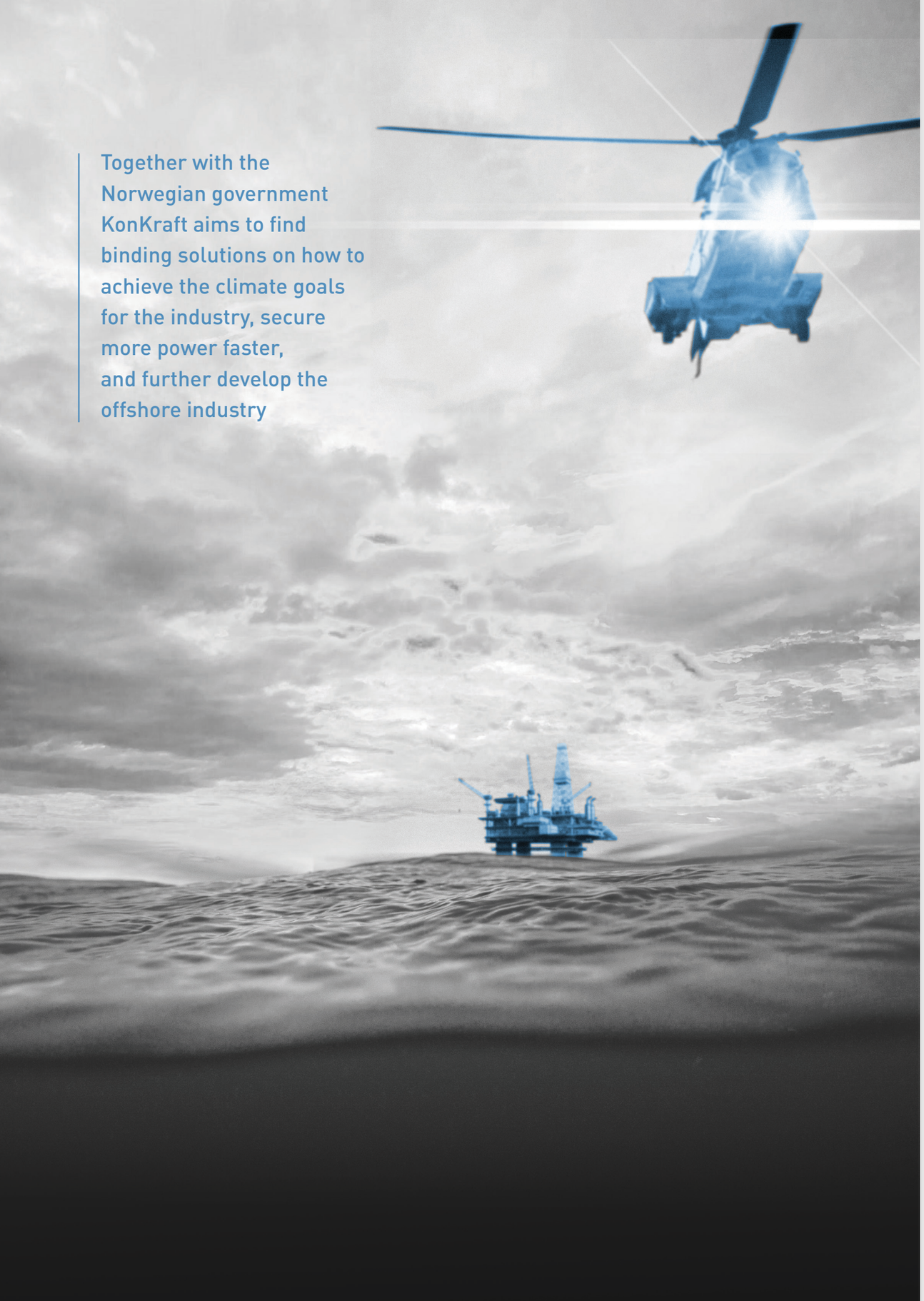
New in this year's status report is a long-term emission forecast for the development of the continental shelf towards 2050. The long-term forecast is related to companies' expectations of potential petroleum activity towards 2050, given a long-term development (including exploration, discoveries, and new production), and not the phasing out of petroleum activity on the Norwegian continental shelf. The forecast shows the need for emission reductions and measures necessary for the oil and gas sector to achieve the long-term emission target of near-zero emissions by 2050. The long-term forecast will also be an important basis for future discussions and setting milestones towards the 2050 goal.

In addition to the goal of reducing emissions from their own operations, the oil and gas industry has ambitions to create a new and forward-looking energy industry on the Norwegian continental shelf that will help other players reduce their emissions. The KonKraft partners aim to develop new value chains for offshore wind, hydrogen, CCS, and seabed minerals on the continental shelf. Annual status reports provide an updated picture of how the industry is progressing towards the 2030 goals and the development of the new value chains based on the planned projects by the stakeholders. This report is the fourth annual status report since the climate strategy was launched in 2020.

In the summer of 2023, the KonKraft partners launched updated ambitions for blue hydrogen in Norway considering developments in the European hydrogen market and Norwegian hydrogen projects. The updated ambitions for blue hydrogen involve a commitment where Norwegian authorities, together with the oil and gas industry and the supplier industry, will collaborate to produce 1 million tonnes (Mt) of blue hydrogen per year by 2032, and to build a pipeline for the export of hydrogen between Norway and the EU by 2030. Further information about the new ambitions is included in Chapter 4.4 Hydrogen, and progress towards these ambitions will be monitored through KonKraft's status reports.

Last year's report significantly improved the data basis for emissions from maritime activities with access to activity-based emissions for a substantial portion of the offshore fleet on the shelf. An intensified effort in the work on maritime emission reductions has been continued, and the KonKraft partners have initiated a collaboration to develop an emission forecast for offshore maritime emissions and identify emission-reducing measures through technological and operational improvements.

6 It includes emissions from operations on the Norwegian continental shelf as well as gas processing plants at Kårstø, Kollsnes, Nyhamna, Melkøya, and the Sture terminal.



Together with the Norwegian government KonKraft aims to find binding solutions on how to achieve the climate goals for the industry, secure more power faster, and further develop the offshore industry

2

STATUS AND PROGRESS FOR EMISSION REDUCTIONS IN 2024

The opportunity space in spring 2024 shows that it has become even more challenging for the Norwegian oil and gas industry to reach the 2030 target compared to last year. To achieve the climate goal of a 50 percent emission cut by 2030, it is necessary for all reported measures, both mature and immature, to be implemented according to schedule. Power from shore remains the measure with the greatest potential for achieving emission reductions, and for the industry to continue implementing cost-effective and necessary electrification measures, it is important to ensure predictability around access to power and the grid.

2.1 Reduced emissions from petroleum activities on the Norwegian continental shelf towards 2030

To ensure we have the best possible foundation for achieving the climate goals, KonKraft prepares an annual status report showing progress towards the target of a 50 percent emission reduction by 2030 compared to 2005. In 2005, emissions from activities on the Norwegian continental shelf totalled 13.6 Mt CO_2e. To meet the climate goal, emissions must therefore be reduced to below 6.8 Mt CO_2e by 2030. The status report analyses the potential for emission reductions across operator companies, based on expected activities and potential emission-reducing measures of varying maturity (opportunity space).

The opportunity space in spring 2024 shows that it has become even more challenging to reach the 2030 target compared to last year. In 2023, emissions were 11.5 million tonnes of CO_2 equivalent (Mt CO_2 a decrease of 0.5 Mt CO_2e compared to 2022). The decline from 2022 to 2023 is partly attributed to electrification using power from shore for Edvard Grieg and the electrification of Snorre and Gullfaks with offshore wind from Hywind Tampen. Additionally, in 2022, various installations underwent work contributing to a temporary increase in emissions, such as upgrades to Ormen Lange, Hyme, and Norne, as well as the decommissioning of Knarr. However, emissions increased in 2023 from Hammerfest LNG, which operated at full capacity throughout the year, and Njord, which resumed production in 2023.

A compilation of operator companies' expected emissions towards 2035, including planned climate actions, indicates a combined potential for emission reductions of 4.4 Mt CO_2e by 2030. Realizing the entire portfolio of climate actions will result in residual emissions of 6.8 million tonnes of CO_2 equivalent (Mt CO_2e), achieving a 50 percent emission reduction target by 2030 for the industry. Therefore, it is crucial that all planned mature and immature measures are implemented according to schedule to meet the climate goal. Without the implementation of climate actions in the coming years, emissions are expected to be around 11.2 Mt CO_2e in 2030. The trend in emissions and the impact of potential emission-reducing measures with varying degrees of maturity towards 2035 are illustrated in Figure 6.

KonKraft's analysis of the opportunity space for emission reductions is based on a review involving all operators on the Norwegian continental shelf in spring 2024 and it considers companies' climate goals, emission forecasts, emission reduction measures, planned new fields, and decommissioning of existing fields.

The figures encompass the total emissions from petroleum activities on the Norwegian continental shelf, including the total emissions from the oil and gas processing plants at Kårstø, Kollsnes, Nyhamna, Melkøya, and Sture terminal.

The measures are categorized into different maturity levels::

- Sanctioned – The investment decision has been made, but the measure is not operational yet (most mature)
- Mature but not sanctioned measures – The technical details are being clarified, and the measure is approaching an investment decision
- Concept – Conceptual studies are underway, and the measure is approaching a preliminary implementation decision
- Opportunity/screening – Opportunities for the measure are being developed and assessed at a preliminary level (great uncertainty)

FIGURE 06 UPDATED OPPORTUNITY SPACE SPRING 2024
Emissions in Mt CO_2e/year

Source:KonKraft

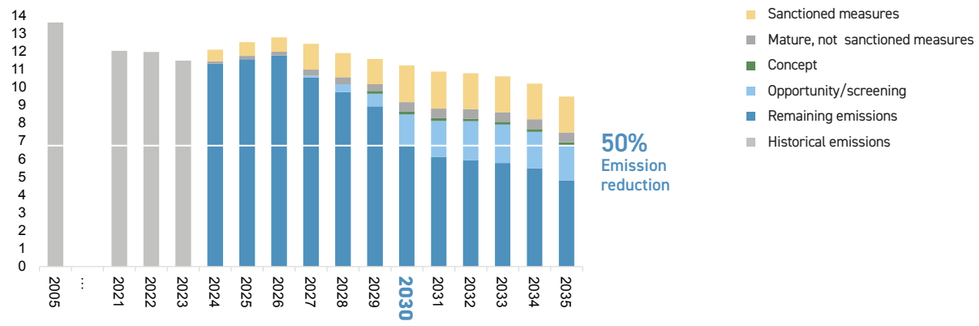


Figure: Updated opportunity space as of spring 2024 with projections for emissions and estimated impact of major sanctioned climate measures and measures under consideration. The projections also include planned new field developments, which vary the overall impact of emission reduction measures across different maturity levels over time.

Emissions from Norwegian petroleum activities are not expected to significantly decline until 2027 due to the commencement of ongoing developments. However, sanctioned climate measures help prevent further increase in emissions, which would have risen to 12.8 million tonnes of CO_2 equivalent (Mt CO_2e) in 2026 if the planned measures were not implemented.

Since the last status update, several significant emission reduction projects have been delayed, and projects previously scheduled to start before 2030 are now planned with expected start dates in 2030.
As more climate measures take effect, emissions are expected to significantly decrease year by year from 2026 onward. Significant and mature climate measures planned towards 2030 include:

- Electrification of Oseberg, which will result in an emission reduction of 300,000 tonnes of CO_2e per year from 2027.
- Electrification of Draugen and Njord, expected to achieve reductions of approximately 180,000 and 120,000 tonnes of CO_2e per year, respectively, starting in the same year.
- Hammerfest LNG will be ready for electrification in 2028, with grid connection expected in 2030, leading to emission reductions of around 700,000 tonnes of CO_2e per year.

Companies are continuously working to identify and mature measures that contribute to emission reductions. Several measures expected to reduce emissions by the end of the 2020s are in the initial stages of development. Projects are expected to consume significant company resources moving forward to ensure achievement of their own climate goals and KonKraft's goals. From 2028 to 2035, planned decommissioning of fields and installations will also contribute to emission reductions. At the same time, it is expected that the landscape will evolve over time, with additional measures for the period after 2030 being reported in upcoming status updates.

Since the last status update, several major emission-reducing projects have been delayed, and projects that were previously scheduled to start before 2030 are now planned with assumed start dates in 2030

2.1.1 The project portfolio aimed at achieving the 2030 target has a maturity profile similar to last year's

The total emission reduction potential in 2030 from various climate measures, categorized by maturity level, in this year's report compared to last year's status update is illustrated in Figure 7. Overall, there are few changes in the maturity of the project portfolio, with most projects at the same maturity level as in last year's report. A decrease in the expected effectiveness of various measures may explain the decline in emission reduction potential across several maturity levels. Additionally, several smaller projects in the *concept* and *mature but not sanctioned* stages have been discontinued and are not included in this year's forecast. These include projects in combined heat and power, local wind power, and some energy efficiency measures.

Of the total potential, approximately 2 million tonnes of CO_2e equivalent are attributed to *sanctioned measures*. Implementation of these *sanctioned measures* will reduce emissions from the oil and gas industry by 35 percent by 2030 compared to 2005 levels. A significant portion—almost 1.7 Mt CO_2 is still in the *Opportunity/ Screening* stage. It typically takes about six years for major climate measures to progress from feasibility studies (DG1) to implementation (DG4). Consequently, it is urgent to mature more of the major climate measures needed to achieve the 2030 target into the concept selection phase (pass DG1) by 2024 for them to be realized on time.

FIGURE 07 CHANGES IN MATURITY LEVEL FOR THE MEASURES IN THIS REPORT COMPARED TO LAST YEAR'S STATUS UPDATE (MT CO_2E IN 2030)

Source: KonKraft

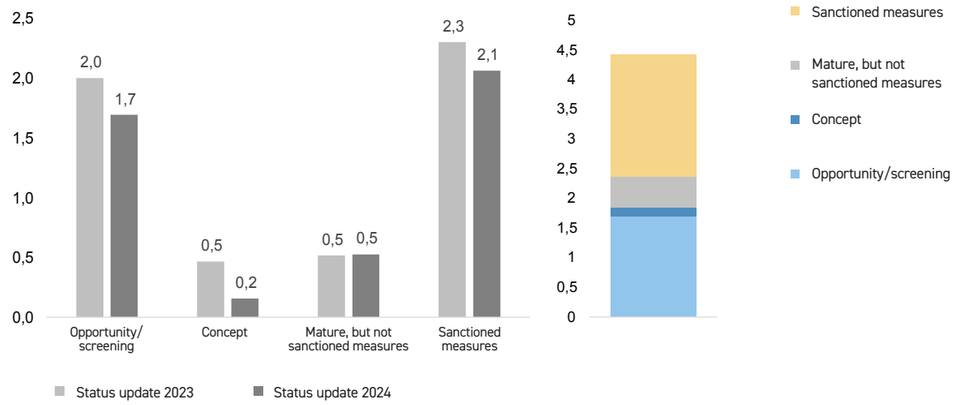


Figure: Changes in maturity level of the measures in this report compared to last year's status update.
*Long-term energy efficiency efforts are included at the "Mature, but not sanctioned measures" stage.

2.1.2 Power from shore is the measure with the greatest reduction potential by 2030, while offshore wind projects are being postponed or dropped from the portfolio

Emission reduction potential in 2030 from various climate projects distributed by type of measures, e.g., electrification or energy efficiency, is shown in Figure 8.

Power from shore remains the measure with the highest potential to reduce emissions by 2030, with a total reduction potential of 3.5 Mt CO_2e. Half of this consists of *sanctioned measures*, while a significant portion, around 1.4 Mt CO_2e, is still in the *opportunity/ screening* phase.

As the surplus of electricity in Norway decreases and pressure on grid capacity increases, operator companies are experiencing increased uncertainty regarding access to electricity and grid connections for new electrification projects. This impression was reinforced when authorities stated before Christmas in 2023 that "*it will be more difficult for rights holders to decide on and obtain regulatory approval for conversion projects to operate with power from shore in the future –partly because they may have undesired consequences for the power system.*" [7] To ensure that the industry can continue implementing profitable electrification initiatives crucial for achieving climate goals, ensuring predictability around electricity and grid access is crucial.

7 The government (22.12.2023) approves the conversion of Draugen and Njord.

FIGURE 08 CATEGORIZATION OF SANCTIONED CLIMATE ACTIONS AND ACTIONS UNDER CONSIDERATION, EXPECTED EFFECT BY 2030 (Mt CO_2e IN 2030)

Source: KonKraft

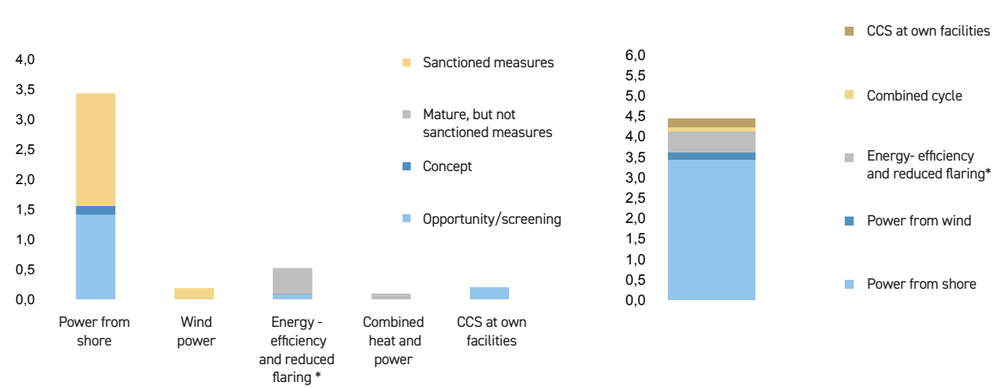


Figure: Categorization of sanctioned climate actions and actions under consideration, expected impact by 2030 (Impact of measures Mt CO_2e in 2030).
*Long-term energy efficiency efforts are included at the "Mature, but not sanctioned measures" stage.

Energy efficiency and reduced flaring can contribute significantly to emission reductions by 2030, totalling over half a million tonnes of CO_2e. The potential is likely even higher as the forecast does not capture companies continuously implementing relevant and profitable projects with short planning horizons. Additionally, energy efficiency measures in conjunction with effective energy management in operational activities could impact company value creation through improved resource management, cost reductions, and better utilization of power from the grid.

Offshore wind power: Offshore wind power with direct connection to installations on the continental shelf represents an emission reduction potential of approximately 185,000 tonnes of CO_2e by 2030. The potential has decreased compared to last year's report due to discontinuation and postponement of projects until after 2030. Hywind Tampen, which achieves full effect this year, is included, while wind power from Brage has been excluded due to lack of Enova support.

Other measures: New in this year's report is the inclusion of the "CCS at own facilities" measure. The measure includes establishing a carbon capture facility at Kårstø, where CO_2 from the exhaust gas of the Craier plant will be captured.

Gassco expects that the Kårstø facility will receive gas streams with higher CO_2 content in the coming years, and installing a carbon capture facility will prevent an increase in emissions from the gas processing plant. Additionally, the carbon capture facility is expected to contribute efficiency gains that will lead to significant emission reductions.

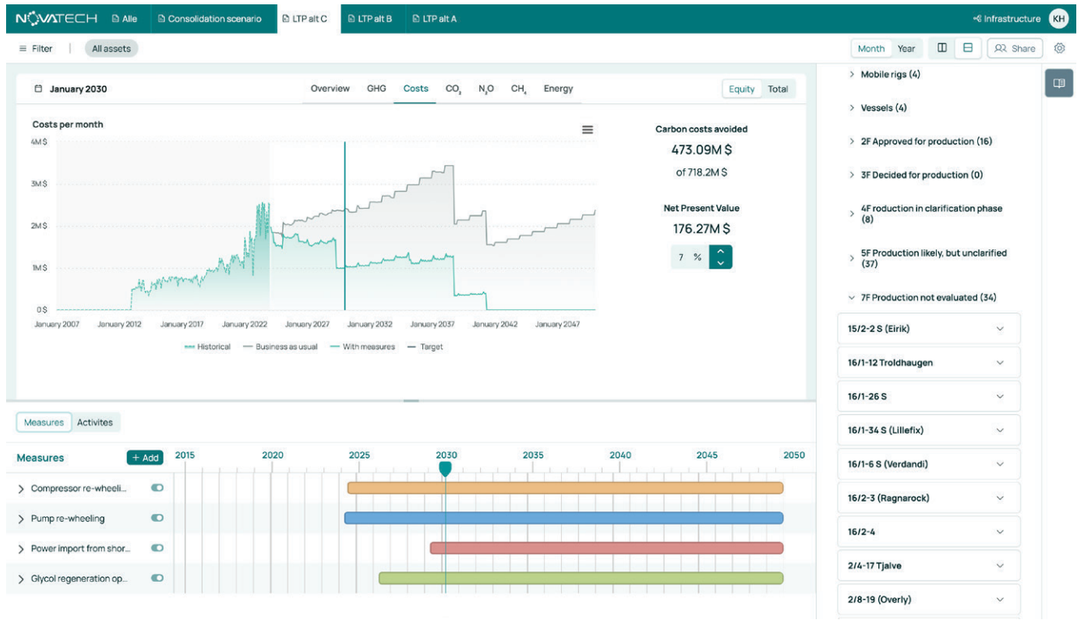
2.1.3 Artificial intelligence and digitalization tools offer multiple opportunities for monitoring and forecasting energy consumption and emissions on the continental shelf

Artificial intelligence can contribute to reducing emissions from energy-intensive industries in several ways. *Novatech NESSi* is a cloud software using artificial intelligence and machine learning to compile forecasts for energy and emissions in complex energy systems, either for individual projects or at portfolio level. These forecasts are linked with a library of emission-reducing measures, and using artificial intelligence, the tool can predict how various measures will impact a company's energy needs, emissions, and carbon costs. *Novatech NESSi* enables real-time collaboration among different disciplines on strategic emission reduction scenarios. An illustration from Novatech's forecasting tool is included in Figure 9.

