nexstep NATIONAL PLATFORM FOR RE-USE & DECOMMISSIONING

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Re-use & Decommissioning report

Responsible decommissioning

2024

Index

Preface

"Responsible decommissioning: that is what Nexstep stands for in 2024 and beyond"

Thijs Starink

General Manager Nexstep

With pleasure I introduce the seventh annual Reuse and Decommissioning Report of Nexstep. It presents the state of affairs on dismantling of E&P infrastructure in the Netherlands at the end of 2023, and signifies trends that we see both onshore and offshore, as well as across other parts of the North Sea. The title of last year's report was 'Stepping up the pace'. So … did we manage to step up the pace?

In 2023, we dismantled a total of eight platforms, more than 5% of the total oil & gas infrastructure in the Dutch North Sea. Besides, another three platforms were scheduled to be removed, but adverse weather in summer and fall of 2023 meant the jackets had to be left in place over the winter – ready to be removed in 2024. A total of 143 platforms still need to be decommissioned, of which for 25 platforms decommissioning is in progress. Effectively, the pace is such that over sixty percent of the infrastructure is expected to disappear in the next decade. Decommissioning is not only in full swing in Netherlands but also in other parts of the North Sea such as the UK. A good result! Take a look at our factsheet on the next page for more detailed decommissioning numbers.

Unfortunately, with other key goals of Nexstep we have not managed to keep momentum. Firstly, the costs for decommissioning tend to increase rather than decrease. The market for heavy lift and support vessels is tightening due to the substantial increase of offshore wind projects. Also, the market is adjusting itself to a higher demand due to increased decommissioning activities. Secondly, labour shortage makes it difficult for our member organisations to free up their people for collaborative projects that drive the efforts of Nexstep, such as joint campaigns for decommissioning. Good technical people are also needed to qualify new technologies and to develop innovations. Lastly, the progress on innovation and development of new technology is slow. Authorities involved in decommissioning are reluctant to accept innovative developments, which can make technical qualification processes lengthy or unpredictable. This all does not contribute to innovating and improving the processes for decommissioning oil & gas platforms and wells in the near future.

Within Nexstep, we are focussing on how to counteract and reverse these negative trends. We need to be smart, creative, and effective in how we go about the decommissioning work. Onshore, we observe some very good examples of this: NAM's novel contracting strategy and Kistos' new pipeline extraction technique. Both are explained in a case study in this report. Also, a new joint campaign is being considered offshore on a much larger scale than the one completed in 2023 for thirty Mud Line Suspended wells. Facilitated by Nexstep, four operators in the southern North Sea are now investigating to jointly decommission some forty platforms over an eight-year period. The plan is to prepare and execute the work with an integrated project team and to have a single set of terms & conditions, including joint technical specifications. This would mean reaching the next level of cooperation. Other operators with a small(er) platform removal scope can join this campaign in due course. To accelerate the qualification and implementation of new technology, we advocate the ALARP (as low as reasonably possible) approach used in neighbouring North Sea countries as a good means of risk assessment. Standardisation of regulatory demands across the North Sea seems sensible and can help to make the work less complex, to increase the supply market across borders and to reduce cost.

Why is reduction of cost so important? Nexstep and its members are very aware that for over 70% decommissioning is paid by the Dutch state, i.e. our society. State participant Energie Beheer Nederland (EBN) pays 40% thereof, and the tax burden on mining activities of just over 50% also means that all costs for oil & gas companies result equally in tax deduction. Therefore we need to work as closely as possible with the authorities in particular, in order to bring decommissioning costs down.

Another very important subject I want to ask your attention for is nature. The ecosystem in the North Sea has suffered from too much activity these last decades and urgently needs to be strengthened. In this year's key note article, Wytske Postma addresses this issue. In the report we also have an article on a project led by EBN, together with Stichting De Noordzee, Natuur en Milieu, NedZero and Nexstep. With this project we are investigating possibilities to perform decommissioning in a more nature-friendly manner.

Finally, the members of Nexstep are of course primarily responsible for the decommissioning task. But we cannot do this alone, we need the collaboration, support and commitment from all parties involved. Together with the key decommissioning stakeholders, we wish to act and execute the work responsibly. Hence the title for this year's report: Responsible decommissioning – that is what Nexstep stands for in 2024 and beyond.

Nexstep Factsheet

Decommissioning in the Netherlands

status December 31, 2023

Operational infrastructure offshore

Gas platforms	Oil platforms	Subsea installations	Wells	Pipeline (km)
102	7	13	342	2843

Operational infrastructure onshore

Well locations	Processing locations	Other locations	Wells	Pipeline (km)
250	31	97	499	1119

Suspended infrastructure offshore

Gas platforms	Oil platforms	Subsea installations	Wells	Pipeline (km)
9	0	4	192	532

Suspended infrastructure onshore

Well locations	Processing locations	Other locations	Wells	Pipeline (km)
45	3	4	401	990

Decommissioning in progress offshore

Gas platforms	Oil platforms	Subsea installations	Wells	Pipeline (km)
20	5	0	33	435

Decommissioning in progress onshore

Well locations	Processing locations	Other locations	Wells	Pipeline (km)
30	1	10	124	21

Decommissioned infrastructure offshore

Gas platforms	Oil platforms	Subsea installations	Wells	Pipeline (km)
33	9	14	893	788

Decommissioned infrastructure onshore

Well locations	Processing locations	Other locations	Wells	Pipeline (km)
38	12	31	1413	141

Decommissioned infrastructure offshore 2023

Gas platforms	Oil platforms	Subsea installations	Wells	Pipeline (km)
5	3	2	72	46

Decommissioned infrastructure onshore 2023

Well locations	Processing locations	Other locations	Wells	Pipeline (km)
1	1	1	1	0

Offshore infrastructure forecasted to be decommissioned 2024-2033

Gas platforms	Oil platforms	Subsea installations	Wells	Pipeline (km)
79	8	16	384	2117

Onshore infrastructure forecasted to be decommissioned 2024-2033

Well locations	Processing locations	Other locations	Wells	Pipeline (km)
200	13	84	722	1342

1 About Nexstep

"Collaboration and knowledge sharing between operators, ministries and supply chain is essential for the safe, effective and cost-efficient reuse and decommissioning"

1 About Nexstep

The Netherlands is facing a major decommissioning challenge. Many oil and gas fields are reaching the end of their economic life, and all will eventually cease to produce. In addition, the use of oil and gas is decreasing due to the energy transition. In the coming two decades, most of the oil and gas infrastructure will be decommissioned, reused where possible, or dismantled. Nexstep is playing a facilitating and coordinating role in this process.

Our vision

Collaboration and knowledge sharing between operators, ministries and supply chain is essential for the safe, effective and cost-efficient reuse and decommissioning of oil and gas infrastructure. Clear laws and regulations as well as government support for the development and application of innovative techniques are important prerequisites.

Our mission

Nexstep's mission is to optimise safe and effective decommissioning of oil and gas infrastructure in the Netherlands. Nexstep drives and facilitates cooperation between the key stakeholders involved and initiates innovation. Nexstep aims to reduce the cost of decommissioning of the oil and gas infrastructure in the Netherlands by 30%, whilst maintaining optimal safety for those involved and with minimal CO_2 and nitrogen emissions.

Strategy

Nexstep employs the following workplan to fulfil its mission:

1. We promote and contribute to clear and predictable **laws and regulations**
2. We initiate, encourage and implement **innovation** and **development of new technologies**
3. We facilitate national and international **collaboration and knowledge sharing**
4. We are the **public face** of reuse and decommissioning and help to increase the transparency of decommissioning processes

Milestones and current projects

Since its inception in 2018, Nexstep, supported by its committees, has achieved several milestones in the areas of regulation, innovation and collaboration. Below is an overview of realised and current projects. For descriptions, see below.

Laws and regulations

✓ **Completed:**

a. Standard 45
b. Comparative Assessment

Innovation/ technology

✓ **Completed:**

c. Through Tubing Cementation (TTC) - partly

⚙ **In process:**

c. Through Tubing Cementation (TTC) - fully
d. PosHYdon (H2 pilot offshore)

Collaboration and sharing knowledge

✓ **Completed:**

e. Joint Well Campaign (JWC)
f. Decommissioning database
g. Online web portal
h. Shared Learnings & Peer Assists

a. Standard 45
Standard 45 is a supplement to the Mining Act that is in line with current legislation and technical capabilities. The industry standard describes special situations that were previously unclear due to a difference between theory and practice, in part because each well is unique and the situation around each well can be different.

b. Comparative Assessment
To assess whether a clean and safe decommissioning or a (partial) removal of the pipelines is preferable, the owners carry out a social cost-benefit analysis. This analysis is submitted to and reviewed by the Minister of Economic Affairs.

c. Through Tubing Cementation (TTC)
TTC is a technology for the plugging of wells without the use of a drilling rig. TTC is more efficient and safer, and it reduces the amount of waste and emissions. For more information, read the article 'Nexstep qualification demonstrates: TTC is a safe and suitable technology', page 44.

d. PosHYdon
This project is an initiative of Nexstep and the knowledge institute TNO, in cooperation with the industry. PosHYdon integrates three energy systems in the North Sea: offshore wind, offshore gas and offshore hydrogen. The aim of this pilot project is to gain experience with the integration of energy systems at sea and the production of green hydrogen in an offshore environment.

e. Joint Well Campaign (JWC)
In 2023, Nexstep successfully completed the decommissioning campaign 'Joint Well Campaign' (JWC). During this campaign, 30 exploration wells in the Dutch part of the North Sea were jointly decommissioned by six Dutch oil and gas operators. For more information, see the article 'Successful Joint Well Campaign as a prelude to future campaigns', page 26.

f. Decommissioning database
The decommissioning database has been set up with the aim of promoting co-operation between operators and reducing the cost of decommissioning activities in the North Sea. The database provides general information about the infrastructure and the expected timing of decommissioning. Cost information through an anonymised cost benchmark is made available to Nexstep members.

g. Online web portal
Nexstep's online web portal provides Dutch heavy lift vessel contractors with an insight into the forecast decommissioning activities. The portal will also enable the supply chain to identify synergies in the projects of the various operators. This will result in improved efficiency and lower decommissioning costs.

h. Shared Learnings & Peer Assists
Since the inception of Nexstep, Shared Learning sessions have been held where operators present lessons learned in recent decommissioning projects. Currently there are about 440 learnings in the database. In 2021 Nexstep organised the first Peer Assist. For more information, read the article 'Knowledge and continuity thanks to Shared Learnings and Peer Assists', page 16.

Insights from Member of Parliament Wytske Postma (NSC)

> "We can bring about the energy transition through smart thinking and cooperation"

Wytske Postma

Member of Parliament (NSC)

The title of the Nexstep report 2024 is 'Responsible Decommissioning', which refers to the responsibility felt by the sector to safely and efficiently decommission the infrastructure, while retaining a focus on the environment. Do you recognise this approach?

"Absolutely! I am delighted that the offshore industry has fully accepted the necessity to take responsibility and to seek collaboration. It is a conviction shared by all parties responsible for building and managing infrastructure. It is fantastic - and very necessary - that this realisation has been arrived at. After all, recent studies once again show the poor condition of the North Sea. To recover and protect nature, we need to avoid thinking in boxes and designating areas as 'mine' or 'yours'. We can bring about the energy transition and utilise the opportunities available to us through smart thinking and cooperation. Nexstep is of real value in this connection, because it brings parties together, promotes cooperation and strives for innovation and cost efficiency. All issues that relate to taking responsibility."

In its programme, NSC suggests that a rethink is needed in the role of the government in the production and distribution of energy, both in terms of oil and gas exploration and the production of renewable energy. According to NSC's vision, what is the role of government?

"In NSC's vision, it is vital that the production and distribution of oil and gas and of renewable energy such as solar, wind, hydrogen and heat, be carried out together with or by the government. The energy system is robust; it is a basic provision that must be affordable, reliable and accessible to everyone. We want the government to take a leading role for example in the reuse of pipelines for hydrogen and for Carbon Capture and Storage (CCS), a technique for capturing and storing CO_2. With that in mind, it is even more important that the removal of infrastructure that has reached the end of its lifecycle and is not suitable for reuse is carried out efficiently, safely and taking into account the needs of nature. The space that is subsequently created is urgently needed to produce renewable energy."

The coming decades will be characterised first by the dismantling of much oil and gas infrastructure - and subsequently of wind farms too. How do you view the extra pressure these activities will place on the ecosystem of the North Sea?
"It is an exciting and tense process, but there are lots of possibilities for implementing it in a responsible manner, while leaving space for nature. It is important that these activities are carried out wherever possible as a collaborative venture, in other words with the owners of the infrastructure, engineers and ecologists working together. Only then will we be able to reduce certain harmful effects on marine life for example caused by noise, and employ techniques that have less negative impact on nature. Take for example the use of vibration systems to help release infrastructure elements. It is also essential that the ecological values that have become established around the platforms and pipelines be retained as far as possible at locations where it offers added value and where it can be achieved safely. The key always lies in finding a balance between fulfilling the obligations and at the same time protecting nature. This also places demands on politics, namely clarity about the nature of the standards and the requirements, the rapid granting of licences and the willingness to make political choices."

How can a balance be found between undertaking the offshore activities that are needed and protecting the interests of nature?
"The North Sea Agreement contains a series of undertakings for achieving a balance between the energy, nature and food transitions. The North Sea may appear huge and infinite, but to find and maintain the balance, we must think smartly about combined use. The climate transition can only be a success if it goes hand in hand with reinforcing biodiversity. If biodiversity reduces further there will be no future for fishery. The area of tension above all lies in retaining space for the fishing industry. Together, we must work to arrive at a situation in which the sum of one and one is not two, but three. For example, by reinforcing nature with activities that are necessary now and in the future. Hard substates in the North Sea can be used as a basis for creating reefs. It is also possible to establish nature in wind farm zones. Drilling rigs located in wind farm zones could in the long term play a role in nature-reinforcing activities in the wind farms. We must recognise that we need to bring about all three transitions. If one becomes uncertain, so will the others. By being aware of this fact, and by constantly searching for a balance and working smartly together, it really is possible to complete the puzzle."

NSC has undertaken to preserve and to recover biodiversity in the Netherlands, both onshore and offshore. What is the vision of NSC on nature-inclusive and nature-reinforcing building on the North Sea.
"It is laid down in the North Sea Agreement that when it comes to building all the new infrastructure for wind, oil, gas and CCS, the work must be conducted in such a way that surrounding nature is protected and reinforced as far as possible. In many cases this can be achieved by taking simple measures we are already aware of, such as the use of techniques for reducing noise levels and transmitting warning signals to underwater animals. Nature-reinforcing building techniques can help create nurseries which will then promote greater biodiversity. For these and other reasons, we have agreed that wind turbines should be built in ecologically poor areas so that they avoid harming rich areas of nature while at the same time delivering a boost to new nature. The Consideration framework for nature-friendly building in the North Sea commissioned by the North Sea Consultation and the Ministry of Economic Affairs and Climate Policy and recently published by Witteveen+Bos could be a valuable tool. I am delighted to see how all stakeholders are taking the necessary steps and are working in a manner that will help reinforce nature. I encourage everyone to learn through doing, to continue experimenting and above all to dare to go further. You sometimes need to try something out, to find out whether it will work or not. The process also calls for politicians who are willing to take the necessary decisions."

2 Reuse & Decommissioning

> "Dismantling is an integral part of the asset management lifecycle"

2 Reuse & Decommissioning

The decommissioning of offshore wells and infrastructure is a global market with increasing activities in the North Sea region and other mature basins. Trends and developments we are seeing nationally and internationally may have an impact on the speed at which decommissioning activities can be carried out.

Trends and developments

A further increase in activities is forecast for the coming years, both on a national and international level. Activity in the Dutch sector has increased significantly in recent years. Data from Offshore Energy UK (OEUK) shows a steep increase in decommissioning activities in the UK with an estimated expenditure level of some GBP 2 billion per year over the next decade. For a detailed forecast of UK Continental Shelf activity over the next decade, see OEUK's Decommissioning Insight 2023 report. Norway is also expecting to increase decommissioning activities in the coming years.

It should be noted that the scope in the Dutch sector is relatively small compared to the overall regional well and infrastructure portfolio. In total tonnage to be removed and in size of platforms, the scope in the Dutch offshore sector is about 10% of the regional North Sea scope. There is a good overview of all infrastructure to be decommissioned, but timing is very much dependent on the impact of national and international developments.