Aker BP is one of several operator companies that have adopted digital tools for continuous monitoring of energy flow on their installations. The *Energy Companion* tool provides information on energy losses in equipment and can be used as part of ongoing optimization efforts to reduce energy consumption on the installation. The company is working to integrate models into field operation planning to obtain accurate forecasts of future energy needs and expected CO_2 intensity throughout the field's lifespan. Such integrated models also provide better decision support for equipment upgrades and other modifications on the installations.

FIGURE 09 EXCERPT FROM NOVATECH'S FORECASTING TOOL BASED ON ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Source: Novatech



Artificial intelligence can help reduce emissions from energy-intensive industries in several ways and offers opportunities for monitoring and forecasting energy consumption and emissions on the shelf

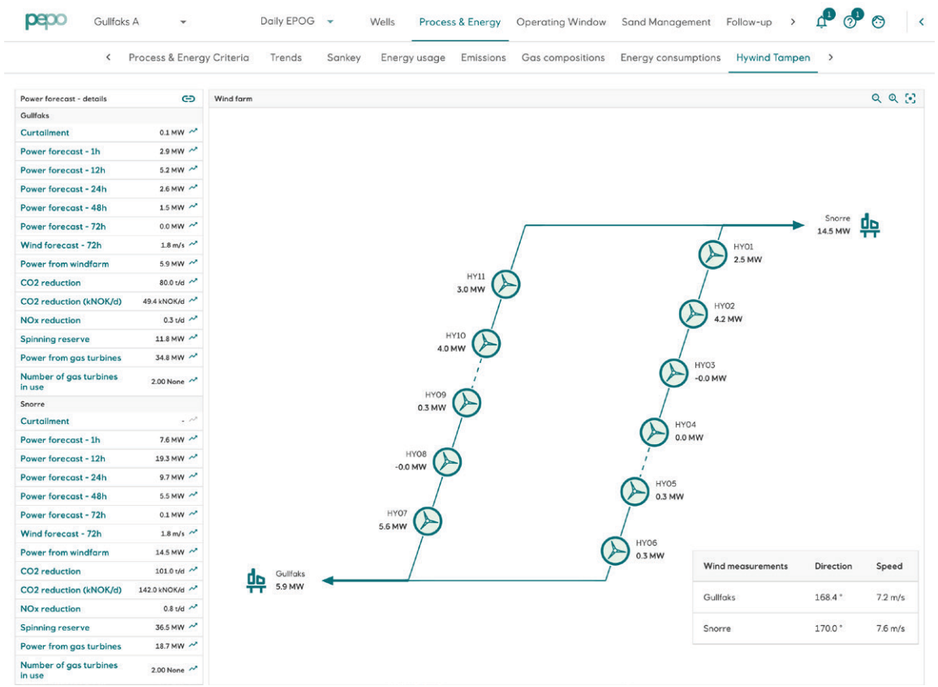
2.1.4 Optimal utilization of offshore wind power

In Equinor, ongoing energy and production optimization of all offshore installations takes place with close collaboration between personnel offshore and onshore. Equinor has developed a web-based solution (Portal for Energy and Production Optimization, PEPO) for the work with access to all relevant energy and production data in real-time, illustrated in Figure 10.

The installations Gullfaks and Snorre have an extra challenge with energy optimization. To ensure the lowest possible CO_2 emissions, most of the power demand is covered from Hywind Tampen, which consists of eleven wind turbines, each with a capacity of 8.6 MW. The rest of the power demand is covered by power from gas turbines. To ensure a stable power supply, ongoing assessments are made about the amount of reserve power the gas turbines should have (so-called spinning reserve) in case of a sudden loss of power from Hywind Tampen. Expected power from the wind turbines is based on wind forecasts. In the PEPO tool, all relevant information is compiled as decision support, allowing the determination of the number of gas turbines that need to be run at each field based on the expected power delivered from Hywind Tampen.

FIGURE 10 EXCERPT FROM EQUINOR'S TOOL FOR ENERGY AND PRODUCTION OPTIMIZATION

Source: Equinor



2.2 Long-term emission forecast for petroleum activities towards 2050

2.2.1 A long-term emission forecast for the Norwegian continental shelf is crucial to demonstrate the path towards near zero emissions by 2050

KonKraft's climate strategy for the Norwegian continental shelf from 2020 set a long-term goal of near-zero emissions by 2050. To achieve this goal, the oil and gas industry must implement extensive emission-reducing measures or phase out parts of its operations on the Norwegian continental shelf. Since both Norwegian authorities and industry players clearly want to develop, not phase out, the Norwegian continental shelf, this means that the goal should primarily be achieved through a focus on emission-reducing measures. For KonKraft and the players on the Norwegian continental shelf, it is therefore important to create forecasts for emissions towards 2050 that show what is needed to reach the goal of near-zero emissions.

KonKraft updates a more short-term emission forecast towards 2035 every year to show the status of the work on the climate strategy, see chapter 2.1.

This forecast shows the effect of sanctioned and potential climate projects that can contribute to achieving the industry's climate goal of a 50 percent emission reduction by 2030. The forecast is based on the operators' RNB reporting, which includes resource classes 1–5 as well as exploration emissions. Thus, the forecast takes limited account of lifetime extensions, increased recovery from existing fields, and new discoveries. Although this forecast is good for a shorter time horizon, it will provide a less reliable picture of the long-term development.

Therefore, a separate long-term emission forecast towards 2050 has been prepared for this year's status report. To compile the forecast, the operating companies have provided their best estimates of long-term activity and emissions towards 2050, including expectations for exploration, new discoveries, increased recovery, and decommissioning of fields. There is significant uncertainty associated with such an initial long-term forecast, but it is still important to assess the industry's transition towards near-zero emissions, which measures are necessary, and what conditions need to be in place to realize these measures.

> There will inevitably be significant uncertainty associated with such an initial long-term forecast, but it is still important to assess the industry's transition towards near-zero emissions

2.2.2 Long-term emission forecast – Continued focus on climate efforts can lead to near-zero emissions in 2050

The first long-term emission forecast for the Norwegian continental shelf is included in Figure 11 and shows that emissions can fall by over 70 percent by 2040 and nearly 95 percent by 2050 if all identified climate measures are implemented. The forecast shows that it is possible to achieve near-zero emissions while continuing development activities on the Norwegian continental shelf towards 2050. On the left-hand side of the figure, emission levels are shown for the Norwegian continental shelf in 2005, which is the reference year for emission reduction targets, and 2023, which is the last year for which we have historical data. The figure further displays two emission pathways. The green line represents the emission pathway over the period assuming all identified climate measures are implemented, while the blue line represents the emission pathway if only *sanctioned measures* are implemented.

The long-term emission forecast also shows the importance of implementing all identified climate measures. Throughout the 2030s, emissions are 2.5 Mt CO_2 higher per year when only sanctioned measures are implemented compared to the pathway where all identified measures are realized. The cumulative emissions will thus be 25 Mt CO_2e higher in the 2030s if only the measures that have already been sanctioned are implemented. Furthermore, the cumulative emissions will represent a significant increase in the industry's quota costs.

Both emission pathways show a significant decline in emissions on the Norwegian continental shelf towards 2050, and the difference between the emission pathways is also decreasing. The decreasing difference between the emission pathways is due to the effect of implemented measures diminishing with reduced production from the installations, the decommissioning of installations that have implemented climate measures, and the fact that several companies have not yet decided which emission-reducing measures to implement in the long term.

FIGURE 11 EMISSION FORECAST FOR THE NORWEGIAN CONTINENTAL SHELF 2030–50
Mt CO_2e

Source: KonKraft

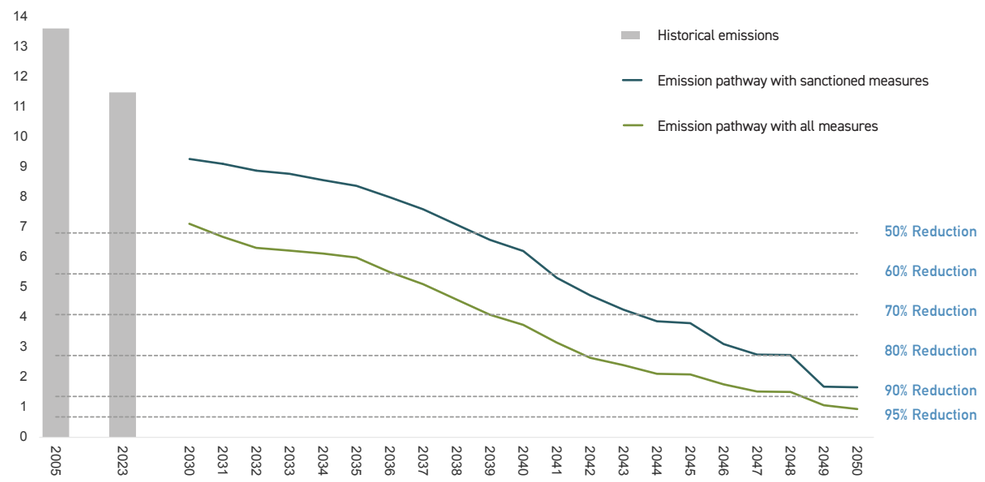


Figure: Emission forecast for the Norwegian continental shelf 2030–50, emission pathway for current sanctioned climate measures and pathway for all planned and potential climate measures.

The decline in both emission pathways from 2040 onwards is therefore mainly driven by expectations of decommissioning installations.

The two emission pathways have different starting points in 2030. The *emission pathway for sanctioned measures* starts at 9.25 Mt CO_2e in 2030, which indicates that the 2030 target of a 50 percent emission reduction will not be achieved. The starting point for the *emission pathway for all climate measures* is marginally above the emission level corresponding to a 50 percent reduction in 2030. Emissions in the long-term forecast with all measures are slightly higher than in the short-term forecast because it includes less mature resource classes. The discrepancy between the short-term and long-term forecasts grows from 2030 towards 2035 since the current expectation for production from sanctioned or likely production volumes decreases in the short-term forecast, while higher production from more uncertain resources is considered in the long-term forecast.

> The long-term emission forecast shows the importance of implementing all identified climate measures

2.3 Electrification and power demand

2.3.1 Updated forecast for power from shore to the Norwegian continental shelf

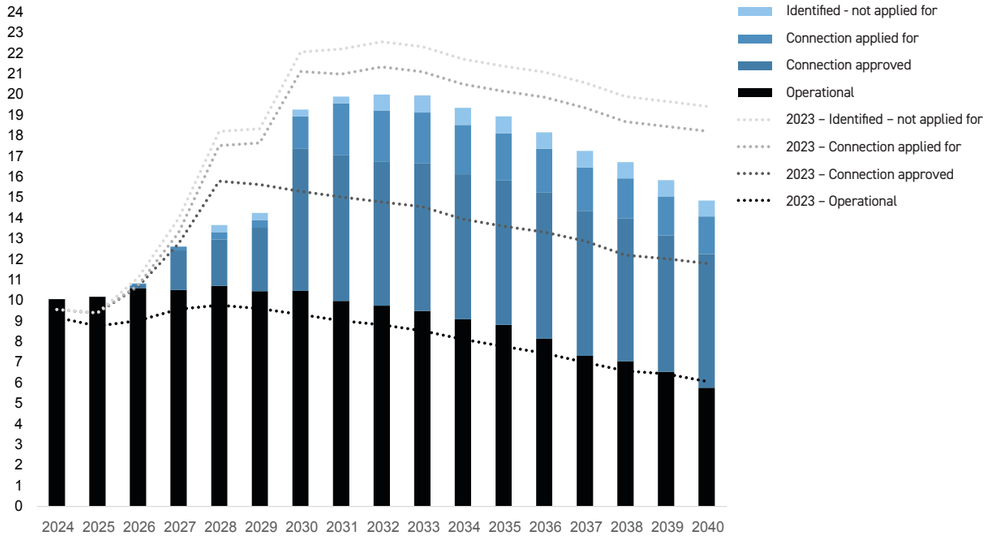
Figure 12 shows the updated power forecast for power from shore to the Norwegian continental shelf as of April 2024. The forecast indicates that the total power demand is expected to continue increasing in 2026 and particularly from 2029 to 2030. By 2030, this year's forecast suggests a power demand of just over 17 TWh for projects in operation or with approved grid connection, up from about 10 TWh in 2024. This year's forecast for 2024 shows a higher power demand for projects in operation compared to last year, approximately 0.5 TWh higher, while expectations for the total power demand from 2026 are lower compared to last year's report.

Since last year, several electrified fields have come on stream, and more have received approved grid connections. Some of the installations that have already received approved grid connections lack approval for either a Plan for Development and Operation (PUD) or a Plan for Installation and Operation (PAD). For these installations, the power demand totals approximately 2.1 TWh in 2030.

The remaining power demand for fields and installations in 2030 that have applied for grid connection but have not yet received approval totalled approximately 1.6 TWh in spring 2024 (increasing to 2.5 TWh by 2032). For identified projects that have not yet applied for grid connection, the power demand is estimated to be around 0.34 TWh in 2030.

FIGURE 12 POWER DEMAND FORECAST ON THE NORWEGIAN CONTINENTAL SHELF SPRING 2024
TWh

Source: Offshore Norway



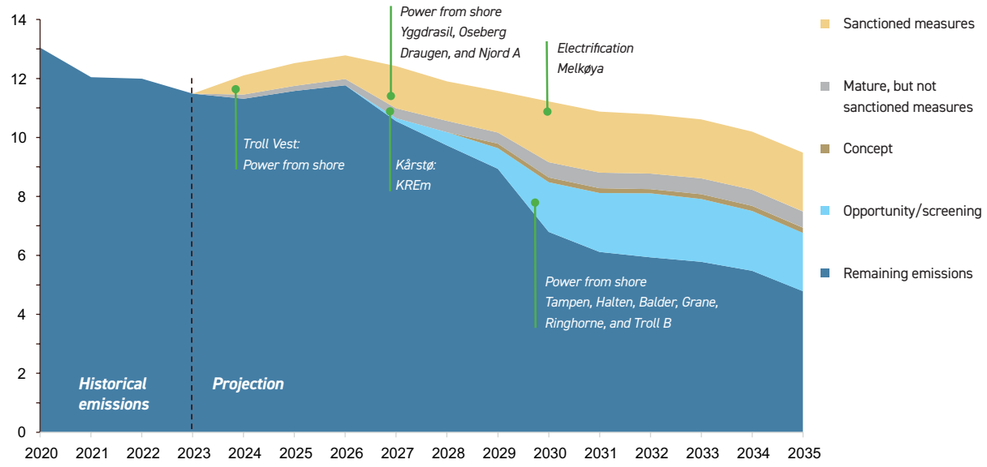
The increase in power demand towards 2030 is linked to electrification projects and the development of new fields with power intended to ensure that the oil and gas industry can deliver products with low production emissions, contributing to the fulfilment of both industry and national climate goals. Electrification of new fields helps prevent increased emissions from the continental shelf; for example, the Yggdrasil development, starting in 2027, will be electrified, potentially avoiding emissions of 260,000 tonnes of CO_2 per year and 6.9 million tonnes of CO_2e over the field's lifetime.

Figure 13 illustrates the link between major electrification projects and emission reductions. As in the power forecast, several projects are expected to come into effect in 2026/2027 and in 2030.

Several electrification projects that will take effect in 2030 are still in the maturity category *opportunity/ screening* awaiting grid connection approval, such as Tampen and

FIGURE 13 OVERVIEW OF VARIOUS ELECTRIFICATION INITIATIVES WITH SIGNIFICANT IMPACT ON TOTAL GREENHOUSE GAS EMISSIONS Mt CO_2e/year

Source: Offshore Notway



The growing demand for power due to planned electrification projects is relevant for all price areas except NO1. Figure 14 illustrates the development of power demand from the continental shelf based on planned electrification initiatives and connection to price areas. For all price areas, it is expected that the power demand will increase significantly towards 2030, especially in NO3 and NO4. For all price areas, the power demand is expected to peak between 2030 and 2035. Except for NO4, a decline in power demand is expected for all price areas by 2040 as production on the shelf decreases. For NO4, annual power demand is projected to remain stable throughout the 2030s.

FIGURE 14 DEVELOPMENT OF POWER DEMAND FROM THE CONTINENTAL SHELF BASED ON CONNECTION TO PRICE AREAS (TWh)

Source: Offshore Norway

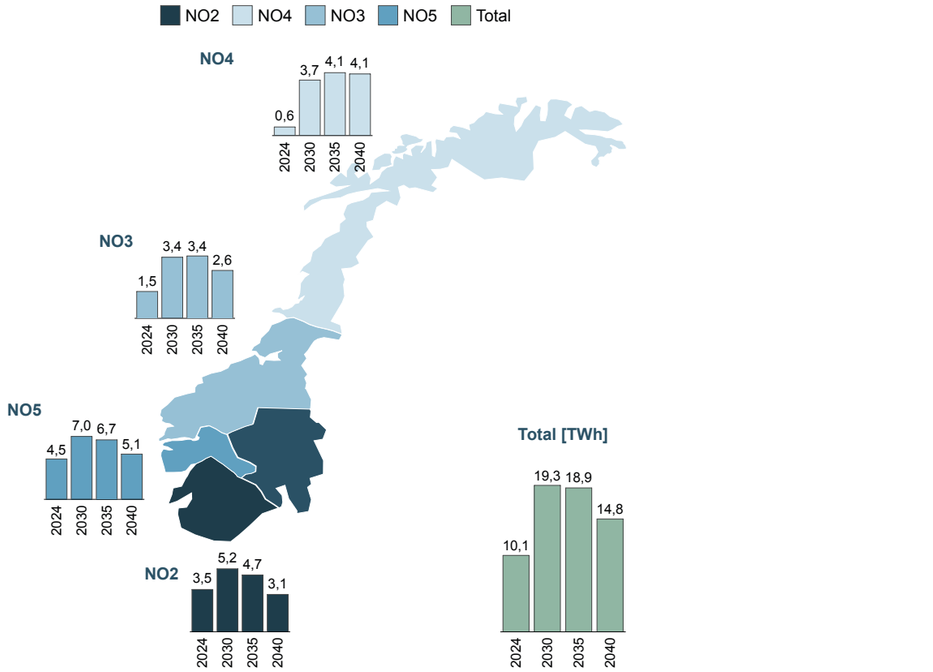


Figure: Development of power demand from the continental shelf based on connection to price areas (includes areas currently in operation, those with approved connection, those applying for connection, and projects not yet applying for connection).

The projected peak power demand from Norwegian petroleum activities is expected to occur in 2032. Figure 15 provides an overview of expected power demand distributed across price areas in 2032 and whether connection has been granted or not. The figure shows that much of the power demand for electrifying the continental shelf has already been accounted for in power system plans, with only 16 percent of the expected power demand in 2032 awaiting connection approval.

There will be a need to secure power access for the remaining portion of projects to achieve the goal of a 50 percent emission reduction by 2030. Statnett's overview of connection cases shows that the power demand from onshore industry, hydrogen/ammonia, and data centres is the highest. Electrification of the continental shelf accounts for only 8 percent of the applied-for power demand, with a significant portion of reserved capacity.

FIGURE 15 POWER DEMAND IN 2032 DISTRIBUTED AMONG OPERATIONAL, ALLOCATED, AND APPLIED FOR CONNECTIONS (TWh)

Source: Offshore Norway

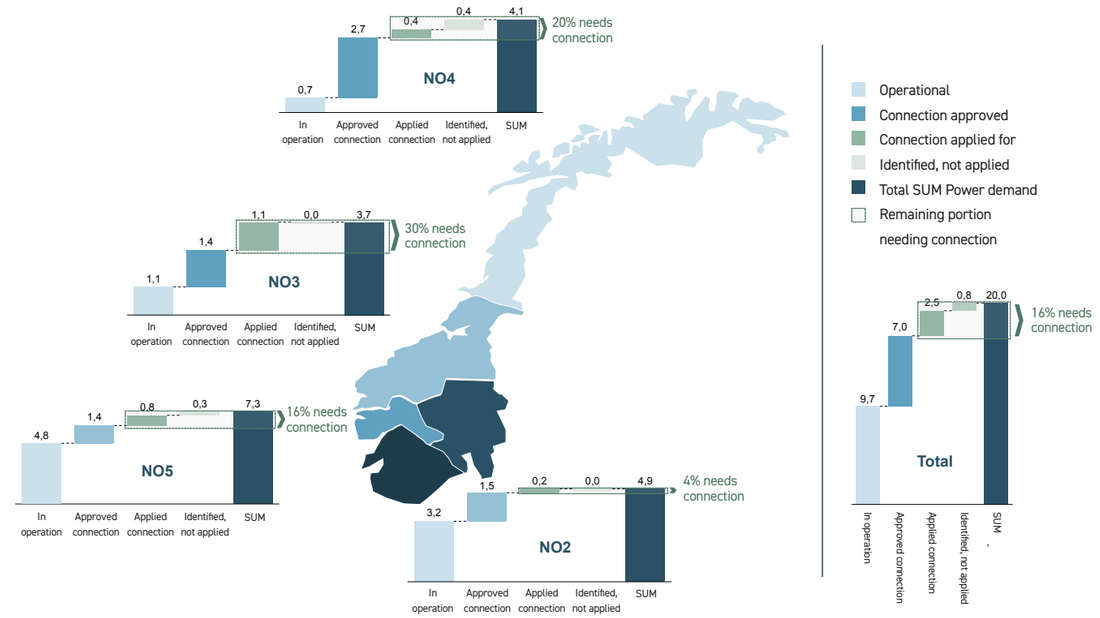


Figure: Power demand in 2032 distributed across areas with connection and currently in operation (light blue), connection approved (dark blue), connection applied for (dark green), and identified needs, but not applied for (light green).

2.3.2 Continued access to power from shore is crucial for achieving cost-effective climate transition

Norwegian continental shelf in the 2000s, authorities required operator companies to consider power from shore as an energy solution. In addition, some installations were electrified through modification projects aimed at ensuring profitability and extending the lifespan of the fields. Combined with the world's highest carbon costs and requirements for best available technology, this has resulted in Norwegian oil and gas being produced with very low emissions compared to oil and gas production in other countries.

Since climate goals were established in 2020, KonKraft has emphasized that power from shore is crucial for achieving the 2030 target. The parliament's increase of the target from 40 to 50 percent the same year contributed to reinforcing the need. Based on the high carbon costs on the Norwegian continental shelf, power from shore is often the most cost-effective measure. Other measures such as offshore wind and CCS will be far more expensive to implement and result in significantly lower emission reductions. The ongoing power debate and political signals create significant unpredictability in planning the major remaining climate measures on the continental shelf that are necessary to achieve the 2030 target.

Since last year's report, securing access to power from shore has become even more challenging.
In the Ministry of Energy's press release regarding the approval of the reconstruction of Draugen and Njord in December 2023, the ministry states that it will generally be *"more challenging for the licensees to decide upon and obtain regulatory approval for reconstruction projects for operation with power from shore going forward – partly because they may have undesired consequences for the power system."* [8].

Eliminating power from shore as a measure to cut emissions on the shelf can be likened to removing the most effective tool from the toolbox.

If power from shore is not allowed as a solution for new projects on the Norwegian shelf, the industry will have to implement measures that, despite operating under the world's highest carbon cost levels, are commercially unviable to meet climate goals. Projects could be put on hold, and restarting with solutions that are not feasible within the 2030 timeframe may become necessary. The result could lead to the decommissioning of profitable oil and gas production from some of these fields, along with reduced energy exports to Europe and decreased value creation for Norwegian society.

If non-sanctioned projects relying on power from shore do not receive connection approval, it will be extremely challenging for the oil and gas industry to achieve the 50 percent emission reduction target by 2030. The Norwegian Environment Agency's report "Climate Actions in Norway Knowledge Basis 2024" also underscores the importance of electrifying oil and gas installations to meet national and industry climate goals.

Several political parties have argued that the oil and gas industry should be given increased responsibility for developing new renewable energy sources. In last year's revised national budget, the governing parties reached an agreement with the Socialist Left Party (SV) that in the autumn of 2024, *"measures will be introduced to reduce greenhouse gas emissions through the electrification of oil installations with offshore wind."* [9] And in March 2024, the Conservative Party and the Liberal Party put forward a representative proposal to parliament, asking the government to introduce new requirements that "[...] *the petroleum industry itself must contribute with replacement power in new electrification projects.*"[10] In May, the government invited the oil and gas industry, represented by KonKraft, to an energy partnership in connection with the 2024 Revised National Budget. The partnership aims to contribute to continued emission reductions and a strengthened power balance. As more offshore oil and gas installations receive cable connections to the mainland, this also paves the way for other types of renewable energy production near shore or onshore to supply the installations with renewable energy.

8 Ministry of Energy (2023) - Approves the conversion of Draugen and Njord
9 SV (2023) – Agreement on the revised national budget
10 Representative Proposal 118 S (2023–2024)

2.4 A committed energy partnership can improve power balance and contribute to emission reductions on the continental shelf

On 13 May, the government invited KonKraft to a dialogue about establishing an energy partnership with the aim of contributing both to measures that improve the power balance and to continued emission cuts on the continental shelf. The energy partnership was also mentioned in the revised national budget for 2024, where the government states they: "*have a clear ambition for a strengthened power balance, with offshore wind development being central, as well as the goal of an energy partnership between the authorities and the petroleum industry to address the power-from-shore issue. The government will therefore consider how an energy partnership with the petroleum industry can contribute both to triggering measures that improve the power balance and to facilitating a continued climate transition in the petroleum sector.*"[11] KonKraft welcomes the establishment of an energy partnership and is ready to quickly enter into the cooperation to find binding solutions together with the government on how to achieve the climate goals for the industry, secure more power faster, and further develop the offshore industry. To ensure the success of the partnership, it is crucial that the government presents a binding solution in the state budget to be presented this autumn, with implementation starting from 1 January 2025.

The petroleum industry will pay around 10 billion NOK in carbon tax in 2024. Until 2040, the industry will pay an average of about 8 billion NOK annually. In addition, there is the European quota price. The purpose of the carbon tax is to serve as an incentive to reduce greenhouse gases and now goes directly into the Government Pension Fund Global (SPU). The carbon tax is a transition tax that has already had a significant effect by reducing emissions in Norway. According to KonKraft's perception, the carbon tax on the continental shelf should contribute to additional emission reductions in Norway through necessary increased power production.

An energy partnership with the government can ensure that we both expand power production and achieve climate goals. Offshore wind is the power technology that will provide the most power quickly and should therefore be prioritized. KonKraft proposes using the carbon tax paid by the petroleum industry to the state to develop more offshore wind power as a climate measure. To ensure predictability and long-term stability for the framework conditions of the oil and gas industry, it is crucial to find solutions that endure over time.

An energy partnership focusing on offshore wind will contribute to industrializing offshore wind efforts in Norway. This will not only give us a competitive advantage internationally but also provide predictability for activity and assignments in the Norwegian supplier industry, which needs activity from 2026. Additionally, an energy partnership could ensure that we reduce emissions by electrifying oil and gas projects on the continental shelf, where it is crucial to make investment decisions in a timely manner to meet climate goals.

KonKraft's proposal means that the state's revenue from the carbon tax can be better utilized to build offshore wind farms, which will provide necessary power both offshore and for mainland Norway. This approach would allow the carbon tax to have a dual impact. Firstly as an incentive to cut emissions, and then as a tool to develop more power. The amount of power that can be developed will depend on the proportion of carbon tax spent.

A binding energy partnership will also help strengthen competitiveness on the continental shelf going forward, allowing the oil and gas industry to maintain energy exports to Europe with progressively lower emissions. This will also help secure jobs and revenue for the community in the decades ahead.

11 The government (13.05.2024) invites to an energy partnership for emission reductions and strengthened power balance.

"KonKraft aims to expand offshore wind to generate more power for electrification, reducing emissions, and developing new industries. It's urgent to get started to achieve the climate goals and enhance the competitiveness of the industry."

Jørn Eggum
Union Leader, The United Federation of Trade Unions

"LO and NHO's Power Initiative shows that Norway could face a deficit in national power balance in just three to four years unless we increase access to renewable energy and expand the grid infrastructure in Norway. In addition, the assignments in the supplier industry will decrease approximately at the same time."

Ole Erik Almlid
CEO, NHO

"We need more power if we are to reduce emissions, secure jobs, and competitiveness. Now we are using the tripartite cooperation to find solutions. We need offshore wind to succeed!"

Peggy Hessen Følsvik
LO Leader

"Electrification combined with offshore wind development simultaneously secures jobs in the Norwegian supplier industry. It is crucial that we succeed in reducing emissions without sending industry abroad. The Norwegian supplier industry is highly motivated to contribute and needs activity from 2026, and we hope that an energy partnership can facilitate rapid clarification of measures to accelerate the development of new offshore energy."

Harald Solberg
CEO, the Federation of Norwegian Industries

The action plan for green shipping has set targets for a 50 percent emission reduction by 2030 in domestic shipping and fishing, which includes maritime activities in the petroleum industry

3

REDUCED EMISSIONS FROM MARITIME OPERATIONS

For 2023, emissions from offshore maritime operations are estimated at 1.73 Mt CO_2, a decrease of 7 percent from 2022 and 18 percent lower than in 2008. Emissions from offshore vessels and tankers have remained relatively stable compared to previous years, while emissions from mobile rigs have seen a significant decline, partly due to energy efficiency measures and lessons learned.

Even though emissions from offshore vessels have remained stable from 2022 to 2023, there is a shift in emission patterns, with decreasing emissions from supply vessels offset by increased emissions from other vessel categories within the segment. Considering the activity within offshore vessels, however, the emission intensity continues to show a downward trend. Increased use of shore power and energy efficiency are important measures currently contributing to emission reductions from offshore vessels, but their utilization could be even more effective. In 2023, for instance, the share of shore power hours increased by 7 percent compared to 2022, and the utilization of shore power for offshore vessels was estimated at 60 percent of the hours the vessels spend in port.

This year's report also includes the first draft of a baseline forecast for offshore maritime activity until 2035. The forecast will be further developed and used as an initial basis for discussions on potential emission reduction targets for offshore maritime segments going forward. Particularly important for the industry's climate efforts in the coming years will be the development of low and zero-emission requirements for offshore vessels starting in 2025 and 2029 respectively. Further, the establishment of a maritime climate partnership between the industry and government authorities will also be key.

3.1 Maritime operations emission goals

The government's action plan for green shipping has set a goal of a 50 percent reduction in emissions by 2030 in domestic sea transport and fishing, where maritime activities in the petroleum industry are included. In 2020, the Norwegian Shipowners' Association also launched its own climate goals for 2030 and 2050.[12]

As part of KonKraft's 2020 climate strategy, it was decided that the Norwegian oil and gas industry, along with shipowners and rig owners, will be a driving force for ensuring that vessel categories within offshore maritime activities actively contribute to achieving the goal in the government's action plan for green shipping of a 50 percent emission reduction. The introduction of specific low and zero-emission requirements for offshore vessels has been announced, with implementation starting in 2025 and 2029.

3.2 The method has been further improved in this year's report

There are three main segments of vessels included in KonKraft's reporting of offshore maritime emissions:

- **Offshore vessels:** Supply vessels (PSV), anchor handling and seismic vessels, and other offshore vessels (e.g., construction vessels and diving vessels)
- **Mobile rigs:** Jack-up, semisub, drilling rigs / vessels
- **Oil and gas tankers:** Shuttle tankers, crude oil tankers, product tankers (oil), LNG / CNG / LPG and combination tankers (gas)

In last year's status report, an important methodological improvement was made by basing the results for offshore vessels for the first time on detailed real-time data from the VPS[13] Maress software for analysis of operational profile, fuel consumption, emissions, etc., which is installed on the vessels. The methodological improvement provided a higher level of precision for total emissions and made it possible to break down emissions from offshore vessels by operational profile and measure the effect of emission reduction measures.

In this year's report, the number of vessels with directly reported data is even higher (almost 70 percent), and VPS has additionally developed data tools to analyse the remaining vessels by matching movement patterns, ship type, and operational profile. The analyses of activity hours and emissions are further broken down this year into different vessel groups and multiple operational modes.

Data quality improves each year, and some adjustments have been made to previous years' data where updated figures are available. The quality of the data for the years 2019–2023 is significantly better than for the reference year 2008, which is associated with greater uncertainty due to the lack of historical emissions monitoring and figures. The estimate of 2.1 Mt CO_2 in 2008 is uncertain but is still considered the best available estimate.

3.3 Emissions are declining despite high activity levels

Figure 16 shows the total domestic emissions from offshore maritime activity[14] in recent years and in the reference year 2008. From 2022 to 2023, emissions fell by 7 percent, and compared to 2008, emissions from offshore maritime activity are now 18 percent lower. Offshore vessels account for well over half of the total offshore maritime emissions in 2023.

12 The Norwegian Shipowners' Association's climate strategy (2020)

13 VPS is an analysis and advisory company that provides services in digital tools, fuel testing, and maritime decarbonization. www.vpsveritas.com

14 Domestic maritime activities related to the Norwegian oil and gas industry are defined as traffic between Norwegian ports and/or offshore installations on the Norwegian continental shelf. This includes sailings between ports in Norway, between offshore installations, between ports and offshore installations, as well as stays in port or at offshore installations.

Emissions from mobile rigs account for slightly over 30 percent, while oil and gas tankers account for just over 10 percent.

Figure 17 shows the development of annual domestic emissions in the Norwegian Economic Zone (NØS) from the various vessel segments for the years 2019–2023. The change in total maritime emissions from 2022 to 2023 for offshore vessels and oil and gas tankers is small. However, there has been varying development among the subcategories of offshore vessels, which is discussed in more detail later in the report.

For mobile rigs, we have seen a significant decrease in emissions over the last few years, including between 2022 and 2023. From a peak level in 2020, emissions have fallen by nearly 30 percent, and in just the last year, we have seen a 20 percent decrease, which also applies compared to the reference year 2008.

Emissions from rigs are activity-dependent and can vary significantly from year to year even without implementing emission reduction measures. Rig emissions are linked to drilling activity, both for production and exploration wells. The decrease in rig emissions since 2020 appears partly due to reduced activity, but the decrease can also be attributed to energy efficiency measures and other emission reduction initiatives. For example, a relatively similar number of production and exploration wells were seen in 2022 and 2023, while emissions fell significantly during the same period. According to the industry, emission reductions can likely be attributed to a combination of factors, including energy management

FIGURE 16 DEVELOPMENT IN EMISSIONS FROM OFFSHORE MARITIME ACTIVITY HISTORICALLY (2008) AND IN THE LAST FIVE YEARS (2019-2023) 1000t CO_2

Source: VPS, DNV og Footprint

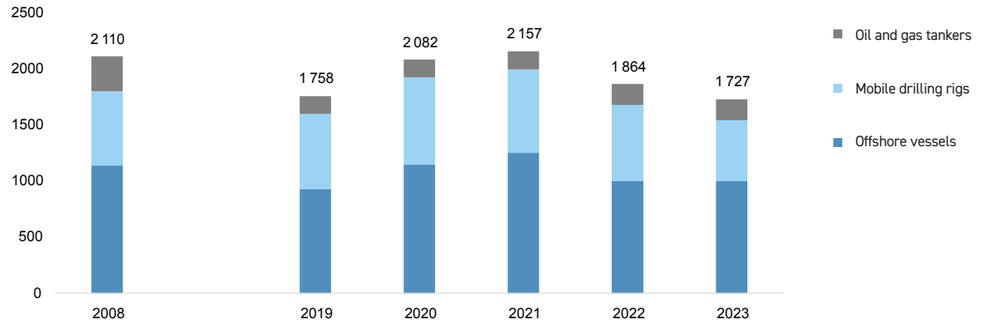
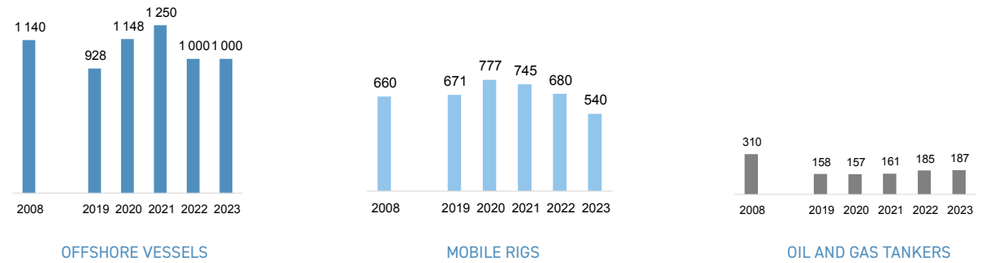


FIGURE 17 DEVELOPMENT IN CO_2 EMISSIONS PER VESSEL SEGMENT 2019-2023 1000t CO_2

Source: VPS, DNV og Footprint [14]



and gain experience on fields with extended drilling operations. Several shipping companies have made significant strides in reducing energy consumption from mobile rigs in recent years, and contract incentives for reduced fuel consumption over several years are now yielding emission benefits.

For example, at the Ekofisk field, there is a clear decrease in emissions per activity for the jack-up rigs West Elara and Linus due to energy management measures implemented in recent years. The rigs have reduced CO_2 emissions by 20–30 percent per barrel drilled from 2022 to 2023. The reductions are partly attributed to mechanical improvements in fuel oil separators and hydraulic power units, enhancements in energy optimization, control, and digitalization related to drilling automation, heat tracing, and heaters, as well as the implementation of K-IMS (Kongsberg Information Management System).

The Transocean Enabler rig, which has been under contract with Equinor in recent years, will also reduce energy consumption by an estimated 20–25 percent per day in operation through a series of completed and planned measures. During the period of 2022 and 2023, several energy efficiency measures were implemented, including the installation of advanced control systems for diesel generators to increase efficiency, and replacing electric heating with a hot water system that provides heat recovery benefits. In addition, measures such as frequency control on cooling pumps and optimized heat tracing management planned for 2024 will contribute to reduced energy consumption.

Another example is Odfjell Drilling, which has seen a 30 percent decrease in absolute emissions across its rig fleet compared to the reference year 2019. The fleet has experienced a significant reduction in CO_2 emissions, largely due to more efficient drilling operations. A new anchoring philosophy with associated modifications has led to reduced energy use for anchoring by minimizing the use of thrusters. In addition, the rigs conversion, including the installation of a hybridized power system, has resulted in fewer generators being used and a significant reduction in power consumption related to cooling.

Deepsea Atlantic Photo: Odfjell Drilling

The NOx Fund, aimed at reducing NOx emissions in the industry, has also contributed to reducing CO_2 emissions from rigs in recent years. In 2023, slightly over 30 rigs reported to the fund. Reporting to the fund of 2023 shows an accumulated CO_2 reduction of approximately 100,000 tonnes from measures on rigs supported by the NOx Fund.

Emissions from mobile rigs are closely tied to other offshore vessels and logistics. The rig's storage capacity and weather conditions have a significant impact on total emissions. To achieve further reductions from mobile rigs in the years ahead and achieve the reduction target on the Norwegian continental shelf, larger industrial solutions and a value chain perspective are necessary.

3.4 Deep dive – emissions and activity from offshore vessels

Offshore vessels accounted for over half of the total emissions from the offshore maritime sector in 2023. The vessel segment consists of various vessels with very different missions and operational profiles. Detailed user data from VPS provides better insight into emissions and activity from vessel segments. Emissions from offshore vessels can be broken down into three subgroups:

- Supply vessels (PSVs)
- Anchor handling and seismic vessels
- Other offshore vessels, including construction, support, emergency response, cable-laying, and well intervention vessels.

Figure 18 shows the number of offshore vessels within each of these three subgroups that were active in the Norwegian Economic Zone in 2023. Overall, there are 372 vessels, including 132 supply vessels, 127 other offshore vessels, and 113 anchor handling and seismic vessels.

In 2023, offshore vessels accounted for 1.3 million activity hours and 1 million tonnes of CO_2 emissions. Figure 19 shows the distribution of hours and emissions per vessel category.

FIGURE 18 NUMBER OF VESSELS PER OFFSHORE SUBSEGMENT

Source: VPS

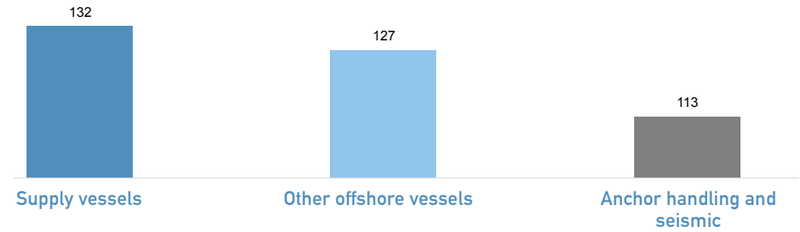
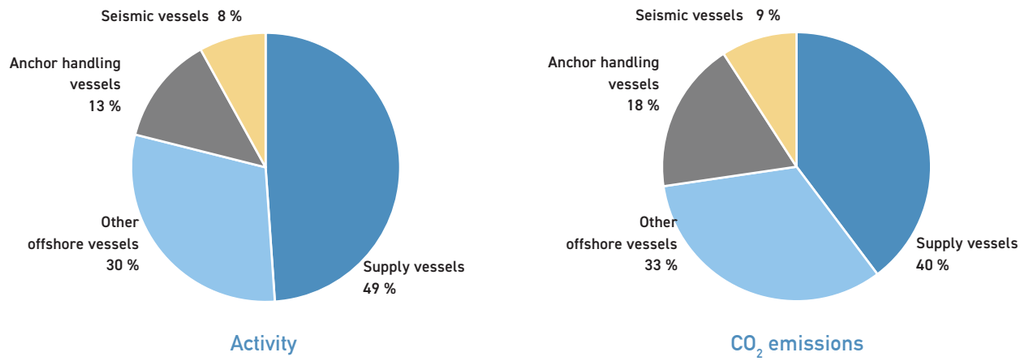


FIGURE 19 DISTRIBUTION OF ACTIVITY HOURS AND CO_2 EMISSIONS PER VESSEL CATEGORY WITHIN OFFSHORE VESSELS

Source: VPS



3.4.1 Stable emissions from offshore vessels – declining emissions from supply vessels offset by increased emissions from other segments

Figure 20 shows the development in emissions from each of the three subsegments of offshore vessels since 2019. Over the entire period, emissions from supply vessels have decreased by around 10 percent, while emissions from anchor handling and seismic vessels, as well as other offshore vessels, have increased by 15 percent and 33 percent, respectively.

From 2022 to 2023, emissions from supply vessels decreased by 17 percent, while emissions from anchor handling and seismic vessels increased by 35 percent, with only a slight increase for other offshore vessels.