Bottlenecks

The labour market is tight, and almost all sectors are short of personnel, both nationally and internationally. This shortage is also being felt in the decommissioning industry, with a particular need for technically qualified personnel. In some cases, this shortage is leading to delays of decommissioning projects. In addition, the ageing workforce is a risk for the loss of know-how. Furthermore, the link to education and training

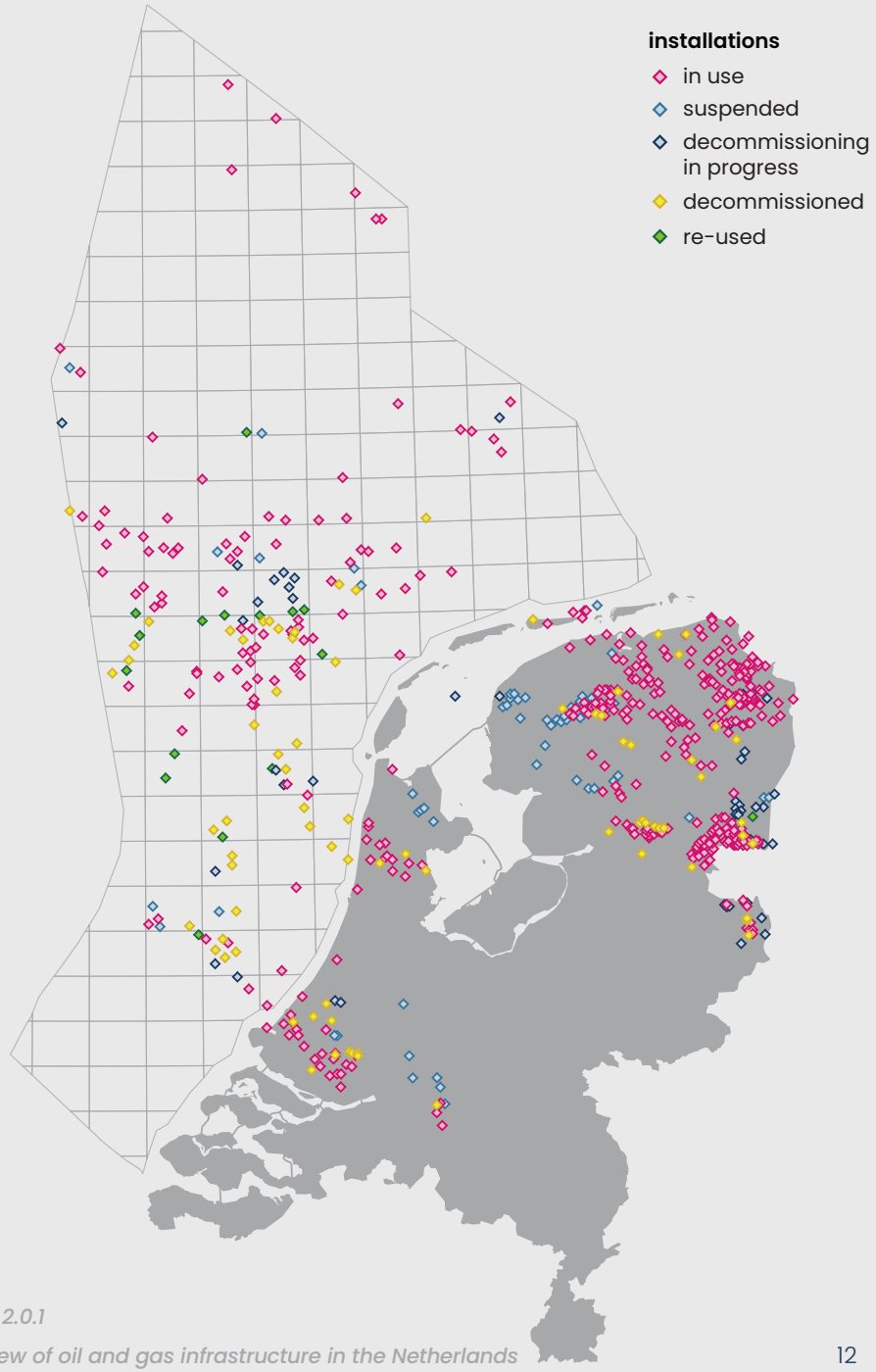


Figure 2.0.1
Overview of oil and gas infrastructure in the Netherlands

is declining as the oil and gas sector are perceived as being less attractive than the renewable energy sector. The development of offshore windfarms is putting pressure on the use of offshore barges and heavy-lifting vessels. Cooperation in decommissioning projects can help to overcome some of these disadvantages.

Opportunities

Current developments also offer opportunities. New assets brought into the market for windfarm installation may be usable for removal of the relatively small platforms and jackets in the Dutch sector. Furthermore, by combining scope, operators can provide flexibility to the market, which will help to attract the necessary resources to the North Sea or inspire contractors to build additional capacity. There is a tendency to move from piecemeal one-off lifting contracts to larger framework agreements that provide more flexibility and clarity to the market.

In the UK, the 'North Sea Transition Deal' includes a voluntary commitment by the sector to achieve 50% local UK content for all new energy transition projects by 2030, as well as in decommissioning. This is providing the necessary push to increase market capacity in the UK. Several new demolition yards have been set up there. In the Netherlands, too, there are initiatives to explore a possible dismantling yard in the Eemshaven. On balance, there seems to be ample dismantling yard capacity available in the North Sea region.

Role of Nexstep

Nexstep is actively participating in discussions with the market and parties in the UK and Norway, to share learnings and explore opportunities. Nexstep participated in and presented at the 2023 OEUK Decommissioning conference in St Andrews. Nexstep was also invited to the 2024 SWIPA conference in Trondheim Norway and a 2024 SPE decom conference in Aberdeen, to share the success of the Joint MLS Well Campaign and development and the application of new technologies to reduce decommissioning cost. Nexstep was given the honour of delivering a keynote presentation on Through Tubing Cementation at this year's SPE Aberdeen Well Decommissioning Conference. At this conference, Nexstep also highlighted the positive results of the Joint MLS Well Campaign. These presentations by Nexstep represent a contribution to sharing knowledge and expertise within the decommissioning industry.

Marieke de Vlaam
Permitting Officer NL at
Neptune Energy Netherlands

Yvonne van den Berg
Decommissioning &
Reuse manager at
Wintershall Noordzee B.V.

The decommissioning process explained

Many of the oil and gas fields in the Dutch part of the North Sea are reaching the end of their economic life and all will eventually cease production. Most of the oil and gas infrastructure will have to be decommissioned over the coming two decades, and wherever possible reused and/or dismantled. There are legal frameworks and guidelines for this process. Which laws are applicable, what do they prescribe and what does the decommissioning process look like? Read all about the ins and outs of decommissioning.

The infrastructure for oil and gas production consists of wells, platforms (drilling installations) and pipelines. The Mining Act, the Mining Decree and the Mining Regulations contain detailed legal frameworks about how this infrastructure should be handled. Wells and platforms are always subject to a removal obligation. Pipelines must be left clean and safe (including monitoring), unless they too are subject to a removal obligation. In certain cases, oil and gas infrastructure can be relocated or reused for example for the transport of hydrogen or the storage of CO_2. When that reuse eventually comes to an end, this infrastructure must also be decommissioned.

The process of relocation and dismantling infrastructure is viewed by the operator as an integral part of the asset management lifecycle. Operators budget for the decommissioning costs well in advance and establish the necessary provisions, including financial guarantees. The Mining Act contains instruments that allow the Ministry of Economic Affairs and Climate Policy (MEACP) to intervene if these provisions or guarantees prove insufficient.

Removal in phases

The removal of the oil and gas infrastructure will take place in phases (see figure 2.0.2). As soon as production is ceased, the infrastructure must be 'decommissioned' pursuant to the Mining Act. Within the industry this moment is known as Cessation of Production (CoP). Following CoP, the platform will be placed in what is known as suspension mode. This means that all wells are temporarily sealed off, the pipelines are cleaned and eventually disconnected from the platform. The platform itself is then cleaned and preparations are carried out for eventual removal. Several statutory maintenance and monitoring obligations continue to apply throughout this phase. This phase is followed by definitive removal of the wells according to the pre-approved plan, after which point the topside and jacket are also removed. Finally, all debris is removed from the seabed and the seabed is returned to its original condition.

Administrative obligations

From the moment that production is ceased, oil and gas companies are subject to the following administrative obligations:

- Notification obligation
- Submission of decommissioning plan
- Request for exemption for reuse (if applicable)
- Decommissioning report

Notification obligation

The oil and gas company appointed as operator issues a notice of CoP to MEACP within four weeks after CoP. If the infrastructure element in question is a pipeline,

the operator includes a so-called Comparative Assessment with the notice. In this assessment, the operator describes the pros and cons of leaving the pipeline in place, as compared to pipeline removal. Relevant aspects of both scenarios include the location of the pipeline (with a view to future use of the area), the risk of exposure due to scouring, and most importantly, the environmental and safety impact. Within six months after submission, on the basis of the Comparative Assessment, MEACP determines whether the operator is permitted to leave the pipeline in situ or if it must be removed. If the pipeline is left in place, the operator ensures that it is clean and safe. In the future, too, the operator is required to monitor that the pipeline is secure. Thanks to this notification system, MEACP has a clear overview of the infrastructure that is no longer in operation.

Submission of decommissioning plan

Within one year following CoP, operators must submit a decommissioning plan to MEACP, for approval. In the plan, the operator explains how and by which deadline the wells will be definitively plugged and abandoned and the platform removed. The removal plan also provides an indication of the costs of this work. In case of a removal obligation for the pipeline, the operator must also submit a removal plan for the pipeline. MEACP can impose further conditions on its approval.

Reuse

If reuse of the infrastructure is both technically and financially viable, a temporary exemption can be granted on the removal obligation and on the obligation to submit a decommissioning plan. Eventually, reused infrastructure will also have to be decommissioned after the reuse purpose has ended.

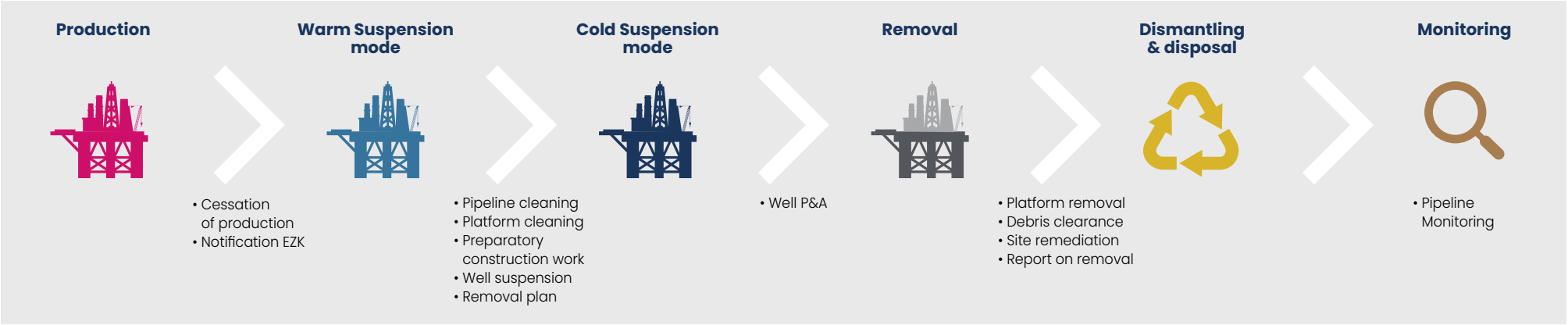
Decommissioning report

The wells, the platform and if applicable the pipelines must be removed in accordance with the submitted and approved decommissioning plan. Following decommissioning, the operator must submit a report to MEACP including a statement that the seabed is free of debris.

Available data and information

- All notices and decisions relating to the decommissioning of production installations and locations are published by MEACP on the licencing website Mijnbouwvergunningen.
- Detailed information about wells, platforms, production and licences is publicly available via the Dutch Oil and Gas Portal NLOG. Much of this information is provided by the oil and gas production companies and is managed by TNO.
- Nexstep annual reports via Nexstep.

Figure 2.0.2. Phases of infrastructure removal



Jules Schoenmakers
Initiator Nexstep sessions

Radboud Bisschop
(First) Team Lead of Nexstep's Shared Learning committee

Knowledge and continuity thanks to Shared Learnings and Peer Assists

> "The operators can offer a wealth of knowledge"

The devil is in the detail: in the dismantling of oil and gas infrastructure, practice may have unexpected results. To offer project leaders and engineers the opportunity to share specialist knowledge and experience, Nexstep launched Shared Learning workshops in 2018 and a database that today comprises more than 440 learnings. They enable knowledge transfer, lower risk and cost savings, but also - or above all - they help establish valuable networks. Also, Peer Assists have been introduced for the initial planning, which can ensure a flying start for new projects.

Contractual setups, managing safety risks or efficiency in the closure of wells: these are just a few examples of subjects discussed during Shared Learning workshops. Jules Schoenmakers, initiator of the Nexstep sessions, explains, "The background to the development of the Shared Learning sessions and the Shared Learning database is the belief that participants in the sessions can improve their own and each other's practices and do this more quickly. The Shared Learning workshops deliver the input for the database. One example of the use of the database is the Joint Well Campaign. When we started preparing for this multi-operator campaign in 2019, a study of the database immediately revealed ten usable learning points from past projects. The JWC eventually resulted in the successful decommissioning of 30 Mud Line Suspended wells and the inclusion of numerous new learning points in the database for future campaigns. The overall benefit is exactly what Nexstep aims to achieve, and to which the learnings make a valuable contribution: safe and cost-efficient decommissioning thanks to collaboration and to the sharing of knowledge and experience."

The power of meeting

The power of the Shared Learning sessions above all lies in the meetings, which lead to natural spinoffs. Radboud Bisschop, first Team Lead of Nexstep's Shared Learning committee explains, "The most powerful sessions are those which the participants attend physically. Sitting together in a shared space and discussing the current activities, creates a sense of collaboration. This also facilitates to seek contact with each other outside the sessions. It is hugely helpful that the participants at the sessions are open, transparent and interested in each other's projects and in the working methods employed by the other participants. The result is a lot of knowledge exchange and real added value from every session. This applies both to seasoned engineers and project leaders

as well as to people with less experience. The latter group often has a greater need to become part of a network and a community. The Shared Learning sessions also contribute to safeguarding continuity in the decommissioning sector."

Structured knowledge sharing

The topics discussed in the Nexstep Shared Learning sessions are varied but use a fixed structure. In Schoenmakers' words, "The operators can offer a wealth of knowledge. The Shared Learning committee organises the sharing of that knowledge, translates it into specific learnings and following each session, enters the lessons learnt in the database. The ideas behind the learnings are generally proposed by the Nexstep committees Wells, Pipelines and Facilities. In this way, the committees contribute to Nexstep's goal of reducing dismantling costs by 30%. We start each Shared Learning session with a short update regarding the developments within the committees, after which four operators present specific experiences. Each presentation is followed by plenty of time for discussion and questioning. Based on this work structure, an average Shared Learning sessions lasts around half a day. It is encouraging to see that the participants are more than willing to free up this time and are keen to share their knowledge. To maximise the outreach of the programme, all Nexstep members can subscribe to receive two-weekly push mails with the new learnings. These updates mean you are guaranteed to never miss newly submitted learnings."

Peer Assist as the starting point for projects

The sharing of lessons learned has proven its value for the Nexstep members. Equally important is the exchange of knowledge before starting a project. With this in mind Nexstep has organised Peer Assists since 2021. Bisschop continued, "In the case of Peer Assists, selected experts share their knowledge and experience with others before the project is started. Operators are stimulated to submit a case. Partly thanks to a Peer Assist, one operator was able to draft a detailed work plan for an offshore trial in advance, based on the experiences of other operators. For removal plans of offshore platforms, a Peer Assist can also be extremely valuable. It is possible to conduct a Peer Assist on multiple occasions during a project or on subprojects, which can result in more efficient processes and further cost reductions. It does of course take some courage to apply for a Peer Assist; to seek advice in advance means that you must be willing to adopt an open mind. That is needed to realise that you may not know everything there is to know and it takes courage to admit that to your peers. However, thanks to the open and supportive attitude of all parties, every Peer Assist delivers added value. Both in the bottom line and in terms of cooperation."

Horacio Ramos, successor of Radboud Bisschop as Team Lead of the Shared Learning Committee: "As decommissioning activities in the Netherlands are poised to rise over the next decade, operators face key technical challenges. Ageing oil and gas wells and production facilities, both onshore and offshore, demand safe and efficient decommissioning. To address this, operators must increase performance and foster collaboration and Nexstep's Shared Learnings and Peer Assist sessions play a pivotal role. By sharing experiences, best practices, and insights, operators can optimise their maturation and execution approaches, ensuring responsible, technically-sound and cost-effective decommissioning."

3 Expected decommissioning in the Netherlands

> "High decommissioning activity is forecast for 2024, as in 2023, both offshore and onshore"

3 Expected decommissioning in the Netherlands

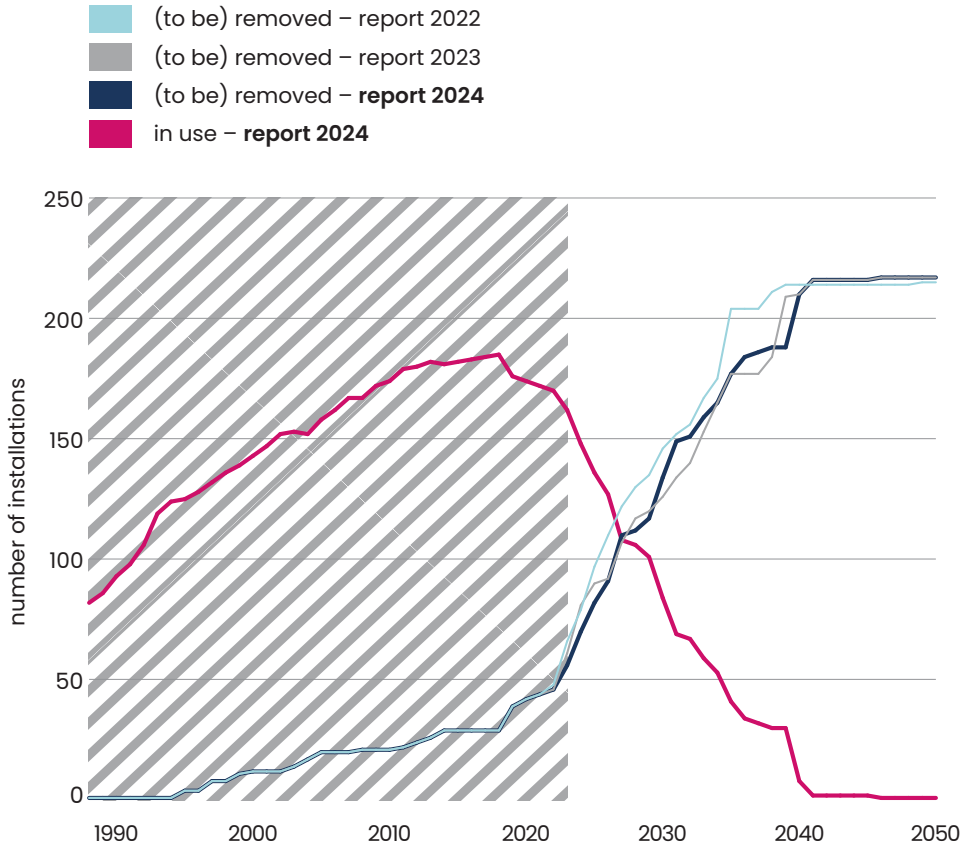
Worldwide there appears to be a surge in the number of projects for the transport and storage of CCS and hydrogen. According to the World Energy Council, over 50 CCS projects are currently under development worldwide and more and more windfarms are being installed, especially offshore.