The development in operating hours for the three segments can be seen in Figure 21. Here, we observe that the number of hours has increased most for other offshore vessels, while it remains more stable for supply vessels and anchor handling and seismic vessels from 2022 to 2023.

FIGURE 20 DEVELOPMENT IN CO_2 EMISSIONS PER SEGMENT OF OFFSHORE VESSELS 2019-2023
1000t CO_2

Source: VPS

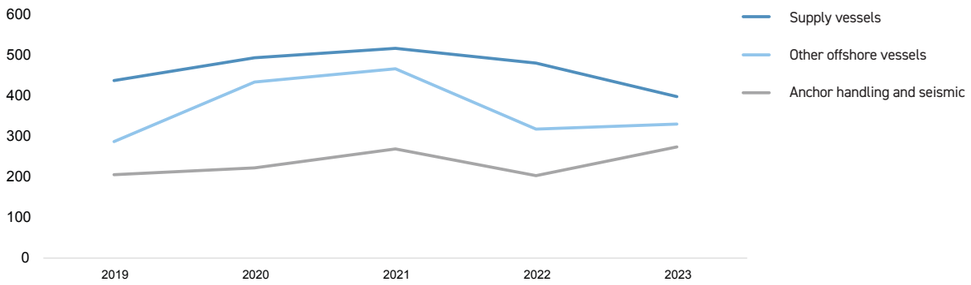
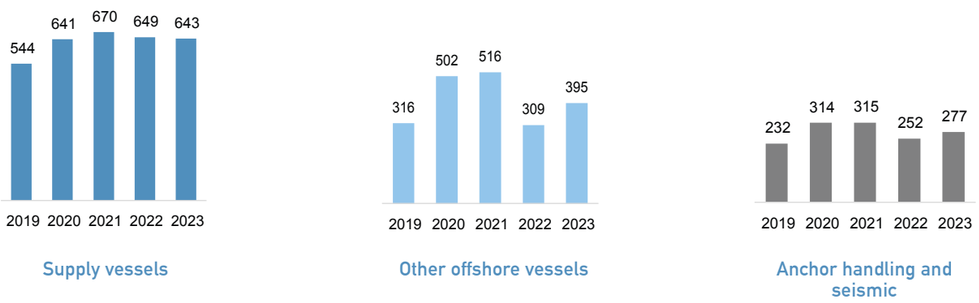


FIGURE 21 OPERATING HOURS PER OFFSHORE VESSEL SEGMENT 2019-2023
1000 hours

Source: VPS



Emissions from offshore vessels vary with the level of activity, including operating hours, the number of active ships, and the annual composition of services from different types of vessels. This correlation is evident in Figure 22 and Figure 23, which show the number of operating hours and emissions from domestic offshore vessels for 2019–2023.

FIGURE 22 DEVELOPMENT IN ACTIVITY AND EMISSIONS FOR OFFSHORE VESSELS 2019-2023
1000t CO_2/ 1000 operating hours and number of vessels

Source: VPS

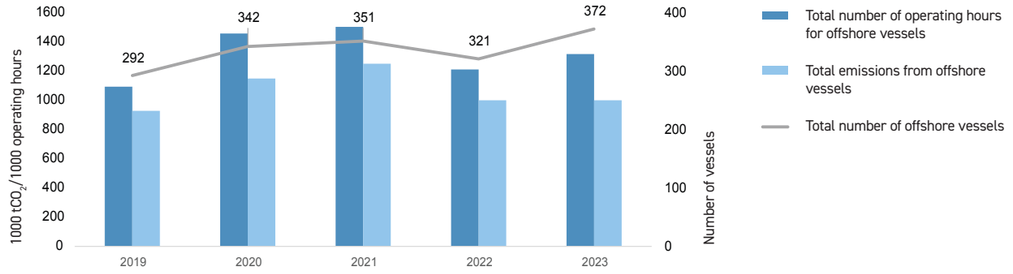
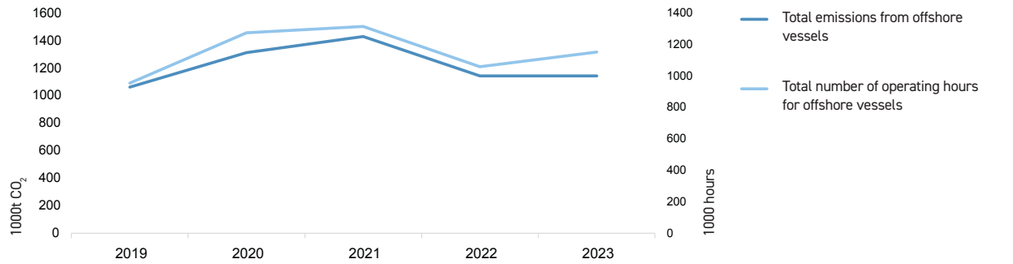


FIGURE 23 OPERATING HOURS AND EMISSIONS FROM OFFSHORE VESSELS 2019-2023
1000t CO_2 / 1000 operating hours

Source: VPS



3.4.2 Emission intensity from offshore vessels continues to decrease

Greenhouse gas emissions from offshore vessels vary with activity levels. In addition to measuring the absolute emissions from the segments, it is therefore also important to measure the development in vessel emission intensity, that is, emissions per hour and activity. Figure 24 shows that emissions per hour have decreased from 2019 to 2023 for offshore vessels in each of the four operational modes (transit, DP, standby, and port). [15]

Figure 25 illustrates the distribution of how vessels spend their time and where emissions occur. The offshore fleet spends up to 40 percent of its time in port, but only 11 percent of emissions occur there. In comparison, nearly 50 percent of emissions occur during transit to and from installations, even though this accounts for only 22 percent of operating hours.

15 Transit: Traveling to and from installations/assignments, DP: Dynamic positioning (keeping the ship stationary at a given point during operations), Standby: support or standby,

FIGURE 24 EMISSION INTENSITY FOR OFFSHORE VESSELS FROM 2019 TO 2023
Percent of CO_2 / hour in 2019

Source: VPS

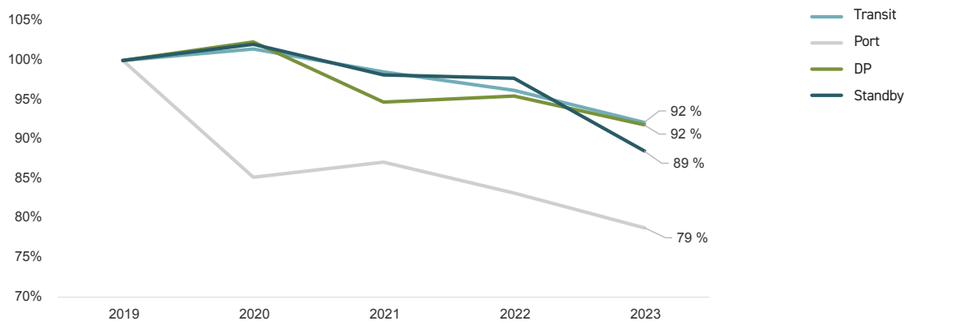
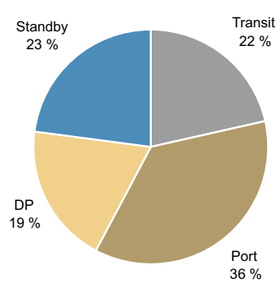
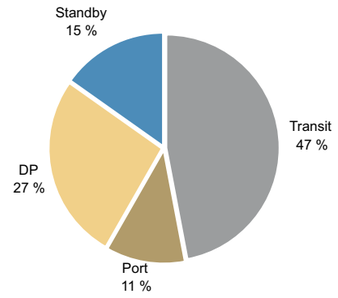


FIGURE 25 DISTRIBUTION OF OPERATING HOURS AND EMISSIONS BY OPERATIONAL MODES FOR OFFSHORE VESSELS

Source: VPS



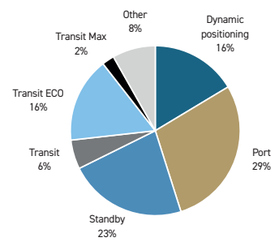
Distribution of operating hours for offshore vessels 2023



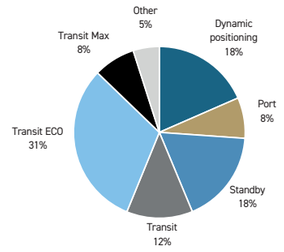
Distribution of emissions from offshore vessels 2023

In this year's report, new data allows for further breakdown of operating hours and emissions into four vessel categories and seven operational modes.

SUPPLY VESSELS (2023)

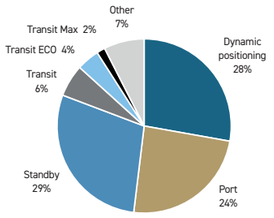


Time allocation by operational mode

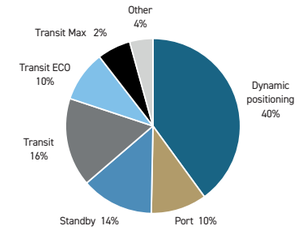


CO_2 emissions by operational mode

OTHER OFFSHORE VESSELS (2023)

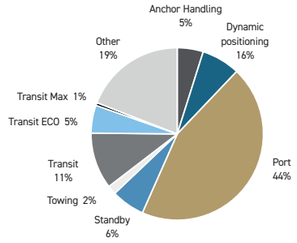


Time allocation by operational mode

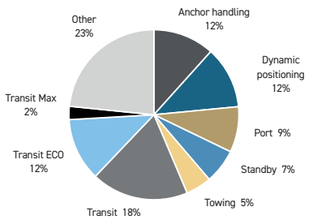


CO_2 emissions by operational mode

ANCHOR HANDLING VESSELS (2023)

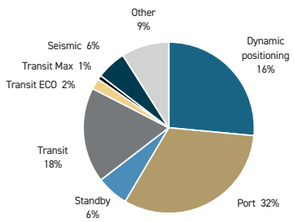


Time allocation by operational mode

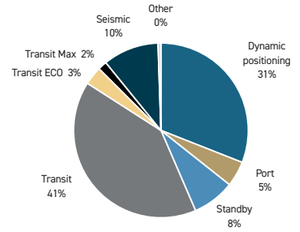


CO_2 emissions by operational mode

SEISMIC VESSELS (2023)



Time allocation by operational mode



CO_2 emissions by operational mode

3.4.3 Increased use of shore power contributes significantly to offshore vessel emission reductions

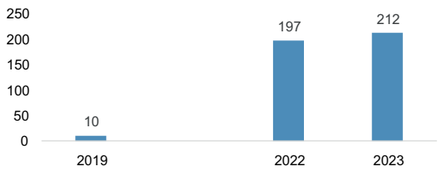
The use of shore power has increased significantly in recent years and continues to grow. Figure 26 shows the development in the number of shore power hours for a representative sample of vessels and the share of shore power hours as an estimated proportion of total hours in port. From 2022 to 2023, the share of shore power hours increased by 7 percent, and VPS estimates that the utilization of shore power is at 60 percent of the hours the vessels spend in port. In Norway, the average daily fuel consumption for offshore vessels in port is 2.5 tonnes, but an increasing number of vessels have reduced consumption to well below 1 tonne per day, indicating that shore power has become the primary energy source for these vessels when they are in port.

The increasing use of shore power is clearly the most important driver behind the 21 percent improvement in emissions per hour in port, as shown in Figure 24.

Several vessels report a strong desire to increase their use of shore power, and there is still great potential to further increase existing shore power infrastructure. However, there is still room to increase usage by expanding facilities at more berths, both at offshore bases and at alternative quay facilities. Effective and standardized connection procedures, as well as operational stability, will also increase the use of shore power.

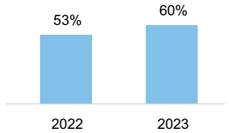
FIGURE 26 SHORE POWER HOURS AND SHARE OF TOTAL TIME IN PORT
1000 hour

Source: VPS



Significant increase in shore power hours

Applies to offshore vessels using Maress (70% of the fleet)



Larger share of time in port

Estimated shore power use for the entire fleet (shore power hours as a share of total time in port)

> VPS estimates that the utilization of shore power is at 60 percent of the hours vessels spend in port

3.4.4 The Norwegian continental shelf is leading in hybrid vessels with batteries, but there is potential for increased utilization

Batteries contribute to emission reductions, and at best, individual vessels have achieved up to 35 percent improvement in fuel consumption after installation. The Norwegian continental shelf accounts for a sizeable portion of the global use of battery-hybrid offshore vessels. Over half of the 107 battery-hybrid offshore vessels that were in operation globally in 2023[16], operated on the Norwegian continental shelf.

Of the vessels that were in operation on the Norwegian continental shelf last year, supply vessels comprised the majority (46). Additionally, there were eight construction vessels and one anchor handling vessel with battery-hybrid technology.

However, usage data from VPS shows that the average improvement for certain ships and within certain operational profiles could be less than 5 percent and well below the design target of 15–20 percent. Better procedures, training, and the use of analysis tools are crucial to fully harnessing efficiency and triggering further emission reductions.

16 Source: Clarksons

SEVEN VIKING is a vessel that has achieved significant efficiency improvements by using batteries. Photo: Eidesvik

3.4.5 Continued energy efficiency potential for the offshore fleet on the Norwegian continental shelf

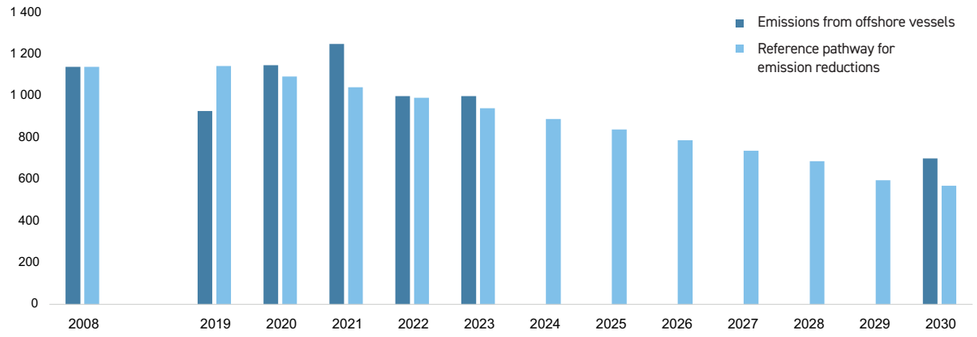
VPS estimates a total maximum emission reduction potential related to energy efficiency in the offshore fleet of 40 percent by 2030 compared to 2008 levels. This potential can be realized through optimal use of operational measures such as speed and route optimization, as well as the use of shore power and batteries.

The potential for emission reductions varies between operational modes. For port stays, VPS estimates a potential for emission reductions of 100 percent, for standby 70 percent, for dynamic positioning (DP) 30 percent, and for transit 20 percent. Overall, realizing the maximum potential in each operational mode, along with logistics planning, could result in emission reductions of 40 percent for offshore vessels by 2030 compared to emissions in 2008. To unlock this potential, improvements related to infrastructure are also necessary.

Figure 27 illustrates a reference pathway for greenhouse gas emissions from offshore vessels if the maximum potential is realized for all operational modes. Further emission reductions can be achieved using zero-emission fuels and the introduction of energy-efficient ship designs.

FIGURE 27 ASSESSMENT OF TOTAL MAXIMUM EMISSION REDUCTION POTENTIAL FOR OFFSHORE VESSELS TOWARDS 2030 (1000t CO_2)

Source: VPS



3.4.6 Alternative fuels

In October 2023, a 6 percent biofuel blending requirement was introduced for maritime transport. The blending requirement is likely to reduce emissions from offshore vessels in the years ahead, but the reduction potential depends on the proportion of the total volume offered by suppliers to offshore vessels, where vessels choose to bunker, and whether the blending requirement is further increased.

ISCC-certified liquefied natural gas (LNG) is an option currently being considered where available and where stable supplies of liquefied biogas (LBG) from local value chains are not available. Both products can benefit from the well-developed LNG infrastructure near offshore supply bases and may be suitable for parts of the LNG fleet.

To transition to alternative fuels such as ammonia and methanol for the offshore fleet by 2030, a bunkering infrastructure must be developed that enables safe bunkering and meets the needs for efficient logistics operations. Stable production capacity of alternative fuels, including methanol and green or blue ammonia, must also be ensured. As a result, fuel production capacity needs to be developed concurrently with the construction of ships that can utilize alternative fuels on the vessel side. This allows for rapid utilization of the investments currently being planned in the offshore segment.

Operators, shipowners, and owners of suitable bunkering locations must collaborate with authorities to find appropriate technical solutions that can serve an offshore fleet powered by alternative fuels without distorting competition. To spread economic risk and ensure a large maritime end-user market for alternative fuels, new fuel infrastructure should also be made accessible to other vessel segments.

Stable production capacity of green and blue ammonia must be ensured

3.4.7 Emission reduction measures for offshore maritime operations

A variety of measures are being pursued to reduce emissions from offshore vessels. Some examples:

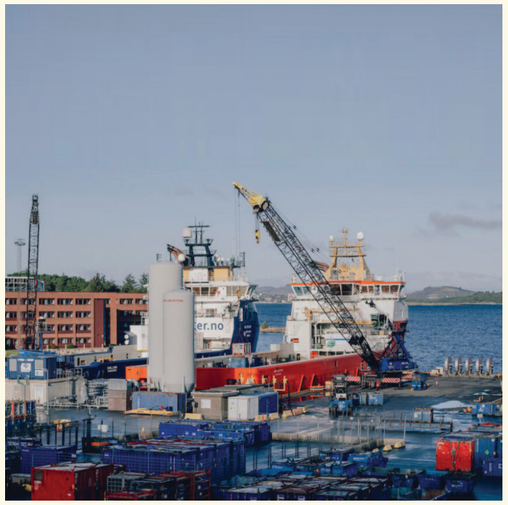
Case 1: Significant emission savings from logistics planning during movement between markets

During a long transit of the construction vessel Normand Superior between markets, Solstad Offshore recently achieved fuel savings of 73 tonnes through reduced speed, route planning, propeller cleaning, and other operational measures. The savings correspond to at least 30 percent in fuel tonnage per nautical mile compared to normal cruising speed during transit.

Normand Superior
Photo: Solstad Offshore

Case 2: Collaborative operational planning reduces emissions in Dusavika

Within operational planning, there are still significant opportunities to reduce the number of vessels needed for an operation as well as to optimize speed and route planning. There are several examples of operator collaboration in offshore supply. For instance, in 2023, Equinor and Vår Energi initiated a pilot project on logistics collaboration from the Dusavik supply base. The pilot aims to achieve a significant reduction in total vessel resources and to ensure integrated logistics planning that guarantees energy-efficient vessel utilization, thereby reducing emissions.



The Dusavik supply base
Photo: NorSea

Case 3: VPS summer campaign for emission reductions

During the summer of 2023, VPS organized a campaign involving over 100 vessels aimed at identifying emission reduction measures through collaboration, sharing best practices, and smart use of data. During the two-month campaign, emissions were reduced by 10,000 tonnes of CO_2. Following last year's success, it has been decided to organize a summer campaign in 2024 involving 12 companies with more than 300 vessels and over 4,000 seafarers engaged.[17]

17 VPS (2023) - Unprecedented collective action slashes 10.000 tons of CO_2 emissions

Stril Barents - one of the winning vessels of the 2023 campaign
Photo: Møkster Shipping

Case 4: DOF Digital Fleet aims to contribute to the optimization of maritime operations

With the digitalization project Digital Fleet, DOF has developed an advanced platform for collecting and integrating data that can be used to optimize operations on land and offshore. Access to operational data enables the company to quickly initiate new projects, and the company is working on new modules including condition-based maintenance, automatic fuel reporting, hull cleaning, and route planning. In addition, the platform simplifies sustainability reporting and provides a comprehensive, real-time overview of emissions.

DOF Digital Fleet
Photo: DOF

Case 5:Low- and zero-emission fuels and technologies are set to drive offshore maritime emissions towards zero, with the first new vessels currently under construction

Energy efficiency and more efficient operations have been and will continue to be crucial for cutting emissions in the coming years, but vessels must adopt low and zero-emission fuels to move towards zero emissions. New vessels must be ready to use low and zero-emission fuels, and existing vessels must be retrofitted where appropriate.

Planned and potential vessel retrofit projects are continuously evaluated against the potential for emission reductions, the expected remaining operational life of the vessels, and the cost of each project. The extent to which retrofitting the existing fleet is a necessary technological interim step before a widespread fleet renewal based on zero-emission technology will depend on the energy carrier and technology chosen. Based on the age profile of the offshore fleet, there is a limited cumulative reduction potential through a broad retrofit strategy. Equinor indicates that the portfolio of supply vessels under long-term contracts could become a zero-emission portfolio by 2040 with a natural phase-out of fossil-fuel vessels, introduction of new vessels using alternative fuels, and adjustments in activities on the Norwegian continental shelf.

Equinor has incorporated such opportunities in a request for supply vessels and ammonia technology. Equinor prioritizes decarbonization of the offshore segment primarily through the supply fleet. Based on the age profile of the offshore fleet, Equinor sees limited cumulative reduction potential through a broad retrofit strategy. Through a natural phase-out of fossil-fuel vessels and adjustments in activities on the Norwegian continental shelf, the portfolio of supply vessels under long-term contracts could become a zero-emission portfolio by 2040.

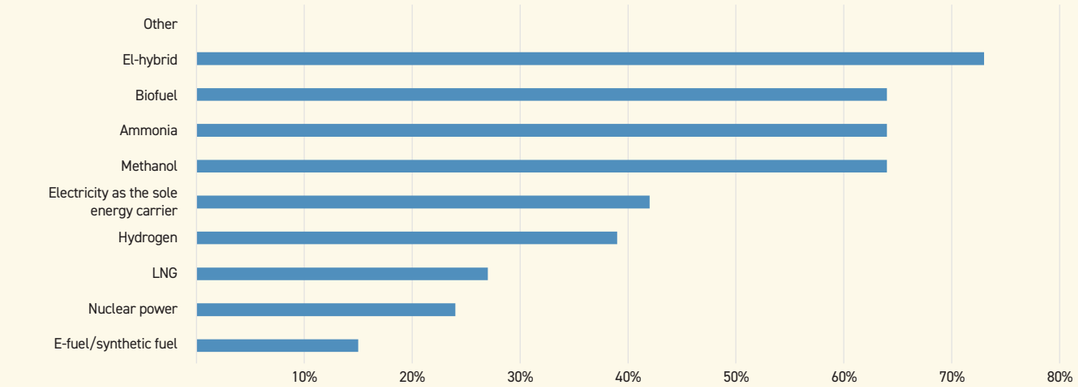
Several shipping companies are also evaluating various low and zero-emission fuels and technologies to achieve emission targets by 2050. In the Norwegian Shipowners' Association's annual Maritime Outlook Report, the types of fuels and energy carriers that shipping companies are considering to achieve climate goals are mapped out. Figure 17 illustrates the responses for offshore service vessels as of 2024. Offshore service shipping companies have a similar assessment to other shipping companies, but they consider electric-hybrid technology more viable – up to 80 percent of respondents are evaluating this technology. Compared to previous years, ammonia and biofuels are the energy carriers that have gained most relevance among shipping companies.

According to the Norwegian Shipowners' Association's annual surveys, shipping companies are considering building 76 new vessels within offshore service over the next five years. At the same time, 9 out of 10 shipping companies state that they plan to build with technology ready for climate-neutral solutions. Several shipping companies have already contracted the construction of new vessels that will be ready to operate on low and zero-emission technology.

For example, Eidesvik Offshore and Agalas have ordered a methanol-powered construction vessel with battery modules, to be delivered from Sefine Shipyard in Türkiye in early 2026. The vessel will be able to carry out inspections, maintenance, and repairs for both subsea and offshore wind activities. A 3–5-year agreement has been signed with Reach Subsea.
Rem Offshore has also entered into a contract with Myklebust Verft for the construction of an Energy Subsea Construction Vessel (ESCV), which can operate on methanol combined with battery packs. The vessel, which is scheduled to be completed in 2026, will reduce the energy consumption by 50 percent compared to current vessels of the same type and be able to operate with net-zero emissions. This contract includes an option for an additional vessel.

FIGURE 28 FUEL TYPES AND ENERGY CARRIERS CONSIDERED BY SHIPPING COMPANIES FOR OFFSHORE SERVICE TO ACHIEVE EMISSION TARGETS BY 2050 (Percentage of total respondents (%), multiple response options possible)

Source: Shipowners' Association



Eidesvik Offshore and Agalas have contracted for a methanol-powered construction vessel with battery packs Photo: Eidesvik

Rem Offshore has contracted for a methanol-powered vessel with battery packs Photo: Myklebust Verft

3.5 Future measures and policies for emission cuts in the offshore maritime sector

3.5.1 Low and zero-emission requirements for offshore vessels

The government has announced the introduction of low and zero-emission requirements for offshore vessels starting in 2025 and 2029, respectively. The authorities and the industry are discussing how the requirements should be implemented and what their structure should be. It is expected that more details about the requirements will emerge during 2024.

Emissions from offshore vessels constitute a significant portion of the total emissions from domestic shipping and are therefore a crucial part of the discussions within the maritime climate partnership. Progress within the partnership is also anticipated during the year.

In the Norwegian Environment Agency's 2035 report presented in spring 2024, emission reductions from the offshore fleet are included as one of ten key contributions to emission reductions by 2030. A case study has also been conducted on the number of possible ammonia vessels by 2035.

3.5.2 EU has introduced a series of climate regulations for the maritime sector – EU ETS, MRV, and FuelEU Maritime

Shipping was included in the EU Emissions Trading System (ETS) as of 1 January this year. The inclusion is gradual, both in terms of the scope of emissions, types of emissions, and which vessels are covered. The offshore fleet will be included gradually, with reporting obligations in the emissions database MRV from 2025 and quota obligations for large offshore vessels over 5000 gross tonnes from 2027. Whether smaller vessels will also be included will be decided by the end of 2026.

There is reason to believe that the cost of quotas will further drive maritime emission reductions, and mandatory MRV emission reporting will provide new insight and improved data for future KonKraft status reports. The shipping industry believes that quota revenues from shipping should be earmarked for the transformation of the maritime sector, including in Norway.

In addition to the inclusion of the maritime sector in the EU Emissions Trading System, regulations for the phased introduction of low and zero-emission fuels are being finalized. FuelEU Maritime is a European regulation aimed at reducing greenhouse gas emissions from ships operating in European waters, which will come into force on 1 January 2025. The regulations require a gradual reduction in emission intensity of energy and the use of shore power. The goal is to make European shipping more environmentally friendly and sustainable. Emissions from energy consumption (well-to-wake) are to be reduced by 2 percent by 2025 and by as much as 80 percent by 2050. From 2030, certain types of ships will also be required to use shore power. Initially, offshore vessels are not covered by the regulations, but they are likely to be included in the future.

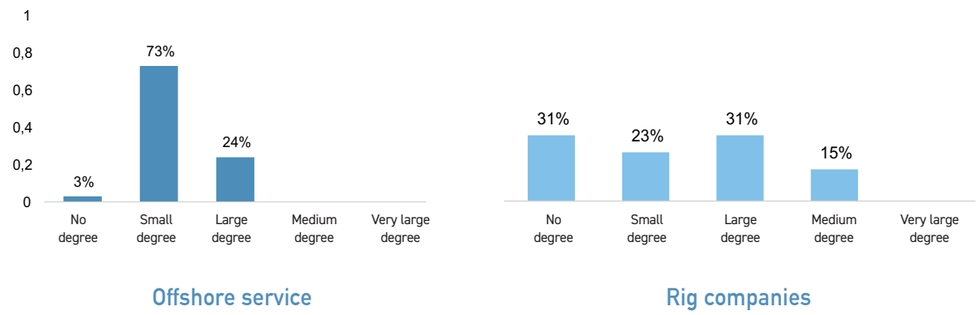
3.5.3 Need for enhanced measures to scale up green transition

For the offshore service segment, the industry points to uncertainty regarding technology choices and a lack of willingness to pay in the market as barriers to investing in climate and environmental technology. Public investment support can play a crucial catalytic role here. Enova has supported numerous maritime projects in initial stages over time, but the support is perceived to halt before solutions are market-ready and ready for large-scale implementation.

The annual survey associated with the Norwegian Shipowners' Association's Maritime Outlook Report 2024 shows that especially companies within the offshore service and rig segments feel that the current set of instruments is insufficient for scaling and deploying climate technology. Enova's mandate is being revised leading up to 2025 and should be expanded to cover more alternative fuels and increased focus on energy efficiency measures.

FIGURE 29 ASSESSMENT OF WHETHER THE INSTRUMENTS ARE GEARED TOWARDS THE GREEN TRANSITION AMONG OFFSHORE SERVICE AND RIG COMPANIES

Source: Shipowners' Association



In the offshore service segment, the industry points to uncertainty related to technology choices, market unwillingness to pay and public investment support as the biggest barriers

3.6 A new forecast strengthens efforts to specify goals for maritime emission reductions

KonKraft's climate strategy sets clear ambitions for emission cuts from offshore maritime activities, and the status reports document how shipping companies and operators have implemented significant measures in recent years, including operational improvements, energy efficiency, and testing of new low and zero-emission technologies.

Following the focus in 2023 on improving the emissions and activity data foundation, KonKraft has prioritized enhancing the analysis of future actions this year and has systematized available data on expected activity and potential emission reductions.

3.6.1 A baseline forecast for offshore maritime emissions

To establish a goal for emission reductions going forward, a forecast has been developed on how offshore maritime emissions could evolve if no further emission reduction measures are implemented. The forecast is a baseline or reference trajectory for offshore maritime emissions. Operating companies have the best information on expected activity on the Norwegian continental shelf, while a wide range of stakeholders have information on emissions from various vessel categories performing diverse types of tasks for the operating companies. There are many different vessel segments that provide services to the oil and gas industry, and in the baseline forecast, we have simplified the work by dividing these into four main categories: Supply and standby vessels, mobile rigs, oil and gas tankers, and other offshore vessels. For each category, a method has been developed to link further activity on the Norwegian continental shelf to maritime emissions, as briefly described below.

3.6.2 Pioneering work that needs to address several methodological challenges

Developing a forecast for offshore maritime emissions requires collecting and combining data that has not previously been compiled together, often with relationships that are not sufficiently defined. There are two main challenges that must be addressed in the forecasting process:

Uncertainty in delineation and numerical basis: Despite KonKraft having improved its numerical basis in recent years for estimating domestic emissions from offshore maritime segments, uncertainty remains regarding the figures for some segments. At times, it is also challenging to clearly define which vessels should be included in the offshore segment and some vessel segments may perform tasks on the Norwegian continental shelf for both the oil and gas industry and other sectors. Efforts are continuously being made to improve both historical emission data, forecasts, and delineations, which will make forecasting easier and improve quality over time.

Uncertainty related to emission drivers for different vessel segments: The main challenge lies in identifying the drivers of emissions for different vessel segments and simultaneously obtaining valuable information on how these drivers will evolve towards 2035. Within the category of other offshore vessels, various types of vessels (such as seismic vessels, lifting vessels, anchor handling vessels ++) will have different drivers, requiring a detailed breakdown of emission figures per sub-segment. There is also a need to identify relevant drivers and gather data on these drivers from operating companies.

For KonKraft, addressing these methodological challenges will be crucial.

3.6.3 Preliminary baseline forecast for offshore maritime emissions

Figure 30 depicts the initial version of the baseline forecast for offshore maritime activity until 2035. It is important to note that the figure shows a baseline forecast for emissions that does not include the effect of emission reduction measures beyond those already implemented. Additionally, it does not account for any impact from the biodiesel blending mandate. The forecast is work in progress and will change as the methodology evolves and the data foundation improves.

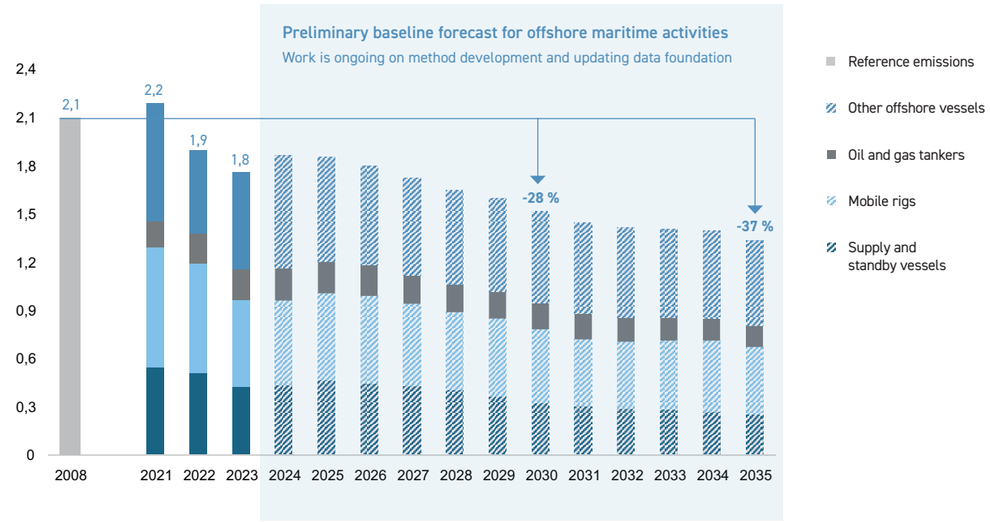
As shown in the figure, the baseline forecast indicates that emissions could decrease by 30–40 percent compared to the 2008 level by 2030 and 2035, respectively. The emissions are expected to decline across all segments for now, without including the emission reduction measures under consideration.

In Appendix 6.1, the baseline forecast for the four segments is illustrated, and the methods used to develop them are briefly described. Moving forward, KonKraft will continue to develop the methodology and data foundation for the baseline forecast.

KonKraft will continue to work on specifying a clear goal for emission reductions and a method for verifying the status. This will be presented in next year's status report.

FIGURE 30 FIRST BASELINE FORECAST FOR OFFSHORE MARITIME EMISSIONS TOWARDS 2035
Mt CO_2

Source: Offshore Norway



A long-term memorandum of understanding with Germany, the Netherlands, and the United Kingdom in December is a significant milestone in the development of the continental shelf as a future hydrogen supplier

4

NEW VALUE CHAINS ON THE NORWEGIAN CONTINENTAL SHELF

Several projects within new value chains on the Norwegian continental shelf are now beginning to materialize. Starting this year, the Norwegian offshore industry can begin delivering products and services within these new value chains, marking the beginning of what could become a new industrial venture on the shelf. One significant development in the establishment of new value chains over the past year is that Northern Lights, the first open source carbon storage facility on the shelf, will be ready to receive CO_2 by 2024. As regards hydrogen, KonKraft launched an updated strategy for blue hydrogen on the Norwegian continental shelf in the summer of 2023 with increased ambitions. In offshore wind, 2024 marks the first year of full operation for the world's largest floating offshore wind farm, Hywind Tampen, and the first offshore wind auction in Norway was held for Sørlige Nordsjø II in March.

4.1 Climate strategy objectives

By focusing on new value chains that facilitate the transition to a zero-emission society in Norway and Europe, KonKraft will develop a forward-looking energy industry on the Norwegian continental shelf. The expertise and experience of operators, suppliers, and the shipping industry in Norway will be leveraged to develop these value chains, ensuring continued value creation and employment opportunities.

The Norwegian offshore industry is already delivering products and services within new value chains starting this year and is only in the initial stages of what could become a new industrial adventure. KonKraft's climate strategy specifically emphasizes value chains in offshore wind, hydrogen, and carbon capture and storage. In 2023, KonKraft launched an updated strategy for blue hydrogen, and the updated ambitions from this strategy are included in this year's status report (in chapter 4.4).

In the climate strategy, KonKraft has decided to work towards realizing the following ambitions related to new value chains:

KonKraft's ambitions	Status
"Production of 1 million tonnes of blue hydrogen per year in Norway by 2032, increasing to 2 million tonnes from 2035. A pipeline for hydrogen export between Norway and the EU will be built by 2030. At least five European industrial companies will utilize hydrogen from natural gas with CO_2 capture and storage in their production by 2030. At least two gas power plants will use hydrogen as fuel in Europe by 2030.»	Shell, Equinor, and Horisont Energi have project plans for large-scale production of blue and green hydrogen, with the forecast for blue hydrogen showing prospects for 1.2 million tonnes of blue hydrogen production annually from 2032. Gassco and Norwegian industry players continue their collaboration with German authorities on developing a hydrogen value chain towards Europe, including a pipeline to Germany. Equinor has signed a memorandum of understanding with Germany, the Netherlands, and the United Kingdom for deliveries of blue hydrogen from 2029.
«Two carbon capture plants in Norway, Norcem Heidelberg cement in Brevik and Fortum energy recovery plant in Klemetsrud, transport infrastructure for CO_2 and CO_2 storage on the Norwegian continental shelf, and Northern Lights operational by 2024."	The capture plants in Brevik and Klemetsrud are under construction, though somewhat delayed. Klemetsrud is still on hold, while the plant in Brevik is scheduled to capture and deliver CO_2 by 2025. The transport and storage infrastructure, Northern Lights, is on track to receive and store CO_2 in 2024.
"CO_2 will be sent for storage on the Norwegian continental shelf from at least five European companies by 2030."	Areas are announced annually, and 11 licences have been awarded with the potential to receive substantial amounts of CO_2 from European sources. The first commercial CCS agreements of their kind have been signed between Northern Lights JV and Yara in the Netherlands and Ørsted in Denmark.
"The oil and gas industry will work to further develop Norway's strong position in renewable energy from offshore wind."	Several companies that also extract oil and gas are participating in the first offshore wind tenders in Norway in collaboration with other industrial and energy players. Norway has conducted its first offshore wind auction, but the development pace in offshore wind in Norway is still slower compared to the rest of Europe.

4.2 Wind power

4.2.1 Overall development over the past year

The offshore wind initiative in Norway has experienced both ups and downs over the past year. In March 2024, the first offshore wind auction was conducted on the Norwegian continental shelf in the Sørlige Nordsjø II area, and the Ventyr consortium won the auction. The successful completion of this auction marks the starting point and is a significant milestone for the development of large-scale offshore wind farms in Norway. In the same month, it was also announced that Enova awarded GoliatVind up to two billion NOK in support for the realization of a floating offshore wind project that will supply renewable power to the Hammerfest region via the Goliat platform in the Barents Sea. But in March, the news also came that the government is postponing the application deadline and thus the allocation of project areas for floating offshore wind at Utsira Nord.

Work is ongoing to open new areas for offshore wind in Norway. The Norwegian parliament and government have a goal to allocate areas for 30 GW by 2040, and the work on new areas for offshore wind is well underway. In April 2023, the Norwegian Water Resources and Energy Directorate (NVE) presented 20 new potential areas for offshore wind production on the Norwegian continental shelf. In September 2023, NVE was tasked with conducting two strategic impact assessment programs (SKU) for the areas Sørvest F, Vestavind B, and Vestavind F, and for the remaining 17 areas. The deadlines for delivering the SKU for Sørvest F, Vestavind B, and Vestavind F are set for the end of November 2024, and these areas are scheduled to open in a round in 2025. The SKU for the remaining 17 areas is scheduled to be completed by the end of June 2025.

> The offshore wind initiative in Norway has been marked by both ups and downs over the past year

4.2.2 Sørlige Nordsjø II has a winner – Ventyr

In March 2024, the first offshore wind auction on the Norwegian continental shelf was conducted in the Sørlige Nordsjø II area, and the consortium Ventyr won the auction. The auction took place just under a year after the government announced the first competitions for offshore wind project areas. After some postponed application deadlines, and the proposed pre-qualification criteria ”sustainability” and ”positive local impact” were changed to minimum requirements, the ministry received seven applications to participate in the auction for the offshore wind project area in Sørlige Nordsjø II on 15 November 2023. Five of the consortia were qualified, and on 18 March at 09:00, the first offshore wind auction on the Norwegian continental shelf commenced. Two days later, the winner – Ventyr – was announced.

Ventyr is a partnership between Parkwind and Ingka Group. Parkwind is a Belgian company that develops and operates offshore wind farms globally. Parkwind is owned by the Japanese energy company JERA. As a partner, they have Ingka Investments, the investment arm of Ingka Group, the largest owner of IKEA. The consortium has a strategic partnership NorSea, which owns strategic port infrastructure and provides port services, bases, and logistics solutions to customers across various industries, including offshore wind.

4.2.3 Utsira Nord delay

On 22 March, it was announced that the tender for Utsira Nord is unlikely to be issued before early 2025. The background was that the Ministry of Energy decided to notify a common model for state aid for Utsira Nord before project areas are allocated. They also plan for a joint notification for Utsira Nord and the areas suitable for floating offshore wind in the 2025 round. The state aid will be notified according to the environmental guidelines in the state aid regulations (CEEAG). In accordance with these guidelines, the ministry will conduct a public consultation on eligibility for support and the key parameters for the allocation of support. The ministry aims to conduct the consultation before summer 2024.

4.2.4 GoliatVind receives support from Enova

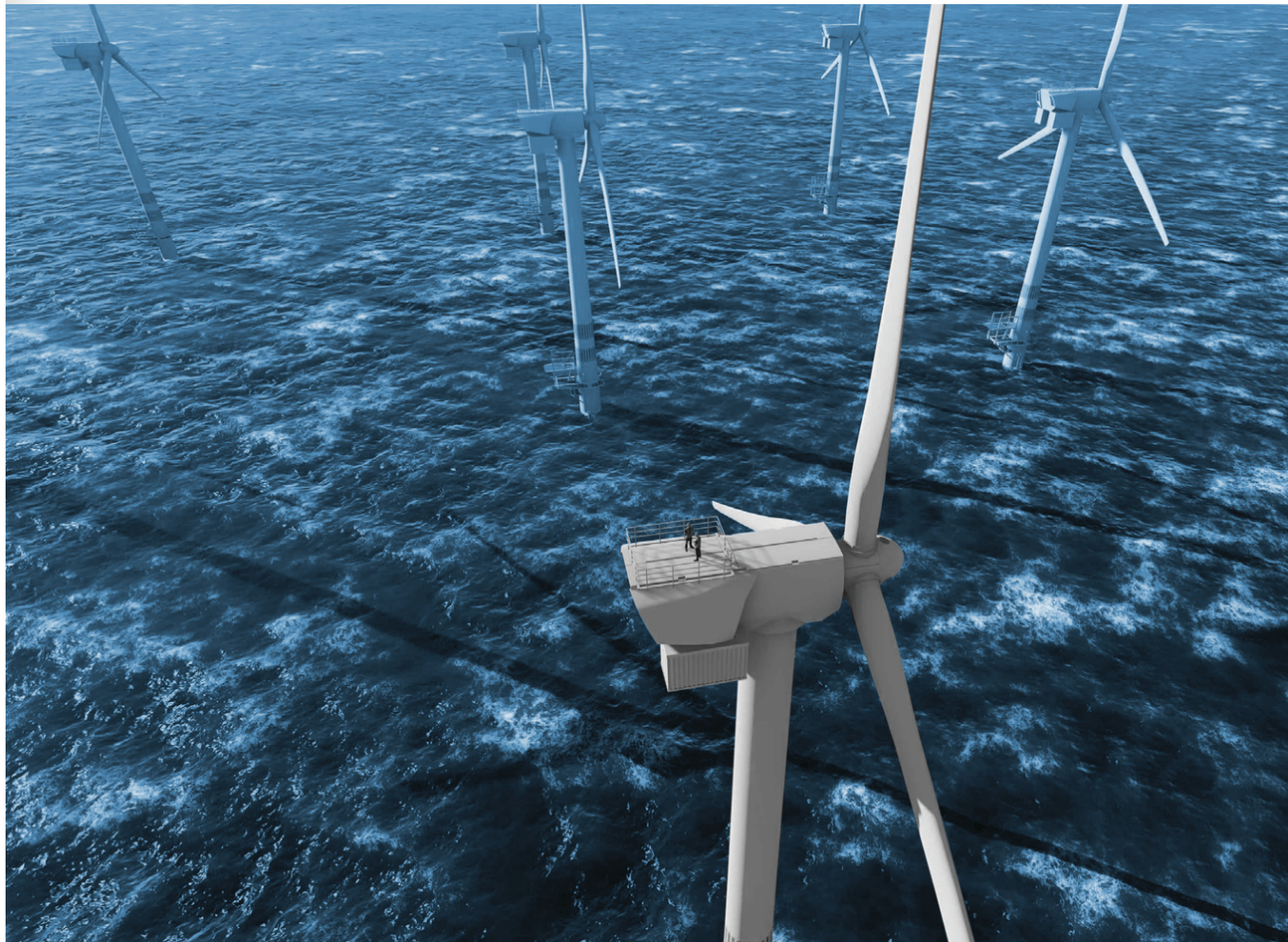
On 8 March 2024, it was announced that Enova will grant up to two billion Norwegian kroner to GoliatVind in support for the realization of the floating offshore wind project, which will deliver renewable electricity to the Hammerfest region via the Goliat platform in the Barents Sea. The bidders in the competition had to commit to submitting a progress plan that requires project commencement within five years, and Enova must be kept informed of the project’s progress and reporting for the disbursement of support.