The Dutch Porthos CCS project advanced to the final investment decision in October 2023 and the construction of the 42 inch diameter onshore gathering pipeline in the Rotterdam harbour area was started in April this year. CO_2 injection in the depleted offshore gas field P18-A is currently predicted to start in 2026. Another Dutch CCS project currently being pursued is Aramis, which aims to build an open-access pipeline to transport liquid CO_2 for underground storage in depleted offshore gas fields. Aramis' start-up is currently planned for 2028 or 2029.

Various large scale hydrogen generation projects using electrolysers are planned onshore. Hydrogen generation offshore using wind energy is seen to be more efficient than transporting electricity to shore and generating hydrogen there. How efficiently electrolysers will operate when supplied with varying renewable offshore power is expected to be one of the learnings from the Dutch PosHYdon project. The set-up is currently being tested onshore and will next be placed on the Q13a-A platform for offshore hydrogen production based on a (simulated) electricity profile from a wind farm.

However, activities at Nexstep are focused on decommissioning and to a lesser extent on repurposing. Not because it is less important, but simply because the potential for repurposing is limited and since companies are more in competition when it comes to repurposing assets.

Figure 3.0.1. Number of offshore installations



Last year's report was subtitled 'Stepping up the pace' and we definitely have seen a much higher level of decommissioning activity offshore from operators like Wintershall Noordzee, Petrogas, TotalEnergies and Neptune Energy (now Eni) and onshore by NAM. Several case studies are included in this report highlighting the status and results of these projects. For 2024, decommissioning activity is again forecast to be high, both offshore and onshore.

A highlight for 2022-2023 obviously was the successful completion of the Joint MLS Well Campaign involving 30 wells and six Dutch operators. The cost savings compared to the initial estimates amounted to well over 50%, mainly thanks to the larger scope and the 4-phased approach using only workboats instead of a jack-up rig.

An important milestone this year is that the onshore Groningen gas field was permanently closed. NAM has established long term partnerships for the decommissioning and restoration of all their onshore assets, consisting of some 350 sites, 800 wells and 1,700 kilometres of pipelines. The timeframe to complete all this work is expected to be at least ten to fifteen years.

In 2023, eight platforms were removed, which is well below the forecast thirteen in last year's report. However, in one of the campaigns it is only a delayed removal for three platforms: the topsides have been removed and shipped to dismantling yards in 2023, but the jackets had to stay behind temporarily due to operational unavailability of a crane vessel. These jackets will be removed this year and as such, the status of these installations is still reported as 'decommissioning in progress' rather than 'removed'.

In 2024, four operators have issued a so-called 'request for interest' to the supply market for a potential joint removal campaign of 30-40 platforms extending over 5-10 years in the Dutch and UK sectors of the Southern North Sea. The market response is currently being evaluated.

3.1 Total overview offshore & onshore

Offshore, the level of installation removals will remain high until 2031, with an average removal of 12 installations (10 platforms and 2 subsea installations) each year, except for a low in 2028-2029. The number of offshore wells forecast to be plugged and abandoned averages 40 every year and this number will require two jack-up drilling rigs working full time. Offshore pipeline decommissioning is expected to be high in 2024 and 2028; on average, the number of pipelines to be decommissioned over the next decade is forecast to be 16 per year.

Onshore, the forecast decommissioning activity remains largely unchanged compared to last year's report. Activities here are dominated by NAM who operates most of the onshore assets. This year, the main activity will involve plugging some 70 wells and this level (or even higher) will continue for the foreseeable future. Pipeline and installation (site) decommissioning will follow the well P&A work logically, with a slight delay.
A separate article/case study about NAM's new partnerships is included in this report on page 46.

Figure 3.1.1. Realised and forecasted decommissioning - offshore infrastructure

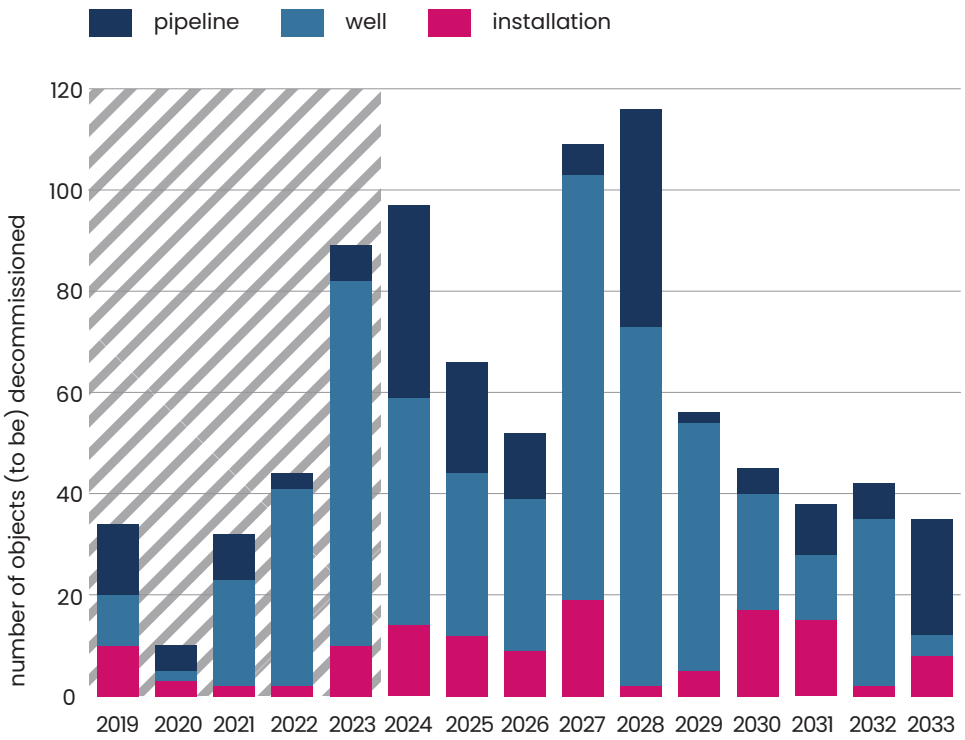
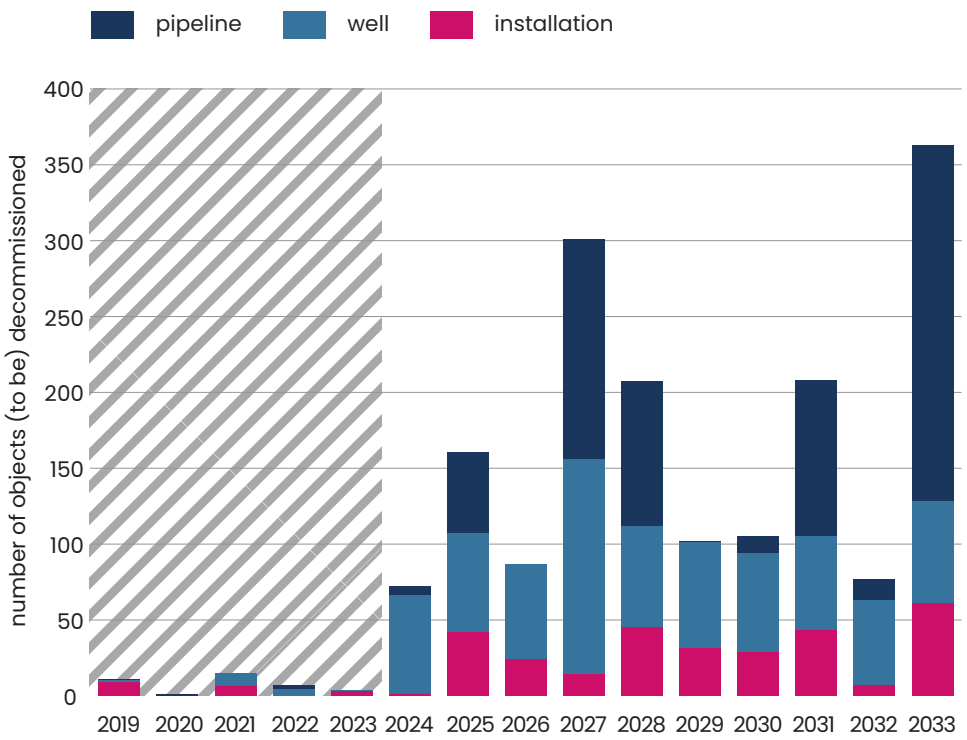


Figure 3.1.2. Realised and forecasted decommissioning - onshore infrastructure



Case Study

Wintershall Noordzee Decommissioning 2023

Wintershall Noordzee B.V. (WINZ) has an extensive decommissioning track record. The first well abandonment and the first platform removal date back to 1988. In the subsequent years, 59 wells were plugged and abandoned (P&A) and 20 platforms were decommissioned on a case-by-case basis, of which 9 were reused.

In 2019, the company launched the WINZ Decom Campaign with the aim of performing future decommissioning projects in a campaign-based manner in order to improve overall efficiency. This approach covers two major sub-campaigns, namely a P&A campaign and a full platform removal campaign. As a frontrunner in offshore decommissioning in the Southern North Sea, WINZ contracted the Swift-10 rig in August 2021 for the well P&A part and over 40 wells were plugged and abandoned by the end of 2023. The P&A campaign will continue with another 20 wells in 2024 and over 10 additional wells expected in 2025. The intensive and long-term collaboration with Swift has indeed led to increased efficiency, which is reflected in a decrease in the average duration of P&A per well.

Since the implementation of the campaign approach, 6 platforms have been removed as part of the platform removal campaign, starting with the Q4-A and Q4-B platforms in 2022 by Scaldis Salvage and Marine Contractors, followed by the removal of the satellites L8-A, L8-H, P6-B and P6-D in 2023. The P12-SW, L5-B, Ravn (DK) and D12-A installations, also included in this contract, will be removed in 2024. A second tender in 2023 led to the awarding of the contract to Scaldis for the removal of P6-A, resulting in a campaign for 5 platform removals in 2024. The excellent collaboration with WINZ started more than 10 years ago with the removal of the K10-B main platform and the installation of the L6-B monopile, both in 2014.

Flying Focus

This valued relationship is essential given the current developments in the heavy lift vessel (HLV) market, where there is increasing competition from the offshore wind industry and hence several contractors are no longer interested to bid on oil & gas decommissioning projects.

The 2023 removal campaign was successfully executed with the HLV Gulliver, starting in the first week of June with removal of the topside of L8-H. Onshore preparations included engineering, permit applications and risk assessments which started in September 2022. Offshore preparations were focused on the inventory of hazardous materials on board the platforms to be removed, such as Mercury and NORM contamination, the removal of equipment such as solar panels, and the installation of lifting points to remove the topside from its jacket. Based on the inventory of hazardous materials, a roadmap was drafted for the handling of these materials during removal offshore, but also for the final disposal onshore. The information was shared with the HLV contractor at an early stage and was part of the contract. For 3 satellites, the reverse installation method was used. After connecting the removal rigging to the topside lift points, the final cuts were made to separate the topside from the jacket. Once separation was confirmed, the L8-H topside was lifted and transported while suspended by the crane to the disposal yard of Hoondert Services and Decommissioning B.V. in Vlissingen, followed by the L8-A topside.

Next in line was the P6-D, a tabletop platform. The hull was lifted from its 4 legs and towed using the float method to Vlissingen, after which the legs were transported to shore in the crane.

Preparations for removal of the L8-A and L8-H jackets included ROV inspections and the removal of soil plugs from the legs. The piles were cut 6 m below the seabed and internal lifting tools were brought into the legs after which the jackets were lifted and transported one by one to Hoondert in the crane hook.

Last in line was P6-B, which followed a similar route as the L8-A and L8-H satellites. In mid-August, the P6-B jacket safely landed on the Hoondert quay, well within the planned timeframe despite some weather delays during execution. An underrun of 5.5% was achieved in the overall costs for the 2023 removal campaign.

Improvement in the execution of decommissioning projects, whether in terms of personal safety, protection of the environment, upholding company values, efficiency or costs, can only be achieved by learning from previous projects. For this reason, WINZ has set up a Decom Lessons Learned Register. Several lessons from this campaign have been added to the Register:

- Cutting the jacket legs from the topside leaves open holes. At one location, a number of birds flew into these holes with fatal consequences. A bird protection system to be placed over the jacket leg holes has been designed by Scaldis and will be used in 2024.
- Oil was found in one of the jacket legs after removal of the topside. It appeared that this oil originated from the crane which was installed just above this leg. The oil was removed, partially in critical vessel time, and shipped to shore. As a lesson learned, in future all sump caissons and legs will be inspected for oil or any other content.
- Not new, but a recurring point of attention is piping on board of the platforms. It is not guaranteed that all pipes are empty, and they need to be checked and marked for NORM and LEL before cutting. It was recommended to drill holes for inspection at the cut locations and to aim for uniformity in the marking of pipes.

All in all, WINZ has set out to remove all assets that are no longer required for future production purposes and will continue to do so. Possible lessons learned from the removal of each asset will contribute to the further improvement of its and others decommissioning activities.

3.2 Offshore wells

Of all wells ever drilled offshore, over 60% have already been decommissioned. Two-thirds of the remaining wells are expected to be decommissioned over the next decade at an average level of 40 wells each year. With an average duration of 2-3 weeks per well, 2 dedicated drilling rigs will be required full time.

Figure 3.2.1. Realised and forecasted decommissioning - offshore wells by well type

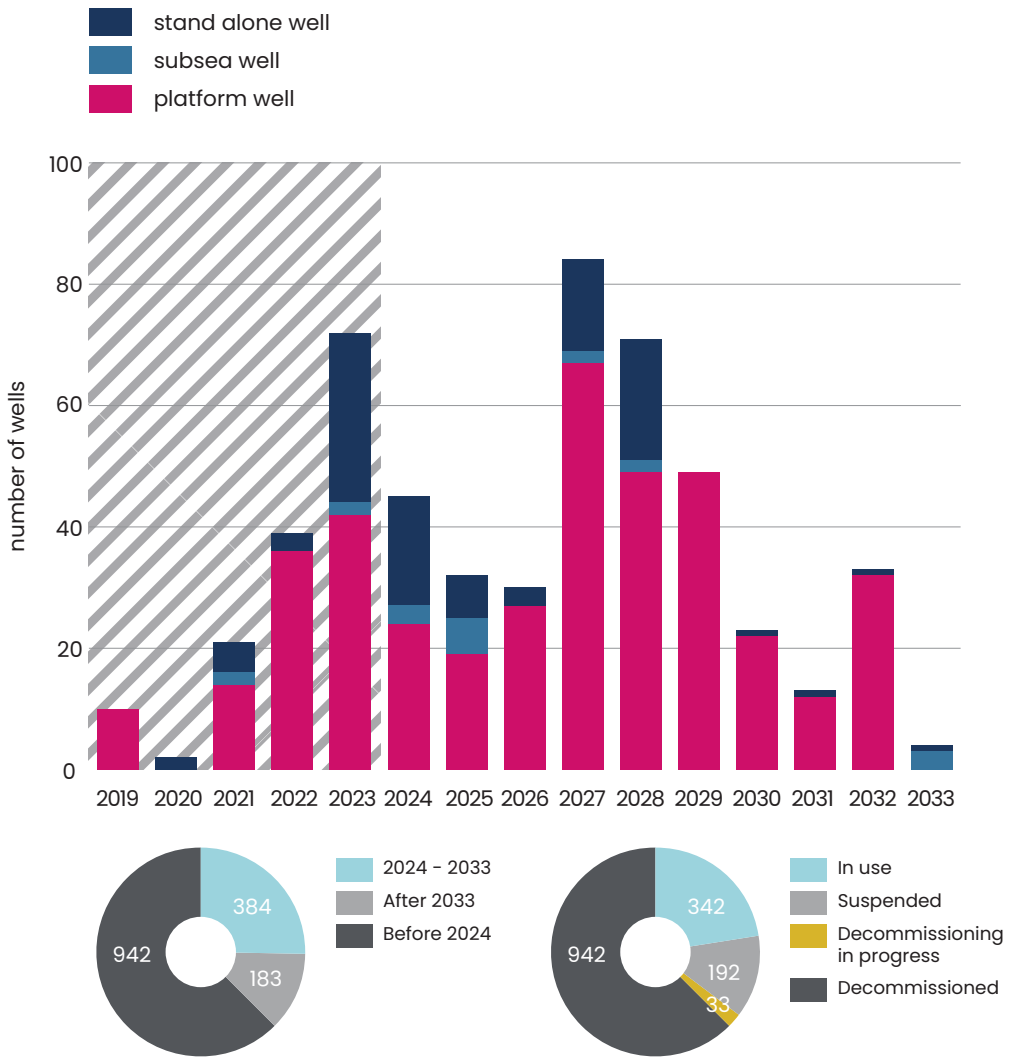
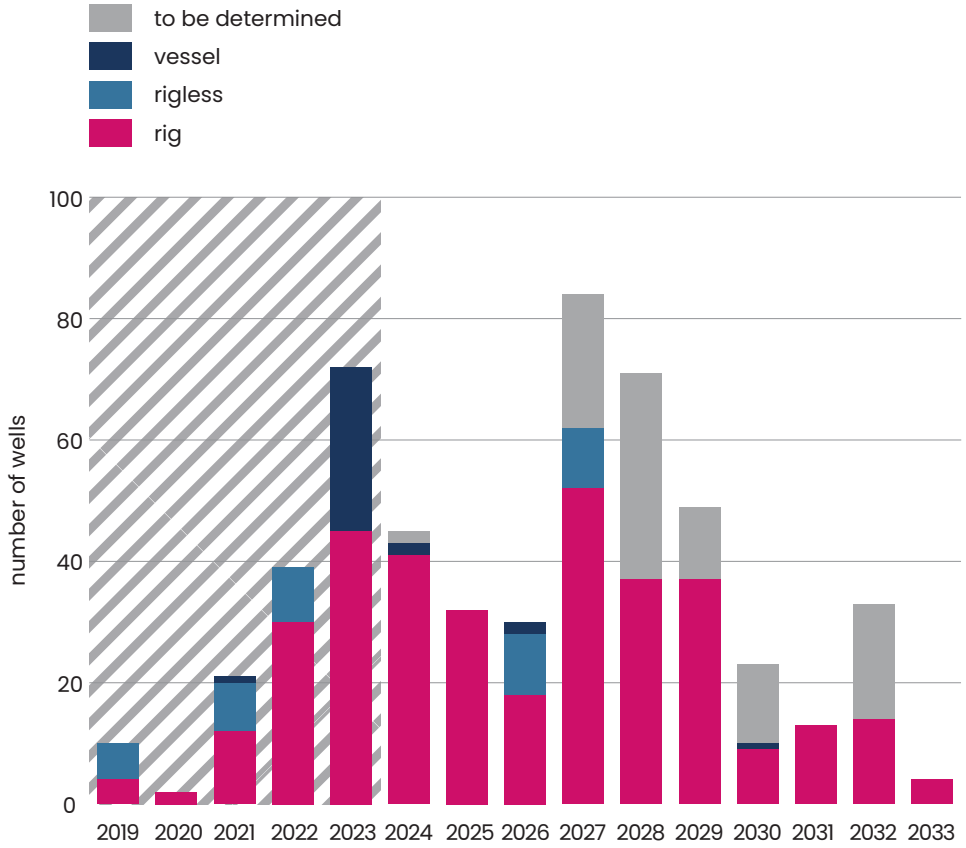


Figure 3.2.2. Realised and forecasted decommissioning - offshore wells by decommissioning method



courtesy Petrogas

Successful Joint Well Campaign as a prelude to future campaigns

> "Mutual trust has delivered collaboration and consistency"

Dick Lont

Nexstep Manager of the JWC

Never before have oil and gas companies collaborated in a joint campaign on such a scale as during the Joint Well Campaign (JWC). Nexstep facilitated and coordinated this dismantling campaign which, thanks to excellent cooperation and the joint deployment of vessels, led to large cost savings and lower CO_2 and nitrogen emissions. Dick Lont, Nexstep manager of the JWC, talks about the objectives, results and lessons learned from this unique campaign.