GoliatVind is owned and supported by three partners: Odfjell Oceanwind, Source Galileo, and Kansai Electric Power Company. The plan includes installing a capacity of 75 MW in the offshore wind farm, distributed across five turbines of 15 MW each. The annual energy production is estimated to be 320 GWh.

4.2.5 Collaboration Forum for Offshore Wind

The Collaboration Forum for Offshore Wind was established by the Ministry of Energy in the autumn of 2021 and is led by the Minister of Energy. The purpose of the collaboration forum is to gather, strengthen, and promote the offshore wind industry. A systematic collaboration will enhance expertise, strengthen competitiveness, and contribute to increased value creation through the export of technology and services, as well as the development of offshore wind resources. An important goal of the collaboration forum is to establish predictable rules for activities and coexistence with existing industries.

Under the Collaboration Forum, three working groups (AGs) have been established: AG1 ”Coexistence”, AG2 ”Industry and Technology Development”, and AG3 ”Infrastructure and network development for offshore”. All working groups have provided valuable contributions over the past year. In March, for example, the document trilogy ”From Gentle Breeze to Strong Gale” was presented, which is the first release from the Industry and Technology Development working group. AG3 ”Infrastructure and network development for offshore” also has extensive activity addressing infrastructure and network issues related to offshore wind power development.



4.2.6 Constraints and needs

Most of the constraints remain unchanged since last year's report, and the industry's desires for offshore wind development and framework conditions have been addressed to a limited extent. These represent time-critical elements for Norway's offshore wind efforts that require clarification. The network and market design must ensure a positive impact for Norwegian consumers, while also ensuring that the development is economically viable both for businesses and society.

Key constraints:

- No overall plan for realizing 30 GW of offshore wind by 2040 is in place. Regular licence awards are required, along with a plan for grid connection which includes how a hybrid grid solution can be established with appropriate market and grid design. This will ensure predictability for offshore wind developers and suppliers looking to invest in Norway.
- Capacity and investments in shipyards and ports for the construction, assembly, and completion of floating offshore wind turbines. Lack of an overall plan and predictability regarding future offshore wind volumes and grid development constrain investments ahead of capacity requirements and make it risky to put industrial capacity in place.
- Slow-moving processes mean that Norway is lagging behind its neighbours and failing to gain full benefits from its advantage in offshore operations.

Industry's desires for offshore wind development and framework conditions:

- The government must make provisions for the development of 2–3 GW of offshore wind annually during the 2030s and 2040s and initiate the opening of new offshore wind areas starting from the current parliamentary term. The government must establish a commercial framework that supports the development of offshore wind.
- Strengthen the commitment to research and innovation related to industrialization and upscaling of offshore wind. The government should prioritize high Norwegian HSE standards and allocate bases to Norway in order to ensure regional and national value creation. Facilitate a grid development in the North Sea to enhance value creation and support a commitment to offshore wind in Norway with an efficient and integrated power market in the North Sea countries.
- Licensing and application processes and administrative capacity must be adjusted to ensure shorter lead times for offshore wind projects on the Norwegian continental shelf.
- Norwegian authorities, including the Ministry of Energy and Petroleum (ED), the Norwegian Water Resources and Energy Directorate (NVE), and Statnett, must play an active role in EU's efforts to develop frameworks for hybrid projects and a potential future offshore grid in the North Sea. Furthermore, Norwegian authorities must actively engage with countries that could be involved in connecting a hybrid project. It is particularly important that Norway is an active partner in the regional collaboration bodies planning coordinated infrastructure development in the North Sea, such as the North Seas Energy Cooperation (NSEC). A clarification of the relationship to the TEN-E Regulation is crucial in this context. If offshore wind farms in hybrid projects are not to receive direct subsidies, they must be given a share of the congestion revenues to strengthen project profitability.

4.3 Hydrogen

4.3.1 KonKraft increases ambitions for blue hydrogen

In its 2020 climate strategy, KonKraft set ambitious goals for the development of blue hydrogen in Norway, including an aim for five European industrial companies and at least two gas-fired power plants to use blue hydrogen from Norway by 2030.

Development in recent years has progressed faster than expected, with numerous stakeholders now advancing hydrogen production projects. Consequently, in 2023, KonKraft launched an updated strategy for blue hydrogen, inviting government cooperation to realize the following ambitions:

- Production of 1 million tonnes of blue hydrogen per year in Norway by 2032, increasing to 2 million tonnes from 2035.
- By 2050, Norway aims to be Europe's leading supplier of blue hydrogen, delivering up to 2.5 million tonnes annually.
- A pipeline for hydrogen export between Norway and the EU will be constructed by 2030.
- Norway is to take an industrial leadership role in carbon management (See Chapter 4.4).
- Technology for blue hydrogen is put into use.[18]

Producing hydrogen from natural gas will be crucial to further develop and ensure the competitiveness of Norway's continental shelf in the energy transition and beyond. To achieve the new goals, close collaboration between Norwegian authorities and the oil and gas industry is crucial, leveraging Norway's competitive advantage as a producer of natural gas with a low carbon footprint during production. The ambitions align with and support LO and NHO's proposal for a national hydrogen strategy from June 2023, which aims for the production and export of 2 million tonnes of hydrogen and hydrogen derivatives annually in the 2030s. These goals also correspond with the intentions behind the Norwegian-German cooperation agreement signed in January 2023.

> Development in recent years has progressed faster than expected, and numerous stakeholders are now developing projects in hydrogen production

18 The role of blue hydrogen in the development of the Norwegian continental shelf (offshorenorway.no)

4.3.2 Rapid development of the hydrogen sector in Norway and Europe – new collaboration agreements, goals, and important legislation established

In December 2023, Equinor entered into a long-term memorandum of understanding with Germany, the Netherlands, and the United Kingdom for deliveries of blue hydrogen starting from 2029 and extending all the way to 2060. The agreement marks a significant milestone in the development of the Norwegian continental shelf as a future hydrogen supplier. A few months later, in February 2024, the German government announced plans to subsidize the development of four hydrogen-ready gas power plants with a total capacity of 10 GW to increase the uptake of hydrogen in Germany's energy mix.[19] The plants are scheduled to operate on natural gas in the initial years before hydrogen is phased in by the 2030s. Both blue and green hydrogen will be viable energy sources.

To justify investments in a hydrogen value chain, the costs associated with hydrogen at the end-user stage must be competitive with alternative costs. If hydrogen is to replace natural gas at the end-user level, the cost of producing and delivering the same amount of energy in the form of hydrogen must be lower than the equivalent energy price of natural gas, including emissions costs. For other applications, competitive pricing levels must be assessed relative to their associated uses. Long-term commercial purchasing commitments among end-users are also necessary to justify the development of large-scale hydrogen production and associated infrastructure.

In the EU, several important legislative texts for hydrogen, including frameworks for infrastructure development, classification criteria, and targets for end-use, have been adopted. Towards the end of 2023, the Council and the Parliament reached an agreement on the hydrogen and decarbonization package for the gas market. The package is a cornerstone in the framework for establishing a European hydrogen economy and aims to ensure market establishment and infrastructure development for hydrogen and other renewable gases in the EU.

The EU's revised Renewable Energy Directive, which came into force at the end of 2023, defines classification criteria and targets for hydrogen use in various sectors. The directive establishes a binding target that 42 percent of hydrogen consumption in industry should be renewable by 2030 and 60 percent by 2035. The EU has also defined criteria for renewable hydrogen, which include strict requirements for production using new renewable electricity. Detailed criteria for low-carbon hydrogen have not yet been finalized, but a proposal is expected to be presented within a year after the gas market package comes into effect. Common classification criteria for hydrogen and clarification of requirements for low-carbon hydrogen will provide Norwegian stakeholders with clarity on which hydrogen products they can supply to the EU.

4.3.3 Production forecast for blue hydrogen

Figure 31 shows an updated forecast for production of blue hydrogen on the Norwegian continental shelf towards 2035. The forecast is based on planned and potential production volumes from stakeholders on the Norwegian continental shelf. There are currently no approved projects, but efforts are underway to mature a significant combined portfolio.

As indicated in the figure, production from the initial projects will commence in 2029 with an annual volume of 220,000 tonnes of hydrogen. Furthermore, there is potential for significant scaling of production volumes in the early 2030s, where volumes could exceed 1 million tonnes of hydrogen per year in 2032 and 1.4 million tonnes of hydrogen per year in 2035. Volumes currently only at an ambition level are also included. To achieve KonKraft's ambition of 2 million tonnes of blue hydrogen production by 2035, it is therefore necessary to develop and mature new projects in the coming years.

19 Power Station Strategy: climate-friendly and secure energy supply (bundesregierung.de)

Some key projects under development in Norway include:

- **Barents Blue:** Horisont Energi's Barents Blue project aims to produce blue hydrogen as an intermediate for ammonia production. The project has postponed its start until 2029 but remains the hydrogen project furthest along in its development path. The first production train is still in the concept phase, but project planning has progressed since the last status update, and PGNiG has joined as the new operator in the storage licence. Ambitions for a doubling in production capacity in the second production train are included from 2034.

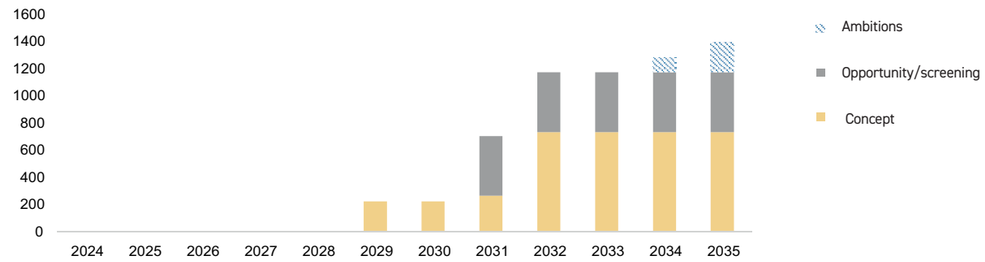
- **Aukra Hydrogen Hub:** Shell, along with partners Aker Horizons and CapeOmega, has plans for a hydrogen production facility in Aukra in Northwestern Norway. The project aims to achieve an annual production of approximately 0.4 million tonnes of blue hydrogen, with estimated production start in 2031.

- **Clean Hydrogen to Europe:** Equinor is planning large-scale hydrogen production on the west coast of Norway through the *Clean Hydrogen* to Europe project. The company is considering various locations for placing hydrogen production near existing gas infrastructure. The project is currently in the *concept* phase and aims to start production in 2031, with further ramp-up of production capacity in the following years.

- **Mongstad:** Equinor is also conducting a feasibility study for producing low-carbon hydrogen at Mongstad. The concept under study initially aims to primarily use refinery flue gas as feedstock for hydrogen production. The hydrogen will then be utilized as an energy source within the refinery. This approach will significantly reduce CO_2 emissions from the refinery due to the CCS (Carbon Capture and Storage) solution being implemented. Depending on the installed production capacity, additional hydrogen can be produced using natural gas as feedstock. This hydrogen can then be used as a resource for local hydrogen-based industries (e.g., sustainable aviation fuel) and/or transported to other markets. Such a hydrogen value chain could have a lifespan far beyond that of the refinery itself. The project is in an early stage of development and poses both technical and commercial challenges, but it has the potential to guide Mongstad through the energy transition.

FIGURE 31 ANNUAL FORECAST FOR PRODUCTION OF BLUE HYDROGEN
1000 tonnes of H_2 per year

Source: KonKraft



4.3.4 Feasibility study by Gassco shows that a German-Norwegian hydrogen value chain is feasible

In January 2022, the leaders of Norway and Germany signed an agreement to strengthen German-Norwegian energy cooperation. The collaboration was further reinforced in 2023 when the countries confirmed a joint intention to develop a large-scale hydrogen value chain with associated infrastructure between Norway and Germany by 2030. In a phased approach, Norway and Germany will respectively produce and consume low-carbon hydrogen based on natural gas with carbon capture and storage. Central to the effort is that it should be led by industry and built to meet the projected demand in industrial projects.

As a first step in this effort, a feasibility study was conducted in 2023 to assess the technical and economic viability of a large-scale hydrogen value chain from Norway to Germany, as well as a CO_2 value chain from Germany to Norway. The work was led by Gassco and the German Energy Agency (Dena) in close collaboration with the industry. The study is based on the two large-scale projects *Clean Hydrogen to Europe* (Equinor) and *Aukra Hydrogen Hub* (consortium of Shell, CapeOmega, and Aker Horizons). The projected demand for hydrogen in Germany is estimated at 3–4 Mt of hydrogen per year, with a scheduled annual transport capacity of 4 Mt of hydrogen.

The study evaluates various solutions for transporting hydrogen from Norway to Germany, see Figure 32. The capital costs associated with the various transport options vary depending on whether existing infrastructure can be reused or if all infrastructure must be built from scratch. Reusing existing infrastructure could provide significant cost savings, but it will simultaneously reduce the total transport capacity of natural gas to German delivery points by approximately 25 percent. A third transport option evaluated in the study is the connection to the AquaDuctus project located in the German economic zone.

The study concluded that a German-Norwegian hydrogen value chain may be feasible, but it requires market willingness, a framework that enables long-term contracts for low-carbon hydrogen, and sufficient capacity for hydrogen storage in Germany to enable a stable system. Technical and regulatory standards, as well as comprehensive technology qualification, will also be necessary to reduce risks and mature technologies moving forward. This includes the qualification of key components such as gas quality and flow meters, compressors, and valves. The project is scheduled to proceed to the next phase, where Gassco will further examine the relevant transport solutions from the initial feasibility study.

The results from the study show that a German-Norwegian hydrogen value chain may be feasible based on the following key assumptions:

The study has the following recommendations:

- To justify investments in a hydrogen value chain, the energy price for hydrogen must exceed the price that of natural gas, including CO_2 emission costs, and long-term commercial commitments are necessary to justify the development of large-scale hydrogen production and associated infrastructure.
- Support schemes such as Carbon Contracts for Difference (CCfDs) and Important Projects of Common European Interest (IPCEI) may help reduce the gap between production cost and market price.
- Maturation of the regulatory framework by authorities is necessary to create predictability for the industry from both the producer's and consumer's perspective. A focus on emission levels in the value chain is important for ensuring long-term sustainability and societal acceptance of energy with the lowest possible total emissions in the value chain. Here, the industry can contribute with facts and knowledge.

FIGURE 32 ALTERNATIVES FOR TRANSPORT INFRASTRUCTURE FOR A GERMAN-NORWEGIAN HYDROGEN VALUE CHAIN

Source: Gassco

Concept 1: Europipe re-purpose

Concept 2: New pipeline to WHV

Concept 3: Tie-in to AquaDuctus

Maturation of the regulatory framework by authorities is necessary to create predictability for the industry from both the producer's and consumer's perspective

4.4 Carbon capture and storage

4.4.1 Norway with new announcements and agreements to develop a Norwegian value chain for carbon management

Several players on the Norwegian continental shelf are working to establish carbon storage as a business area, and since the Ministry of Energy began allocating areas for carbon storage in 2018, there have been seven (as of June 2024) licensing rounds, with a total of 16 different companies awarded storage licences, either alone or in collaboration with others.

In April, Norway signed bilateral agreements with Belgium, Denmark, the Netherlands, and Sweden that allow for cross-border carbon transport.[20] In 2024, Northern Lights, as the first open source storage project in Europe, will be ready to receive CO_2 for permanent storage on the continental shelf. However, injection is not likely to start until 2025 due to delays at Heidelberg Cement's carbon capture facility in Brevik.

In KonKraft's new strategy for blue hydrogen, launched in the summer of 2023, ambitions are set for Norway to take an industrial leadership role in carbon management. In the years ahead, the interaction between the value chains of CCS and blue hydrogen will become more important to leverage synergies and succeed in scaling up both industries on the Norwegian continental shelf. Particularly relevant is CO_2 captured in conjunction with the production of blue hydrogen in Norway, for example from projects such as Horisont Energi's *Barents Blue,* Shell's project in Aukra, and Equinor's *Clean Hydrogen to Europe*. The combination of carbon capture and storage with blue hydrogen production may involve offshore operators taking more integrated control over project development and the establishment of new value chains on the continental shelf.

4.4.2 Increasing focus on CCS as a tool to achieve EU's climate goals

The development of value chains for carbon management, which includes capture, utilization, transport, and storage of CO_2, is highlighted by the EU as crucial to achieving the goal of net-zero emissions by 2050. Over the past year, the EU has continued to work on developing a European market for carbon management. In February, the European Commission presented a strategic document for industrial carbon management.[21] This strategy document outlines various initiatives and development plans for technology, regulatory frameworks, and investment mechanisms to support EU's overall climate ambitions and create a more integrated approach to developing a CO_2 market. The EU estimates that there will be a need for an annual CO_2 injection capacity in the EEA of at least 250 Mt CO_2 by 2040.

20 Norway and the EU are strengthening energy cooperation for a sustainable future - government.no
21 Towards an ambitious Industrial Carbon Management for the EU

The strategy emphasizes that the carbon management industry is still in its initial stages, and that input and contributions from relevant industries will be crucial for developing the sector. It is noted that the oil and gas industry's experience and expertise in geology, pipeline infrastructure, and drilling operations will be valuable for developing regulations and value chains for carbon management. The EU also emphasizes that scaling up and maturing a commercial market for carbon management will require support. They point to carbon pricing, CO_2 removal within the EU ETS, and Contracts for Difference as particularly important mechanisms to make CCS/CCUS projects profitable.

In February 2024, political agreement was also reached within the EU on the Net-Zero Industry Act (NZIA). The regulation aims to accelerate the development of industrial value chains for several strategic net-zero technologies. Within the regulation, the EU has agreed on a target for an annual CO_2 injection capacity of 50 Mt CO_2 in the EU by 2030. The EU considers the regulation to be relevant to the EEA, and if the NZIA is incorporated into the EEA Agreement, the injection capacity target will be adjusted accordingly.

The European Commission implemented a revised version of The European Strategic Energy Technology (SET) Plan[22] in 2023, aimed at better harmonizing with other EU initiatives such as the EU's Green Deal, REPowerEU, and the Net-Zero Industry Act. The plan aims to accelerate the development of green technologies and includes specific key actions for CCS and CCU.

4.4.3 Forecast for injection capacity on the shelf

Figure 33 illustrates an aggregation of potential annual injection capacity on the continental shelf up to 2035. The forecast is based on planned injection capacity associated with awarded storage licences and certain companies' ambitions for carbon storage beyond awarded licences. The first year of injection is expected in 2025, and initially, Northern Lights will be able to receive 1.5 Mt CO_2 annually. Companies' plans for developing CO_2 injection capacity on the continental shelf involve rapid scaling up towards the end of the 2020s if there is sufficient customer demand. The updated forecast in this year's report indicates that projects categorized as *sanctioned* and *mature, but not sanctioned*, correspond to 25 Mt CO_2 by 2030. If less mature projects and ambitions are included, the total volume will amount to 51 Mt CO_2 by 2030. Further scaling beyond the 2030s indicates a rapid increase in potential injection capacity.

There are several ongoing carbon storage projects on the Norwegian continental shelf, but commitments from customers are needed to make investment decisions. Northern Lights Phase 1 is currently the only project categorized as *sanctioned*, with expected CO_2 injection start-up in 2025. The forecast includes estimates for further scaling of injection capacity in the two additional phases of Northern Lights. Phase 2 is categorized as *mature*, *but not sanctioned*, and Phase 3 is in the *concept* phase. Wintershall's projects Luna

22 Revision of the Strategic Energy Technology (SET) Plan

and Havstjerne are also under further development and categorized as *mature, but not sanctioned*, with planned injection start dates in 2030 and 2028/2029, respectively. Equinor's Smeaheia project is *mature, but not sanctioned*, with a planned injection start in 2028. The project has the potential to scale up to an annual injection capacity of 20 Mt CO_2.