In the complexity of this campaign, the common thread employed for the JWC was characterised as 'fair and transparent'. Participants in the JWC were six Dutch operators, one main contractor and three key subcontractors. They worked alongside various government bodies and the large partner (state participant) Energie Beheer Nederland. As Lont explains, "The primary objective of the JWC was to reduce the cost of decommissioning and restoring (D&R) by developing new working methods and by encouraging collaborative ventures between Dutch operators. This principle applied for this campaign and would set an example for future campaigns. Looking back, we can conclude that the campaign certainly delivered the intended results. There were a number of determining factors: we all shared a common goal, there was broad support by the management, the team of operators was diverse in its makeup, the discussions were open and transparent and there was a considerable level of mutual trust. In other words, there was a shared desire to learn from each other and to bring the campaign to a successful conclusion. This led to new insights, improved cooperation, considerable cost reductions and lower environmental emissions."

Size of the prize

The JWC is a reflection of the goals of Nexstep: to reduce both dismantling costs and emissions, to facilitate and coordinate cooperation, to increase efficiency and to encourage innovation. As Lont further explains, "Since the start of the implementation of the JWC in April 2022, through to its completion in September 2023, we inspected and dismantled thirty of the almost eighty remaining exploration wells in the Dutch part of the North Sea in a responsible, safe and efficient manner.

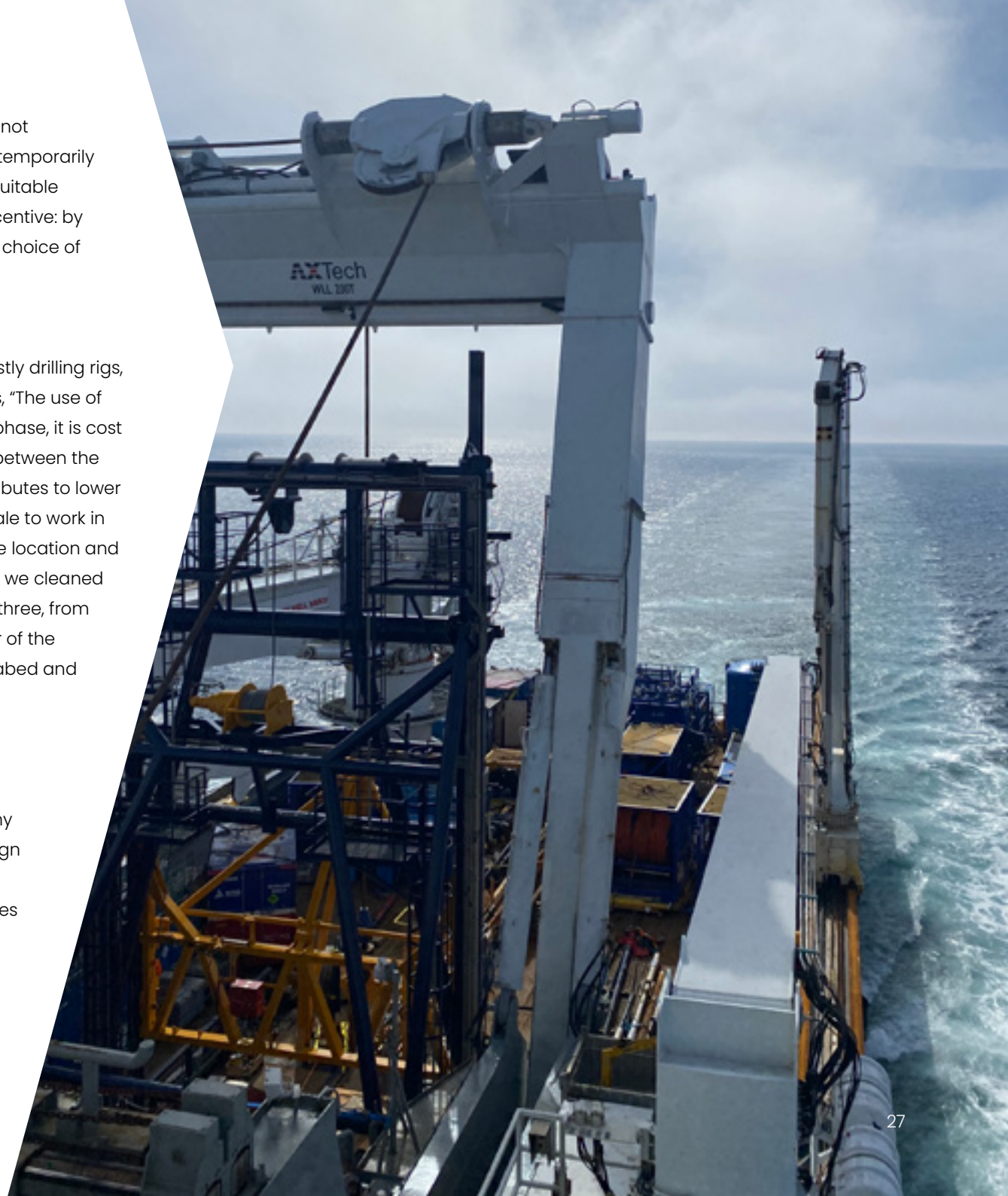
These exploration wells, also known as Mud-Line Suspended wells, are not connected to a production platform, and were for good reasons only temporarily suspended after being drilled, sometimes long ago. This made them suitable for a joint campaign. The size of the prize principle was the primary incentive: by conducting the campaign jointly, it was of sufficient scale to allow the choice of alternative dismantling methods, leading to greater efficiency."

Benefits of vessel deployment

Whereas the majority of dismantling campaigns involve the use of costly drilling rigs, during the JWC, the leading role was played by vessels. In Lont's words, "The use of vessels offered a range of benefits: by using different vessels in each phase, it is cost effective and offers the opportunity to evaluate and adjust the plans between the phases and to implement lessons learned. The use of ships also contributes to lower environmental emissions. The size of the campaign gave sufficient scale to work in four phases. In phase one, from the vessel Vos Sugar, we inspected the location and external status of the wells. In phase two, supported by the Levoli Ivory, we cleaned the wells and inspected the temporary abandonment caps. In phase three, from the Island Valiant, we installed an additional cement plug in a number of the wells. Phase four involved cutting off the wells six metres below the seabed and cleaning up the seabed area from the Island Vanguard."

Nexstep brings parties together

Generally speaking, for oil & gas projects, operators follow their own agenda, business plan, work program & budget and (parent) company specific contractual conditions. The implementation of a joint campaign benefits from an independent party that brings together both the content and the process. Nexstep is ideally suited for that role. Lont goes on, "The operators themselves made the technical and contractual preparations. Nexstep then initiated and facilitated the cooperation between all parties. We issued a competitive tender for the selection of the main contractor. In addition to price, a key criterion for



this selection was experience with the safe removal of Oil-Based Mud. The Mud Containment System eventually deployed prevents leaks of contaminated drilling fluids. We contracted Oceaneering, which subsequently faced the challenge of identifying working methods that satisfied the requirements of the State Supervision of Mines as well as being approved by all operators. The first stage of sharing experience and processing everyone's contributions in generic procedures took some time, but eventually resulted in a high-quality, consistent and solid working methods. In this process, it is the task of the campaign manager to prepare joint decisions and at the same time to maintain the pace of progress."

Common terms & conditions

One key element of the contractual agreement was the use of the same set of 'terms & conditions'. Arriving at this common set of terms & conditions led to much discussion at the start and required considerable preparations. However, by focusing on the intent of the contractual conditions, the various parties managed to reach agreement. Moreover, by applying NOGEPA and International Association of Oil & Gas Producers guidelines, the technical standards and procedures could be successfully harmonised. Lont goes on, "Not only did we share the project management, but also ensured that the same offshore supervisors were deployed for all operators. These supervisors followed the same step-by-step plan and the same procedures, including the life-saving rules. This meant that all operations were carried out in a consistent manner. This uniform approach called upon all participants to show willingness to compromise. However, based on the principles of fairness, transparency and mutual trust, everyone eventually came on board. Also, by recognising that wells partially abandoned in the past nevertheless have to satisfy current regulations, the cooperation helped bring about unity and consistency. The contract was designed to be sufficiently flexible that wells could be added or exchanged in each phase, depending on new information that emerged during implementation."

Prelude to future dismantling projects

Campaigns like the JWC offer the opportunity to learn and improve. Lont concludes, "The JWC shows that joint dismantling delivers better results in less time and at lower cost. The experience we acquired in removing these 30 wells will enable the various parties involved to refine their processes, technologies and collaboration models and make them more efficient for future dismantling projects. Over the next few years, this could result in acceleration of decommissioning activities, also for production wells connected to a platform and for the production platforms themselves. In this way, the JWC will make a meaningful contribution to the decommissioning challenge that is still ahead of us all - and helps the energy transition."

The participating operators in the JWC were NAM BV, Neptune Energy Netherlands BV, ONE-Dyas BV, Petrogas E&P Netherlands BV, TotalEnergies EP Nederland BV and Wintershall Noordzee BV. The main contractor was Oceaneering and key subcontractors were BlueStream, Island Offshore Claxton and Plexus.

Case Study

Eni Energy Netherlands Plug and Abandonment Campaign

Neptune Energy Netherlands, now Eni Energy Netherlands B.V., has so far enjoyed a successful campaign involving two rigs to permanently abandon 18 wells, in accordance with Dutch legislation. The project started 3 years ago, with the establishment of a team to plan a portfolio of Plug and Abandonment (P&A) programmes for 4 platform wells and 2 subsea wells. Upfront engineering provided detailed data mining from sometimes inherited wells as well as assessing wells for annular pressures; ordering long lead equipment and performing rigless well suspensions to reduce the risks and time required for the subsequent P&A rig operations. Two jack-up rigs were contracted to perform the abandonments: Borr's Prospector 1 and the Wellsafe Protector.

Many challenges had to be overcome. Two of the stand-alone subsea wells had historically high A-annulus pressures and integrity issues. Due to uncertainties regarding well bore access, these wells required significant (coiled tubing) contingency planning in respect of salt squeeze, and divers had to be deployed to operate manual valves and connectors. On one platform well, the team faced the challenge of milling the production packers to gain access to the cap rock below. By washing over the slips, it was then possible to push the tailpipe to the bottom of the well, where it was then used as a solid base for setting a reservoir P&A plug above. This avoided having to retrieve the tailpipe and set a separate cement base.

Casings were logged wherever required to verify good annular cement, and on three occasions the logs covering salt sections showed bond improvements as compared with logs recorded during the original drilling phase. This information allowed the team to reduce the number of annular remediations required to just one section milling operation.

Multi-string casing and conductor cuts proved to be challenging at times. Going forward, an alternative cutting technique, abrasive water jet cutting, will be applied and evaluated.

The handling of well bore fluids and retrieval of well bore equipment was a key focus area in situations where NORM and benzene vapours posed an HSE risk. Upfront planning, filtering of fluids in a closed system, continuous measurements and registration ensured safe working conditions on board the rigs.

Much of this campaign was performed over the autumn, winter, and spring months, where worse than average weather adversely affected rig move operations, platform interfaces and the mobilisation of equipment. This resulted in 26 extra days of waiting, compared to plan. Not taking these weather delays into account, the rigs beat the plan. The Borr Prospector 1 was released in mid-March, and the Well-Safe Protector moved to UK waters in mid-May to perform P&A activities for Eni UK, and will be coming back to the Dutch sector in August to continue P&A operations.

Over the course of this campaign, it has become apparent that all Dutch operators enjoy a very open and cooperative relationship in respect of technical decommissioning work in wells, as is evident in the Nexstep and Element NL collaborations and shared learning sessions. We can expect to gain a lot of improvements and insights that may lead to even more cost-effective and safe (rigless) operations, using technologies that follow a well-researched guideline.

3.3 Offshore installations

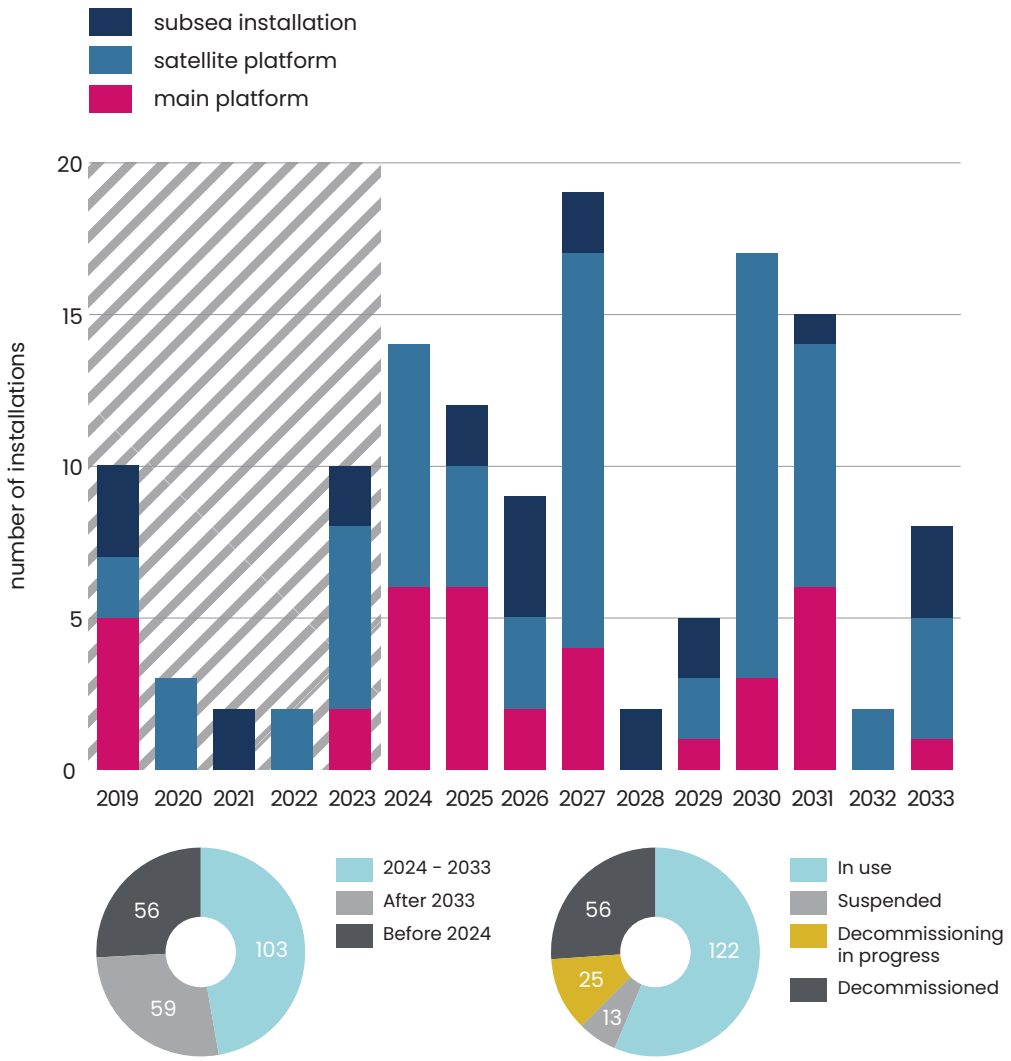
Of all installations (platforms and subsea installations) ever installed, 25% have been removed to date. Of the remaining installations, 15% are currently in the process of decommissioning. The activities range from the cleaning of the installations, engineering studies and tendering through to physical preparations for the removal. Following the end of production, most platforms are placed in so-called lighthouse mode whereby the platform is made free from hydrocarbons and only limited visits are required for inspection. This reduces the operational expenses until the platform is removed.

The number of offshore installations to be removed over the next decade is just over 100, of which almost 90 are platforms. Several removal campaigns are currently ongoing or being planned by Petrogas, TotalEnergies, Wintershall Noordzee, NAM and Neptune Energy (now Eni).