Several storage projects on the Norwegian continental shelf are still in early project stages, with significant volumes listed as *Ambitions* in this year's status update. There has been little progress in the projects since the 2023 report, and a significant volume in the Ambitions category highlights the considerable uncertainty regarding the development of the projects. Polaris is categorized as *Concept*, while Trudvang and Poseidon are in the *Ambitions* – licensed category. All projects are scheduled to start before or in 2030, with gradual increases in capacity.

Other particularly large projects include Sval, Storegga, and Neptune's Trudvang project with an annual injection capacity of 9 Mt starting from 2029. Storage capacity in the *Ambitions - no licence awarded* category reflects certain companies' carbon storage ambitions. It is associated with the identification of storage areas and internal project maturation within the companies.

FIGURE 33 PROGNOSIS FOR ANNUAL CO_2-INJECTION CAPACITY FOR STORAGE PROJECTS ON THE SHELF
Mt CO_2/year

Source: KonKraft

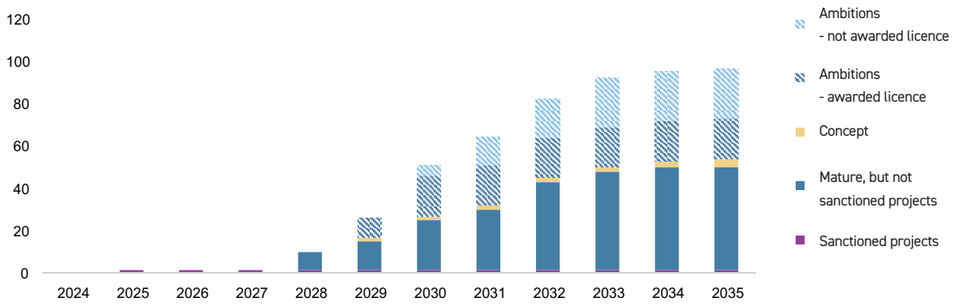


Figure 33. Forecast of annual CO_2 injection capacity for storage projects on the continental shelf with varying degrees of maturity (Mt CO_2/year). The graph shows the expected future cumulative injection capacity in storage projects planning to commence injection before the year on the x-axis. Note that storage projects typically scale up injection over time as they contract and receive CO_2 from multiple customers. Commencing injection in a particular year therefore does not imply reaching full injection capacity in the same year.

4.4.4 Northern Lights ready to store CO_2

In 2024, Northern Lights, with an annual injection capacity of 1.5 Mt CO_2/year, will be ready to receive CO_2 for the first open source carbon storage facility on the Norwegian continental shelf. However, storage is not expected to commence until 2025 due to delays on the capture side of the Langskip project, where the establishment of the carbon capture facility at Heidelberg Cement's plant in Brevik has taken longer than anticipated. The Northern Lights value chain is illustrated in Figure 34, including the capture side of the Langskip project.

In 2023, Northern Lights entered into two commercial agreements for carbon transport and storage with Yara and Ørsted. The agreement with Yara involves annual transport of 800,000 tonnes of CO_2 per year starting from 2025, while the agreement with Ørsted covers 430,000 tonnes of CO_2 per year starting from 2026.

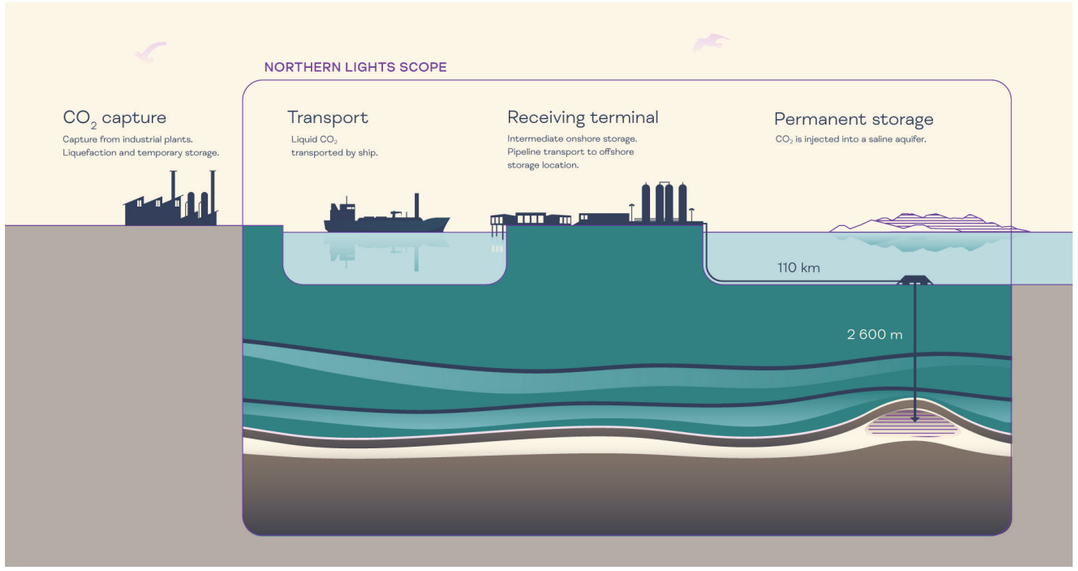
4.4.5 Gassco and Dena study on large-scale CO_2 transport

As part of the German-Norwegian collaboration on developing a hydrogen value chain, Gassco and Dena also conducted a study on establishing a CO_2 value chain between Germany and Norway. The study evaluates the possibility of carbon capture and overland transport in Belgium and Germany, and offshore transport of 20–30 Mt CO_2 per year to storage facilities on the Norwegian continental shelf. Central to the study are ongoing industrial initiatives aimed at establishing a European CO_2 infrastructure and value chain.

Four transport solutions have been considered to facilitate the transport of CO_2 from Germany and Belgium to six storage sites on the Norwegian continental shelf (Smeaheia, Northern Lights Future (Aurora), Luna, Poseidon, Havstjerne, and Trudvang), see Figure 35. The transport options being considered

FIGURE 34 NORTHERN LIGHTS VALUE CHAIN FOR CO_2 TRANSPORT AND STORAGE

Source: Annual report 2023, Northern Lights



are a combined pipeline infrastructure solution, reuse of existing pipelines, new pipeline infrastructure with two separate lines, and transport by ship. An overview of the transportation options is shown in the figure below.

The study shows that it is technically feasible to establish large-scale solutions for CO_2 transport from Northwest Europe to the Norwegian continental shelf. The option with two separate pipelines to the shelf is considered the most robust solution. Reusing the Europipe pipeline for CO_2 transport under the conditions outlined in the study presents significant technical challenges that must be addressed before it can be considered feasible. The varying storage conditions such as distances, water depths, and reservoir pressures can make it challenging to integrate the six storages into a combined pipeline transport system. These challenges can be addressed by designing pipeline systems with different operating conditions or by incorporating facilities such as pressure support or heating as part of the storage facilities.

With the assumptions underlying the large-scale study, pipeline options are the most cost-effective compared to transport by ship. Equinor is advancing in the project "CO_2 highway Europe" with an option for a CO_2 pipeline linked to Belgium, and the company is now considering whether to resume work on further developing a CO_2 pipeline to Germany.

FIGURE 35 GASSCO AND DENA - STUDY CO_2 TRANSPORT ALTERNATIVES

Source: Gassco

Combined pipeline | Dedicated piplines | Repurposed pipeline

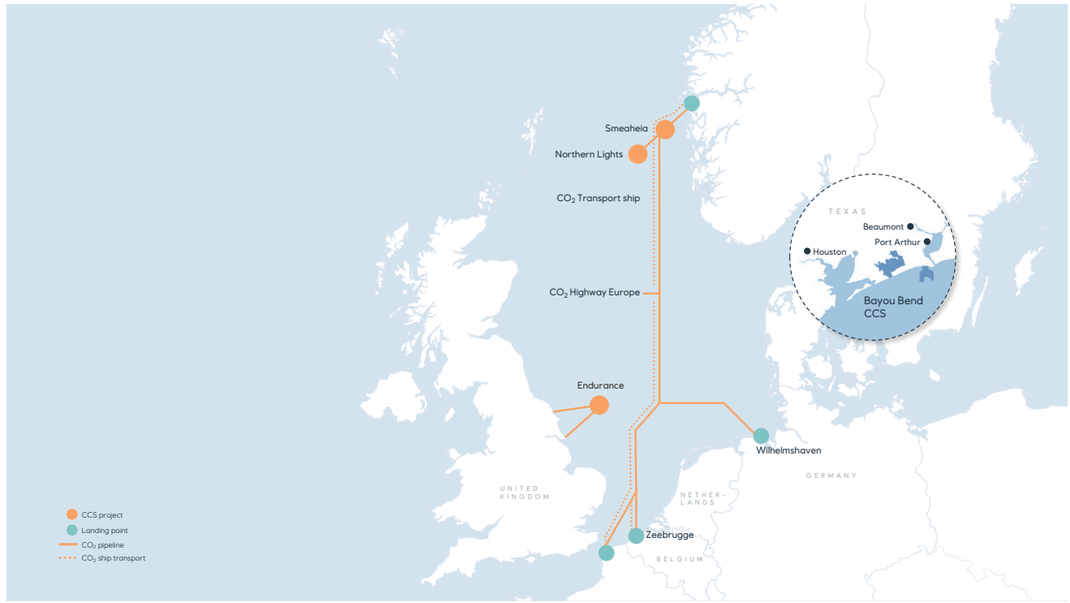
4.4.6 «CO_2 highway Europe» – Large-scale CO_2 infrastructure with capture in Europe to storage in Norway

In connection with Equinor's storage project at Smeaheia, pipeline solutions are planned for transporting CO_2 from Europe to storage in the North Sea, see concept illustration in Figure 36. The project will connect customers in Northwestern Europe to large storage facilities at Smeaheia, thereby representing a groundbreaking change for CO_2 transport. The pipeline solution reduces transport costs associated with CO_2 transport by more than 50 percent compared to shipping, and it also offers benefits related to higher operational reliability and reduced lifecycle emissions. The projects are conducted by Equinor in collaboration with Fluxys and Wintershall. The transport capacity of the pipeline is planned to be established by 2030, with ambitions to increase utilization to 30–50 Mt CO_2 per year by 2035.

> The study shows that it is technically feasible to establish large-scale solutions for CO_2 transport from Northwestern Europe to the Norwegian continental shelf

FIGURE 36 CO_2 HIGHWAY EUROPE AND NORWAY-GERMANY PIPELINE

Source: Equinor ASA



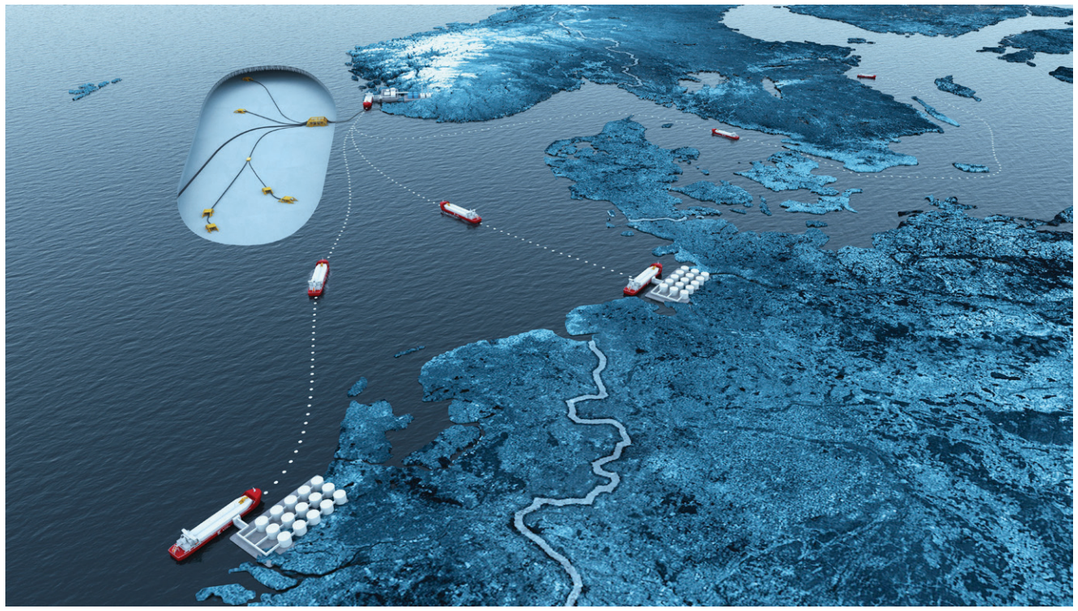
4.4.7 CO_2-terminal Gismarvik

Horisont Energi is working to establish a CO_2 terminal for temporary carbon storage before transporting it via pipeline for storage in the North Sea. The project will be tied to Haugaland Industrial Park located at Gismarvik. The terminal will have the capacity to temporarily store CO_2 for projects with a combined annual injection capacity of 24 Mt CO_2 per year and will receive CO_2 from both local and European customers, see concept illustration Figure 37.

In 2023, Gassnova awarded project funds to the CCS Haugalandet consortium to conduct a technical-economic analysis of the benefits of a shared infrastructure for transport and storage of CO_2 from industrial facilities in the region. The consortium, consisting of Sintef, Eramet Norway Sauda, Hydro, Gassco, Equinor, and Haugaland Industrial Park (HNP), had a total emission of 1.5 Mt CO_2 in 2022. Emissions are expected to increase as new industries are established adjacent to Haugaland Industrial Park. The study evaluated four different logistics options and assessed the profitability of each based on the amount of CO_2 transported, distance to the CO_2 storage terminal, and pressure reduction during transport. The study found that collaboration on logistics development, along with proximity to onshore storage facilities as planned by Horisont Energi, could provide cost-effective solutions.

FIGURE 37 CONCEPT FOR GISMARVIK CO_2 HUB

Source: Horisont Energy



4.4.8 Enova is increasing its focus on point source emissions and allocating funds for pioneering carbon capture projects

In 2024, the Norwegian government increased its allocation to Enova by NOK 1.5 billion to reduce point source emissions. Nine grants for pioneering carbon capture pre-projects totalling NOK 198.4 million were announced on 18 March.

The interaction between markets, incentives, and regulations has not been sufficient to enable carbon capture as a viable climate solution in time to reach climate targets by 2030. The projects are too costly and carry too much risk for companies. Enova's program is designed to address some of these barriers, and the funds for pre-studies are intended to mobilize the market and catalyse many valuable projects.

Overview of grants for pre-studies carbon capture:

- Kårstø Membran CO_2 Removal Plant, Tysvær: 50.0 million NOK
- CCS & Energy hub Rana, Rana: NOK 16.8 million
- RÅCCS – Rådalen CCS, Bergen: NOK 28.6 million
- Pre-project Forus CO_2, Sandnes: NOK 11.3 million
- Bio-incineration at Follum, Ringerike: NOK 11.6 million
- Eidsiva Bioenergy at Trehørningen, Hamar: NOK 12.2 million
- Equinor Tjeldbergodden Development Plan, Aure: 15.6 million NOK
- NorDAC Kollsnes Carbon Capture from Ambient Air, Øygarden: NOK 26.3 million
- Norse Pine – Climeworks Norway DAC Feasibility Study, Bergen: NOK 26.0 million

> The interaction between markets, incentives, and regulations has not been sufficient to enable carbon capture as a real climate solution

4.4.9 Constraints and needs

The Norwegian Environment Agency's assessment
In the report "*A 2035 Contribution Ensuring National Transition – Assessments and Recommendations from the Norwegian Environment Agency*", the agency examines the impact of 62 different measures to reduce greenhouse gas emissions, with fifteen measures accounting for 84 percent of the emission reduction potential by 2035. Carbon capture and storage alone account for about one-third of the emission reductions, with a potential to deliver approximately 5.5 million tonnes of emission reductions by 2035. Access to storage and the establishment of transport infrastructure have been identified as constraints. Storage operators generally also need to secure contracts for significant volumes to make investment decisions.

To realize carbon capture and storage in line with the identified potential in Norway, there will be a need for support for infrastructure and coordination of capture projects in clusters so they can deliver volumes that are commercially attractive for storage operators. Alternatively, the state could acquire storage facilities on behalf of capture operators through public ownership or other measures, fostering competition among storage providers. However, it should be noted that the Norwegian Environment Agency's report focuses on what is required to realize capture at facilities in Norway, and to a lesser extent addresses what is needed for Norway to establish a commercial carbon storage industry on the continental shelf.

Key constraints:

- A lack of clarity persists about the tax regime which will apply to these activities, what financial security must be offered, and acceptance criteria for leakage risk.
- Significant financial and technical risks related to large investments in infrastructure, especially in value chains and markets during an establishment phase.
- Several licences have been awarded, but competition is sharp and maturing and preparing an application is tremendously expensive with a significant risk of losing the investment. A particularly high level of maturity is required for the application, which in turn calls for spending which might not be recovered. Furthermore, requirements and guidelines for the application process are continuously adjusted, which in turn contributes to uncertainty over the process.
- Uncertainties in the EU's Net Zero Industry Act pose a significant risk for storage operators on the Norwegian continental shelf.

Industry needs:

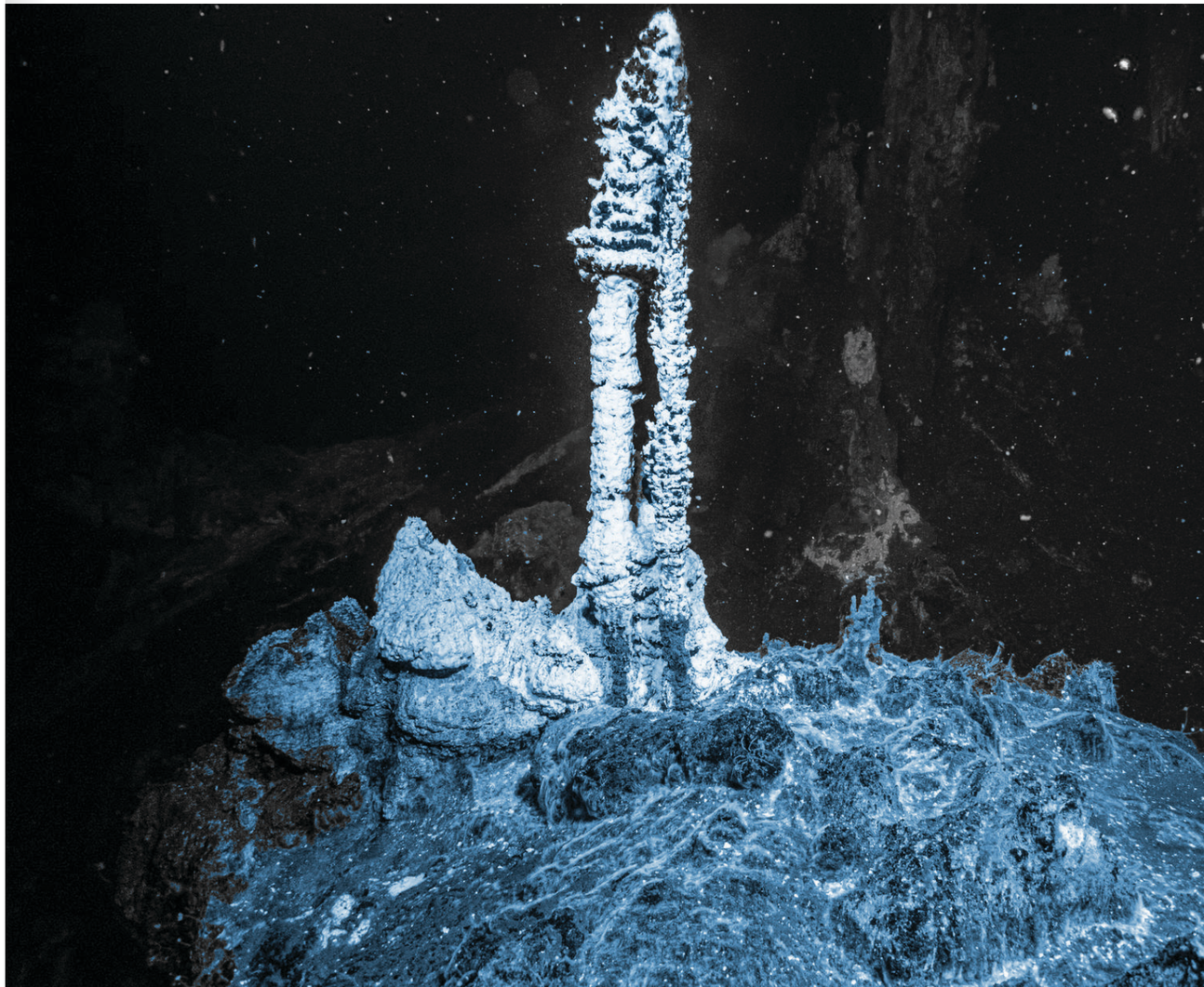
- The support framework should be tailored to help reduce financial risk and facilitate maturing solutions to ensure necessary scale, learning, and cost reductions for both carbon capture and storage. The focus should be on the entire CCS value chain, implementing measures to strengthen the business foundation for emitters that provide incentives for capture and storage.

4.5 Seabed minerals

KonKraft supports the process of exploring and extracting seabed minerals on the Norwegian continental shelf. Exploration and extraction of marine minerals will create new jobs and generate value while ensuring access to critical minerals both to meet global demand and to reduce geopolitical challenges. The new industry will also ensure that technology and knowledge from the Norwegian offshore and process industries are further developed.