Nature-friendly decommissioning

Installation of new offshore infrastructure is executed using novel methods to limit the negative impact on marine life. To limit the noise generated during the piling of jackets and wind turbines new techniques are currently being employed, such as combining traditional hydraulic impact hammering with water jetting or low and high frequency vibrations. Around the working area also a so-called bubble curtain may be applied to protect porpoises and other marine mammals from the generated underwater noise; the air bubbles absorb most of the noise. Decommissioning activities also generate noise of course, and the above techniques may be applied to minimise the impact on marine life.

Figure 3.3.1. Realised and forecasted decommissioning - offshore installations by type



Man-made offshore structures are known to attract marine life on and around them. When these structures are removed the marine life on and possibly around the structures will be lost. The project 'Nature-friendly Decommissioning of Assets in the North Sea' which was launched last year will assess whether the partial dismantling of platforms is an option and according to precisely which conditions, or not.

With the underlying aim of stimulating nature development, the policy for installing new energy structures offshore is that they are required to be constructed in a so-called 'nature inclusive' manner. For offshore windfarms Witteveen+Bos and Wageningen Marine Research have developed a catalogue for nature inclusive designs with a focus on various native species. However, like oil and gas installations, offshore wind farms also have a limited operating life after which they are required to be decommissioned. The first generation offshore windfarms Egmond aan Zee and Prinses Amalia, operational since 2007 and 2008 respectively, will be decommissioned in the coming years. The decommissioning policy for the new nature-inclusive windfarms is yet to be developed; a monitoring period may provide guidance whether leaving (part of) the substructures is desirable, or not.

Figure 3.3.2. Realised and forecasted decommissioning - offshore installations weights

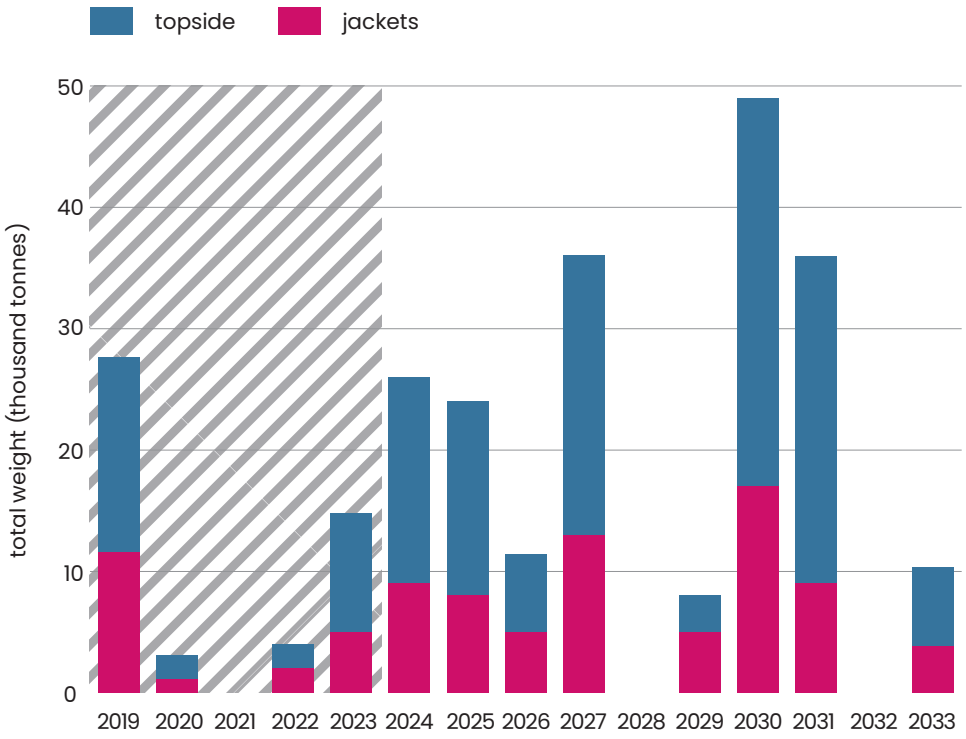
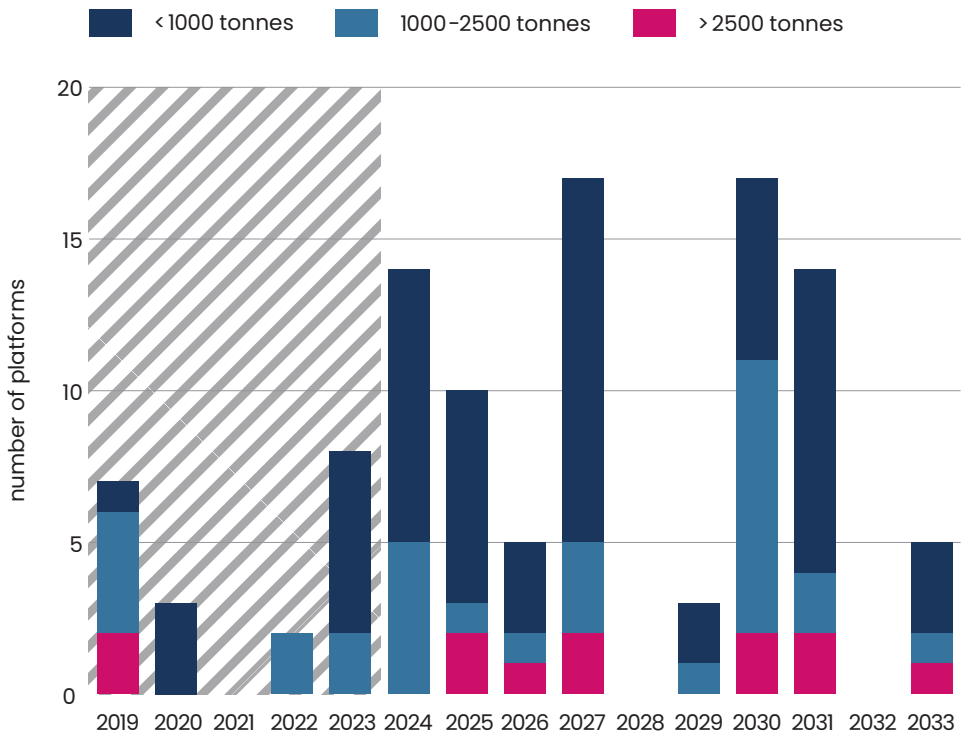
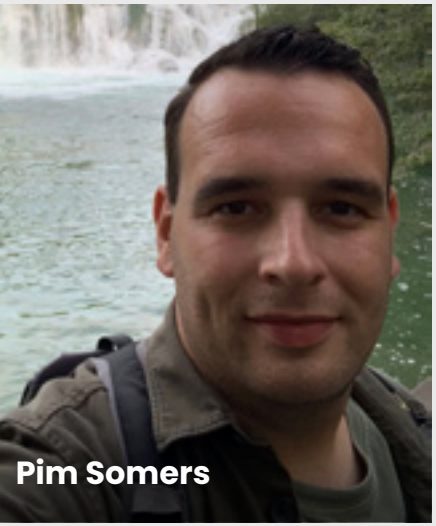
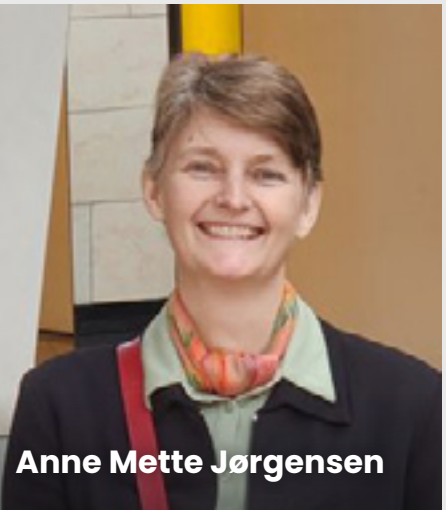


Figure 3.3.3. Realised and forecasted decommissioning - offshore installations by heaviest module weight




Oskar van Megen


Pim Somers


Anne Mette Jørgensen

Nature-friendly decommissioning

a stepping stone towards nature recovery

Intensive use of the North Sea, combined with climate change, has left the North Sea nature in poor condition. To ensure future resilience of North Sea nature, the pressure from human activity must be urgently reduced - 'passive recovery' - in combination with the active recovery of specific forms of nature such as reefs. Undertakings have been laid down in the North Sea Agreement regarding a coherent approach to the energy, food and nature transition, aimed at achieving a healthy North Sea. In the project 'Nature-friendly dismantling', the participating parties are investigating the conditions according to which permanently abandoned manmade objects with the capacity to reinforce nature can contribute to nature recovery and conservation in the Dutch North Sea.

Last year, in its report 'Stepping up the pace', Nexstep introduced the project initiated by Energie Beheer Nederland (EBN) 'Nature-friendly dismantling of assets in the North Sea'. This project is a joint undertaking by EBN, Nexstep, Element NL, Natuur & Milieu, NedZero (formerly NWEA) and the North Sea Foundation. It addresses the question whether, and if so under what conditions, abandoned elements of manmade objects - such as artificial reefs or parts of energy installations - can deliver added value to nature. The project is also investigating whether and how this can be established.

Anne-Mette Jørgensen, project manager/leader for Nature-friendly dismantling on behalf of EBN, Pim Somers, project leader Nature-friendly Energy at the North Sea Foundation and Oskar van Megen, project manager De Rijke Noordzee at Natuur & Milieu, discuss in this article the added value of collaboration, the thought processes that have played a role in this project and what is needed in order to achieve and maintain a good ecological status.

Active protection of North Sea nature

The conclusions of the 'OSPAR Quality Status Report 2023' and 'The State of the North Sea' (2023) are crystal clear: there is a great deal amiss with the quality of North Sea nature, and turning the tide will be a drawn-out process. At the same time, there are hopeful examples which show that negative trends can be broken and that nature recovery is possible. To a considerable extent, nature itself recovers simply by being left completely undisturbed, as for example is the case in strictly protected areas. On occasion, however, active nature recovery is needed, for example by installing (artificial) hard substrate and thereby kickstarting reef-building species that have now disappeared entirely. Research also suggests that special nature species exist on certain parts of the infrastructure, which over a period of many

years becomes an integral and important element of the surrounding ecosystem. Jørgensen explains, "Until recently, ecology played a subordinate role in the decision to build or dismantle infrastructure. The realisation has grown over the past few years that in addition to technical and economic criteria, ecological aspects must be taken far more seriously in decision making on the location, scale and design of infrastructure. The huge changes to use of the North Sea and the increasing volume of human activity are compelling us to look differently at the role of manmade structures in nature. Until now, we have seen them as purely negative; we are now looking for ways in which a positive relationship can be created. That then is the underlying objective in the agreements about nature-reinforcing building in the North Sea Agreement."

Nature-friendly dismantling

The concept of 'Nature-friendly dismantling' of decommissioned infrastructure combines two aspects. Jørgensen continues, "On the one hand it refers to the use of techniques, as per the North Sea Consultation assessment framework, that enable infrastructure to be removed in such a way that it causes the least possible disruption to the surrounding environment. For example, the use of vibrations to release infrastructure components rather than ripping them from the seabed with brute force. On the other hand, it refers to a concept according to which the potential ecological value of the various elements of the infrastructure is considered, prior to removal. It should be possible for ecological experts to inspect which species are present on or close to the substrate and to assess their influence on the biodiversity and the food chain of the surrounding ecosystem. If the conclusion is that parts of a structure represent added value for the ecosystem, it is then possible to assess whether these components can be safely left behind in the sea. Take for example the jacket of a gas platform or the scour protection for a wind turbine. It is up to the owner of the other parts of the infrastructure to remove it in accordance with the applicable legislation and regulations. Remember, the only arguments that should play a role in these considerations must be nature related."

Anne-Mette Jørgensen:

"The huge changes to human use of the North Sea are compelling us to take active steps to protect the ecology"

Collaboration between oil and gas and wind

There are many reasons why the oil and gas sector is working alongside the wind sector in this project. In Jørgensen's words, "The oil and gas industry and the wind industry face similar challenges, in respect of dismantling. Both oil and gas installations and wind farms are in principle subject to a strict removal obligation, with specific regulations regarding pipelines and cables. Collaboration with the oil and gas sector offers real added value for the wind sector, because oil and gas already has considerable experience with infrastructure dismantling and reaching agreements with the State about the handover of long-term responsibilities. In the same way, oil and gas installations, just like shipwrecks, can serve as examples for the expected development of ecological values on and around wind turbines and platforms for other purposes. It is even possible that parts of oil and gas platforms located in the wind farm zones could in the long term play a role in nature-reinforcing activities in wind farms. For the oil and gas sector, collaboration with wind has added value because of the wealth of knowledge available within the wind sector about nature-reinforcing building."

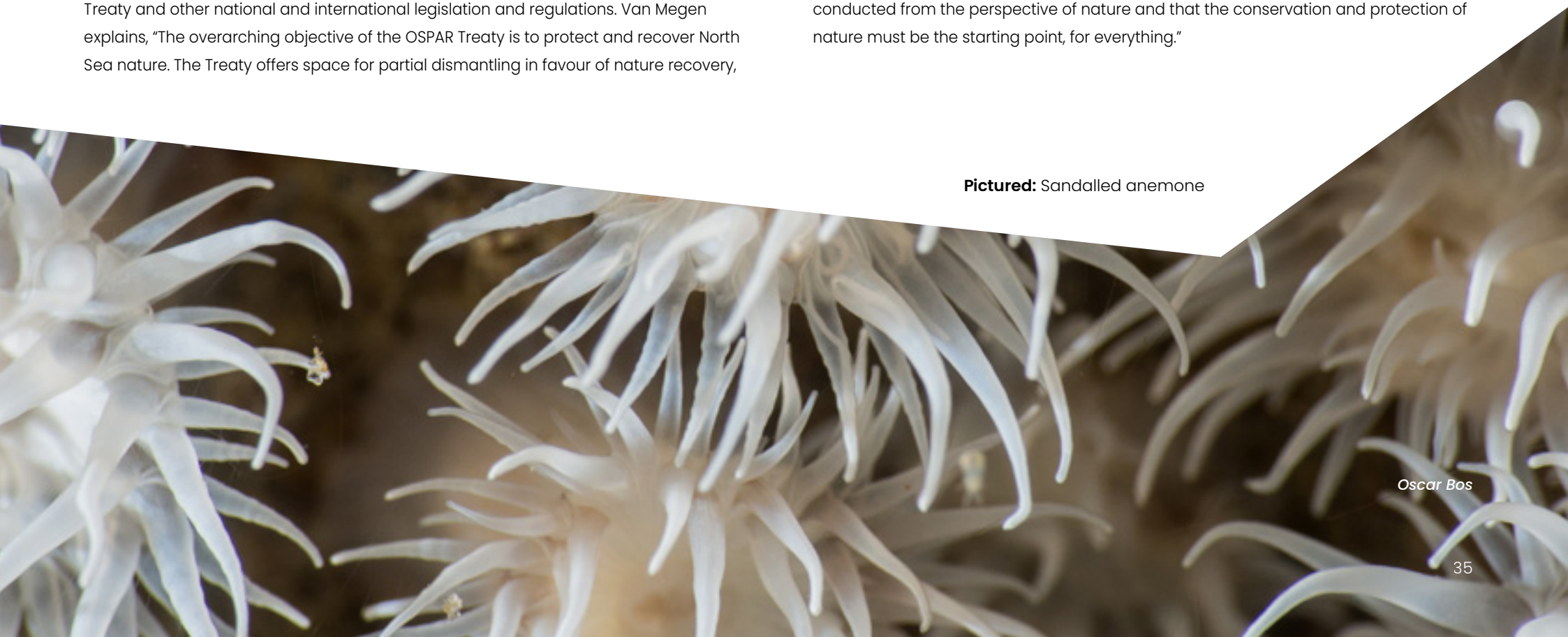
Nature-reinforcing value

Whether infrastructure has a nature-reinforcing value depends heavily on the current status and the diversity of species around the infrastructure in relation to the broader ecosystem. In the words of Somers, "You first need to know which species are already present on a substrate, and for example whether they are protected species or species that play an important role in maintaining nature.
You could also investigate evidence of ecological connectivity.

That involves assessing whether a structure can serve as a stepping stone for further colonisation towards natural reefs, thereby reinforcing the resilience of natural reef environments. Jørgensen adds, "Within oil and gas, our main interest lies in examining production platforms in protected areas, in which it is possible to provide free passage depth for ships of at least 25 metres, where no seabed-disturbing fishery is permitted and where there is minimum disruption for other users. We also aim to investigate whether parts of oil and gas installations located in wind farm zones could also have added value for nature-reinforcing projects in the wind sector. By using existing substrate, it is possible to preserve nature that has already become established while avoiding the costs, uncertainties and risks that are involved in installing new elements."

Independent supervision

One essential criterion for nature-friendly dismantling is that it must tie in with the OSPAR Treaty and other national and international legislation and regulations. Van Megen explains, "The overarching objective of the OSPAR Treaty is to protect and recover North Sea nature. The Treaty offers space for partial dismantling in favour of nature recovery, as long as strict conditions are complied with. One crucial element that has not yet been fully elaborated is who bears long-term responsibility for abandoned infrastructure elements. According to current legislation, the oil and gas companies that own a drilling structure remain permanently responsible for monitoring and maintenance, even following cessation of production. Jørgensen adds, "If you wish to permanently abandon certain components, that is not a desirable situation from the perspective of nature reinforcement; energy companies are not nature conservationists and are unable to offer sufficient guarantees that they will still exist in a hundred years' time. If nature reinforcing objects are abandoned following partial dismantling, the long-term responsibility must be placed with an independent and 'permanent' body, such as the State, possibly in collaboration with the operator. The aim of this project is to elaborate these kinds of options, also including lessons learned from the mining industry and other countries. The underlying principle at least is that monitoring and management must be conducted from the perspective of nature and that the conservation and protection of nature must be the starting point, for everything."



Pictured: Sandalled anemone

Oscar Bos

Pictured: European lobster (1), Brown Crab (2), Devonshire cup coral (3), Violet sea slug (4)

Oscar Bos

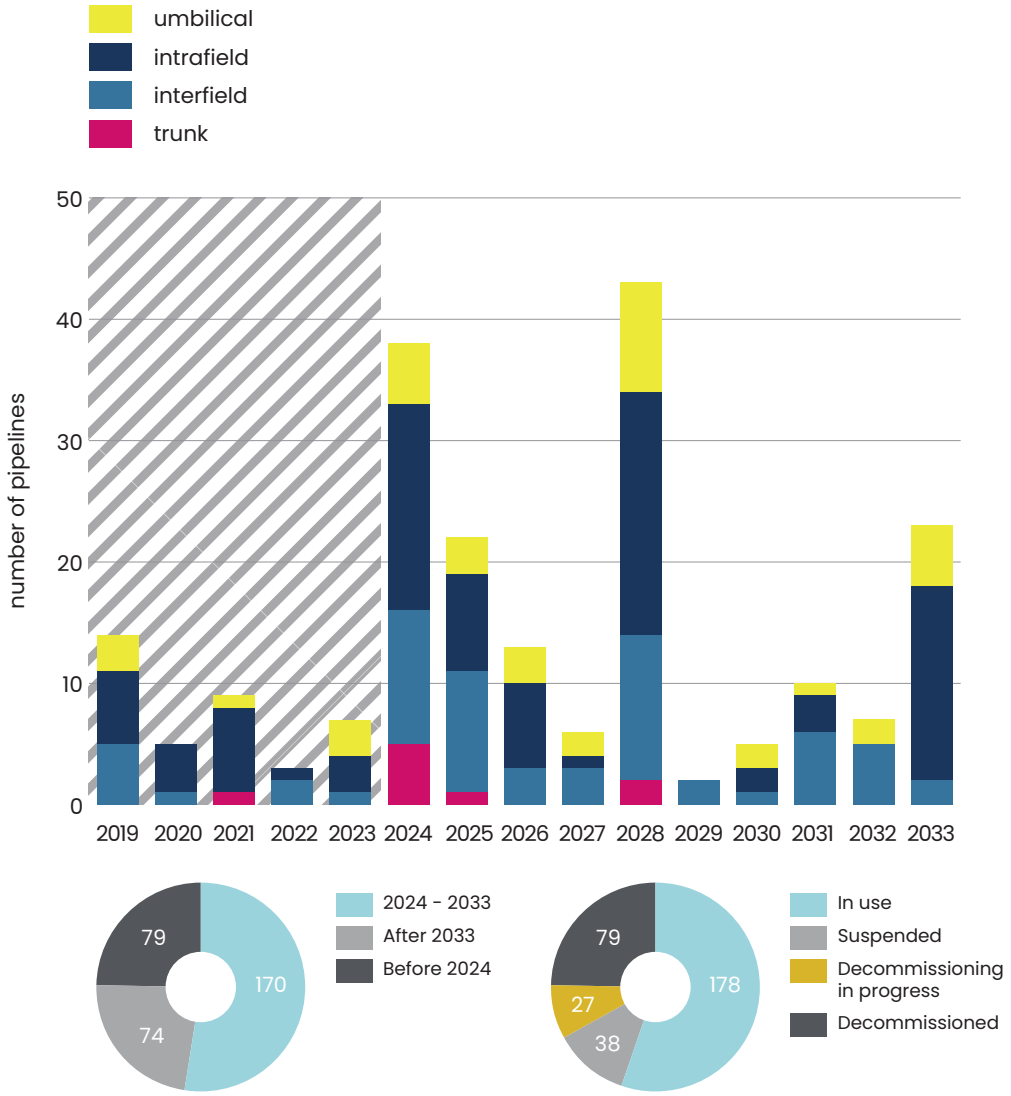
3.4 Offshore pipelines

There is a delay in the decommissioning of pipelines compared with the forecast for 2023 in last year's report. In 2023 the decommissioning plans to leave 3 pipelines in-situ after cleaning and securing were not approved. Appeals against this decision have been filed and formal responses are expected soonest. Other decommissioning plans were subsequently withheld from submission to await clarity on the regulatory framework. Concerns are possible contamination of pipelines with residual hydrocarbons, mercury and naturally occurring low radio-active deposits which originate from the producing reservoirs. The recently established comparative assessment guideline is now being expanded, based on quantitative risk assessments.

Monitoring policy

The Dutch policy on pipeline decommissioning is that in principle they can be left after being cleaned and secured, unless the Ministry specifies that removal is required. Following in-situ decommissioning, the pipelines must be regularly surveyed for location and burial. Based on the results of subsequent surveys, the time interval may be increased but there is currently no end to this obligation and the liability remains with the last owner(s). This issue is being addressed in Nexstep.

Figure 3.4.1. Realised and forecasted decommissioning - offshore pipelines by pipeline type



Hans Janssen
Managing Director of Northern Offshore Gas Transport (NOGAT)

Ron Hagen
Managing Director of Noordgastransport (NGT)

Collaboration between NGT-NOGAT for optimum (re)use of pipelines

As the energy hub of the future, the North Sea will play a vital role in the transition to a carbon-free economy. Part of this scenario is a massive increase in green hydrogen production. The reuse of existing oil and gas pipelines is crucial to that process. Ron Hagen, director of Noordgastransport (NGT) and Hans Janssen, director of Northern Offshore Gas Transport (NOGAT) discuss the benefits of reuse and the unique collaboration they initiated to make system integration possible.

The western part of the Dutch North Sea is connected to the northern part by around 500 kilometres of pipelines. Via these pipelines, every day, NGT transports around 30 to 35% of the gas produced on the Dutch Continental Shelf to Uithuizen. The northern and southern parts of the North Sea are connected by around 265 kilometres of pipeline, via which NOGAT transports around 10 million Nm^3 of gas to shore in Den Helder, every day. Janssen explains, "The pipelines operated by NGT and NOGAT intersect each other and are positioned close to planned northern offshore wind energy zones. These factors offer opportunities to contribute to the ambitious transition goals of the Dutch government in terms of offshore wind production and the offshore production of green hydrogen. This will be tested in the near future in the PosHYdon project. By working together, NGT and NOGAT can free up a single pipeline for the transport of hydrogen, and via the other pipeline, are able to bring the gas ashore, that will be produced now and in the future."

Unique collaboration

NGT and NOGAT have joined forces in the H2Shore project, intended for hydrogen transport. Hagen explains, "At the latest by 2050, the Netherlands must be disconnected from the natural gas supply. Although NGT and NOGAT will indeed continue to supply gas transport services right up to the last moment, long before that date, a phase will arise in which we are able to allocate a new use for our pipelines. Although our pipelines have been in use on the seabed for a considerable time, they are still in excellent condition. In 2022, NOGAT and NGT received a certificate 'for fitness' for the transport of among other products 100% pure hydrogen, from Bureau Veritas. Our joint study at the end of 2023 also revealed that our offshore infrastructure could be available for

reallocation by the end of 2030, by redirecting the gas into a different pipeline. Within this project we will continue to provide our gas transport services individually - in other words, we will uphold the existing gas transport contracts - while we will join forces in developing the possibility of transporting hydrogen. This form of collaboration is unique, and could serve as a template for other initiatives in the field of system integration."

Benefits of reuse

The reuse of existing pipelines offers huge benefits compared with the construction of new infrastructure. Janssen continues, "Firstly, reuse is far less burdensome for the ecology and the environment because it demands less excavation and construction work, in an already busy North Sea. Furthermore, reuse will result in lower investments in electricity networks; hydrogen produced offshore will reduce the need for electricity cables to shore, for connection to the grid. In addition, reuse will enable a rapid rollout of large-scale production, partly because of the efficiency gains achieved in the construction of new pipelines. Another benefit lies in the possibility of storing hydrogen in depleted gas fields that are already connected to the gas network. Additionally, the knowhow and experience of current operators of offshore pipelines can be called upon. The final benefit is that reuse is a cheaper solution for society; according to external estimates, the costs of reuse are about 80% lower than the construction of new infrastructure. NOGAT and NGT have participated in the "Energie Infrastructuur Plan Noordzee" study (EIPN), an initiative of the MEAC looking at the development of an offshore hydrogen network. Together with Gasunie, the reuse of the existing NOGAT and NGT pipelines has been investigated and discussions are still ongoing."

Janssen:

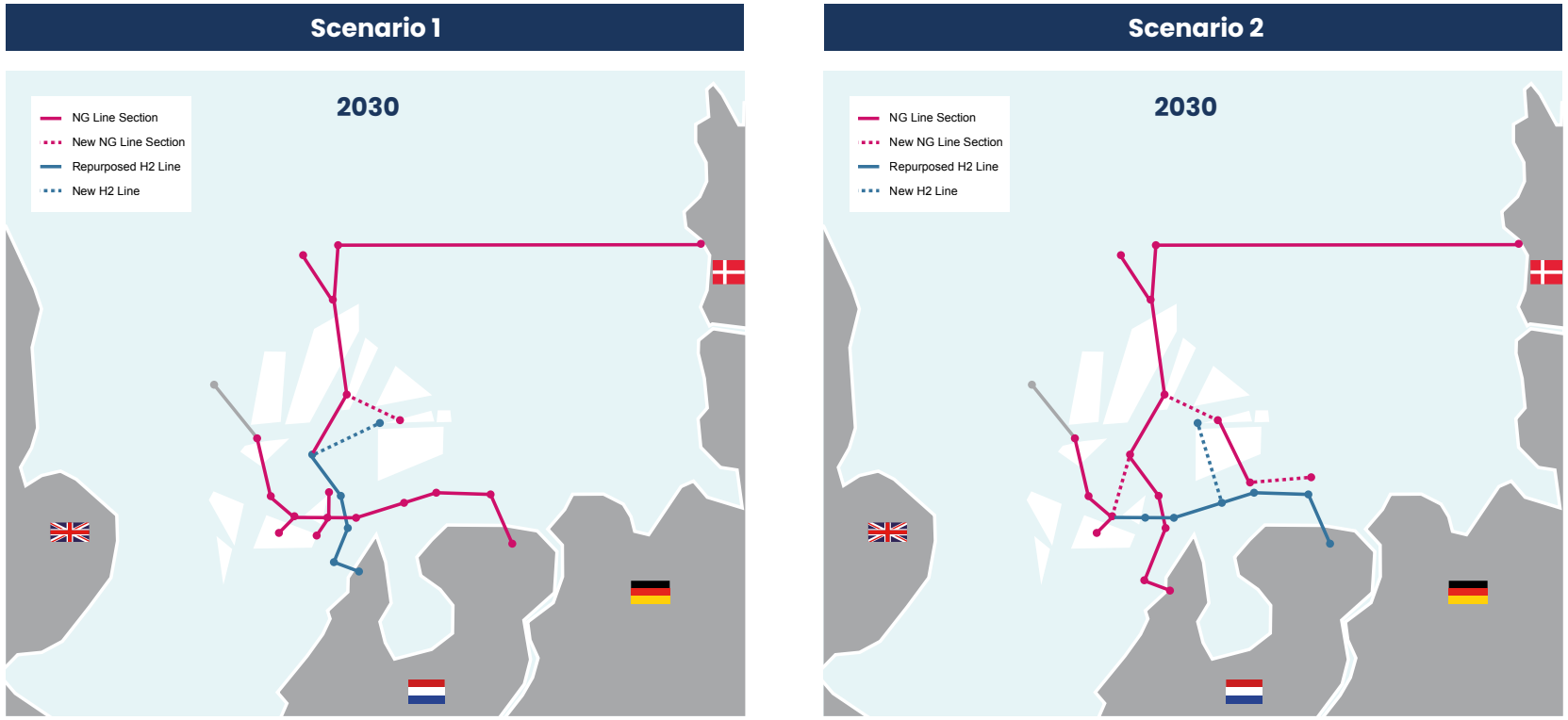
> **"The reuse of pipelines is more environmentally friendly, faster and cheaper compared with the construction of new infrastructure"**

Futureproof scenarios

Thanks to the certification of the offshore infrastructure of NGT and NOGAT, in addition to natural gas, the pipelines are suitable for transporting pure hydrogen and a mix of the two gases. In Hagen's words, "Research by Guidehouse and H2Sea led to the selection of two scenarios. In both scenarios, one of the main pipelines is used for hydrogen transport, while the other pipeline satisfies current and future demand for gas transport. In the first scenario, the NOGAT pipeline is reused from 2030 onwards to transport hydrogen to Den Helder. In the second scenario, from 2030 onwards, the NGT pipeline is reused to transport hydrogen to Uithuizen. In both scenarios, at some point between 2040 and 2050, both pipelines will become available to transport around 14 gigawatts of hydrogen each, when the transport of gas comes to an end. In addition to releasing a single pipeline for 100% hydrogen, it is also possible to mix smaller quantities of hydrogen with the natural gas. This will be ideal for example for the smaller planned pilots and demonstration projects for hydrogen transport. Consequently, reuse is not only faster, cheaper and less burdensome for the environment; thanks to the optimum connections to the planned wind exploration zones, it is also futureproof."

International connection

The future proofness of reusing existing offshore infrastructure is not restricted only to Dutch waters. Janssen continues, “Parts of existing pipelines are already connected to other countries, including Denmark and Germany, and they too offer possibilities for connections to other North Sea countries and projects being undertaken in those countries. This not only applies to pipelines; existing connected gas fields can in the future also act as storage capacity for wind and hydrogen produced offshore. This is in line with the task set by government, namely reuse wherever possible. It will however require clear national and international regulations if the scenarios are to be implemented. The H2Shore project could supply valuable input for current and future processes, and standardisation and could as such serve as a catalyst for initiatives that help bring about the energy transition.”



Case Study

Petrogas Decommissioning Q1/P9 platforms

Petrogas is decommissioning the Q1/P9 platforms in the Dutch sector of the North Sea – Haven, Helder, Helm, Hoorn & Horizon. The platform installation dates range from 1982 to 1993. Cessation of production for the platforms ranged from 2016 to 2022. Platforms were brought to lighthouse mode between late 2021 and mid-2023. The first two platforms, Haven and Hoorn, were removed in 2023 by Heerema's HLV Thialf. The remaining platforms are scheduled to be removed in 2024 by the Thialf.

The first phase was bringing the platforms into lighthouse mode. Subsequently, the Engineering, Preparation, Removal and Disposal contract for the platforms was awarded to Heerema Marine Contractors (HMC).

The lighthouse mode activities required coordination and cooperation between the operations and projects departments. Platforms needed to be safely shut down, process systems drained/cleaned, navigation aids installed and other removal preparations carried out.

The platform removal preparation responsibilities of Petrogas and HMC were split to allow for the most efficient allocation of resources, to minimise Heavy Lift Vessel time in order to enable a smooth removal campaign, and to reduce offshore execution costs. For example, Petrogas prepared access to lift-point locations, cut & lift tested conductors and disconnected caissons from the topside during the lighthouse mode preparations.

courtesy Petrogas

As part of the activities to reach lighthouse mode, Deco developed an abrasive water jet cutting tool that was capable of cutting through 3 layers of steel including grout in the two annuli of well conductors. This tool was successfully utilised on Helm, Helder and Hoorn to cut the conductors below seabed level. Additionally, an abrasive water jet tool was developed to cut holes in the conductors in order to install a lifting pin. This allowed the conductors to be test lifted with a 125 mT capacity hydraulic lifting frame to demonstrate that a full cut had been achieved.

For the platform removal, a reverse installation approach is employed. Splices are made to separate the main platform modules which are then lifted off one by one. This allows for reuse of the installation lifting points (if still in place) or for installation of new lifting points at the old locations.

For the removal of Hoorn and Haven in 2023, the extensive engineering and preparation by HMC resulted in a successful offshore campaign. The close contact between HMC, Petrogas and the marine warranty surveyor contributed to a safe, adaptable and collaborative approach to the offshore execution. The offshore execution was completed with only four minor HSE events recorded from over 150,000 man-hours worked.

The onshore disposal of the platforms is taking place at Sagro Decom B.V. in Vlissingen. The aim is to achieve 95%+ recycling of the platform materials. Currently, we are on track to meet this target.

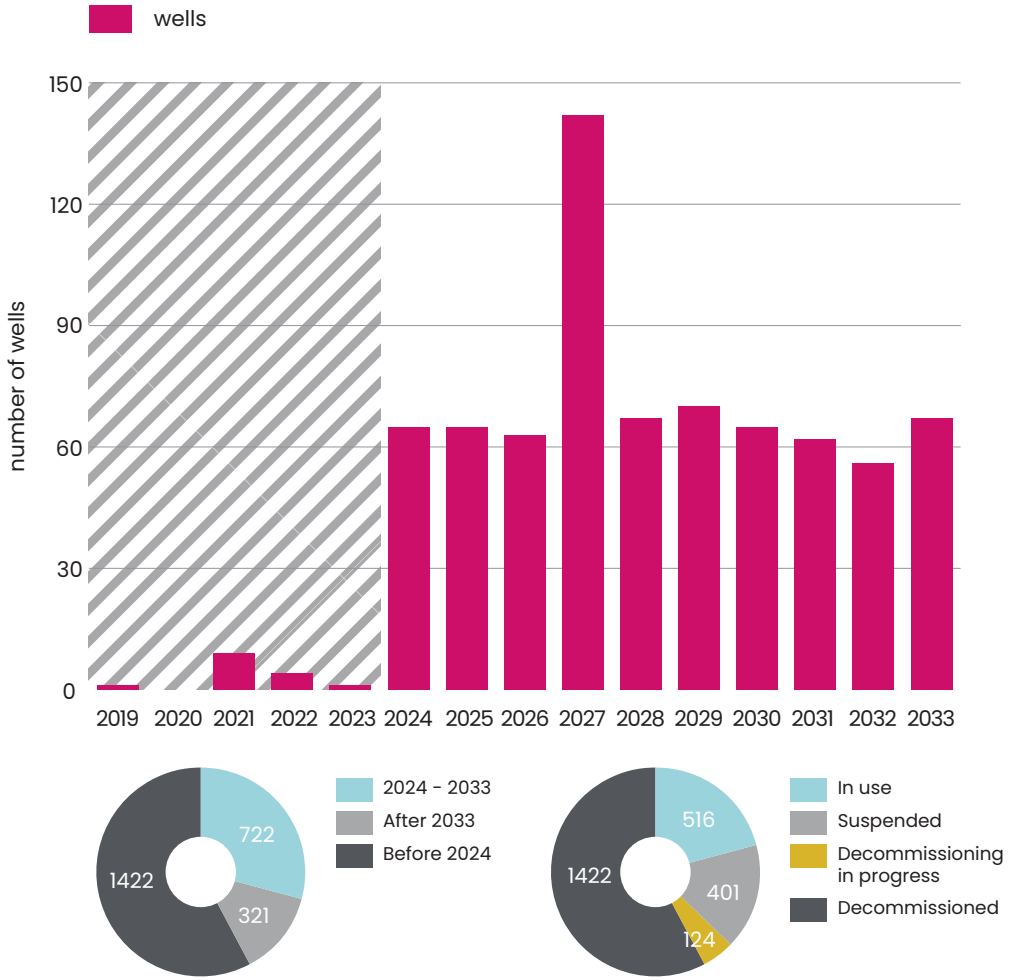
In 2024, Petrogas is looking forward to the successful removal of Helder, Helm and Horizon.