Now that an opening decision has been made, licensing for exploration activities should be initiated. Opening an area does not mean starting extraction. KonKraft supports the gradual approach outlined for the initial exploration, and potential extraction of seabed minerals. Extraction of seabed minerals will only proceed if the exploration phase demonstrates that it can be done in an environmentally sound and economically viable manner.

Moving forward, establishing financial, spatial, and labour-related frameworks is crucial to ensure predictability in the industry's development.



Developments in EU energy and climate policy have crucial implications for KonKraft's efforts to develop a future-oriented energy industry on the Norwegian continental shelf

5

EU CLIMATE AND ENERGY POLICY IS CRUCIAL FOR NCS DEVELOPMENT

The EU is the most important market for Norwegian petroleum resources, and developments in EU energy and climate policy are crucial for the development of a future-oriented energy industry on the Norwegian continental shelf. For the Norwegian oil and gas industry, the EU's tightening of energy and climate policies will particularly impact the end-user market. EU also has great ambitions and is developing policies to scale up value chains for CCS, hydrogen, and offshore wind. EU framework conditions in terms of market design, support schemes, carbon prices, and requirements will be of great significance for the investment in these value chains on the Norwegian continental shelf. Norwegian authorities must be engaged, coordinated, and proactive to ensure that Norwegian players maintain and strengthen their competitive advantages.

5.1.1 EU energy and climate policy is crucial for development on the Norwegian continental shelf – many important decisions have been made, and even more are expected in the future

EU energy and climate policy developments are crucial for KonKraft's efforts to develop a future-oriented energy industry on the Norwegian continental shelf. The EU is the most important market for Norwegian petroleum resources, and the Union's efforts to phase out fossil energy in a way that does not compromise prices and supply security will be absolutely crucial for the further development of Norwegian resources. The EU also has great ambitions and is developing policies to scale up value chains for CCS, hydrogen, and offshore wind. EU framework conditions such as market design, support schemes, carbon prices, and requirements will significantly impact the pursuit of these value chains on the Norwegian continental shelf.

In 2020, the European Commission launched the *European Green Deal*, a comprehensive plan for green growth for the EU by 2050. The package aims for a profound transformation of the economy and society through ambitious emission reduction targets by 2030 and 2050. These climate ambitions have since guided all further policymaking related to climate, energy, and industry in Europe. To achieve the goal of a 55 percent emissions cut by 2030, the Commission subsequently introduced the Fit-for-55 package.

The package entails tightening all existing climate frameworks and introducing numerous new measures and regulations. In recent years, the European Parliament and member states have negotiated agreements on most of the Fit-for-55 package, and implementation has already begun. Alongside efforts to achieve the 2030 target, long-term strategies and plans are being developed to ensure that the EU can meet its ultimate goal of net-zero emissions by 2050.

EU climate and energy policy has been and will continue to be strongly influenced by developments in other areas:

- **Security policy:** Russia's invasion of Ukraine and reduced gas deliveries sparked a strategical focus on phasing out Russian energy supplies. This has led to increased ambitions in energy efficiency and renewable energy deployment, but also to diversification of gas imports, which is of great significance for Norway's role as a supplier of natural gas and other energy carriers. Desire for a more self-sufficient EU also leads to a greater need to strengthen the strategic value chains in the green transition from extraction to finished product.
- **Trade policy:** The EU faces increasing global competition, including from the USA and China, to lead in key value chains for the low-emission society (batteries, hydrogen, solar power, CCS, etc.). Extensive use of support schemes and subsidies by global competitors have consequences for the regulatory frameworks the EU develops to stimulate the green transition.
- **Nature and biodiversity:** In parallel with the climate crisis, there is also increasing attention on risks associated with the loss of habitats and biodiversity, and on pollution. The EU has great enviromental ambitions, which also has implications for policies and regulations in the energy sector.

Efforts to reduce greenhouse gas emissions will be crucial in the years to come. The new European Commission that will take office in 2024 is anticipated to adopt targets for emission reductions by 2040 and follow up with a package of measures that can ensure goal achievement. Combined with a more tense geopolitical security situation, a more demanding global competitive environment, and great ambitions related to environmental and nature protection, this will have crucial significance for the development of the energy industry on the Norwegian continental shelf in the years to come. The need to monitor, understand, and influence developments in the EU will therefore become increasingly important for KonKraft going forward.

5.1.2 Overview of EU energy and climate policy with implications for KonKraft

In this year's status report, KonKraft has compiled an overview summarizing key trends and legislation from the EU that will affect stakeholders on the Norwegian continental shelf towards 2030 and 2050. The overview is intended to serve as a reference point for the climate and energy policy changes in the EU that will have the greatest impact on stakeholders on the Norwegian continental shelf.

The overview highlights which provisions and processes affect individual or multiple areas: oil and gas, CCS, hydrogen, and offshore wind. Furthermore, the overview distinguishes between specific provisions in various legislative acts (above the timeline) and specific ambitions and goals, particularly for 2030 (below the timeline). Processes that span longer periods such as the development of markets and infrastructure for new value chains, as well as key climate frameworks, are included at the bottom of the figure. The overview of EU energy and climate policy is not exhaustive but covers many important provisions affecting the industry in the coming years.[23]

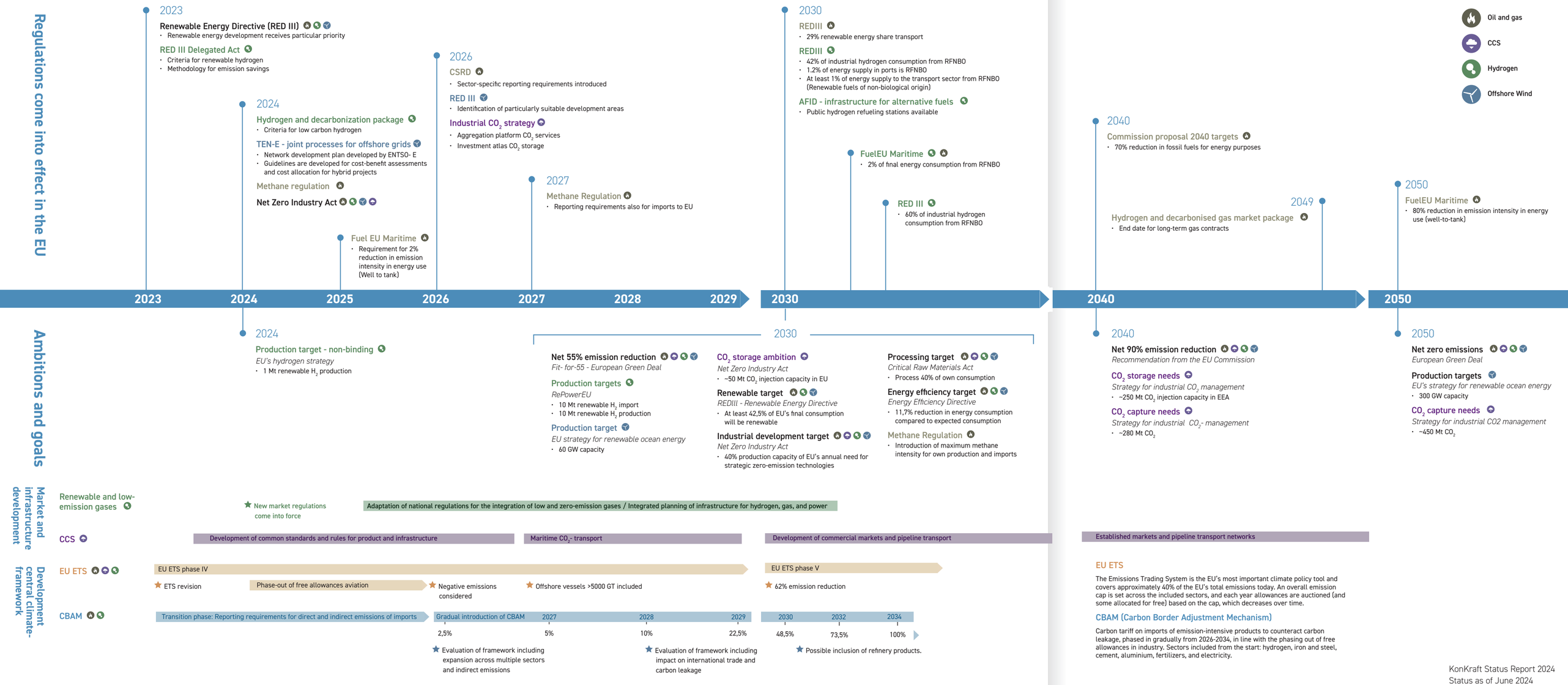
23 In the future, consideration may be given to creating a digital version of the overview, which would provide increased opportunities to include more information, segment the overview by individual sectors, and update it continuously.

TIMELINE

Key changes in the EU's climate- and energy policy framework

The timeline provides an overview of the EU's climate and energy policies, encompassing regulations and strategies that will impact various business areas related to activities on the Norwegian continental shelf in the future.

The compilation includes key provisions and ambitions, referencing the source (regulation, strategy), as well as the business area affected, through the use of colour coding.



EU ETS

The Emissions Trading System is the EU's most important climate policy tool and covers approximately 40% of the EU's total emissions today. An overall emission cap is set across the included sectors, and each year allowances are auctioned (and some allocated for free) based on the cap, which decreases over time.

CBAM (Carbon Border Adjustment Mechanism)

Carbon tariff on imports of emission-intensive products to counteract carbon leakage, phased in gradually from 2026-2034, in line with the phasing out of free allowances in industry. Sectors included from the start: hydrogen, iron and steel, cement, aluminium, fertilizers, and electricity.

5.1.3 Some important developments for the Norwegian continental shelf

The infographic summarizes some key changes in EU legislation and the consequences for various parts of KonKraft's areas of operation. For **the oil and gas industry**, the EU's energy and climate policies will particularly affect the demand side. Goals of reduced energy use in combination with binding targets for an increased share of renewable energy will lead to declining consumption of fossil energy. At the same time, the focus on phasing out energy supplies from Russia will also increase the importance of Norwegian energy supplies going forward. New requirements for measuring and monitoring methane emissions through the Methane Regulation will also have a significant impact on Norwegian offshore and onshore petroleum activities. This underscores the importance of reducing production emissions from the Norwegian oil and gas industry to further strengthen competitiveness on the continental shelf in the future and secure jobs and revenue for the community.

The EU is also becoming increasingly important for **offshore maritime activities**. Maritime emissions will be included in the EU's emissions trading system, and the FuelEU Maritime Regulation sets binding requirements for decreasing emissions intensity over time. There is still some uncertainty regarding which vessel segments will be included and when, but over time, the EU's framework conditions could become a significant driver for the transition to low and zero-emission fuels on the Norwegian continental shelf.

Offshore wind is highlighted as one of the key technologies to ensure sufficient renewable energy to achieve the EU's ambitious climate goals. The EU sets requirements for feasibility studies, quick case processing, and the establishment of targets for renewable energy per marine area to stimulate increased development. The need for cooperation between member states is seen as important for efficient development of European offshore wind resources, and the EU facilitates coordination and collaboration in several different ways.

Through the updated hydrogen and decarbonised gas market package, the EU has adapted the European regulations to accommodate an increasing share of low and zero-emission gases, including **hydrogen**. The EU has defined criteria for *renewable hydrogen*, and work is ongoing to define the criteria for qualifying *low-carbon hydrogen* Ambitious targets have been set for the production and consumption of renewable hydrogen both at EU level and for specific sectors such as industry and transport. There are no targets for the use of low-carbon hydrogen, such as blue hydrogen, but provisions have been made for its adoption in all sectors.

The EU has made significant strides in **carbon management** in recent years. Rising emission costs make carbon capture from industry, waste incineration, and other emission points more relevant. The need for negative emissions also highlights the combination of biogenic energy sources with carbon capture (BECCS) or direct air capture of CO_2 (DACCS). Targets have been set for a CO_2 injection capacity at 50 Mt by 2030, and further targets have been proposed in a strategic document from the Commission in spring 2024. Further developments in the EU's targets, instruments, and framework conditions for carbon management will have significant implications for efforts in this area on the Norwegian continental shelf.

For offshore wind, hydrogen, and carbon management, the ongoing work in the EU will provide crucial guidelines for establishing markets for products and services to realize these value chains. Norwegian authorities must be engaged, coordinated, and proactive to ensure that Norwegian players maintain and strengthen their competitive advantages.

Oil and gas operations

Reduced demand for oil and gas

The ambitious climate goals adopted for 2030 will lead to a faster phase-out of fossil energy sources. A wide range of concrete measures in the fit-for-55 package are drivers for this development.

- Energy efficiency
- Increased share of renewables
- Higher price on greenhouse gas emissions
- End date for long-term gas contracts
- Requirements and measures for emission reductions in buildings, industry, road transport, aviation, maritime sector

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At the same time, increased focus on energy security and value chain emissions can provide advantages for Norwegian energy supplies.

- The EU has dedicated goals to reduce dependence on Russian gas, including increasing imports from other sources and strategic partnerships
- Market regulation opportunities to exclude gas from Russia/Belarus
- EU climate policy increasingly considers upstream emissions, giving Norwegian pipeline gas deliveries an advantage

The Methane Regulation provides important guidelines and could have significant implications for offshore and onshore oil and gas operations.

Offshore maritime operations

Maritime emissions are now fully integrated into EU climate policy:

- Maritime emissions are included in ETS
- FuelEU Maritime imposes binding requirements for reduced emission intensity and the use of shore power

The EU adopts a technology-neutral approach to low and zero-emission fuels, and it is unclear whether all technologies should be pursued or whether a strategic approach is needed

Offshore vessels will be included in the coming years, but there is still uncertainty about which segments and when they will be included.

- Fuel costs will eventually increase due to emission trading obligations
- There is increased pressure to transition to low and zero-emission solutions, but high implementation costs mean major retrofits are likely to be delayed

It will take some time before we see the full effects of the European framework.

- Gradual inclusion in ETS
- Limited requirements for reduced emission intensity in the short term
- The Norwegian framework is likely just as important as the European one in the short term

CCS

Increasing emission costs and ambitions for emission reductions make CCS increasingly relevant.

- Tightening of the ETS and stricter requirements for national and regional emission cuts make carbon capture and storage more economically viable
- Going forward: Negative emissions in ETS

Cross-border CO_2 infrastructure continues in TEN-E, potential for PCI status.

CO_2 injection capacity targets in the Net Zero Industry Act.

- EEA relevance may be crucial for whether Norwegian projects are included

Industrial Carbon Management Strategy launched in February 2024

- Targets for capture and storage
- Framework for planning and development of infrastructure

Hydrogen

Several legislative texts facilitate and set binding goals for increased use of hydrogen in the European energy system by 2030:

- Renewable Energy Directive: Industry, transport
- Cross-border hydrogen infrastructure included in TEN-E
- EU Gas Market Regulations expanded to include hydrogen

Clear goals for renewable hydrogen, details regarding low-emission hydrogen are pending

- Non-legally binding ambition for 10 Mt by 2030
- Binding targets for increased use of renewable fuels of non-biological origin (RFNBO) in industry and transport

Hydrogen is covered by CBAM

Free allowances for hydrogen production will be phased out over time.

Wind Power

Offshore wind will be crucial to achieving ambitious European climate goals.

Key decisions in the past year include:

- Requirements for shared ambitions for offshore renewable energy per marine area
- ENTSO-E to develop joint offshore grid plans for the North Sea
- Regulations for cost-benefit assessments are in place
- Requirements for maximum processing times for offshore wind within and outside the renewable acceleration areas

5.1.4 Norwegian climate and energy policies for the offshore industry and their alignment with EU ambitions

Norway is not a member of the EU, so the EEA relevance of legislation must be assessed on a case-by-case basis. Currently, parts of the EU's energy and climate framework have been incorporated into the EEA Agreement and Norwegian law, while other parts have either been decided as not EEA-relevant or are still under consideration. Norway, for example, is part of the EU's Emissions Trading System (ETS), while the newer versions of the Renewable Energy Directive have not been incorporated into Norwegian law. It is important that Norwegian authorities evaluate the consequences and possibly the need for their own measures when EU legislation in the climate and energy sector is deemed not relevant to the EEA or remains under evaluation for an extended period. In its report on a Norwegian climate target for 2035, the Norwegian Environment Agency discusses the EU's combination of the emissions trading system (ETS) with other instruments:

"In public debate, it is often assumed that the emissions trading system (ETS) will 'sort things out' as long as the emissions cap is tightened. Here, Norway differs from the EU, which has integrated policies that complement the role of the emissions trading system as an instrument.

The EU combines the emissions trading system with other instruments. For example, the Renewable Energy Directive, implemented in 2009, sets renewable energy targets for each EU country that requires national measures. Extensive support for renewable electricity production through feed-in tariffs and power purchase agreements has significantly increased the EU's share of renewable energy and facilitated the reduction in production from emissions-regulated coal and gas power plants. Therefore, the quota price has not effectively reflected the marginal cost of emission reductions within the emissions cap."[24]

24 Norwegian Environment Agency (2023) - A 2035 Contribution Ensuring Transition Nationally

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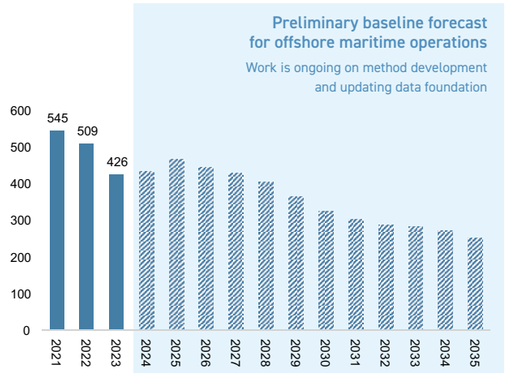
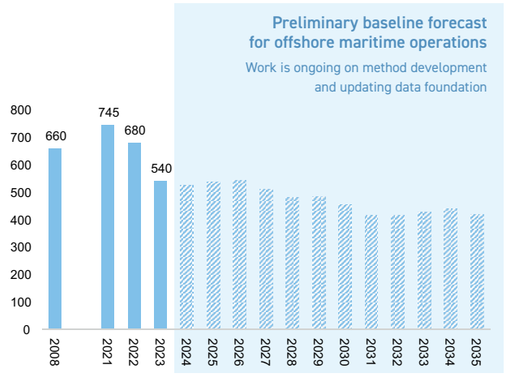
APPENDIX

6.1 Baseline emission forecasts per vessel segment and a brief summary of the method and data foundation. Historical emission data provided by VPS and DNV (1000t CO_2)



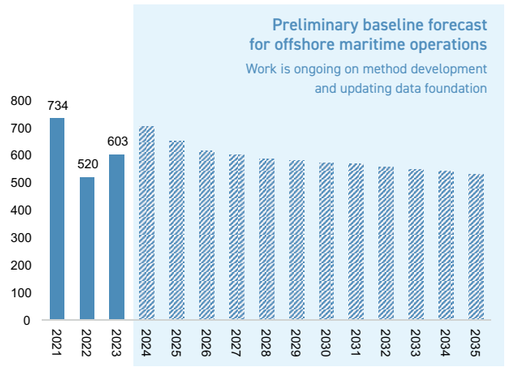
Supply and standby vessels

Data and method: The operating companies in the working group have made forecasts for expected activity and associated emissions related to supply and standby vessels for their oil and gas activities on the continental shelf. The emission figures are adjusted to account for emissions from other activities on the Norwegian continental shelf. It is assumed that the emission intensity remains at the same level as today, i.e., the figures do not account for future emission reduction measures. Although the data represents the best estimates from the companies and should align with the forecast for emissions from oil and gas activities, there will inevitably be some uncertainty associated with such a forecast.



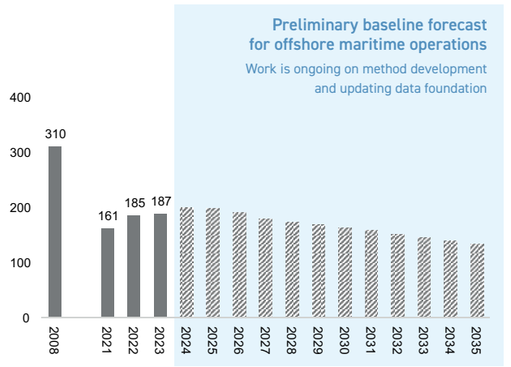
Mobile rigs

Data and method: The operating companies in the working group have prepared forecasts for rig emissions related to their expected activities up to 2035. The emission figures have been adjusted to account for rig activity from other operators on the Norwegian continental shelf. It is challenging for the companies to make definitive statements about rig usage beyond the next few years, and it is therefore emphasized that the figures will be associated with a degree of uncertainty. Nevertheless, the data represents the best estimates from the companies and is based on the forecast for emissions from oil and gas activities.



Other offshore vessels

Data and method: Other offshore vessels encompass a wide range of vessel segments, making it challenging for companies to create forecasts for activity and emissions. It is also difficult to clearly identify drivers for emissions on a national level, as these vessels are involved in many different types of activities. As a preliminary approach, we have used the Shelf Directorate's forecasts for total costs on the Norwegian continental shelf (investments, operations, and decommissioning) up to 2028, and then used the change in overall production volume as a basis for estimating year-to-year changes.



Oil and gas tankers

Data and method: The forecast is based on emission figures from DNV for 2023. Further development towards 2035 is estimated based on changes in oil and gas exports from the Norwegian Offshore Directorate's production forecasts. It is assumed that the emission intensity will remain at the same level as today, i.e., the figures do not account for future emission reduction measures. It is thus assumed a percentage change in gas and oil export volumes similar to the emissions from both gas and oil tankers.

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