3.5 Onshore wells

A final decision was reached in 2024 to permanently close down production from the Groningen gas field. As the Dutch underground gas storages are required to be filled at the start of the winter, the supply of natural gas is considered to be sufficiently secured.

NAM has now entered new partnerships for the complete decommissioning and restoration of all their onshore assets consisting of some 350 sites, 800 wells and 1,700 kilometres of pipelines. This work scope will take at least 10 to 15 years to complete. A separate case study is included on this subject on page 46.

Figure 3.5.1. Realised and forecasted decommissioning - onshore wells



Nexstep qualification demonstrates:

TTC is a safe and suitable technology

Around 1990, a new technology was introduced for the closure of wells in the Gulf of Mexico. Since that time, the same technology has been employed in many countries, albeit under different names. Through Tubing Cementation (TTC), the name given to the method by Nexstep, is an efficient technology for the decommissioning of wells without requiring a drilling rig. In response to requests from the State Supervision of Mines (SSM), Nexstep qualified TTC on the basis of an existing industry standard. Nexstep recently described the positive results in a report, that attracted much attention in the Netherlands and abroad.

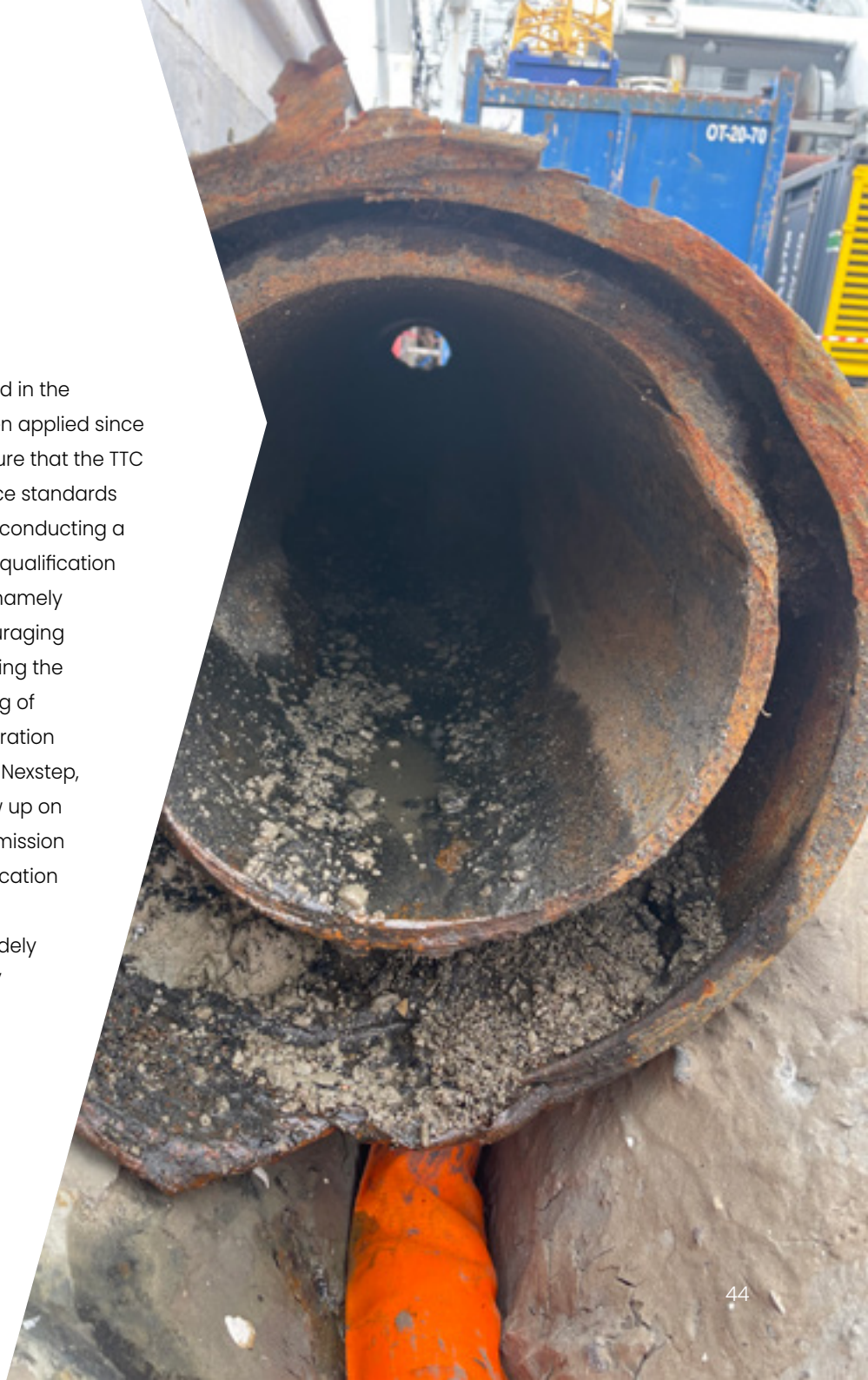
In the TTC method, a cement isolation is placed without removing the well's tubing. In this process, the tubing is filled both inside and outside with cement. After the cement is fully cured, a sustainable and permanent barrier is created between geological formations. This prevents undesirable movement of liquids between those formations. Jules Schoenmakers, Nexstep's expert on the closure of wells and project leader for the qualification process, talks about the TTC method, its qualification and the conclusions.

Qualification encourages innovation

Although the TCC technology was used in the Netherlands in the past, it had not been applied since 2004. Schoenmakers explains, "To ensure that the TTC technology meets today's performance standards for the closure of wells, SSM proposed conducting a technology qualification process. This qualification tied in with the objectives of Nexstep, namely promoting standardisation and encouraging innovation, and consequently supporting the safe, efficient and effective dismantling of infrastructure by strengthening cooperation between the various stakeholders. For Nexstep, these were sufficient grounds to follow up on the suggestion from SSM, and to commission the structured assessment and qualification of the TTC technology. In this process, Nexstep based its approach on the widely used industry standard DNV-RP-A203."

TTC Task Force

For the reintroduction of TTC, Nexstep established a TTC Task Force, as part of its Wells Committee. The Task Force was made up of



members representing various operators. They described the qualification process and the conclusions in the report 'Technology Qualification for decommissioning of well sections in the E&P sector using Through Tubing Cementation'. Schoenmakers goes on, "The aim of the qualification was to determine a set of selection criteria for suitable wells and to lay down the related design requirements. For the qualification itself, various operators conducted TTC pilots in 14 gas wells, via Nexstep. We also commissioned the Nuclear Research & Consultancy Group (NRG) to investigate TTC. The qualification report includes a demarcation of applications, a description of requirements and focus areas for safeguarding the quality of cementation and the well closure."

New technological insights

No project is free of setbacks. This qualification process too faced some unexpected developments, but specifically these developments led to new insights - and even new techniques. Schoenmakers continues, "We started using logging tools for the verification: measuring instruments that can be lowered into the well, and that allow the assessment of the quality of the cement based on acoustic signals. However, due to disrupting artefacts, the logging tools proved unsuitable. This meant we had to come up with a different test method. We now make holes in the tubing and insert a packer with pressure sensors at the top and bottom. By applying pressure to the tubing, we can see whether pressure also changes below the packer, which would indicate a leak path. Using these methods, we were able to demonstrate that a seal is present. The new method is more reliable and more accurate than logging instruments, which are unable to identify the presence or otherwise of a leak path. In addition to measuring techniques of this kind, we introduced advanced computer simulations. They provide considerable insight into the cement placement processes. As well as delivering clear and reliable results, the TTC qualification also led to new technical insights."

Conclusions

It was already known that the TTC method offers huge benefits in the dismantling of production wells. The method is safer, faster, reduces cost, is less labour intensive and generates less waste and CO_2 and nitrogen emissions than the regular method involving a drilling rig. The Nexstep qualification underpins these benefits and offers an insight into further opportunities for development. Schoenmakers concludes, "The tests show that TTC also satisfies today's performance standards for the sealing of vertical production wells. The identified risks do not occur within the demarcated applications. For application in other well configurations – e.g. deviated wells – a further qualification step will be needed. This is something we are currently working on. Based on the qualification, we have become convinced that within the described applications, TTC is the most suitable and safe method available. Although the tests were conducted onshore, TTC can also be deployed offshore, for example by working from a boat. All in all, there are plenty of possibilities ahead for making the dismantling of production wells even safer, more efficient, and more effective in the future".

Case Study

NAM: Rationale | How it started

In 2018, the Minister of Economic Affairs and Climate Policy announced the upcoming closure of the Groningen gas field due to the impact of induced seismicity. This closure was made definitive by 1 October 2024. Over the years, a growing number of gas and oil production sites from small fields have been terminated. This increase in scope demands a different and more focussed Decommissioning and Restoration (D&R) portfolio approach.

Building on previous solid performance, decommissioning and well abandonment expertise, a proven track record of working safely and commitment to excellence in the D&R field, NAM has now chosen Arcadis and WellGear as long-term partners. This cooperation for onshore D&R between NAM, Arcadis and WellGear is referred to as 'SITURN'.

In December 2023, agreements were signed for the complete onshore D&R portfolio of approximately 300 locations and 1,700 km of pipelines, and for plug and abandonment (P&A) of some 800 wells. Execution started in the first quarter of 2024. This includes the removal of facilities, equipment, and returning the sites to their initial state, in good cooperation with authorities, landowners and the local residents.

SITURN vision

In the SITURN cooperation, the three parties will work together in a long-term (10-15 years) partnership to decommission NAM's onshore portfolio according to a shared a shared vision, goals and objectives.

ANP/Kees van de Veen

SITURN future - 2028

In 2028, the SITURN cooperation is expected to have developed into a mature D&R and redevelopment partnership that can safely deliver projects, covering both the surface and subsurface scope. The SITURN cooperation will allow NAM to keep its core focus. SITURN will keep up its Goal Zero track record of working safely with zero incidents, and will demonstrate and develop its core competencies in programme management, demolition, cleaning, pipeline removal and well abandonment management and execution. SITURN is playing an active role in the region, through its learning programme to attract new talent and new related businesses to the industry, thereby supporting a sustainable economy for the Northern Netherlands.

Strategy

NAM has transitioned towards a 'relational outcome based' contracting model, centred around a common ambition in which the parties will share in both risks and rewards. A shift in mindset towards 'What is in it for We' will dominate all commercial discussions. Mobilising and educating a dedicated team of highly motivated and competent employees and acquiring specialised equipment are vital for the success of the programme.

> **"We are returning former NAM oil & gas production areas to the best possible status and thereby contributing to the desired energy transition"**

SITURN impact

It is SITURN's ambition to economically strengthen the regional community by setting up a high-standard D&R partnership that attracts, develops, and educates regional employees for this long-term challenge. The partnership advocates working with regional partners to collectively develop required knowledge and expertise that in due time can be utilised to contribute to the growing scope of decommissioning of oil and gas assets.

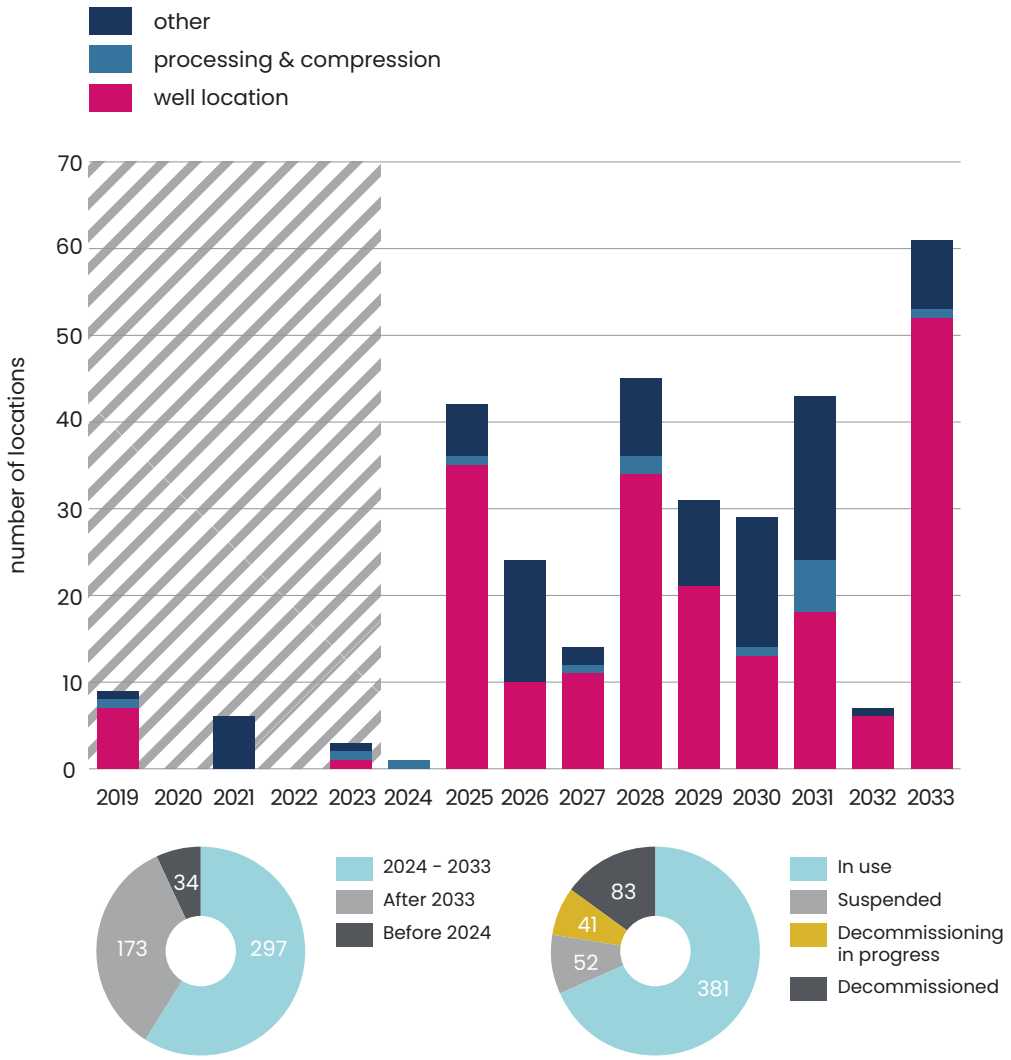
The other value driven contributing objective is that we will be open to local opportunities for developing potential solutions that accelerate the (local) energy transition whilst maximising the reuse and/or reconfiguration of existing infrastructure.

It is our genuine intent to leave with a positive impact.

3.6 Onshore locations

The reuse of onshore locations is being actively pursued. NAM's Emmen GZI gas plant was the first processing site to be reused successfully for the production of solar power, hydrogen and biogas. Vermilion's processing site in Harlingen was suspended following the cessation of production of the Zuidwal platform and in the future will be reused for the production of biogas.

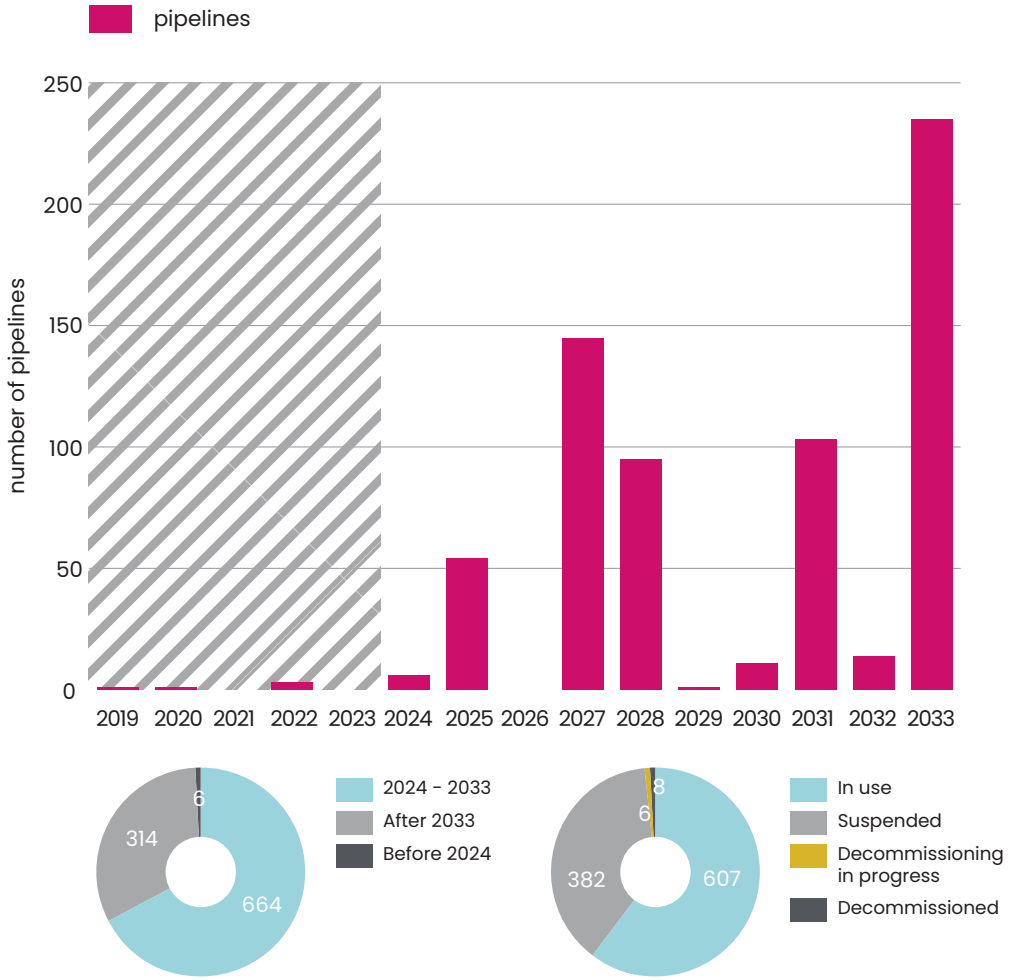
Figure 3.6.1. Realised and forecasted decommissioning - onshore locations by function



3.7 Onshore pipelines

This year's survey shows no change in the forecast decommissioning activity compared with last year's report. An interesting, innovative method to remove pipelines onshore without full excavation of the trajectory has been developed by Callidus and has been used by Gasunie successfully. This year this method was tested by Kistos. The case study is described on page 50.

Figure 3.7.1. Realised and forecasted decommissioning - onshore pipelines



Case Study

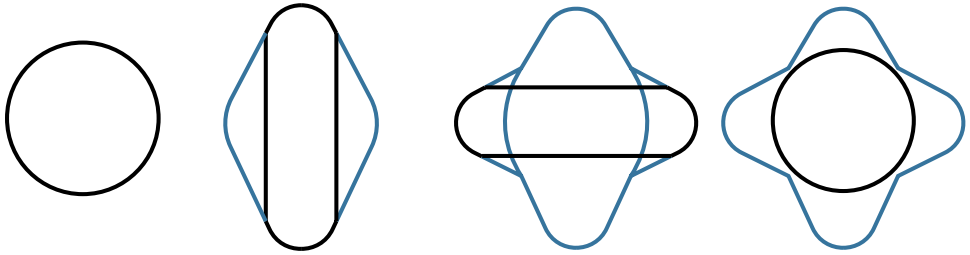
Kistos pilot for onshore pipeline removal

As well as offshore, a large network of pipelines also exists onshore in the Netherlands. Some 2,000 kilometres of onshore oil and gas pipelines transport produced hydrocarbons from well sites to processing installations. The processed gas is supplied to the high-pressure distribution grid of Gasunie, consisting of over 12,000 kilometres pipelines in the Netherlands, and onwards to the low-pressure networks for supply to consumers.

Onshore pipelines typically cross the land of several owners and are in principle required to be removed when no longer in use, except when the landowner agrees to leave the pipeline after cleaning. The traditional method for removing a pipeline onshore after internal cleaning is by excavating the complete trajectory (in sections), lifting the pipeline from the trench, cutting and removing the pipeline and transporting it for recycling and waste treatment. Finally, the open trench is backfilled and the surface restored to its original state. In a densely populated country like the Netherlands this is a seriously disruptive activity, except for road and river crossings which are typically not recovered but left backfilled.

courtesy Kistos

A new trenchless method developed and patented by Callidus, sometimes referred to as the varicose vein technique, consists of excavating the pipeline at a limited number of excavated locations. The pipeline is then cut at these locations and slightly deformed using an internal tool to loosen the pipeline wall from the surrounding soil; see below a cross-sectional schematic for the pipe deformation.



The pipeline can then be pulled out and the resulting void filled with a special material.

Kistos decommissioned the wells of Hemrik and Donkerbroek and subsequently completed decommissioning and restoration of both well locations in 2023. Kistos is now preparing for the removal of some 19 kilometres of pipelines, ranging from 3 to 10 inch in diameter. The novel technique reduces the volume of excavation by as much as 95% and thus limits the impact to landowners. In 2023, Gasunie has successfully employed this method on a 6 inch diameter pipeline in dry sandy soil. The soil for Kistos' 6 inch diameter Hemrik pipeline is wet and consists of sand, peat and clay. The maximum section length obviously depends on the type of soil, the shape of the trajectory and the diameter and wall thickness of the pipeline. For the Hemrik pipeline, with a wall thickness of 5.6 mm, it was expected to be able to retrieve sections up to 250 metres. However, the maximum section retrieved during the pilot was 421 metres!

Kistos also tested the retrieval from a canal crossing which was constructed using horizontal directional drilling. In this case, the pipeline was not deformed as it was expected to have limited friction from the bentonite which was used during the drilling and drawing of the pipeline.

Based on the results of the 1,200 metres of pipeline retrieved during the field pilots, Kistos has detailed the full project planning for the remaining 18 kilometres of pipelines.
Onshore, only a limited number of operators are active in the Netherlands. The learnings from Kistos' pilots will be freely shared with the other onshore operators.

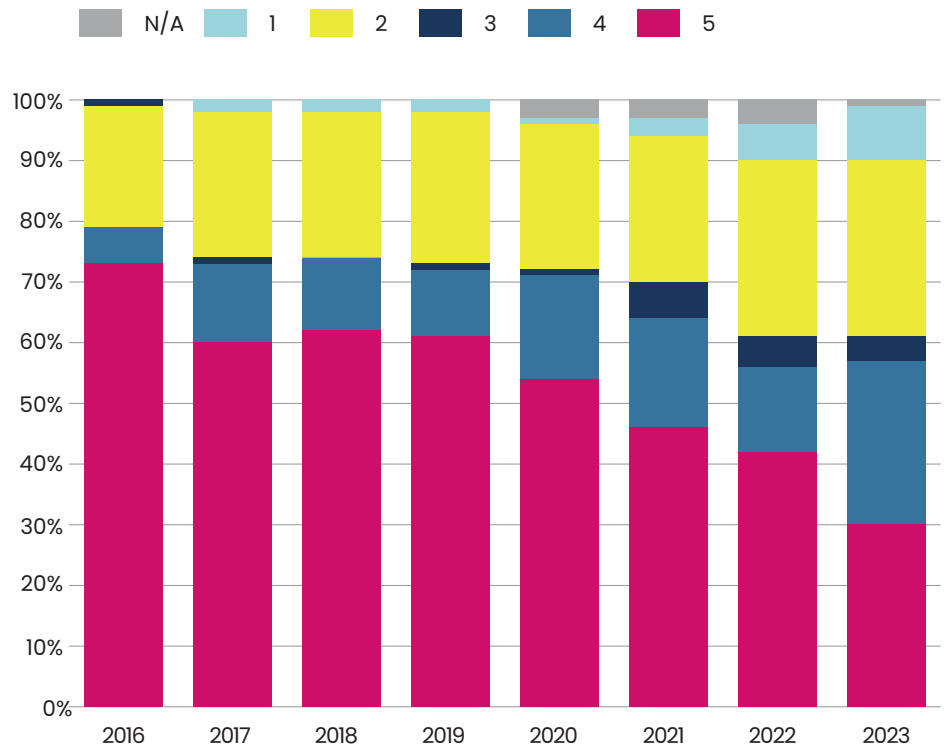
4 Expected offshore decommissioning costs 2024 – 2033

"Spending on decommissioning is expected to reach an average of some EUR 300 million each year, of which wells and platforms each take up 40%"

4 Expected offshore decommissioning costs 2024 - 2033

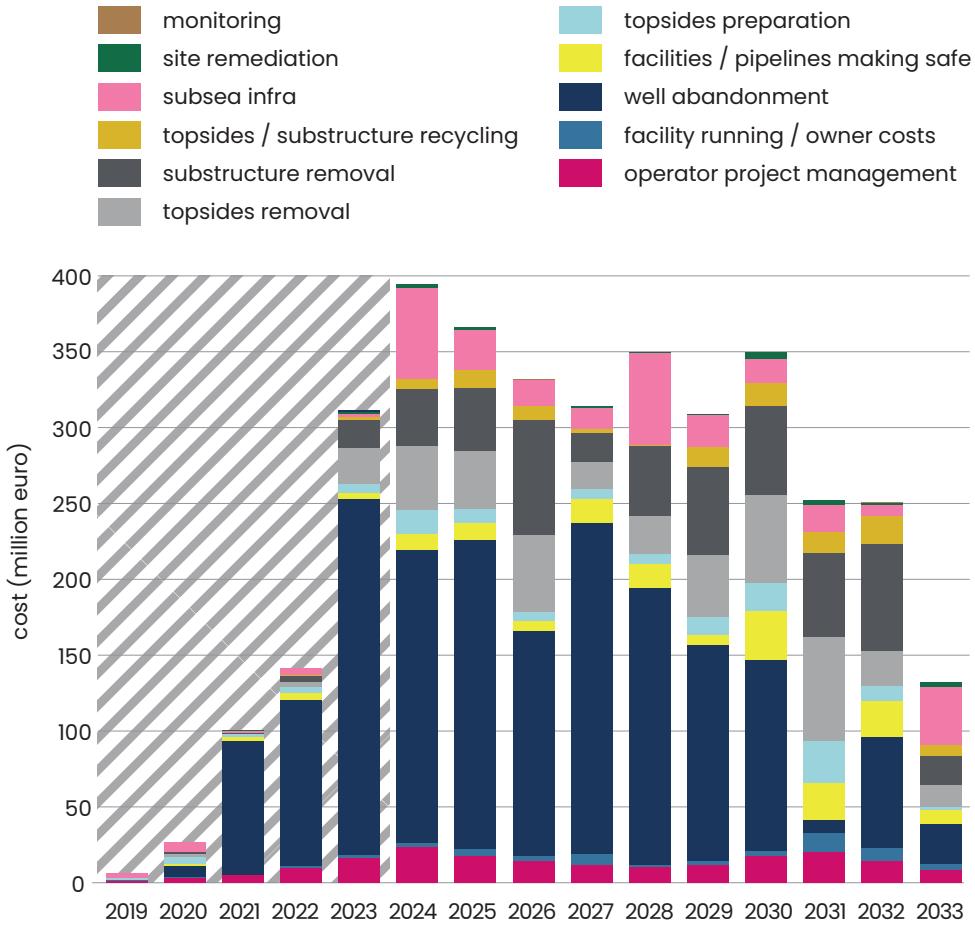
With an increasing number of realised decommissioning projects, the cost estimates become more accurate over time; 40% of the estimates last year were of the lowest accuracy Class 5 compared to 30% this year. These estimates improved from a Class 5 to a Class 4 estimate. A Class 5 estimate for the feasibility phase typically has a confidence interval with a low estimate of -20 to -50% and with a high estimate of +30 to +100% around the deterministic cost estimate. For an approval of expenditure, typically a Class 1 estimate is required, with a typical low estimate confidence interval of -3 to -10% and a high estimate of +3 to +15% around the deterministic estimate.

Figure 4.0.1. Cost estimates by ASTM class



Cost forecasts are being reviewed by the operators on a regular basis, but their internal processes are not synchronised. While one operator may review the decommissioning cost in detail based on recent projects, other operators may make adjustments for inflation and escalation only. Compared to last year's survey the forecasted total decommissioning cost are some 12% higher. The main increase is related to platform removal and, to a lesser extent, well decommissioning. Over the next decade the spending on decommissioning is expected to reach an average of some EUR 300 million each year, of which wells and platforms each take up 40%. This is clearly higher than last year's forecast and is related to the cost increase and a larger number of wells and platforms in this period.

Figure 4.0.2. Annual expected costs of offshore infrastructure by category

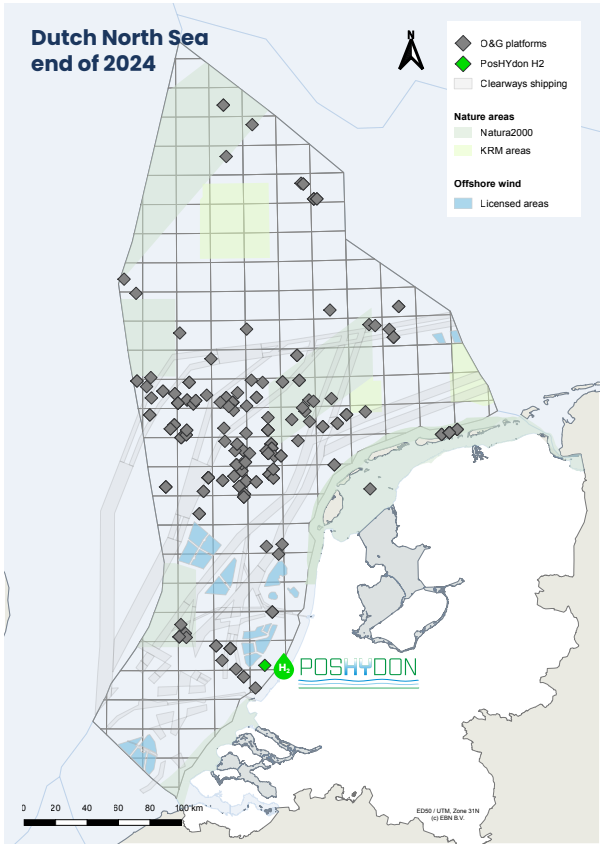


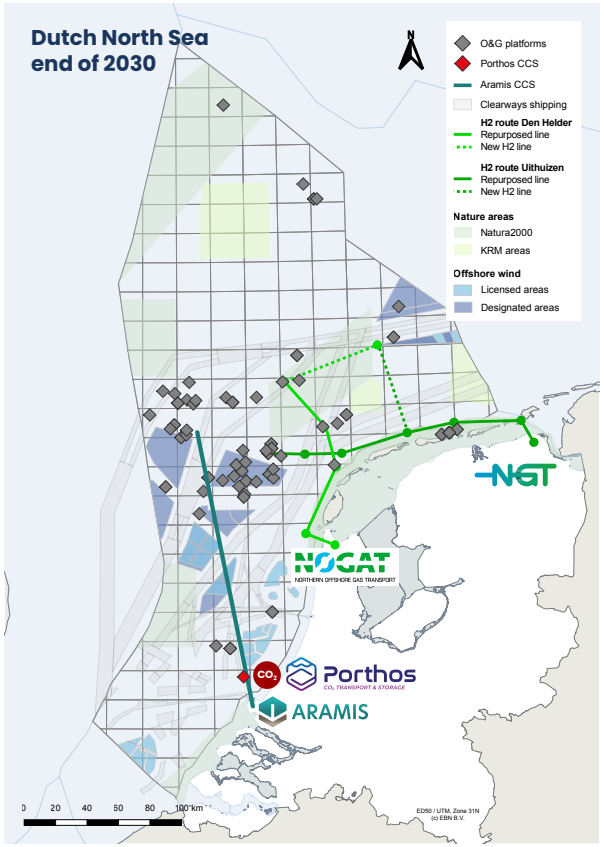
5 Use of space North Sea 2024 I 2030 I 2040

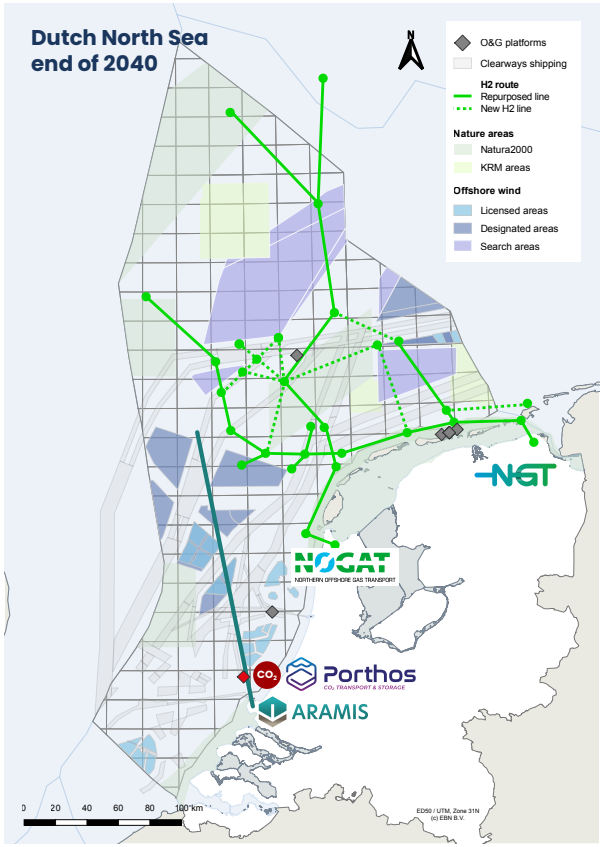
"Over the next decades we'll see a shift in activities at the North Sea, like fishing, shipping, production of oil and gas, sand extraction and energy transition projects"

5 Use of space North Sea 2024 I 2030 I 2040

The North Sea is one of the busiest seas in the world used for fishing, shipping, production of oil and gas, sand extraction, electricity and communication cables, wind farms and mariculture, among others. Over the next decades we'll see a shift in these activities illustrated in the current and future views. While today still some 150 platforms and interconnecting pipelines produce and transport oil and gas, the main shift will be towards the further development of offshore wind farms, CO_2 storage and hydrogen production and storage. At the same time, all other activities need to be considered.







"Responsible decommissioning: that is what Nexstep stands for in 2024 and beyond"

Nexstep's 7th annual report highlights the progress made in dismantling E&P infrastructure in the Netherlands. In 2023, 8 platforms were dismantled, with 60% of the infrastructure expected to disappear in the next decade. However, challenges such as rising costs, labour shortages, and slow progress in innovation hinder the momentum. Nexstep is countering these trends through smart, creative, and effective strategies, such as NAM's novel contracting strategy and Kistos' new pipeline extraction technique. Joint campaigns and standardisation of regulatory demands across the North Sea are also being considered. The report emphasises the importance of reducing costs, as decommissioning is largely funded by the Dutch state. Additionally, the report highlights the need to strengthen the ecosystem in the North Sea and perform decommissioning in a more nature-friendly manner. Nexstep stands for responsible decommissioning in 2024 and beyond.

www.nexstep.nl